CHAPTER 4

TRANSMISSION PLAN

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4.0 500 kV Transmission plan

In this section transmission study for Bojonegara coal thermal power plant (1,000 MW × 2unit) was conducted. Two transmission options were proposed and evaluated.

4.1 Study cases

4.1.1 Bojonegara power plant

Outline of power plant is described in Table 4.1.1-1. This power plant is coal-fired thermal power plant, which is adopted Ultra-super-critical technology (USC). It is expected to generate for base load because of high efficiency plant. Two 1,000 MW units are designed in this project. The first unit is assumed to start operating in 2021, and the second unit will start operating in the future.

Table 4.1.1-1 Outline of Bojonegara power plant

Location	Banten province
Fuel type	Coal
Capacity	1,000 MW * 2unit
Start to operate	1,000 MW in 2021 (another unit 1,000MW in the future)
Steam condition	USC (Ultra-super-critical)

Source: JICA Study Team

4.1.2 Transmission options

Following two cases are proposed as transmission options considering location and configuration of existing power system. Each case mapped on the existing power system is shown in Figure 4.1.2-1.

Case 1: Access to Balaraja 500 kV substation which is located but near the plant site
Case 2: Access to newly built 500 kV lines which go through near the plant site

There are several power plants operated in Banten area. Sularaya power plant, whose capacity is 3,000 MW, supply the power to Jakarta by 500 kV double circuit transmission line. In addition new Sularaya power plant was developed near existing Sularaya site in 2011 and new 500 kV double circuit transmission line for the new plant is now under construction (as of May 2012). This line is expected to energize in Oct. 2012. According to RUPTL 2011-2020, a power plant will be developed by IPP in Banten and connected to new 500kV transmission line in 2016.

In case 1, the distance between the power plant site and Balaraja substation is approximately 60 km. According to PLN, there are no protected forests, which prohibit from constructing transmission lines, in the area between the plant site and Balaraja substation.

In case2, the length of access transmission line will be very short (less than 500 m) because the new 500 kV transmission line is designed to go through the power plant site. IPP power plant will be

planned to connect to same line in 2016, therefore capacity of the transmission line is concerned in case 2.

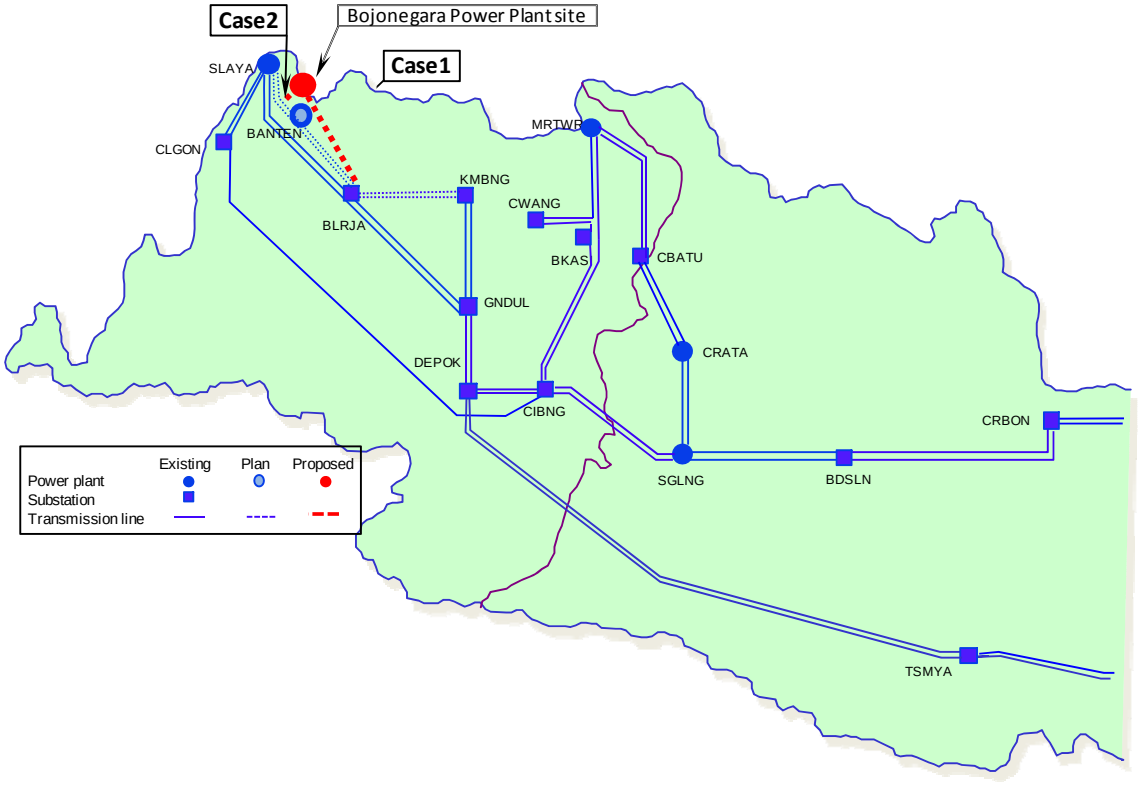


Figure 4.1.2-1 Bojonegara Power Plant Site And Study Case of Transmission

Source: JICA Study Team

4.1.3 Power flow analysis

(1) Precondition

Power flow analysis was conducted by P3B. The Peak demand estimation and generation plan were assumed base on the RUPTL 2011-2020.

Power flow analysis was conducted by P3B. All the expansion planning in Java Bali system (transmission lines, power plants, substations, peak load, etc.) are based on the RUPTL 2011-2020.

The peak load of 2021 is assumed 38,872MW, which is expected to increase 6.8% from 2021 projection in the RUPTL2011-2020.

Power system reliability complies with 'N-1 criteria'. Planning and operation criteria of Java-Bali system is shown in Table 4.1.3-1.

Table 4.1.3-1 Plannning and operation criteria in Java

(a) Load

	Normal	Contingency
500 kV	100% of rated capacity	100% of rated capacity
150 kV		
70 kV		

(b) Voltage

	Normal	Contingency
500 kV	+5%, -5%	+10%, -10%
150 kV	+5%, -10%	+10%, -10%
70kV	+5%, -10%	+10%, -10%

(c) Fault current

500kV	50kA
150kV	50kA

Source : PLN

Table 4.1.3-2 shows size and capacity of t he typical conductors which PLN use for 500kV transmission lines.

Table 4.1.3-2 Capacity of typical conductors PLN uses

Name	Size	Type	Capacity (MVA)	Capacity (MW)
4 × Dove	4 × 282mm^2	ACSR	1,985	1,786
4 × Gannet	4 × 338mm^2	ACSR	2,209	1,988
4 × Zebra	4 × 429mm^2	ACSR	2,771	2,493

Source : PLN

Power flow analysis was conducted by PSS/E (Power System Simulator for Engineering), which PLN use for system analysis work.

Figure 4.1.3-1 shows the power flow diagram of original plan 'RUPTL 2011' focused on west Java. New power plant 'Banten' will be developed and connected to new 500 kV Suralaya-Balaraja line in 2016.

(2) Power flow and voltage analysys

1) Case 1: Bojonegara (1,000MW) connected to Balaraja substation

In this case Bojonegara power plant is connected to Balaraja substation by a new double circuit 500 kV (4 × Zebra, 2,771 MVA per circuit) transm ission line of a pproximately 60 km in route length.

Figure 4.1.3-2 shows the result of power flow an alysis of case 1. There are no lines overloaded in normal condition and N-1 contingency. JICA study team confirmed that co mpliance to N-1

criteria after installing one more 1,000 unit in the future (2021 – 2025).

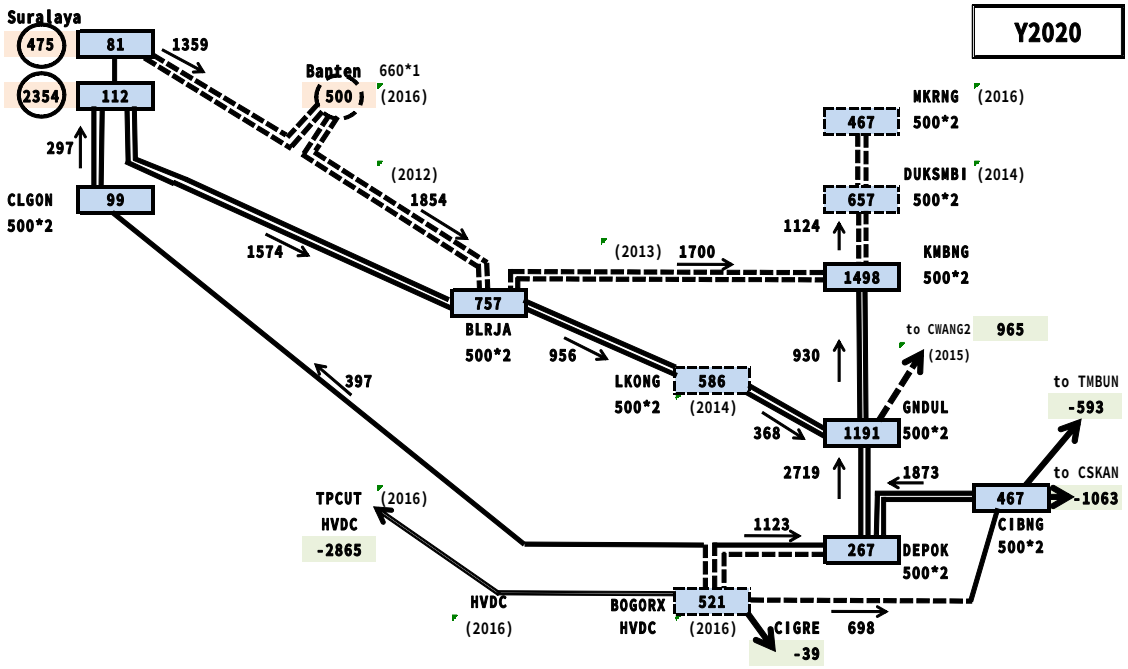


Figure 4.1.3-1 Power Flow Diagram Year 2020 (RUPTL 2011)

