out by a Tripika team, PLN teams, and community leaders who are members of the land acquisition team (Team 9) in accordance with the agreement with the proponent resident landowners.

Table 1.1. Extensive Land Usage

No	Type of Usage	Area (m^2)
1	Construction of the power plant, PLTMG	
	C. Home Diesel	1.000
	CI. Workshop	2.000
	CII. Clean Water Tank	5.000
	CIII. WWTP (waste treatment)	3.500
	CIV. Control room	3.000
	CV. WTP (Water Treatment)	20.000
	CVI. Fire house	6.000
	CVII. Water reservoir	2.000
	CVIII. Warehouse	5.000
	CIX. Turbine houses	40.000
	CX. Installation of substation	80.000
	CXI. Security post	500
	CXII. Office Buildings	5.000
	CXIII. Turbine Control Room	5.000
	CXIV. Parking area	10.000
	CXV. Pump house	1.000
	CXVI. Mosque	1.000
	CXVII. RTH	80.000
Total		**270.000**

Source : PT. PLN (Persero)

Compensation plan implementation will be conducted on affected land of footprint tower, plants and tall buildings and exposed the limits of free space.

Land acquisition refers to Government Regulation No. 65 Year 2006 on Land Acquisition for Public Interest and the Regulation of the Minister of Mines and Energy No. 01 of 1992 on Free Space Air Line High Voltage (SUTT) and the Air Line Extra High Voltage (SUTET) For the Distribution of Electric Power. Tower across the forest will be lifted up to ± 9 m in order to avoid the felling of trees that fall into a free space. Compensation will be given to land which has

footprint tower STT 150 kV, while land and buildings under SUTT 150 kV lines will get compensation in accordance with the Ministerial Decree.

Table 1.2. Free Space Air Line High Voltage (SUTT) and the Air Line Extra High Voltage (SUTET) For Distribution of Electric Power

No	Location	SUTT 70 kV (m)	SUTT 150 kV (m)	SUTET 500 kV	
				Dual Circuit (m)	Single Circuit (m)
1.	Open field or open area	6,5	7,5	10	11
2.	Regions with specific circumstances				
2.1	The non-fireproof building	12,5	13,5	14	15
2.2	Fireproof building	3,5	4,5	8,5	8,5
2.3	Traffic / highway	8	9	15	15
2.4	Trees are generally forests, plantations	3,5	4,5	8,5	8,5
2.5	Sports field	12,5	13,5	14	15
2.6	Other SUTT, air conductor low voltage, telecommunication networks, radio antenna, antenna television and cable cars	3	4	8,5	8,5
2.7	Regular rail	8	9	15	15
2.8	Ordinary bridges, retaining iron frame conductor, the nearest electric trains etc.	3	4	8,5	8,5
2.9	The highest point on the tide mast / highest on air traffic	3	4	8,5	8,5

Source : SNI 04-6918-2002

B. Construction Phase

1. Mobilization and demobilization of labor

   Mobilization of the workforce that will be used during the construction phase is relatively large in number as compared to the operating phase. Labor can be taken from the local village communities in accordance with the criteria required where recruitment system will be coordinated with the components of the local community (village head) in a transparent manner. The contract system will be applied to workers during the construction

period. Labors that are needed during the construction phase include contractors, power sub-contractors, suppliers, labor inspectors from the PLN, and field workers (unskilled labor). Estimates of the amount of labor needed based on his expertise are as follows:

Table 1.3.
Estimated Manpower Requirement
Based on Expertise In Construction Phase

No	Expertise	Needs (people)
1	Project manager	5
2	Machine operator	10
3	Steel workers	15
4	Workers mechanical field	15
5	Power installation	15
6	Electrical power	15
7	Power Piping	15
8	Power timber	15
9	Field force iron	15
10	Power painting	10
11	And unskilled laborers	40
12	Another worker	25
Total		**195**

Source: PT PLN (Persero)

2. Manufacture and operation of base camp

   Manufacture and operation of *base camp* is done to facilitate the construction activities. At the location of activities, *base camp* was built and is now standing, and it is include the buildings for PT. PLN (Persero), Wartsila, PP, and Labor. This activity includes the provision of clean water, lighting facilities and communication devices as well as sanitary facilities.

3. Making the Access Road

   In early development, the work to be done is the construction of access roads as it is supporting the mobilization of equipment, material and labor required.

a. Design and construction of vehicles adapted to cargo transported
b. Has a cargo security equipment, including the charge that hangs towards the rear up to 2 meters, such as clamps, special screws, steel wire rope, webbing harnesses, chains, nets, tarpaulins, ropes polyester / polypropylene and shoring bars.
c. Maintain a minimum Ground Clearance on trailer
d. Adding bulkhead (headboard / sideboard), beams, transverse beams, valves and others
e. Including the company name clearly on the body of the vehicle next to the left and right
f. Using the driver's nameplate on the dashboard
g. Equipped with a letter of Lading

The vehicles that carry material containing Hazardous and Toxic Materials (B3) will use portable tanks and containers that have obtained the certificate of type test and road worthiness. Each of the transport vehicles will be equipped with placards according to type B3 taken and safety equipment, health and safety. During transport will use the path that has been determined by considering the frequency of traffic.

Types of heavy equipment commonly used in the work of this project are as follows:

Table 1.4. The type and The Amount of Needs of Heavy Equipment

No	Equipment	Unit
1	Crawler cranes	2
2	Truck Cranes / Lowbed Trailer	4
3	Hydraulic Cranes	4
4	Pick-up Truck	12
5	Dump Truck	10
6	Bulldozer	3
7	Excavator / Back Hoe	5
8	Compactor / Motor Grander	2
9	Hydraulic Shovels	1
10	Fork Lift	2
11	Concrete pump	2
12	Asphalt Pavers	1
13	Submersible water pump	5
14	Compressor	5
15	Welding Machines	5
16	Generator	3
17	Misc Motors	10
18	Scraper	1
19	Pile Driver / Hammer	3
20	Wheel Loader	2

Source : PT PLTN (Persero)

5. Land preparation

Stages of civil works on site preparation activities include:

a. *Site preparation*

b. *Site development*

- *Stripping* (Peeling land)
- Landfill obtained from outside locations
- Soil compaction pile
- Manufacture of channels and strengthening existing water (irrigation canals, small rivers)

Broadly speaking, land preparation activities include:

- *Site preparation* is the project site clearance of existing vegetation around the site, stripping topsoil and disposal to a predefined location. Then the flatten process of land of rocky material, soil ridges,

waterways and other constructions that are not needed.