Source: PLN

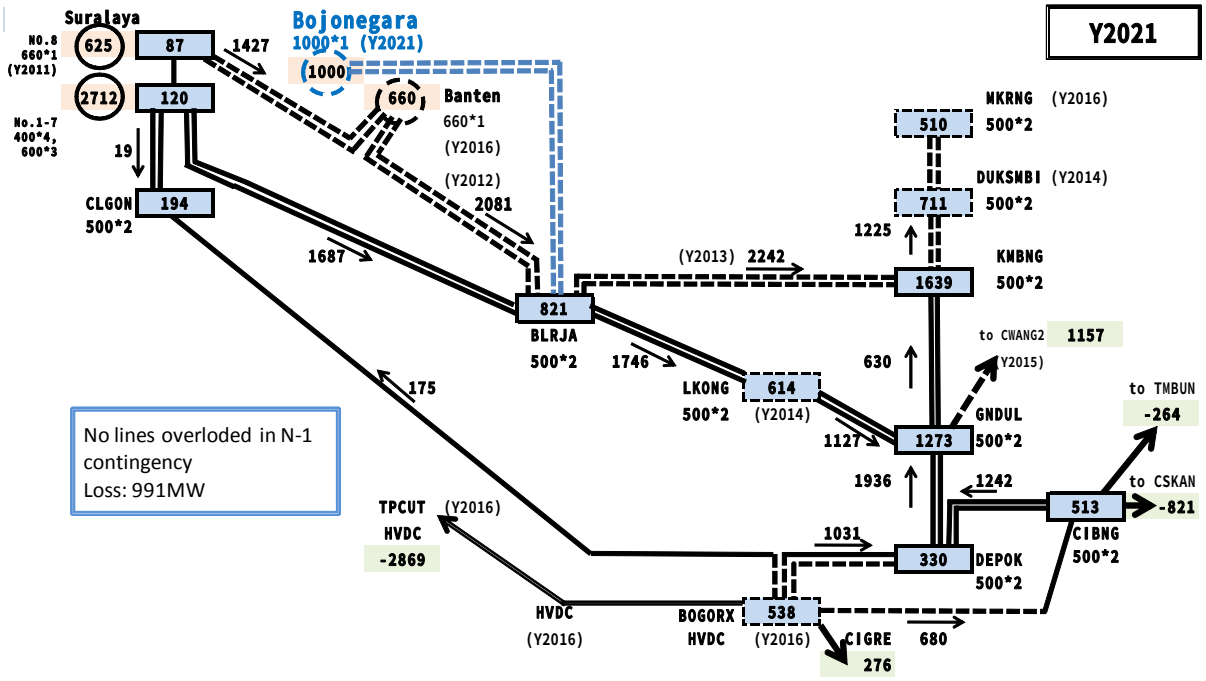


Figure 4.1.3-2 Connecting to Balaraja Substation in 2021

Source: PLN

2) Case 2: Bojonegara (1,000 MW) connected to 500kV line.

In this case Bojonegara power plant is connected to new double circuit 500 kV (4 × Dove, 1,985 MVA per circuit) transmission line which begins at Suralaya No. 8 power plant and terminates at 500 kV Balaraja substation. Length of incoming lines from the new transmission line to power plant is very short because the new line go through the power plant site.

Figure 4.1.3-3 shows the result of power flow analysis of case 2.

A new IPP power plant (660 MW) is planned to connect this transmission line in 2016. Therefore while the N-1 criteria is complied in normal condition (Figure 4.1.3-3 (a)), the new 500 kV transmission line (between Banten to Balaraja) is overloaded in N-1 contingency (Figure 4.1.3-3 (b)).

a) Countermeasure study in N-1 contingency of Case 2

To meet N-1 criteria, 500 kV transmission line upgrade from Banten power plan to Balaraja substation, approximately 60 km length, is required. Table 4.1.3-3 shows upgrade options. Considering transmission capacity to accommodate one more 1,000 MW unit (total 2,000 MW) in the future, Option 3 (4 × Lisbon) in Table 4.1.3-3 is selected.

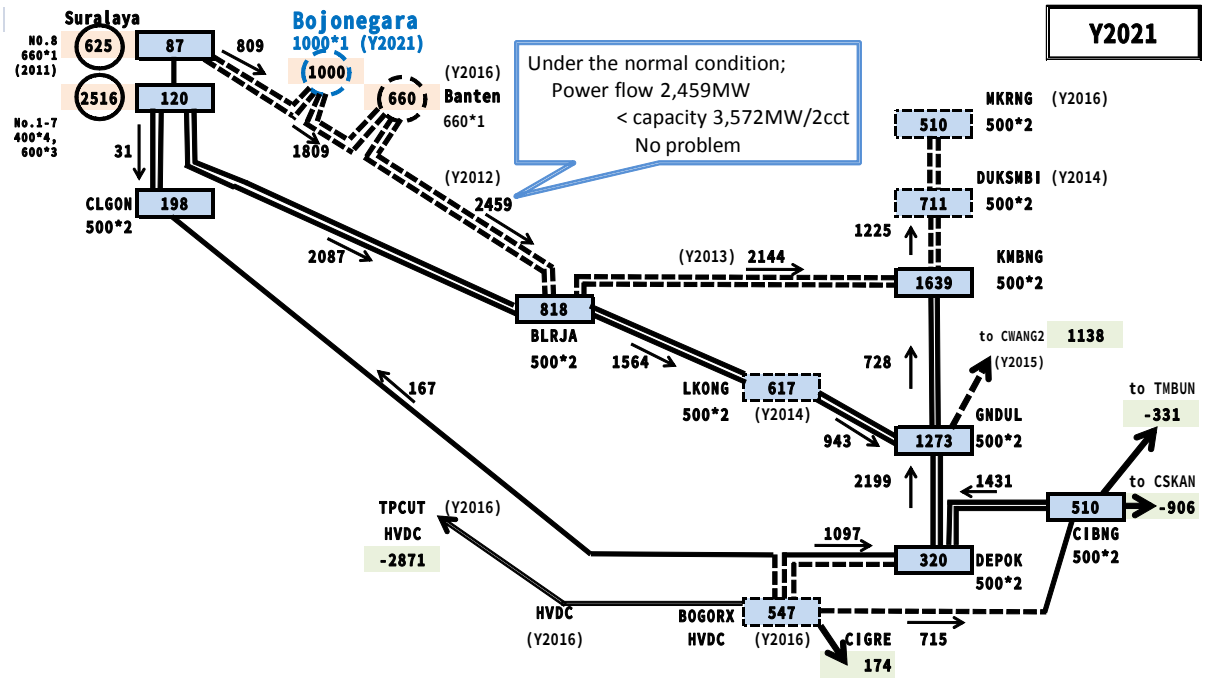
Figure 4.1.3-4 shows power flow diagram after upgrade to '4xLisbon'.

Table 4.1.3-3 Evaluation of reconductoring

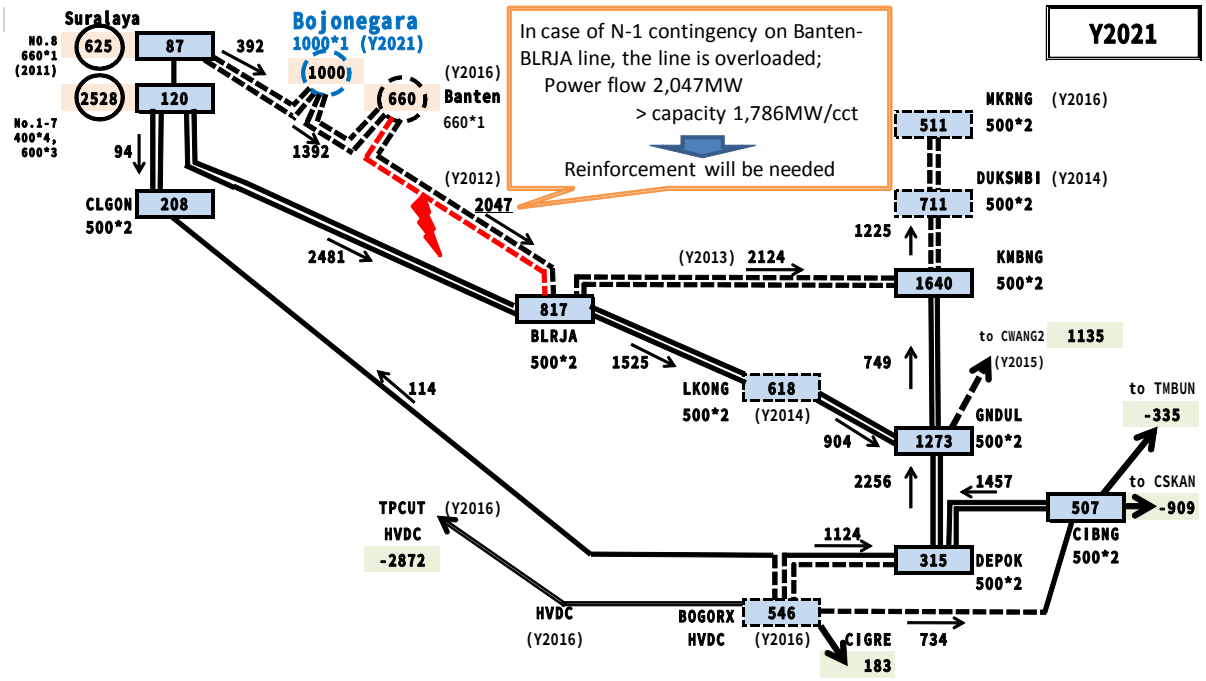
	Before	After		
		Option 1	**Option 2**	**Option 3**
Conductor Size	DOVE 4 × 282 mm^2	BRUSSEL 2 × 415 mm^2	LISBON 2 × 310 mm^2	LISBON 4 × 310 mm^2
Capacity (MW)	1,786/cct 3,572/2cct	2,780/cct 5,560/2cct	2,305/cct 4,610/cct	4,610/cct 9,220/cct
Tower design	-	Reinforcement(*)	Non(*)	Non(*)
N-1criteria	-	Not complied (N-1 contingency on Suralaya-Balaraja line)	Not complied (N-1 contingency on Suralaya-Balaraja line)	Complied
One more 1,000 MW unit	-	×	×	OK
Length	-	60 km	60 km	60 km
Cost	-	29MUSD	26MUSD	32MUSD

(*)Detail study of tower design will be needed on FS or DD stage.

Source: PLN



(a) Normal condition



(b) N-1 contingency on Banten - Balaraja lines

Figure 4.1.3-3 Power Flow Diagram Year 2021 with Bojonegara

Source: PLN

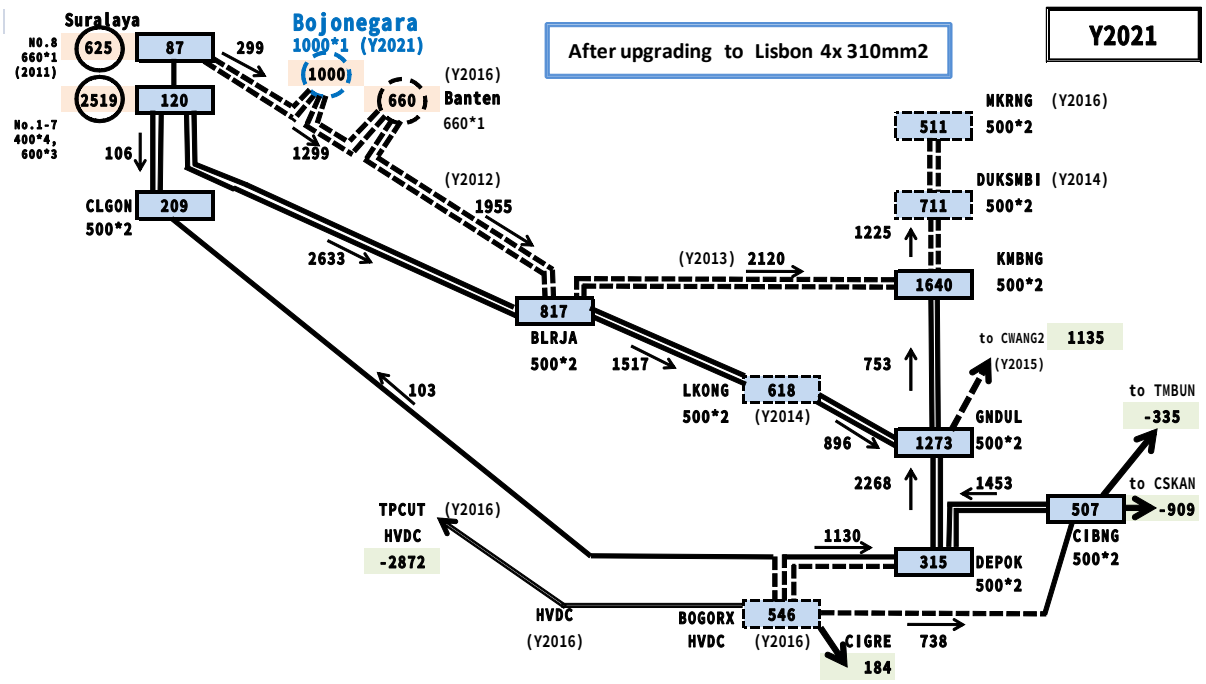


Figure 4.1.3-4 Power flow Diagram after Reconductor

Source: PLN

4.1.4 Cost estimates

The construction cost of each case is shown in Table 4.1.4-1. The construction costs were calculated using unit cost per km. Levelized cost was calculated under the condition below;

Discount rate : 12%
Life time : 30 year (Project duration)

Table 4.1.4-1 Construction cost

	Contents	Cost	Total cost	Levelized cost
Case 1	Access TL (4xZebra) : 60 km 500kV switchgear in SS: (2sets)	50MUS$ 4.5 MUS$	54.5MUS$	6.8 MUS$
Case 2	Access TL (4xZebra) : 0.5 km Reconductoring :60 km	0.2MUS$ 32MUS$	32.2MUS$	4.0 MUS$

Source: JICA study team

According to the results of power system analysis, the system peak loss of Case 2 was 12 MW larger than that of Case 1. Therefore loss cost should be considered as additional cost on Case 2.

Table 4.1.4-2 shows loss costs. Annual loss costs were calculated by using equations below;

Annual loss = Peak loss * LLF *8760
LLF (Loss load factor) = 0.2 * Load factor + 0.8 * (Load factor)^2
Load factor = 0.75

Unit generation cost = 5 cent/kWh

Table 4.1.4-2 Loss cost

	Peak loss	Annual loss	Additional cost
Case 1	991MW	5,209GWh	-
Case 2	1011MW	5,313GWh	-
Case2-1	20MW	104GWh	5.2MUS$

Source: JICA study team

Additional O&M cost of Case 1 was calculated using O&M ratio (2%) to construction cost. Regarding Case 2, additional O&M cost was assumed to be nearly zero because the length of incoming transmission line is very short (less than 500m).

Table 4.1.4-3 O& M cost

	O&M cost
Case 1	1.1 MUS$
Case 2	0

Source: JICA study team

Total annual cost produced from each case is shown in Table 3.5-8. While construction cost of Case 1 is more expensive, Case 1 is considered to be comparable economical with Case 2 in comparing total annual cost.

Table 4.1.4-4 Construction cost

	Levelized cost	Loss cost	O&M cost	Total annual cost
Case 1	6.8 US$	-	1.1 M US$	7.9 MUS$
Case 2	4.0 US$	5.2 MUS$	0	9.2 MUS$

Source: JICA study team

4.1.5 Conclusion

Case 1 ; The configuration of power system is so simple for operation that there is no need to upgrade of existing power system and less power losses. In addition Case 1 has more economical efficiency as Case 2 comparing each annual cost, which includes loss cost and O&M cost. On the other hand, the access transmission line has long distance and difficulty of ROW acquisition, which may cause longer construction time.

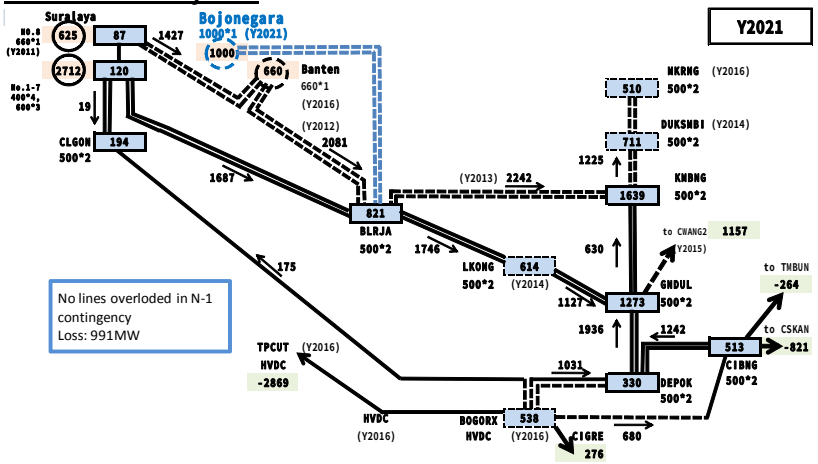
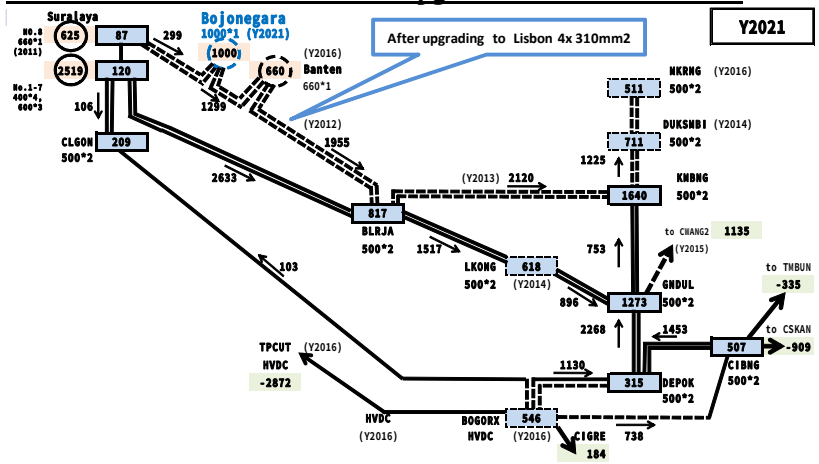
Case 2 ; It is easy to construct the access transmission line because the new 500kV transmission line goes through the power plant site. However, upgrade of transmission line is required and power flow is unbalance after two power plants connect to same line. These situations impose complexity on system operation.

Study Team suggests that Case 1 should be a proposal of pre-FS study considering it's simple

configuration for operation of power system. However, Case 1 is pointed out the additional delay risk due to difficulty of ROW acquisition. Therefore Case 2 can be considered one of alternatives as the countermeasure against delay risk of Case 1.

Table 4.1.5-1 shows the summary of comparison study among cases.

Table 4.1.5-1 Comparison Between Transmission Study Cases For Bojonegara Power Plant

	Case 1	Case 2
Description	**Access to Balaraja S/S** 	**Access to the T/L near the site and upgrade to 4x310mm2 Lisbon** 
Construction cost	(i) Access line (60km) 50 MUS$ (ii) Switchgear (2 sets) 4.5 MUS$ Total cost 54.5 MUS$	(i) Access line (0.5km) 0.2 MUS$ (ii) Reconductor (60km) 32 MUS$ Total cost 32.2 MUS$
System loss	Peak loss 991 MW Annual loss 5,209 GWh	Peak loss 1,011 MW ('Case2-1=' 20MW) Annual loss 5,313 GWh ('Case2-1=' 104GWh)
Annual cost	7.9 MUS$/year	9.2 MUS$/year
Remark	➢ The route length of access line is long (60km) and term of construction may become longer due to difficulty of the acquisition of ROW. ➢ There is no need to upgrade of existing system for N-1 criteria. ➢ Although the construction cost is more expensive, the annual cost is cheaper than Case 2 because of lower transmission loss. ➢ Operating is easier and effective due to exclusive line from Bojonegara.	➢ The route length of access line is very short (less than 500m) because new T/L will go through beside the power plant site. ➢ Reconductoring is needed in order to comply with N-1 criteria. ➢ The reconductoring work needs planned outage of 500kV line, which will force uneconomical operation during the work. ➢ The power flow with two plants operated on Suralaya-BLRJA line is unbalance and disadvantage in system loss.