- Furthermore, the initial excavation and burying work of soft ground or surface layer of soil stripping *(stripping),* and the results of stripping the surface to be collected at the *stock pile.*
- Usually the material requirements for burying land is according to the limit of soil surface, in detail the design has been made

The land acquisition activities for SUTT are to clean the tower footprint of plants and other distractions before foundation construction work begins. In this activity was also conducted felling stand / tree at the site of the tower and stands entering the free space along the path of SUTT development.

6. Construction of the main and supporting buildings

Implementation activities of this work include:

- Installation of piles
- Manufacture of concrete foundation
- Construction of steel structures and reinforced concrete structures *(reinforced concrete* structure)

Steel structure chosen for buildings that require a fast time in the process of development. Although the structure is a steel structure, but some parts of the structure can be such boned concretes like other plates.

While supporting the development of work includes:

- Road construction site in the neighborhood
- Construction of drainage channels
- Green belt development

In general, the main and supporting building for the power plant to be constructed is as follows:

a. Plant House Development

Construction of plant houses include:

- Building Turbines and Generators
- Administration buildings
- Building Control Sub Station
- Building Control *Water Treatment*
- Building Control Gas
- Workshop *(Workshop)* and Warehouse
- Building chimney *(Stack)*

b. Development of Water and Wastewater Treatment Unit

Wastewater treatment systems will be built with sufficient capacity to collect and treat water from all activities in the power plant to meet the criteria to be discharged into the body of receptor. Liquid waste derived from domestic activities (sanitary waste) will be processed with the *treatment* of its own appropriate quality requirements of water discharge.

c. Construction of Cooling Water System Facilities

For cooling the production process equipment, used underground water (deep wells), where underground water is taken and fed into the pump house that is fitted with a filter, and then released back into the path of *discharge. Intake line* is *barried pipe* to the *intake* tower, while the *discharge line* from *condenser* to *seal the pit* is *barried* pipe, then, from the *seal pit* to the *out fall* is an *open* channel.

d. Air Quality Control Development

Air quality control to be built to prevent impact on the environment is the chimney *(stack)*. Chimney will be built using a *steel flue liner* made of steel and coated with concrete chimney. The unit is also equipped premises continuous emission monitoring system / *Continuous Monitoring Emission* (EMS) to monitor the content of the exhaust gases such as SO_x, NO_x and CO.

e. Against the Dangers of Fire Prevention System

To prevent the danger of fire, the fire hydrant system will be used in power plant buildings, such as:

- *Fire water system* for buildings, etc.
- *Foam system* for *oil tanks*
- CO_2 *system* for hardware and electronic equipment

Fire Protection System consists of:

- *Automatic controlled high velocity spray water* to the turbine hall and transformer
- *Automatic controlled low velocity water* to the fuel tank
- *Automatic total flooding system* for computer rooms and control rooms
- Portable fire extinguisher assembled in strategic area
- For fire alarm and fire detection systems

And the current stage of development that is being worked on and built is a plant house.

While, construction activity in the construction SUTT include:

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While, construction activity in the construction SUTT include:

a. Installation of foundation and erection of tower

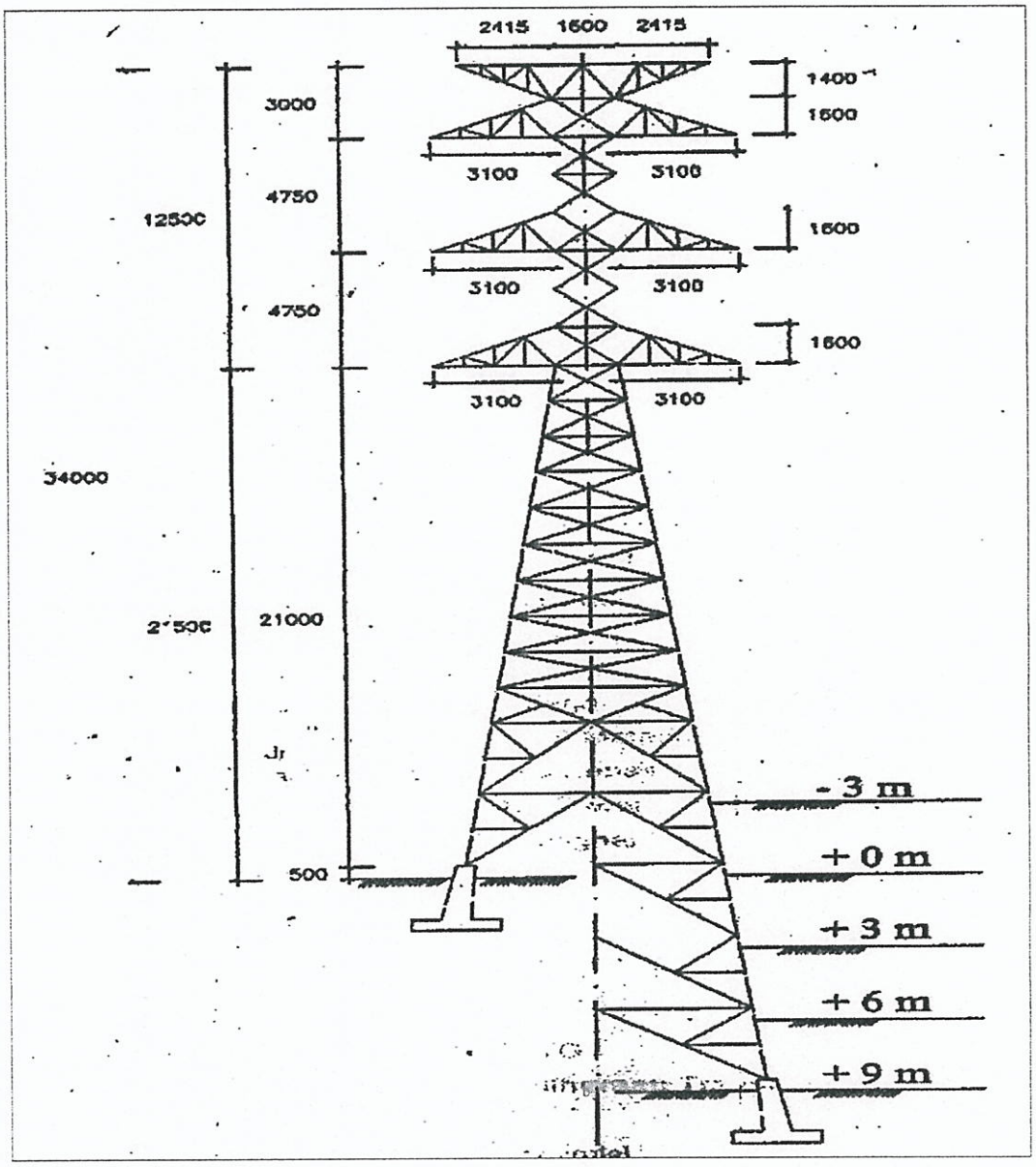
Construction of the foundation and establishment SUTT tower construction project is based on the type and size of the tower foundation. The type and size of the tower foundation is designed and built based on the results of the investigation of soil and the amount of load calculation tower. These activities include digging a hole for the foundation, manufacturing iron begesying and casting the foundation for mounting the tower that to be installed.