Source: JICA study team

CHAPTER 5

ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

CHAPTER 5
ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

This Chapter summarizes the findings of environmental and social considerations study that have been done as a part of preliminary feasibility study for the CCT 1,000MW coal-fired power plant at Bojonegara. Accordingly to the study stage, the concerned environmental and social considerations study has been conducted as an initial environmental examination and evaluation study (the IEE Study), which has been assisted by JICA as a part of its assistance on the Project for Promotion of Clean Coal Technology (CCT) in Indonesia

5.1 Environmental Regulations and Plans relevant to the Plan

5.1.1 Laws and Regulation related to the Plan

Environmental management:

- Law No.32 / 2009 on environmental protection and management
  First enforced with Law No.4 of 1982, and major amendment in Law No.23 of 1997
  It was amended again and promulgated as the new law that took effect on October 3, 2009.
- Law No. 5 / 1990 on conservation of natural resources and ecosystems
- Government regulations No.7 / 1999 on preserving flora and fauna species
- Joint circular letter between Minister of Home Affairs and State Minister of Environment on reorganization of local governmental environmental institutions (No.061/163/SJ/2008 AND SE-01/MENLH/2008）

Environmental Impact Assessment (AMDAL):

- Government regulation No.51 / 1993 and its amendment No.27 / 1999 on environmental impact analysis
- MOE Regulation No.17 / 2001 and its amendment No.11 / 2006 on the types of business and/or activities required to prepare EIA (*There are guidelines relevant to the regulation.)
- MOE Regulation No.08 / 2006 on guidelines for preparing EIA (based on Decree of the Head BAPEDAL No.09 / 2000)
- MOE Regulation No.24 / 2009 on appraisal guidance of EIA document (based on MOE Decree No.02 / 2000)
- MOE Regulation No.27 / 2009 on guidelines for strategic environmental assessment
- MOE Regulation No.13 / 2010 on environmental management and monitoring measures and statement for environmental management and monitoring capacity
- MOE Decision No.86 / 2002 on guidelines for environmental management and monitoring measures
- MOE Decision No.05 / 2000 on EIA preparation guidelines for development activities in wetland areas

- MOE Decree No.41 / 2000 on gui delines for est ablishment of EIA evaluation co mmittee of districts/ municipalities
- Decree of Head of BAPEDAL No.8/ 2000 on p ublic involvement and information disclosure in the process of EIA

Spatial planning (including Protected Area management):

- Law No.26 / 2007 on spatial planning
- Government Regulation No.26 / 2008 on the national spatial plan
- Government Regulation No. 68/1998 on nature reserves and conservation areas
- Presidential Decree No. 57 / 1989 on the coordination team for the national spatial management
- Presidential Decree No. 32 / 1990 on management of protected areas
- Government Regulation No. 69 / 1996 on implementation of the rights and obligations, and forms and procedures for community participation in spatial planning
- PU Regulation No.15/PRT/M/2009 on technical guidelines for provincial and local spatial plan - ning

Air pollution control:

- Government Regulation No. 41 / 1999 on air pollution control
  (*Relevant Guidelines are issued in the MO E Regulations concerned, and environm ental standards are set on this government regulation No.41 / 1999)
- MOE Decree No.13 / 1995 on environmental standards of emission gases from stationary sources
- MOE Decree No. 45 / 1997on environmental standard index of air pollution
- MOE Regulation No.07 / 2007 on environm ental standards of emission gases from stationary emission sources of Boiler
- MOE Regulation No.21 / 2008 on environmental standards of emission gas from stationary emission sources of thermal power plant enterprises and / or activities
- MOE Regulation No.12 / 2010 on implementation of regional air pollution control

Noise, Vibration and Odor:

- MOE Decree No. 48 / 1996 on environmental standards of noise levels
- MOE Decree No.49 / 1996 on environmental standards of vibration levels
- MOE Decree No.50 / 1996 on environmental standards of odor levels

Water pollution control:

- Government Regulation No. 82 / 2001 on water quality management and water pollution control
  (*Relevant Guidelines are issued in the MOE Regulations concerned, and environmental standards are set on this government regulation No.82 / 2001)
- Government Regulation No.19 / 1999 on control of marine pollution and destruction
- MOE Decree No.51 / 1 995 and its amendm ent No.122 / 2004 on environmental standards of effluent wastewater quality from industrial activities

- MOE Decree No.04 / 2001 on environmental criteria for coral reef damage
- MOE Decree No.37 / 2003 on the m ethod of surface water quali ty analysis and surface water sampling
- MOE Decree No.110 / 2003 on guidelines for determination of carrying capacity of water pollu - tion charges in water resources
- MOE Decree No.51 / 2004 and its amendment No. 179 / 2004 on sea water quality standard
- MOE Decree No.201 / 2004 on standa rd criteria and guidelines for determination of mangrove damage
- MOE Decree No.112 / 2003 on domestic wastewater quality standards
- MOE Decree No. 113 / 2003 on environmental standards of waste water quality from coal mining enterprises and /or activities
- MOE Regulation No. 08 / 2009 on environmental standards of waste water qualit y from thermal power plant enterprises and /or activities

Solid waste management:

- Law No.18 / 2008 on solid waste management
- Government Regulation No.18 / 1999 a nd its amendment No.85 / 1999 on hazardous and toxic materials (B3) waste management
- Government Regulation No.74 / 2001 on B3 management
- Decree of Head of BAPEDAL No.1/BAPEDAL/09/1995 on procedures and technical require- ments for w aste storage and collection of B3 (N o.2, 3, 4 and 5/ BAPEDAL/09/1995 are also re- lated)
- MOE Regulation No.03 / 2007 on collection and storage facilities of B3 waste
- MOE Regulation No. 02 / 2008 on the use of B3 waste
- MOE Regulation No.18 / 2009 on licensing and management of B3 waste

Others relevant regulations regarding environmental assessment and mea sures for coal-fired power plants:

Laws;

- Law No.5 / 1994 on ratification of the Convention on Biological Diversity (CBD) 1993
- Law No.41 / 1999 on forestry
- Law No.81 / 2000 on navigation
- Law No.7 / 2004 on water resource management
- Law No.32 / 2004 on local government
- Law No.24 / 2007 on disaster management
- Law No.27 / 2007 on management of coastal areas and small islands
- Law No.4 /2009 on mineral and coal mining
- Law No.36 / 2009 on health

- Law No.45 / 2009 on fisheries

Government Regulations;

- Government Regulation No.20 / 2010 on aquatic transport
- Government Regulation No.10 / 2010 on changes in the forest status
- Government Regulation No.24 / 2010 on the use of forest areas

Ministerial decrees and regulations;

- MEMR Decree No.1899 / 1994 on technical guidelines for environmental monitoring of electrical power
- MEMR Decree No.1457. K/28/MEM/ 2000 on technical guidelines for environmental management in mining and energy
- MOH Decree No.876/Menkes/SK/VIII/ 2001 on technical guidelines for health impact assessment

Regional regulations and Governor's decrees:

- Provincial Regulation of West Java Province No.22 / 2010 on land utilization and spatial structure of the province (2010-2030)
- Provincial Regulation of Banten Province No.2 / 2011 on land utilization and spatial structure of the province (2011-2031)
- Provincial Regulation of Banten Province No.51 / 2002 on operation of environmental impact assessment
- Decree of Governor of Jakarta No.670 / 2000 on standards of emission gases from stationary sources including thermal power plant in Jakarta
- Decree of Governor of Jakarta No.551 / 2001 on environmental standards of ambient air quality and noise level in Jakarta
- District Regulation of Serang District No 10 / 201 1 on land/space utilization and spatial structure of the district for the period of 2011-2031

5.1.2 Spatial Plans concerned with the Plan

(1) Spatial Plan of Banten Province

Current Banten Province Spatial Plan has been enacted through *'Provincial Regulation (PERDA) of Banten Province No.2 / 2011 on land utilization and spatial structure of the province (2011-2031)'*, namely Provincial Spatial Plan (RTRWP) of Banten Province. According to the RTRWP, Banten Province is divided into 3 Development Work Area (WKP [1]); namely, WKP I covering Tangerang, Tangerang City, and South Tangerang City, WKP II including the District of Serang, the Serang City, and Cilegon City, and the WKP III covering the remaining districts of Pandegelang and Lebak District.

[1] The Development Work Area (WKP) is the areal category set in Banten Province, which is experiencing very rapid growth, to play different characteristics and development focus in development objectives and functions. The WKP is expected to contribute effectively to: 1) Creating harmony and coherence in the spatial hierarchy structure of the level of services local, regional and national levels; 2) Supports spatial policy strategies in the development of Banten region; 3) Support Banten spatial structure plan as an integral part of the national spatial structure and spatial structure of cities / counties.

The Development Work Area (WKP) II, where Bojonegara project site is located, is directed for the development activities of government, education, forestry, agriculture, industry, ports, warehousing, tourism, services, trade, and mining.

In addition to the above land use plan, a part of Banten Province has defined as a center of the growing regions that has a national strategic value. This area covers the Bojonegara - Merak - Cilegon area with key sectors of industry, port, tourism, agriculture, fisheries, and mining. The spatial plan also directed the development of Krakatau and its surroundings that are featured with marine fisheries sector, mining, and tourism. At national level, this Development Area is a part of the National Strategic Development Area (KSN) of Jembatan Selat Sunda (The Bridge of Sunda Straight) which covers a part of Banten Province and Southern Part of Lampung Province.

1) Local Protected Areas

There are two local protected areas namely coastal and river borders that are found in Serang District as well as in Bojonegara Sub District as location of the assumed project site.

Protection of coastal border is done to protect coastal areas from activities that interfere with the preservation of the beach. The criteria for protected coastal border along the mainland coast are of a width proportional to the shape and physical condition of the beach at least 100 feet from the point of highest tide landwards.

The legal basis for protection of coastal boarder was originally based on the Presidential Decree No.32/1990 regarding Management of Protected Area which was later adopted by many kind of laws and regulation such as Law No.7/2004 regarding Water Resources, Law No.27/2007 regarding Small Islands and Coastal Zone, Government Regulation (PP) No.38/2011 regarding River, Ministerial Decree of Public Work No 63/PRT/1993 regarding river boarder, river unitized area, river authority area, and area ex river, Ministerial Regulation of Forestry No.35/Menhut-II/2010 regarding the process of technical forest rehabilitation plan and watershed area. Those laws and regulations are adopted in preparation of spatial plan from national up to district/city level, which later on will make a new national/provincial/district and city law.

Protection of river borders aims to protect the river from human activities that can disturb and damage the quality of river water, the physical condition of the edge and bottom of a river and secure the flow of a river. Criteria for determination of protected river border are as below;

- To protect at least 100 meters on either side of the river and 50 meters for left and right tributaries outside residential areas.
- For the river in the area of settlement, river borders may be enough to build the road inspection between 10-15 meters.

River borders in Banten province consists of Ciujung Watershed, Cidurian, Cilemer, Ciliman, Cibanten, Cidanau, Cimanceuri, Cisadane, Cibinuangeun, Cihara, Cimadur, and Cibareno Watershed with a total length of streams 788 km river border with an area of approximately 7,877 ha (0.91%) of Banten province while vast areas of forests for watershed determined at least 30 (thirty) percent.

2) Conservation Area

The Banten Province Spatial Plan designates the Banten Bay as one of the marine conservation area with a total of 30 ha. This marine conservation area is based on and refers to Law No.27/2007 regarding small Islands and Coastal Area. The Banten Bay is offshore of the Bojonegara project site. However, since the scale of the spatial plan is of 1:250.000, therefore, further study is needed particularly for marine conservation plan. Besides, this marine conservation area has not been adopted by Serang District Spatial Plan. The Banten Bay marine conservation area is presented in Figure 5.1.2-1.

SPATIAL PLANNING OF BANTEN PROVINCE 2010 - 2030

Legend

1 Fisheries Landing Base Area of Cituis

2 Sea Grass Cultivation Area of Tenjoayu

3 Fisheries Harbor Area of Karangantu Beach

4 Marine Conservation Area of Banten Bay

Figure 5.1.2-1 Coastal and Small Island Zonation in Banten Province

(2) Spatial Plan of Serang District

The Spatial Plan (RTRW) of Serang District has been enacted through *'District Regulation No 10/2011 regarding land/space utilization and spatial structure of the district for the period of 2011-2031'*.

1) Protected Forest

In the Serang District, protected forest area is managed by Forest Estate Company called Perhutani KPH Banten. According to Decree of the Ministry of Forestry No.419/Kpts-II/1999, protected forest area in Serang District covers an area of approximately 652 ha scattered in several areas, namely:

- Protected forests of Gunung Karang in Sub-district Ciomas; and
- Protected forests of Gunung Gede in Sub-district Bojonegara, Gunung Ampel and Kramatwatu

The protected forest is given by the MOF Decree mentioned above. However, based on the existing land use (Land use, 2008), the coverage of the protected area is mostly of non forest use or in other word the protected forest has become cultivated area. The land use of the Bojonegara site is presented in Figure 5.1.2-2.

2) Local Protected Area

In Serang District, local protected areas are directed to the lake border and river border region including major rivers such as River Ciujung, Cidurian River and other rivers and to the coastal border area.

Protection of river border area is set along the river side, including manmade rivers, canals, irrigation primer canals, which has important benefits to maintain the preservation of the river. In Serang District, the demarcation line of river border protection is defined by considering the amount of river discharge. The largest river discharge in Serang District is about 20 m^3/ sec. Demarcation line settings are as follows:

- Rivers with discharge of 15 to 30 m^3/ sec have a line of demarcation border at 100 m from the river
- Rivers with discharge of less than 15 m^3/ sec have a line of demarcation border at 50 m

River border area management directives to be carried out:

- Establish a utilization plan of the river border area while maintaining the function of the river and is equipped with a ban on the use (cultivation) in the border areas of the river;
- Determination of the technical requirements for ecological farming activities, which are permitted;
- Restrict the expansion of activities in the area defined as border area of the river;
- Socialization to the people who live on both sides of the river and associated with the development actors regarding utilization plan of the river border areas; and

- Actively involve local communities in controlling the use of river border area, monitoring and supervision of river border areas

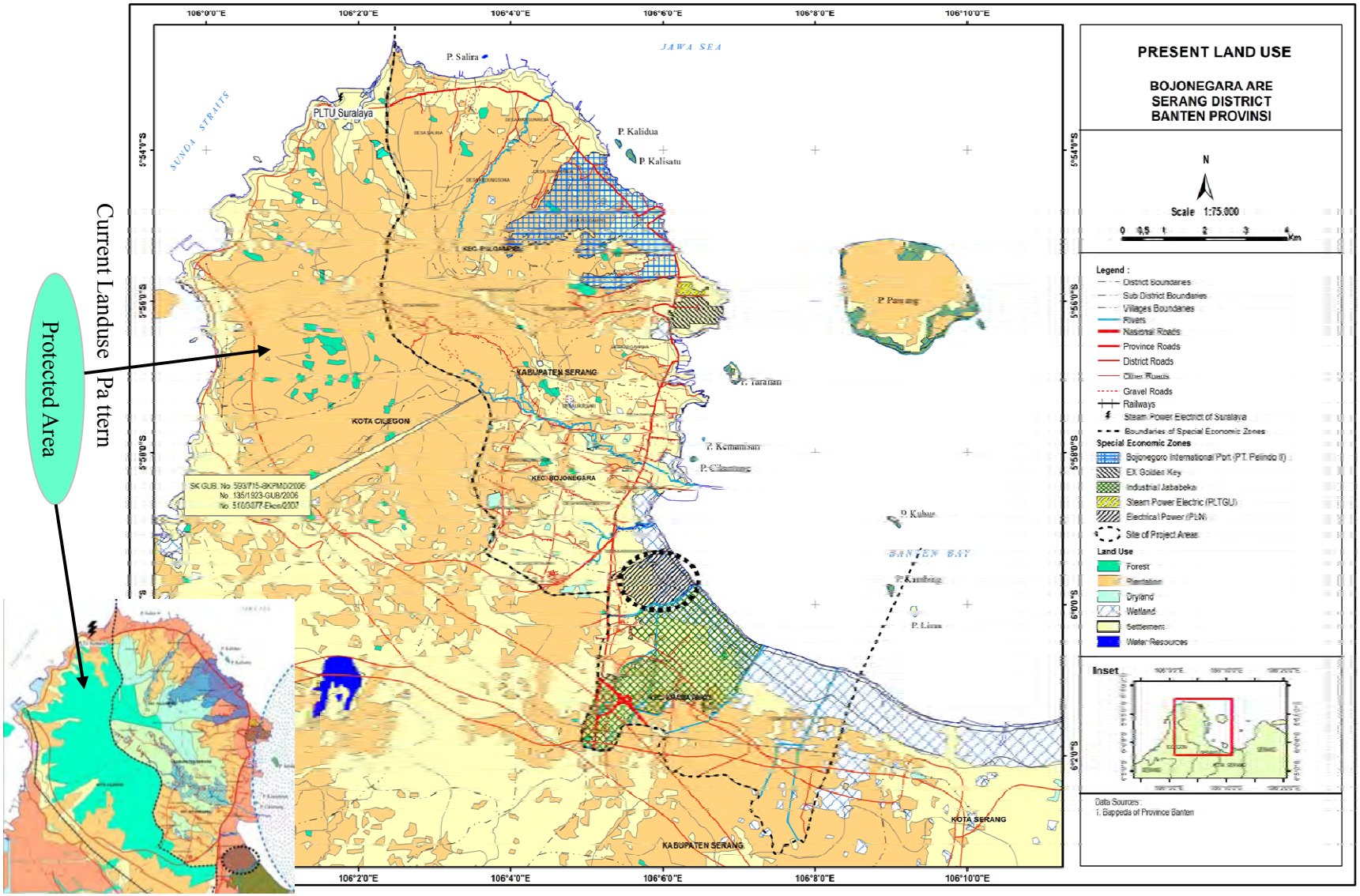


Figure 5.1.2-2 Present Land Use of Serang District, Banten Province

Source: Data sources from Bappeda of Banten Province and Topographic Map (scale 1/ 250.000), Bakosurtanal, 1999

Coastal border area is a specific area a long the coast that has important benefits to maintain the preservation of a beach. In accordance with its characteristics, this region lies in the coastal areas in Serang District stretching in the north (Sub-dist rict of Tanara, Pontang, Tirtayasa, Bojonegara and Pulo Ampel) as well as in the west (Sub-district of Anyar and Cinangka). At this time, the coastal areas of Serang District have been utilized for cultivation activities, among others, fishing pond (Sub-district of Pontang, Tirtay asa and Tana ra), industrial and port (Su b-district of Bojonegara and Pulo Am pel) as well as tourism activities (Sub-district of An yar and Cinang ka). Therefore, the protection of coastal border is needed to prevent environmental damage and coastal ecosystems.

Criteria for determining the demarcation of coastal border area in the coasts of Serang District i s to preserve land along t he shoreline with a width proportional to the shape and phy sical condition of the beach with the following conditions:

- In urban areas with wave heights < 2 m, the width of border is 30-75 meters from the highest tide point landward;
- In urban areas with wave height > 2 m, the width of border is 50-100 meters from the highest tide point landward;
- Outside urban areas with wave heights < 2 m , the width of border is 100-200 m eters from the highest tide point landward (which the Bojonegara project site may be applied to) ;
- Outside urban areas with wave height > 2 m, the width of border is 150-250 meters from the highest tide point landward.

Coastal border area management directives to be carried out:

- Establish utilization plan for coastal bo rder area while maintaining the function of coastal protection;
- Restriction of aquaculture activities in c oastal border area of potential environ mental damage;
- On the border region that has a function as a cu ltivated area such as: urban and rural settlements, tourism, ports, defense and s ecurity, industry and other areas, development must comply with specified land use in coastal spatial/utilization plans;
- Restrict the expansion of activities in the are a that has been design ated as a co astal border area;
- Determination of the technical requirements of ecological farming activities, which are permitted;
- Socialization to l ocal communities and releva nt development actors about the utilizati on plan of the coastal border;
- Actively involve local co mmunities in controlling the use of coast al border, monitoring, supervision and control of coastal border area;
- Applied the Environmental Impact Assessment (EIA) for the business or activities to be carried out in the coastal border in corresponding to the laws and regulations.

3) Nature conservation area

Coastal mangrove forest is a natural conservation area, which is intended to preserve for the mangrove forest ecosystem and the proliferation of a variety of marine life, as well as protection of coastal sea water erosion, and inland cultivation area.

Coastal mangrove forest areas, for the band width that stretches landward 130 times the value of the average yearly difference between the highest and the lowest tide from the low tide line, is designated as mangrove natural conservation area. In Serang District, they are designed in the coastal area of Sub-district Tanara, Tirtayasa, Pontang, Kramatwatu, Bojonegara, and Sub-district Pulo Ampel, with an area of approximately 9,871 (nine thousand eight hundred and seventy-one) ha.

The presence of mangrove brackish water around fishpond must be maintained, and if necessary the fishpond directly facing the sea should be covered by mangroves. Besides, the existence of inland forests should be maintained to avoid the occurrence of natural disasters such as undesirable land sliding, erosion, sedimentation, floods, and so forth. Utilization plan of the mainland coastal areas is subject to the protection of mangroves.

The directions for the management of coastal mangrove forest area are as follows:

- To place the benchmark demarcation, especially in areas that have not have benchmark;
- To make inventory and evaluation of the potential, location and distribution of mangrove ecosystems;
- To rehabilitate and restore degraded mangrove forest areas;
- To have monitoring and evaluation of potential mangrove forest area;
- To plant mangroves in the coasts of slope or mud and perennials in steep beaches and rugged coasts;
- To protect mangrove ecosystem from destruction, disturbances, threats, and pests and diseases.

4) Areas prone to natural disasters

Coastal areas in Seang District are prone to tsunami disaster. Tsunami-prone areas in the Serang District include the Sub-district Anyar, Cinangka, Ampel Pulo, Bojonegara, Pontang, Tirtayasa, and Tanara.

5) Fishery Area

The allocation for fisheries area is an area that can be used for fishing, cultivation, and fishery product processing industry and does not interfere with the preservation of the environment.