The foundation used is the foundation Lattice Tower with reinforced concrete construction to tie the tower legs (stub) with the earth. Type of tower foundation adapted to the soil conditions of the site where the tower is located, and the burden that will be borne by the tower. Foundation tower which bear the brunt of tensile (tension) is designed stronger / bigger than the tower-type suspension. Stub installed together with the installation of the foundation and fastened together with the foundation, where the top stub appears to be about 1 meter from the ground and covered with stucco and then painted to not easy to rust. Most types of tower foundation that will be used on line 150 kV of Bangkanai SUTT - Muara Teweh is a kind of Auger foundation.

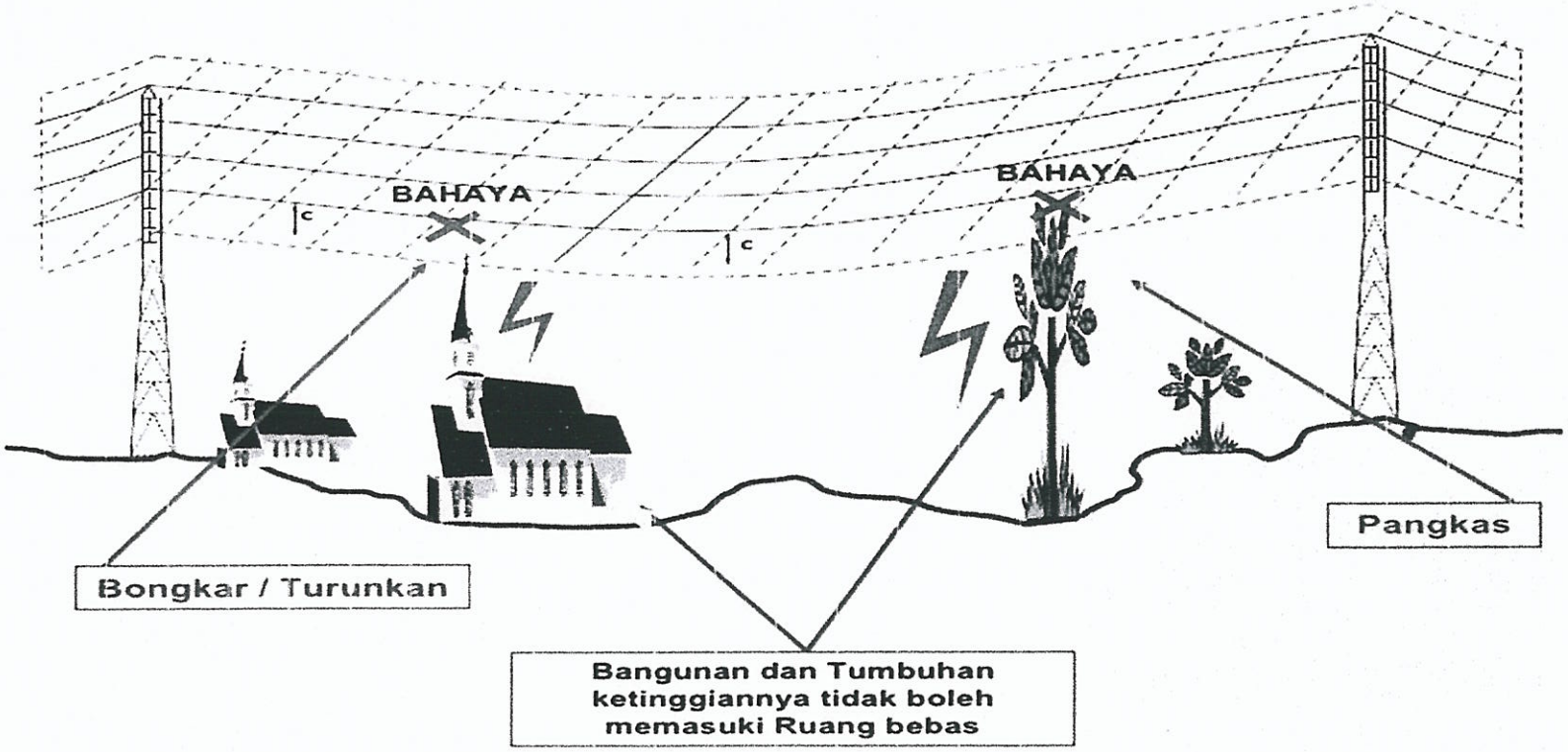
Position or condition that is located on sloping land positions built concrete or masonry couple of times to avoid landslides. While the foundation is located in the

rice fields, swamps and sandy places built around the boundary wall to prevent soil erosion.

Tower type / tower is Lattice Tower made of steel profiles and every one tower consists of several sections / pieces. Steel truss tower fitted every distance between 200-400 m, in tune with the ground / topography. Normal tower height of about 32 m, can be lifted as needed to +3, +6, +9, +12 to +60 +22 even. Elevation of the tower is also made if the change of high buildings and trees around as well as the height of terrain changes. How to install the tower body carried out each piece-by-piece from the bottom piece and successively mounted thereon connections and assembled using bolt system and also bound by using bolts. Tower network secured from lightning by using a safety system that consists of conductors mounted on the top of the tower to the other and in grounding at every tower.



Picture 1.6. Tower SUTT 150 kV Type



Picture 1.7. Wide Longitudinal Section of Free Space of SUTT

b. Installation and withdrawal of wires

Conductor installation and withdrawals work are made after the erection of the tower is completed. Implementation of the conductor wiring is done and one section to the next section in sequence with the design and tension of the tension tower to other towers. Location of tension tower is chosen in an open and quite extensive area, because the tension drum tower is a conductor, tension meter and other equipment. Location Tension is at every corner and every corner if the distance is too long, then every 10 towers created a tension tower. Once compiled conductor drum exact location of the end of the conductor is connected to *york*, which is then connected to the wire inducement.