Criteria for determining allocation of fisheries areas are:

- The area which technically can be used for fishing activities;
- The area which can be used for fishing activities and in space can provide benefits;
- Increase fish production and utilizing investments are nearby;
- encourage the development of economic sectors in the surrounding area;

- Have the ability to harness the potential of public water area and aquaculture optimally; and
- Have the ability to contribute to increase export

Fishery commodities in Serang District include capture fisheries and aquaculture results, whether conducted in the waters of the sea or in freshwater. The area of marine capture fisheries and aquaculture in Serang District scattered in northern and western coastal regions covering Sub-district of Pontang, Tirtayasa, Tanara, Kramatwatu[2], Bojonegara, Pulo Ampel, Anyar, and Cinangka. While the regions of freshwater capture fisheries and aquaculture in Serang spread across the waters of rivers, reservoirs, lakes, and small lake (Situ) especially in the Sub-district of Baros, Pabuaran, Padarincang, and Ciomas.

Directives, limited to items possibly related to the concerned Plan, for fishery area management include:

- Increase the re-stocking public waters in order to preserve and improve the socio economic conditions of surrounding water regimes;
- Develop a regional fishery processing centers in the Sub-district Pontang, Tanara and Tirtayasa;
- Develop a fishing area in the village Lontar (Sub-district of Tirtayasa) and the village of Pulo Ampel (Sub-district of Pulo Ampel);
- Maintain access of fishermen to go fishing grounds;
- Increase fishing ports level;
- Develop facilities and infrastructure activities to encourage the development of fisheries areas;
- Maintain and rehabilitate the mangrove forest area in an attempt to preserve the ecosystem.

6) Industrial Area

The development of industrial activities is one of the major functions in Serang District. The center for development of industrial activities in the district is Sub-district of Bojornegara and the Cikande area of eastern Serang. Based on data in 2007, there were 15,372 industrial business units, consisting of large scale industries, small and medium ones (formal) and household handicraft industry (non-formal). Bojonegara Industrial Zone, Pulo Ampel and Kramatwatu accommodate 147 companies engaged in the basic metal machinery industry, chemical industry, maritime and port industries. Eastern Serang Industrial Zone accommodates 283 industrial companies engaged in the electronics industry, footwear, garments, toy and so on. Currently, the industrial sector's contribution to the economy of Serang is still dominant.

Since the locations of Serang are relatively distant from the harbor (Tanjung Priok), they are, despite considerable interest in industrial investment, less able to compete with other industrial areas such as those located in the district of Tangerang and Jakarta. These conditions give a thought that the development of ports in Bojonegara becomes very important because its pres-

[2] The project site for the model plant is located in Sub-district (Kechamatan) Kramatwatu administratively. Sub-district Bojonegara, same as the project name, is a neighbor town on the north of Kramatwatu.

ence will increase the competitiveness of industrial zones in the District of Serang.

Important issues that should be conside red are that many of these developing lands have be en productive agricultural land. Consideration given in allocating land development is that, to some extent, the econom ic value of land shows higher potency if used as industrial develop m ent, so that its contribution i n improving the District's economy could be further im proved. Besides, in terms of job creation, industrial activity is m ore likely to gi ve employment more extensive. However, this development is s till considering the proportion of available land so that dist rict's agricultural production can be m aintained. With these considerations, the allocation of industrial land development is conc entrated in a reas that ha ve been or wi ll have the infrastructure that supports the development of industrial activities. While this deve lopment covers an area in the Sub- district of Binuang, Kibin, Cikande, Kragilan, part of Pamarayan and Jawilan, the industrial development in the Area of Bojonegara is directed at Sub-district of Pulo Ampel, Bojoneg ara and Kramatwatu.

Direction for industrial area management and designation include:

- Industrial area designation to be m ade with consideration of ecological aspects and ot her technical aspects, especially environmental and traffic;
- Control and restrictions on industrial developments, especially in coastal areas or other areas that are vulnerable to negative impacts of industrial activity;
- To develop processing industries for pr oduced product/commodity in order to increase th e multiplier effect of local industrial sector to other sectors;
- Development of designated industrial a reas to be supported by t he green li ne as a buf fer between areal functions;
- Industrial designation to be limited proportionally to the development of other land uses and functions in t he region ba sed on technical studies, the im pact either directly or indirectly caused;
- Any industrial activity to use environmentally friendly methods or technologies to the extent possible, and to be accompanied with management efforts against the possibility of disasters due to the existence of the industry.

5.1.3 Environmental and Emission/Effluent Standards relevant to the Plan

(1) Emission Standards for Thermal Power Plant

Table 5.1.3-1 Emission Gas Standards of Thermal Power Plant of Fix Source (without CEMS)

No	Parameters	Maximum Standard Limit (mg/Nm^3)		
		Coal	Oil	Gas
1	Sulfur Dioxide (SO_2)	**750**	1,500	150
2	Nitrogen Oxide (NOx) representing by NO_2	**850**	800	400
3	Total Particulate	**150**	150	50
4	Opacities	**20%**	20%	

Note: CEMS stands for Continuous Emission Monitoring System
Ministry of E nvironment Regulation No. 21/2008 regarding Emission Limit for Thermal Powel Plant (Annex 1a)

Table 5.1.3-2 Emission Gas Standards of Thermal Power Plant Fix Sources (with CEMS)

No	Parameters	Maximum Standard Limit (mg/Nm^3)		
		Coal	Oil	Gas
1	Sulfur Dioxide (SO_2)	**750**	650	50
2	Nitrogen Oxide (NOx) representing by NO_2	**750**	450	320
3	Total Particulate	**100**	100	30
4	Opacities	**20%**	20%	

Note: CEMS stands for Continuous Emission Monitoring System
Ministry of Environment Regulation No. 21/2008 regarding Emission Limit for Thermal Powel Plant (Annex 1b)

1. Volume of gas is measured in standard condition (temperature 25.0 degree C and pressure 1 atmosphere).
2. Opacities is used as practical monitoring indicator
3. All parameters are corrected with O_2 as much as 7 % for coal in dried except opacities.
4. All parameters are corrected with O_2 as much as 5 % for oil in dried except opacities.
5. All parameters are corrected with O_2 as much as 3 % for gas in dried except opacities.
6. All the emission limit for 95 % of operational time for at least 3 days.

Table 5.1.3-3 Emission Gas Standard for Thermal Power Plant in Jakarta based on Governor Decree

No.	Parameter	Maximum Limit (mgr/m^3)
1	Total Particle	150
2	Sulfur Dioxide (SO_2)	750
3	Nitrogen Oxide (NOx)	850
4	Opacity	20 %

Source: Annex 2 of Decree of Jakarta Governor No.670 / 2000 on Emission Gas Standards from Fix Sources

(2) Effluent Standards for Thermal Power Plant

1) Central Processing Unit (CPU)

Table 5.1.3-4 Effluent Standards for CPU of Thermal Power Plant

No	Parameters	Unit	Limit
1	pH	-	6-9
2	TSS	mg/L	100
3	Fat and oil	mg/L	10
4	Free Chlorine (Cl2)*	mg/L	0,5
5	Total Chromium (Cr)	mg/L	0,5
6	Copper (Cu)	mg/L	1
7	Iron (Fe)	mg/L	3
8	Zinc (Zn)	mg/L	1
9	Phosphate (PO^{4-})	mg/L	10

Note: In case no cooling tower blow-down leads to IPAL if Phosphate is injected.
Source: Ministry of Environment Regulation No.8 / 2009 (annex 1)

Table 5.1.3-5 Effluent Standards for Boiler Blow-Down of CPU of Thermal Power Plant

No.	Parameters	Unit	Limit
1	pH	-	6-9
2	Copper (Cu)	mg/L	1
3	Iron (Fe)	mg/L	3

Note: In case no cooling tower blow-down leads to IPAL if Phosphate is injected.
Source: Ministry of Environment Regulation No.8 / 2009 (annex 1)

Table 5.1.3-6 Effluent Standards for Cooling Tower Blow-Down of CPU of Thermal Power Plant

No.	Parameters	Unit	Limit
1	pH	-	6-9
2	Free Chlorine (Cl2)*	mg/L	1
3	Zinc (Zn)	mg/L	1

Note: In case no cooling tower blow-down leads to IPAL if Phosphate is injected.
Source: Ministry of Environment Regulation No.8 / 2009 (annex 1)

Table 5.1.3-7 Effluent Standards for Demineralization of Water Treatment Plant of CPU

No.	Parameters	Unit	Limit
1	pH	-	6-9
2	TSS (Total Suspended Solid)	mg/L	100

Note: In case no demineralization/WTP leads to IPAL.
Source: Ministry of Environment Regulation No.8 / 2009 (annex 1)

2) Supporting Unit

Table 5.1.3-8 Effluent Standards for Cooling Water

No.	Parameters	Unit	Limit
1	Temperature	^0C	40
2	Free Chlorine (Cl2)*	mg/L	0,5

Note: In case no cooling water leads to IPAL.
Source: Ministry of Environment Regulation No.8 / 2009 (annex 2)

Table 5.1.3-9 Effluent Standards for Desalination

No.	Parameters	Unit	Limit
1	pH	-	6-9
2	Salinity	0/00	Within 30 m from the exit point of discharged wastewater to the s ea, the salinity of waste water shall remain the same as n atural salinity of the sea water.

Note: In case no desalination leads to IPAL.
Source: Ministry of Environment Regulation No.8 / 2009 (annex 2)

Table 5.1.3-10 Effluent Standards for FGD System (Sea Water Wet Scrubber)

No.	Parameters	Unit	Limit
1	pH	-	6-9
2	$SO4^{(2-)}$	%	The maximum increase of the sulfate from inlet sea water not more than 4 %

Note: In case no FGD (Sea Water Wet Scrubber) leads to IPAL.
Source: Ministry of Environment Regulation No.8 / 2009 (annex 2)

3) Coal Stock Pile

Table 5.1.3-11 Effluent Standards for Coal Stockpile

No.	Parameters	Unit	Limit
1	pH	-	6-9
2	TSS	mg/L	100
3	Fe	mg/L	5
4	Mn	mg/L	2

Note: In case no coal stockpile leads to IPAL.
Source: Ministry of Environment Regulation No.8 / 2009 (annex 2)

4) Oily Water

Table 5.1.3-12 Effluent Standards for Oily Water

No.	Parameters	Unit	Limit
1	COD	mg/L	300
2	TOC	mg/L	110
3	Fat and Oil	mg/L	15

Note: In case no oily water leads to IPAL.
Source: Ministry of Environment Regulation No.8 / 2009 (annex 3)