Conductor wire drawing activities carried out by using *pulling winches machines* or manually or using manpower. Conductor withdrawal work activities include:

- Installation insulator (separator between the wire conductors with the body of the tower) and equipment
- Withdrawal conductor and the ground wire
- Setting sag and tension

Installation of insulator is done if all the towers or tower had stood, then if all the insulators have been installed, the withdrawal of wires can be done. Conductor wire drawing done by putting coils of wire conductor in the most accessible locations which are

then connected with a wire rod horizontally from one tower to another. After a long wire conductor is sufficient then the wire rod will be removed and the wires will be drawn in accordance with a certain size under prescribed conditions.

For the system grounding (ground wiring) there are 2 types of materials that can be used is a wire made of copper and made of steel coated aluminum ACSR (Aluminum Conductor Steel Reinforced). Conductor used on this transmission line is 2 cct, ACSR 2 x 240 mm 2.

7. *Activity of Commissioning*

Activity of commissioning is a series of inspection activities and testing of electrical installations both means for tools, sub-systems and sub-systems in part, as stated in the contract so that it meets certain requirements and is declared ready to operate safely and reliable.

At the stage of commissioning to be checked against the installed power that can be generated compared to the power (output) plan, and also to determine the level of success in its operational time. When the power generated is less than the plan, then the potential revenue gain will be reduced, which will eventually result in failure of the overall planning, including financial projections. The process of commissioning including trial tests to plants generally carried out at the time of discharge conditions reaches a maximum, so the test can be performed

optimally and the period of implementation of reliability tests conducted over ± 600 hours continuously without termination.

C. Operation Phase

1. Recruitment

To support operations, it is required that labor with different specifications to suit the needs of about 50 people with skills specific. This activity will take place in the time before and after the operation, where labor requirements will be made in a planned customized based management and organizational structure have been made.

Recruitment at the time this project has been in operation will create new jobs. This becomes a great hope for the surrounding communities to gain employment and improve living standards for its economy.

2. Gas Distribution

Distribution of the main fuel in the form of natural gas carried by pipeline owned by PT. Salamander which then flowed into CNG Plant. The gas will be supplied by PT. Salamander, and it is estimated at 20 million standard cubic feet per day (MMSCFD) for which the contract expires in 2033.Gas will be compressed on Plant of *Compressed Natural Gas* (CNG) by maintaining the phase of natural gas remains in the gas phase. CNG process is done with the help of the existing compressor to compress so that the pressure (pressure) will rise. Fuel delivery process must always be controlled because it is very risky of leak and fire.

3. Operation of PLTG/MG and Maintenance

This plant is planned to operate every day for 24 hours straight. Distribution of power from this plant will be divided by 2, namely to Melak CGI and Muara Teweh CGI. This operation activity will generate electrical energy from two (2) plant is a power plant of 140 MW and 155 MW with PLTMG of fuel produced on CNG Plant. Gas engine Technology used on machines of this plant is Wärtsilä 34 SG which has a high combustion efficiency and low pollution.

At the time of operation of the generating system has a short start time is ± 20 minutes and future operating or maintenance interval of up to ± 4000 hours. The instrumentation and control system carried out during plant operation are as follows:

a. Basic System

The control system is designed on the plant aims to obtain optimum function control processes, reliable, safe and easy to operate but still meet the economic principle. The level of economic operation can be achieved by using a control system based microprocessor called *Distributed Control System* (DCS). DCS is used to integrate control systems *Gas Turbine Generator* and for other auxiliary equipment control systems that use a *Programmable Logic Controller* (PLC) such as water treatment systems and other equipment control system. Besides, can reach the level of the operation of the economy, the level of reliability of DCS is quite high because of the

redundancy system both within each module process and the data bus that connects each module *processor.* In addition to the redundancy in hardware, pattern control system design also requires that if any *module* or the process is interrupted, the *module* or the process should not affect the *module* or a healthy process.

b. Configuration Control System

The plant control system configuration can be seen in the picture section of this document, which its configuration shows equipment group that is controlled by DCS and equipment group controlled by the PLC, and the integration of the control system for each piece of equipment being controlled. In addition, there is main control room that monitors and operates the entire equipment. Each control room is equipped with electronic which has function as a space to put *marshaling cubicle* and control equipment based on *microprocessor.*

c. Plant Control System

Plant control system based on DCS is designed specifically to control the entire process in plants and integrating each control function in order to achieve the most economical operating level. Level operation economically this can be achieved due to the use of *micro-processor* is very fast so as to record the data changes in the order of 1 *millisecond,* is able to carry out the *processing time* for *open-loop* within 150 *milliseconds* and *closed loop* within 250 *milliseconds,* able to detect damage to the equipment on the very

early stages through *diagnostic systems* that exist in the *Engineering Station* (ES).

Remote I / O usage is optimized to reduce the amount of control cable that connects the sensor and *transmitter* in the field with the I / O *module* in the electronic space.

d. Operator Sistem (OS)

Proses Process of plant operation and monitoring is done via the *operator station* supported by the *Generic Personal Computer* as a data *processor.* Plant operation can be done in a way that is without operator panel CRT or *static mimic panels.* These panels and *static mimic* can be eliminated due to the function of monitoring and control functions of each panel were replaced by some OS that can be alternated and mutually *back-upping* each other. The OS provides all the important data required by the operator to monitor and operate plants in *line* with *real time* data. This can be achieved because each OS simultaneously and *independently* receive data directly from the main data bus. Software for OS developed for easy use by the operator and has a high level of security both in terms of process control and operator side. Impressions of data on CRT are designed in the form of *graphic display, pull down menus, pop-up windows, dialog boxes* and *icons* so that the operator can easily select the information display on the LCD. With the facility shows that *"user friendly",* the OS can guide and assist

the operator in daily operation and when required swift action to deal with emergencies.

e. ***Engineering Station* (ES)**

Engineering Station based on Generic Personal Computer provides all the needs of engineering and maintenance for Generation Control System, Operator Station and Management Station which include:

- *Facility to compose and edit the look on the OS in the form of a collection of graphical components that already have attributes link to other control components.*
- *Managing database for process control, reporting in the Management Station, statistical calculations and other calculations.*
- *Facility to create and revise logic control.*
- *Facilities for carrying out diagnostic system for all components of the control system.*
- *The exchange of data from field instruments with ES through the main data bus, while the exchange of information from the ES to the OS and MS via Ethernet*

f. ***Management Station* (MS)**

Management Management Station which was placed in the main control room and in the administration building, designed to present data in the form of managerial reports generator that enable operators and operations managers do the right decision in the plant operate as economical as possible.

Management Station has access to the entire database that is to be able to provide:

- Statistical reports such as *stack emissions,* fuel consumption, and the relationship between electric powers generated by the fuel.
- Report for work and efficiency.
- Manual input of data.
- Facility to make a report.
- Graphical display of an existing report.
- Long-term data storage.

Plant maintenance that is performed is in order to perform maintenance, inspection and repair in order to maintain the efficiency and reliability of the plant. Maintenance activities include preventive maintenance (routine and periodic), prediction and improvement.

Maintenance is routinely conducted when the unit is operating and ready for the road. While periodic maintenance activities carried out during a certain time, which includes:

a. Examination of Fuel Space / Room

This checking process is performed by stopping the plant operation during a certain time every 300 times *the start-stop* or has reached 4,000 hours of operation. The activities that need to be made include:

- Examination of the combustion chamber, the channel between the *(transition piece), single-level turbine blades*
- Recalibration control equipment, measuring and securing

- Check the level of wear and tear, damage to equipment corrosion, dirt on the equipment in the combustion chamber and completeness
- Planning the need for spare parts

b. Examination of Passing Line of Gas

Gas passing line inspection activities by stopping the operation of plants for a certain time every 600 times the *start-stop* or has reached 8,000 hours of operation, including :

- Examination of the combustion chamber
- Inspection of turbine-compressor section
- Check the extent of damage the combustor and turbine sections
- Planning the need for spare parts

c. Overall Examination

Pemeriksaan Examination of whole plant parts will be done after the plants do 1200 times the start-stop and have reached 16000 hours of operation or in accordance predetermined time. The inspection activities include:

- Hot gas passing line inspection
- Inspection of all parts of the turbine
- Check the level of the level of damage across parts of turbines
- Planning the need for spare parts

4. Distribution Activity of Electrical Energy

The electric power generated in power plants is channeled through the transmission line after it first raised by a voltage transformer voltage riser. The transformer used in

this plant is a type of artificial P0 Siemens with a power of 50 MVA. High voltage lines used are Air Line High Voltage (SUTT) 150 kV. The plan is that the energy produced by the plant will be channeled to the second substation (GI) GI is Muara Teweh Central Kalimantan and Melak - East Kalimantan GI.

5. Transmission Network Maintenance Activities

Transmission Network maintenance holds a very important role in supporting the quality and reliability of electricity supply to consumers. This maintenance is the process of activities aimed at maintaining or maintains the condition of the transmission network, so as to operate the transmission network can always function in accordance with the design characteristics and prevent destructive interference. Thus, the effectiveness and efficiency of maintenance of the transmission network can be seen from:

- Increase *reliability, and efficiency availability* transmission network
- Extension of the life of the transmission network
- Overhaul interval prolongation (major maintenance) on the transmission network
- Reduction of the risk of failure or damage to the transmission network
- Increased *safety*
- Reduction of the length of time outages
- Effective recovery time
- Maintenance cost efficient / economical.

This transmission network maintenance can be done preventively to prevent sudden damage and to maintain

optimal performance technical age appropriate, through periodic inspections, testing and measurement functions for diagnosing the condition of the equipment. Maintenance activities are performed based on the instruction manual of the plant, the existing standards like (IEC, IEEE, CIGRE, ANSI, etc.) or experiences and observations in the field. Routine maintenance that is periodically to ground patrol is conducted weekly and quarterly while to climb up inspection carried out at least 1 (one) time in 5 years.

Maintenance of the transmission network will also be done through predictive maintenance in a way to monitor and make trend analysis of the results of maintenance to be able to predict the conditions and symptoms of early damage. Monitor results and trend analysis will be used as reference for the follow-up to Planned Corrective Maintenance. This maintenance can be done by testing thermovisi, corana detector, ITECE, puncture insulator, and the tower grounding resistance.

To support the activities at this stage of the operation, it is required other activities which include:.

1. **Waste Management Activities**

   Waste management which is including B3 is an action in the handling of the waste generated by the operating activities of the project. Planning of waste management activities at this stage of this operation needs to be done properly and correctly, which includes the identification of pollutant sources of waste, the identification of the

relevant rules and regulations, identification of system management and monitoring and evaluation of waste management performance.

Waste on this project that will be generated consisting of solids, liquids, gases and B3. Most types of B3 waste generated, namely:

- Liquid Waste
  - *Lubricant*
  - *Used-catharsis Fuel*
  - *Reject Purifier Waste*
  - *Sewage spills from machinery*
  - *Waste of water treatment plant and laboratory waste*
  - *Blowdown and drain water steam cycle*
- Solid Waste
  - *Filter / Used Strainer*
  - *Used Batteries*
  - *Asbestos / ceramic insulation*
  - *Used Material and Non Material*
  - *Unburned Carbon*

Management of waste on the activities of this operation is to provide trash facilities, septic tank waste, special waste containment tank B3 and Waste Water Treatment Plant (WWTP) / WWTP / Settling Pond.

Liquid waste from power generation activities processed in Waste Water Treatment Plant (WWTP) / wastewater before

it is released into surface water bodies or streams. Its function is to contain, treat and dispose of wastewater produced by plants and water runoff. Broadly speaking, the stages of the treatment process through the addition of coagulant stirring rapidly, stirring slowly and sedimentation, filtration and final adjustment of pH levels. Water that has been processed and free of oil then will be discarded or channeled into rivers through drainage channels, estimated discharge of waste that comes out is approximately 12 m 3 / sec. Settling Pond made in the form of rectangular and lower land project site, so that water can get in natural and can then be poured into the river through the sewer. Settling pond has an outlet in the form of the discharge pipe with a diameter of between 25 to 30 cm and a capacity of 100 l / sec.

The calculation formula of the settling pond is as follows:

$$A = Q_{total} \, x \, V$$

Where :

A = area of *Settling Pond* (m^2)

Q_{total} = Debit incoming water *settling pond* (m^3/det)

V = Speed precipitation (m/det)

Limbah Organic, inorganic solid waste and B3 will be collected and provided a space / trash receptacle at each corner by using different colors container vessel to be easy to manage. B3 while liquid waste will be collected and stored in place Collecting Temporary (TPS) in the form of a special tank that is then submitted to a 3rd party who has

been appointed and has a waste management permit and utilizing B3.