(3) Environmental Standards

Table 5.1.3-13 Environmental Standards of Ambient Air Quality

No	Parameter (time measurement)	Unit	Standard	Metoda/Alat
1	Sulfur Dioxide (SO_2)			
	(1 hour)	µg/Nm^3	900	Pararosanilin
	(24 hour)	µg/Nm^3	365	Pararosanilin
	(1 year)	µg/Nm^3	60	Pararosanilin
2	Nitrogen Dioxide (NO_2)			
	(1 hour)	µg/Nm^3	400	Saltzman
	(24 hour)	µg/Nm^3	150	Saltzman
	(1 year)	µg/Nm^3	100	Saltzman

No	Parameter (time measurement)	Unit	Standard	Metoda/Alat
3	Carbon Monoxide (CO)			
	(1 hour)	$\mu g/Nm^3$	30.000	NDIR
	(24 hour)	$\mu g/Nm^3$	10.000	NDIR
	(1 year)	$\mu g/Nm^3$	-	NDIR
4	Hidrocarbon (HC) *(3 hours)*	$\mu g/Nm^3$	160	GC / Flame Ionization
5	Oxsidant (O_3)			
	(1 hour)	$\mu g/Nm^3$	235	Chemiluminescent
	(1 year)	$\mu g/Nm^3$	50	Chemiluminescent
6	Dust (TSP) *(24 hours)*	$\mu g/Nm^3$	230	Gravimetric
	(1 year)	$\mu g/Nm^3$	90	Gravimetric
7	Pb *(24 hours)*	$\mu g/Nm^3$	2	Gravimetric
	(1 year)	$\mu g/Nm^3$	1	Gravimetric
8	PM_{10} *(24 hours)*	$\mu g/Nm^3$	150	Gravimetric
	$PM_{2.5}$ *(24 hours)*	$\mu g/Nm^3$	65	Gravimetric
	(1 year)	$\mu g/Nm^3$	15	Gravimetric
9	Dustfall			
	On settlement (30 days)	$tons/km^2$	10	Gravimetric
	On industry (30 days)	$tons/km^2$	20	Gravimetric
10	Total Fluorides (as F)			
	(24 hours)	$\mu g/Nm^3$	3	Specific Ion
	(90 days)	$\mu g/Nm^3$	0,5	Electrode
11	Fluor Index *(30 days)*	40 cm^2 of limited filter paper	100	Colourimetric
12	Chlorine & *(24 hours)*	$\mu g/Nm^3$	150	Specific Ion
	Chlorine Dioxide *(24 hours)*	$\mu g/Nm^3$		Electrode
13	Index Sulphat *(30 days)*	Mg SO_3/100 cm_3 Of lead peroxide	1	Colourimetric Peroxide Candle

Note: No.10 through 13 only coming into force for the area/region of Chemical Industry Base (example : Petro Chemical Industry, Preparation of sulfuric acid industry)

Source: Government Regulation No.41 / 1999

Table 5.1.3-14 Ambient Air Quality Standard based on Provincial Regulation of Jakarta

No.	Parameter	Measurement Time	Quality Standard
1	Sulfur Dioxide (SO_2)	1 Hour	900 ug/Nm^3 (0,34 ppm)
		24 Hour	260 ug/Nm^3 (0,1 ppm)
		1 Year	60 ug/Nm^3 (0,02 ppm)
2	Carbon Monoxide (CO)	1 hour	26.000 ug/Nm^3 (23 ppm)
		24 hour	9.000 ug/Nm^3 (8 ppm)
3	Nitrogen Dioxide (NO_2)	1 Hour	400 ug/Nm^3 (0,2 ppm)
		24 Hour	92,5 ug/Nm^3 (0,05 ppm)
		1 Year	60 ug/Nm^3 (0,003 ppm)
4	Oxidant (O_3)	1 hour	200 ug/Nm^3 (0,05 ppm)
		1 year	30 ug/Nm^3 (0,015 ppm)
5	Hidrocarbon (HC)	3 hour	160 ug/Nm^3 (0,24 ppm)
6	Particle < 10 urn (Pmio)	24 hour	150 ug/Nm^3
7	Particle < 2.5 um ($PM_{2,5}$)	24 hour	65 ug/Nm^3
		1 year	15 ug/Nm^3
8	Dust (TSP)	24 hour	230 ug/Nm^3
		1 year	90 ug/Nm^3
9	Plumbum (Pb)	24 hour	2 ug/Nm^3
		1 year	1 ug/Nm^3

Source : Annex 1 of Jakarta Governor Decree No.551 / 2001 on Ambient Air and Noise Level Standard for Jakarta

Table 5.1.3-15 Environmental Standards of Surface Water Quality (River, Swamp, Lake)

No.	Parameter	Unit	Standard	Method/Tool
I	**PHYSICAL**			
1	Temperature	^oC	Deviation <3	APHA, ed. 20, 1998, 2550-B
2	TSS +	mg/L	1000	APHA, ed. 21, 2005, 2540-D
3	TDS +	mg/L	50	APHA, ed. 21, 2005, 2540-C
II	**CHEMICAL**			
1	pH *)		6 to 9	APHA, ed. 21, 2005, 4500-H+-B
2	BOD5 *)	mg/L	2	APHA, ed. 20, 1998, 510-B/Winkler
3	COD +	mg/L	10	APHA, ed. 21, 2005, 5220-D
4	DO	mg/L	6	APHA, ed. 14, 1975, 422-F
5	Phosphate (PO_4-P)	mg/L	0,2	APHA, ed. 14, 1975, 425-E
6	Ammonia (NH_3-N) +	mg/L	0,5	APHA, ed. 21, 2005, 4500-F
7	Nitrate (NO_3-N)	mg/L	10	APHA, ed. 14, 1998, 4500-NO3-B
8	Nitrite (NO_2-N) +	mg/L	0,06	APHA, ed. 21, 2005, 4500-B
9	Chloride (Cl)	mg/L	600	APHA, ed. 20, 1998, 4500-cIF
10	Arsenic (As)	mg/L	0,005	APHA, ed. 20, 1998, 3114-As-A
11	Cobalt (Co)	mg/L	0,2	APHA, ed. 20, 1998, 3113-B/AAS
12	Barium (Ba)	mg/L	1	APHA, ed. 20, 1998, 3111-B/AAS
13	Selenium (Se)	mg/L	0,01	APHA, ed. 20, 1998, 3111-B/AAS
14	Cadmium (Cd)	mg/L	0,01	APHA, ed. 20, 1998, 3111-B/AAS
15	Chrome Hexavalen (Cr_6+)	mg/L	0,05	APHA, ed. 20, 1998, 3111-B/AAS
16	Copper (Cu)	mg/L	0,02	APHA, ed. 20, 1998, 3111-B/AAS
17	Iron (Fe) +	mg/L	0,3	APHA, ed. 21, 2005, 3500-Fe-B
18	Lead (Pb)	mg/L	0,03	APHA, ed. 20, 1998, 3111-B/AAS
19	Manganese (Mn)	mg/L	0,1	APHA, ed. 20, 1998, 3500-Mn/AAS
20	Mercury (Hg)	mg/L	0,001	APHA, ed. 20, 1998, 3500-Hg
21	Zinc (Zn)	mg/L	0,05	APHA, ed. 20, 1998, 3111-B/AAS
22	Cyanide (CN)	mg/L	0,02	APHA, ed. 20, 1998, 4500-CN-E
23	Fluoride (F)	mg/L	0,5	APHA, ed. 20, 1998, 4500-F-D
24	Sulfate (SO_4-S)	mg/L	1	APHA, ed. 20, 1975, 427-C
25	Chlorine (C_{l2}) free	mg/L	0,03	APHA, ed. 20, 1998, 4500-CI-B
26	Sulfide (H_2S)	mg/L	0,002	APHA, ed. 20, 1998, 4500-S2-F
27	Oil & Grace	µg/L	1	APHA, ed. 20, 1998, 5520 B-C
III	**MICROBIOLOGY**			
	E-Coli	sum/100ml	0	APHA, ed. 20, 1998, 9221 1-F/MPN
	Total Coli	sum/100ml	0	APHA, ed. 20, 1998, 9221 A-F/MPN

Source: Government Regulation No.82/ 2001

Table 5.1.3-16 Environmental Standards of Ground Water Quality (Well Water)

No.	Parameter	Unit	Standard	Method/Tool
I	**PHYSICAL**			
1	Total Dissolved Solid	mg/L	1000	APHA, ed. 21, 2005, 2540-C/Gravimetric
2	Turbidity	NTU	5	APHA, ed. 20, 1998, 2130-B/Turbidimetric
3	Temperature	^{o}C	Neutral	APHA, ed. 20, 1998, 2550-B/Turbidimetric
4	Color	TCU	15	APHA, ed. 20, 1998, 2120-C/Colorimetric
5	Odor		Neutral	Organoleptik
II	**CHEMICAL**			
1	Mercury (Hg)	mg/L	0,001	APHA, ed. 20, 1998, 3500-HG/Spektro
2	Arsenic (As)	mg/L	0,01	APHA, ed. 20, 1998, 3114-As-A/Spektro
3	Barium (Ba)	mg/L	0,7	APHA, ed. 20, 1998, 3111-B/AAS
4	Boron (B)	mg/L	0,3	APHA, ed. 20, 1998, 3111-B/AAS
5	Cadmium (Cd)	mg/L	0,003	APHA, ed. 20, 1998, 3111-B/AAS
6	Chrome Cr)	mg/L	0,05	APHA, ed. 20, 1998, 3111-B/AAS
7	Copper (Cu)	mg/L	2	APHA, ed. 20, 1998, 3111-B/AAS
8	Cyanide (Cn)	mg/L	0,07	APHA, ed. 20, 1998, 4500-CN-E/Spektro
9	Fluoride (F)	mg/L	1,5	APHA, ed. 20, 1998, 4500-F-D/SPADNS
10	Nickel (Ni)	mg/L	0,02	APHA, ed. 20, 1998, 3113-B/AAS
11	Nitrate (NO_3-N)	mg/L	50	APHA, ed. 14, 1998, 4500-NO3-B/Brusin Slft/Spectro
12	Nitrite (NO_2-N)	mg/L	3	APHA, ed. 21, 2005, 4500-B/Colorimetrik, Spektro
13	Selenium Se)	mg/L	0,01	APHA, ed. 20, 1998, 3111-B/AAS
14	Ammonium (NH_3-N)	mg/L	1,5	APHA, ed. 21, 2005, 4500-F/Phenat/Spectro
15	Aluminium (Al)	mg/L	0,2	APHA, ed. 20, 1998, 3111-B/AAS
16	Chlorine (Cl)	mg/L	250	APHA, ed. 20, 1998, 4500-F/Spectro
17	Calcium Carbonate ($CaCO_3$)	mg/L	500	APHA, ed. 20, 1998, 2340-C/Titrimetrik EDTA
18	Sulfide (H_2S)	mg/L	0,05	APHA, ed. 20, 1998, 4500-S2-F/lodometrik
19	Iron (Fe)	mg/L	0,3	APHA, ed. 21, 2005, 3500-FeB/Spektro
20	Manganese (Mn)	mg/L	0,1	APHA, ed. 20, 1998, 3500-Mn/AAS
21	pH	mg/L	6.5-8.5	APHA, ed. 21, 2005, 4500-H+B/pH meter
22	Natrium (Na)	mg/L	200	APHA, ed. 20, 1998, 3111-B/AAS
23	Sulfate (SO_4)	mg/L	250	APHA, ed. 20, 1998, 4500-E/Spectro
24	Zinc (Zn)	mg/L	3	APHA, ed. 20, 1998, 3111-B/AAS
III	**MICROBIOLOGY**			
	E-Coli	sum/100ml	0	APHA, ed. 20, 1998, 9221 1-F/MPN
	Total Coli	sum/100ml	0	APHA, ed. 20, 1998, 9221 A-F/MPN