2. Greening

Greening will be carried out in and around the area and also the location of activities. In accordance with Government Regulation No. 63 of 2002 and Regulation of the Minister of Public Works No. 5 of 2008, the function of this greening to create urban forests in the plant that is stressed to improve and maintain the micro-climate and aesthetic value, absorb water, creating balance and harmony of the physical environment and support the conservation of biodiversity.

In addition to the plant site area, planning of green open space (RTH) for reforestation activities include SUTT green lane, lane river banks, raw water sources / springs, the supporting area and area of settlements. The reforestation plan must take into account the population and needs oxygen environment.

For the structuring and management of green spaces must be performed optimally and periodically by planting plants that have characteristics can absorb dust, noise and water well. Greening activities outside the site area will be done in coordination with stakeholders and surrounding communities. Here are the characteristics of the plants used in reforestation activities:

a) Vegetation for Yard
   - has a prominent aesthetic value

- enter the root system in the soil, which does not damage the construction and building
- Non-toxic, not easily broken
- Annual or seasonal plant species
- Green color with another color variations balance
- Wherever possible it is a plant that invites the presence of birds

b) Vegetation for City Park

- enter the root system in the soil, which does not damage the construction and building
- non-toxic, not easily broken
- annual or seasonal plant species
- green color with another color variations balance
- wherever possible is a plant that invites the presence of birds
- speed of growth is medium
- in the form of habitats of local plant and crop cultivation
- the spacing of the meeting and pretty shady canopy

c) Vegetation for City Forest

- evergreen has varied heights
- long-lived
- tolerant of limited sunlight and water
- resistant to pollution and the motor vehicle industry
- stems and robust branching system
- strong upright stems and is not easily broken
- strong root system
- including a group of evergreen plants

d) Vegetation for Green Belt (Buffer Area)

- dense leaves, thick and relatively large in order to reduce noise
- high measuring the size of the area sufficiently to reduce heating effects
- overcome flooding

- windbreaks and absorbent / warden of smell

e) Vegetation for SUTT track

- strong branches, are not easily broken and the roots do not interfere foundation
- stab roots into the soil
- the leaves are not easily fall by the wind
- it is a tree with small category
- sapling phase is growing fast, but at the adult stage will grow slowly
- no fruit that can be consumed by humans

f) Vegetation for River Border

- a strong root system, so as to withstand the shifting ground
- grow well on solid ground
- the root system into the ground, do not damage the construction and building
- speed of growth is varies
- in the form of local plants and crops
- is an annual plant
- pretty shady canopy and compact, but not too dark

3. *Corporate Social Responsiblity* (CSR)

Based on the Law of the Republic of Indonesia Number 40 Year 2007 regarding Limited Liability Company, corporate social responsibility (CSR) is an obligation of the company that needs to be done. This activity is not only beneficial for the community, but also it will bring a positive attitude and perception of the people towards the company. CSR activities will create a mutually beneficial relationship between the company and the surrounding community.

development of forest and agricultural products around SUTT, aid in agriculture and forestry, support the development of agriculture and forestry, management training UKM.

4. Human Resources Management

Activities of human resource management (HRM) implemented as an effort to create quality human resources, improve the welfare of employees and foster a good relationship with employees. The activities or efforts in human resource management are:

- Create a work environment that is healthy, safe and comfortable
- Determination limit working time of employees includes regular working time, working time and working time turns special
- Overtime compensation in accordance with law
- Setting a minimum wage received over the regional minimum wage (UMR) and allowances in accordance with the applicable decision
- Noting the recognition and enforcement of human rights aspects in all its operational activities
- Organizing activities and training undertaken by all employees to improve their competence and skills
- Set up a cooperative to provide employee welfare
- Program that gives awards to employees, including merit awards, devotion and retirement

1.6. Significant Impacts Studied.

1.6.1. Important Hypothetical Impact.

Identification of the impact of development Capacity activities of Bangkanai PLTG of 140 MW, 150 kV Bangkanai SUTT-Muara Teweh and PLTMG Bangkanai 155 MW and CNG Plant Central Kalimantan is done by using matrices and flowchart methods.

Below is a table of the potential impact of activities, impact identification matrix and flowcharts of Capacity Building activities of Bangkanai PLTG of 140 MW, 150 kV Bangkanai SUTT-Muara Teweh and PLTMG Bangkanai 155 MW and CNG Plant Central Kalimantan.

Table 1.5 Table of Activity Potential Impact

No	Activity	Hypothetical Impact
	Pre-Construction Phase	
1	Preliminary Survey & Licensing	Public unrest
2	Project Socialization	Public unrest
3	Land acquisition	• Increase of revenue • Public unrest
	Construction Phase	
	A. Plant Development	
4	Mobilization & Demobilization of Labor	Employment Opportunity
5	Manufacture & Operation Base Camp	Domestic wastewater (Sanitary Conditions)
6	Making the *Access Road*	• Road damage • Dust and air quality deterioration • Increase of noise • Disturbance of flora and fauna • Public unrest
7	Mobilization & Demobilization of Equipment and Materials	• Traffic disruption • Road damage • Dust and air quality deterioration • Increase of noise • Public unrest
8	Land preparation	• Dust and air quality deterioration • Increase of noise • Disturbance of flora and fauna
9	Main & Supporting Building Development	• Dust and air quality deterioration • Increase of noise • Decline in surface water quality • Public health disorders
10	Activity of *Commissioning*	• Increase of vibration • Dust and air quality deterioration • Increase of noise

No	Activity	Hypothetical Impact
		• Improved electrical energy
	B. Development of SUTT	
11	Mobilization & Demobilization of Labor	Employment Opportunity
12	Mobilization & Demobilization of Equipment and Materials	• Traffic disruption • Road damage • Dust and air quality deterioration • Increase of noise • Public unrest
13	Cleaning Tread Tower & Free Space	• Disturbance of flora and fauna • Public unrest
14	Development &Establishment Tower Foundations	• Dust and air quality deterioration • Increase of noise • Public unrest
15	Installation & Withdrawal of Conductor Wire	• Public unrest
16	Activity of *Commissioning*	• An increase in the magnetic field and electric field • Improved electrical energy • Public unrest
	Operation Phase	
	A. Plant Operation	
17	Acceptance of Labor	Employment Opportunity
18	Distribution of Gas	Public unrest
19	Operation & Maintenance	• Public unrest • Dust and air quality deterioration • Increase of noise • Heaps of waste • Improved electrical energy
	B. Operation of SUTT	
20	Electrical Energy Distribution activities	• An increase in the magnetic field and electric field • Improved electrical energy
21	Transmission Network Maintenance activities	Disturbance of flora and fauna

Table 1.6. Potential Impact Matrix

No.	Component Activity / Environmental components	Pre-Construction Phase			Construction Phase													Operation Phase				
					Plant Development							Transmission Development									Plant Development	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
A.	Geophysics - Chemical																					
1	Traffic disruption							■					■									
2	Damage to Roads						■	■					■									
3	Increased Vibration										■											
4	Dust & Air Quality Decline						■	■	■	■	■		■		■					■		
5	Improved Noise						■	■	■	■	■		■				■			■	■	
6	Decrease in Surface Water Quality									■												
7	Improved Magnetic and Electric Field																■				■	
8	Heaps of Waste																			■		
9	Improved Electrical Energy										■						■			■	■	
B.	Biology																					
1	Flora and fauna disorders						■		■					■								■
C.	Social, Economic and Cultural																					
1	Employment Opportunity				■							■						■				
2	Increased Revenue			■																		
3	Public unrest	■	■	■			■	■			■		■	■	■	■	■		■	■		
D.	Public health																					
1	Public Health Disorders									■												
2	Domestic Waste Water (Sanitary Conditions)					■																

Table 1.7. The Reasons for Potential Impact Being and Not Being Important Hypothetical Impact

No.	Component Activity	Potential Impact	Reason	Conclusion
Phase of Pre-Construction				
1	The initial survey and Licensing	Public unrest	Principle permits and location permits already done. The absence of action or activity that is directly felt by the public, so that the impact on public unrest is not too felt or insignificant or relatively small.	Not being an important hypothetical impact
2	Socialization Project	Public unrest	Less correct perception of the project may cause public unrest.	Being an important hypothetical impact
3	Land acquisition	Public unrest	Compensation for land or land that would be released if there is no agreement, it will cause people unrest.	Being an important hypothetical impact
		Increase of revenue	Compensation for community land acquired for the construction of a price has been agreed, it will lead to increased revenue for the land owners.	Being important hypothetical impact
Construction Phase				
1	Mobilization and demobilization of labor	Employment Opportunity	Recruitment of local labor during construction activities would be beneficial for the community so that the creation of employment opportunities is an important hypothetical impact	Being an important hypothetical impact
2	Manufacture & Operation Base Camp	Domestic waste generation	Domestic waste generated from workers of the project when the base camp is starting its operation if it is not properly handled it will be a problem for the environment	Being an important hypothetical impact
3	Making the *Access Road*	A decrease in air quality	Activity of using heavy equipment for *the Access Road* will increase the amount of particulate or dust on the location of activities.	Being an important hypothetical impact

No.	Component Activity	Potential Impact	Reason	Conclusion
		Increase of noise	Activity of using heavy equipment for *the Access Road* will cause increase of noise in the location of activities.	Being an important hypothetical impact
		Road damage	Heavy equipment used to manufacture *Access Road* of location of plants in an effort not to cause harm to *the Access Road* of the road over to the location of the plant.	Not being an important hypothetical impact
		Public unrest	Increasing the amount of dust and noise during the Making of *Access Road* will affect the people living around the project site.	Being an important hypothetical impact
		Disturbance of flora and fauna	The number of plants harvested for activities of Making *Access Road* will cause disruption of flora and fauna in the location of activities.	Being an important hypothetical impact
4	Mobilization and demobilization of equipment and material	A decrease in air quality	Activity of Mobilization and demobilization of equipment and material will lead to the increase of number of particulate or dust on the location of activities.	Being an important hypothetical impact
		Increase of noise	Activity of Mobilization and demobilization of equipment and material will cause increase of noise in the location of activities.	Being an important hypothetical impact
		Road damage	Activity of Mobilization and demobilization of equipment and materials will cross the road project in the form of logging roads.	Not being an important hypothetical impact
		Traffic disruption	The number of heavy vehicles passing by will cause inconvenience for road usage in the traffic, and it will be disturbed. Because the activities of the company will be crossing the road, it is expected to cause a traffic accident so that it becomes an important hypothetical impact.	Being an important hypothetical impact

No.	Component Activity	Potential Impact	Reason	Conclusion
		Public unrest	The Increase of amount of dust and increase of noise during mobilization and demobilization of equipment and material, so it will affect the people living around the project site.	Being an important hypothetical impact
5	Land preparation	A decrease in air quality	Activity of area preparation will lead to the increase of amount of particulate or dust on the location of activities.	Being an important hypothetical impact
		Increased noise	Activity of land preparation activities will cause increased noise in the location of activities.	Being an i important hypothetical impact
		Disturbance of flora and fauna	The number of plants harvested for area preparation will causes disruption of flora and fauna in the location of activities.	Being an important hypothetical impact
6	Construction of the main building and supporting	A decrease in air quality	Development Activity of the main and supporting building will cause the increase of number of particulate or dust on the location of activities.	Being an important hypothetical impact
		Increase of noise	Development Activity of the main and supporting building will cause the increase of noise in the location of activities.	Being an important hypothetical impact
		Decline in surface water quality	The presence of water or drainage channel setup is right near the project site so as not to cause waterlogging which will cause a decline in water quality at the location of activities. In project operations conducted in the form of WWTP operation with lap pool.	Being an important hypothetical impact
		Public health disorders	The Increase of amount of particulates in the location of the construction activities of the main and supporting building in the community will cause health problems for people living close to the location of activities.	Being an important hypothetical impact
7	Cleaning tread tower and free space	Disturbance of flora and	The number of plants harvested during tower footprint and free	Being an important

No.	Component Activity	Potential Impact	Reason	Conclusion
		fauna	space cleaning activities will cause disruption of flora and fauna in the location of activities.	hypothetical impact
		Public unrest	Compensation for crops harvested if it does not comply with the agreement will cause disquiet impact on the owner of the plant.	Being an important hypothetical impact
8	Construction of the foundation and the erection of tower	Dust and air quality degradation	Activities of the foundation construction and the establishment of the tower will increase the amount of particulate or dust that is around the location of activities issued from the chimney power plant.	Being an important hypothetical impact
		Public unrest	The Increase of the amount of dust and the increase of noise during the construction of the foundation and establishment of tower, so it will affect the people living around the project site.	Being an important hypothetical impact
9	Installation and Withdrawal wires	Increase of noise	Noise will be caused from the installation and withdrawal activities wires are relatively small.	Not being an important hypothetical impact
		Public unrest	Lack of information given to the public associated with the activities of the installation and withdrawal wires will cause unrest in society.	Being an important hypothetical impact
10	*Commissioning* Transmission	An increase in the magnetic field and electric field	Activities of *Commissioning* Transmission is merely a temporary testing equipment so that the occurrence Improved magnetic field and electric field	Being an important hypothetical impact
		Public unrest	Lack of information given to the public associated with the activities of *Commissioning* Transmission will cause unrest in society.	Being an important hypothetical impact
		A decrease in air quality	Activity of *Commissioning of the* plant will increase the amount of gas that is around the	Being an important hypothetical