Source: Decision of Minister of Health No.907 / 2002

Table 5.1.3-17 Environmental Standards of Sea Water Quality

No.	Parameter	Unit	Standard	Method/Tool
I	**PHYSICAL**			
1	Clarity	Meter	>5	Secchi disk
2	Odor	-	Alami	Chemical sense
3	Turbidity	Ntu	<5	Turbidimeter
4	Total Suspended Gerbage	mg/L	80	APHA 20th 1988, 2540 D/Gravimetri
5	Gerbage	-	Nihil	Visual
6	Temperature	ºC	28 – 32	APHA 20th 1988, 2540 D/Gravimetri
7	Oil Film	mg/L	N/A	Spectrophotometric
II	**CHEMICAL**			
1	pH		7-8,5	APHA, 20th 1998, 4500-H*-B/pH meter
2	salinity	%	33-34	APHA, 20th 1998, 2520-B/Refractometrik
3	dissolved Oxygen	mg/L	>5	APHA, 20th 1998, 2520-O-B/Winkler/DO meter
4	BOD5	mg/L	20	APHA, 20th 1998, 2520-OX-B/ Winkler/DO meter
5	Total Ammonium (NH_3-N)	mg/L	0,3	APHA, 20th 1998, 4500F/Spectrofotometer
6	Phosphat (PO_4-P)	mg/L	0,015	APHA, 20th 1998, 4500-P-E/ Spectrofotometer
7	Nitrate (NO_3-N)	mg/L	0,008	APHA, 20th 1998, 4500-NO3-B/ Spectrofotometer
8	Cyanide (CN)	mg/L	0,5	APHA, 20th 1998, 4500-CN-E/ Spectrofotometer
9	Sulfida (H_2S)	mg/L	0,01	APHA, ed. 20th 1998, 4500-S2-F/lodometrik
10	Phenol	mg/L	0,002	APHA, ed. 20th 1998, 5530-C/Amino Antifirin
11	Surfactant (detergen)	mg/L/MBAS	1	APHA, ed. 20th 1998, 5540-C/MBAS
12	Oil and Grace	mg/L	1	APHA, ed. 20th 1998, 5520-B-C/Gravimetrik
III	**METAL**			
1	Mercury (Hg)	mg/L	0,001	APHA, 20th 1998, 3500-Hg
2	Khromium heksavalen (Cr_6)	mg/L	0,005	APHA, 20th 1998, 3111-B/AAS
3	Arsen (As)	mg/L	0,012	APHA, 20th 1998, 3114-As-A
4	Cadmium (Cd)	mg/L	0,001	APHA, 20th 1998, 3111-B/AAS
5	Copper (Cu)	mg/L	0,008	APHA, 20th 1998, 3111-B/AAS
6	Lead ((Pb)	mg/L	0,008	APHA, 20th 1998, 3111-B/AAS
7	Zinc (Zn)	mg/L	0,05	APHA, 20th 1998, 3111-B/AAS
8	Nickel (Ni)	mg/L	0,05	APHA, 20th 1998, 3111-B/AAS
IV	**BIOLOGY**			
1	Coliform total	MPN/100 ml	1000	APHA, 20th 1998, 9221-A-F
2	Fecal coli	Sel/100ml	Nihil	APHA, 20th 1998, 9221-A-F

Source: Decision of Minister of Environment No.51 / 2004

Table 5.1.3-18 Environmental Standards of Noise

Land Utilization Type/Activity Environment	Level of Noise db (A)
a. Land Utilization Type	
1. Housing Complex and Settlement	55
2. Trade and Service Center	70
3. Office and Trade Area	65
4. Green Open Space Area	50
5. Industrial Area	70
6. Government and Public Facility	60
7. Recreation Area	70
8. Specific Area:	
- Airport	-
- Railway Station	60
- Sea Port	70
- Cultural Heritage	-
b. Activity Environment	
1. Hospital	55
2. School	55
3. Religion Facility	55

Note: Decree of Ministry of Environment No.48/1996

Measurement methods of noise level can be done in the following two ways:

1) Simple Ways in measuring Noise Level

With a sound level meter used to measure the sound pressure level db (A) for 10 (ten) m inutes for each measurement. readings performed every 5 (five) seconds. 2) How to Jump Integrating with a sound level meter which has a facility LTMS measurement, ie LEQ by measuring the time every 5 seconds, do measurements for 10 (ten) minutes.

Time measurements were made during 24-hour activity (LDN) dencan way during day activities of the highest level for 10 hours (LD) at intervals 06.00-22.00 and activities in the day for 8 hours (LN) on the interval 22:00-6:00. Each measurement must be able to re present a certain time interval with establis h at least four times during the da y and the m easurements at night at least 3 days of measurement time, for example:

- L1 was taken at 7:00 mewakli hours 06:00 to 9:00
- L2 is taken to represent the hours of 10:00 hours 09:00 to 11:00
- L3 was taken at 15.00 hours represent the hours of 2:00 p.m. to 17:00
- L4 taken on at 20.00 represents, at 17:00. - 22.00
- L5 was taken at 23:00 hours represent hours of 22.00 - 24.00
- L6 was taken at 01:00 hours represent hours of 24.00 - 03.00
- L7 was taken at 04:00 hours represent hours of 3:00 to 06:00

Description:

- LEQ: Equivalent Continuous Noise Level Noise Level or continuous Equivalent noise is a particular value of an arbitrary noise (fluctuating over time, which is equivalent to the noise level of noise is steady (steady) at the same time interval. Its unit is dB (A).
- LTND = Leq a time sampling every 5 seconds
- LD = Leq during the daytime
- LN = Leq during the night
- LSM = Leq during the day and night.

2) Method of calculation:

(from example)

L_D is calculated as follows:
LD = 10 log 1/16 (T1.10 01L5 +.... + T4.1001L5) dB (A)

LN calculated as follows :

LN = 10 log 1/8 (T5.10 01L5 +.... + T7.1001L5) dB (A)

To determine if noise levels already exceed the noise levels it is necessary to find the value of L_{DN} from field measurements. L_{DN} is calculated from the formula:

LDN = 10 log 1/24 (16.10 01L5 +.... + 8.1001L5) dB (A)

3) Method of Evaluation

L_{DN} values are calculated in com parison with the standard noise level specified with a tolerance of +3 dB (A)

Table 5.1.3-19 Environmental Standards of Vibration for Pleasant and Healthy Environment

Frequent (Hz)	Value of Vibration level in micron (10^{-6} meter)			
	Annoting (sometimes)	Annoying	Unpleasant	Unhealthy
4	< 100	100 - 500	> 500 - 1000	> 1000
5	< 80	80 - 350	> 350 - 1000	> 1000
6,3	< 70	70 - 275	> 275 - 1000	> 1000
8	< 50	50 - 160	> 160 - 500	> 500
10	< 37	37 - 120	> 120 - 300	> 300
12,5	< 32	32 - 90	> 90 - 220	> 220
16	< 25	25 - 60	> 60 - 120	> 120
20	< 20	20 - 40	> 40 - 85	> 85
25	< 7	17 - 30	> 30 - 50	> 50
31,5	< 2	12 - 20	> 20 - 30	> 30
40	< 9	9 - 15	> 15 - 20	> 20
50	< 8	8 - 12	> 12 - 15	> 15
63	< 6	6 - 9	> 9 - 12	> 12

Source: Decree of Ministry of Environment No 49/1996 (annex1)

Table 5.1.3-20 Standard Limits of Shock Vibration

Class	Type of Building	Vibration Speed (mm/second)
1.	Heritage and historical Building	2
2.	Building with minor damage	5
3.	Building with less damage	10
4.	Strong Building	10-40

Source: Decree of Ministry of Environment No.49/1996 (annex 4)

Table 5.1.3-21 Environmental Standards of Single Odor

No	Parameter	Limit	Unit	Method	Equipment Used
1	Ammonia (NH3)	ppm	2	Indophenol Methods	Spectrophotometer
2	Methyl Mercap-tane	ppm	0.002	Absorption Gas	Gas Chromatograph
3	Hydrogen Sulfide	ppm	0.02	a. Mercury Tiosinate b. Absorption Gas	Spectrophotometer Gas Chromatograph
4	Methyl Sulfide	ppm	0.01	Absorption Gas	Gas Chromatograph
5	Styrene	ppm	0.1	Absorption Gas	Gas Chromatograph

Note: ppm = perts per million
Source: Decree of Ministry of Environment No 50/1996

Mixed Odor:
The odor level, which comes from mixed odor is determined through sensor detection by more than 50 % of the EIA members or at least 8 member/persons.

5.1.4 JICA Guidelines for Environmental and Social Considerations

JICA is assisting the prefeasibility study for the Bojonegara Model Power Plant Plan. Therefore, it requires the Plan to comply with the JICA Guidelines for Environmental and Social Considerations, April 2004 (the JICA-ESC Guidelines), which can be accessed at the web site (http://www.jica.go.jp/english/operations/social_environmental/index.html).

JICA assistance for the prefeasibility study at Bojonegara is a part of assistance for 'The Project for Promotion of Clean Coal Technology (CCT) in Indonesia'. Therefore, the study is defined in the JICA Guidelines above as follows:

- Project type : Technical Cooperation for Development Planning < corresponding to 'Development Study (Master Plan Study)' in the 2004 Guidelines, which is applied to the Study concerned) >
- The Project is defined as Category-A project by JICA
- The Study includes the following 2 stages , and now at Stage 2 Pre-FS for model plant
  - Stage 1: Formulation of the roadmap of CCT introduction (M/P type)
  - Stage 2: Pre-feasibility study for model coal-fired power plant(s)

JICA Advisory Committee for ESCs was organized in October 2011, to give advice on the ESC process of this Project whether it comply with the JICA-ESC Guidelines.