No.	Component Activity	Potential Impact	Reason	Conclusion
			location of activities issued from the chimney of power plant.	impact
		Increase of noise	Activity of *Commissioning of the* plant will result in increase of noise in the location of activities.	Being an important hypothetical impact
		Increased vibration	Vibrations arising from operation of the plant are small and are not harmful for the operators and the public.	Being an important hypothetical impact
		Improved Electrical Energy	Pilot activities for ± 600 hours will produce electrical energy that will benefit the surrounding community	Being an important hypothetical impact
Operation Phase				
1	Recruitment	Employment Opportunity	Recruitment of local labor during Plant Operation activities will benefit the community so that the creation of employment opportunities is an important hypothetical impact	Being an important hypothetical impact
2	Distribution of gas	Public unrest	Lack of information given to the public associated with the activities of distribution of gas for generating interest through a gas pipeline would cause unrest in society.	Being an important hypothetical impact
3	Operation and maintenance of plant	A decrease in air quality	Activity of plant will potentially decrease the quality of air ambient in the vicinity of the activities.	Being an important hypothetical impact
		Increase of noise	Plant operation activities will lead to the increase of noise that is in the activity location.	Being an important hypothetical impact
		Improved Electrical Energy	Operations of the power plant will produce electrical energy that can be channeled to supply the electricity needs of households and economic activities around	Being an important hypothetical impact
		B3 waste generation	Operation Activity of the plant will be potentially the B3 waste generation.	Being an important hypothetical impact

No.	Component Activity	Potential Impact	Reason	Conclusion
		Public unrest	The potential decrease in air quality and the potential for increase of noise if it is not done with proper management it will potentially unrest in the community in the vicinity of the location of activities.	Being an important hypothetical impact
4	Distribution of electrical energy	An increase in the magnetic field and electric field	The potential for the magnetic field and electric field when SUTT of 140 kV operation will cause Increase of magnetic field and electric field at the location of 150 kV network or SUTT of Muara Teweh - Bangkanai	Not being an important hypothetical impact
		Increase of noise	Noise appears only in the rainy season (Kata Beach), however, the sound generated is relatively not cause a nuisance to the public.	Not being an important hypothetical impact
5	Maintenance of transmission network	Disturbance of flora and fauna	Plants that go into free space of voltage in transmission lines will be cut in order to not cause interference on the transmission network.	Being an important hypothetical impact

Methods for classification and critical priority of hypothetical are structured as follows:

1) Priority ranking is done by making the impacts ranked from the greatest to the smallest in each phase.
2) Results of classification and priorities listed in Flow Chart.
3) The flow chart of priority obtained significant impact per activity phase is summarized as follows:

A. Pre-Construction

- Public unrest
- Increase of Revenue

B. Construction

- Employment Opportunity
- Domestic waste generation

- A decrease in air quality
- Increase of noise
- Community Unrest
- Traffic disruption
- Disturbance of flora and fauna
- Public health disorders
- Improved electrical energy

C. Operation

- Community Unrest
- A decrease in Air Quality
- Increase of Noise
- B3 Waste Generation
- Disturbance of flora and fauna
- An increase in magnetic and electrical field
- Improved electrical energy

1.7. Study Area and Study Time Limit

The scope of the study area are intended to limit the broad environmental impacts which are studied in accordance with the results of the scoping of significant impacts and taking into account the limited resources, time and energy. The scope of the AMDAL area of study of Capacity Building activities of Bangkanai PLTG of 140 MW, 150 kV Bangkanai SUTT-Muara Teweh and PLTMG Bangkanai 155 MW and CNG Plant Central Kalimantan based on consideration of the limits as follows::

1.7.1. Project Boundary

Boundary of the project area is the space where activity plans will be executed, either at the pre-construction, construction and operation. This business area and / or activities become the source

of impacts on the surrounding environment, including alternative locations in terms of business plans and / or activities. The position of this limit is expressed in coordinates. Limits of Capacity Development Project of Bangkanai PLTG of 140 MW, 150 kV Bangkanai SUTT-Muara Teweh and PLTMG Bangkanai 155 MW and CNG Plant Central Kalimantan are in Karendan Village. Project boundary is presented in Appendix maps of study activities.

1.7.2. Ecology Boundary

Ecology boundary is impact distributing space from planned activities in settlements, roads, and industrial surroundings. Natural process that goes on in that space is expected to undergo fundamental changes. These include the ecological limits of the ecosystem area around the project site and this limit is set based on the distribution of impacts on physic-chemical components and biology. On Capacity Building activities of Bangkanai PLTG of 140 MW, 150 kV Bangkanai SUTT-Muara Teweh and PLTMG Bangkanai 155 MW and CNG Plant Central Kalimantan is determined radius of about 2.5 km from the center of the project. Further ecological limits are presented in Appendix maps of study activities.

1.7.3. Social Boundary

Included in the social boundaries is space around the business or activity that is the venue for a variety of social interaction in accordance with the norms and values of certain well-established, including systems and social structures in accordance with the social dynamics of a community group that is expected to undergo fundamental changes as a result of the occurrence of an business or activity. In the AMDAL study social boundaries is usually taken nearby residential areas expected to be affected by a business or

activity. Further social boundaries are presented in Appendix maps of study activities.

1.7.4. Administration Boundary

Administrative boundaries are the boundaries of space where the community around the project plan of Capacity Development of Bangkanai PLTG of 140 MW, 150 kV Bangkanai SUTT-Muara Teweh and PLTMG Bangkanai 155 MW and CNG Plant Central Kalimantan can freely carry out activities of socio-economic and socio-cultural in accordance with existing laws. Administrative boundaries in this study cover the whole territory of Karendan Village, Lahei District. Further administration limit is presented in Appendix maps of study activities.

1.7.5. The Boundary of Area of Study

Boundary of the study area is unity (resultant) of the four areas mentioned above but adapted to the determination implementing capabilities that typically provide limited sources of data such as time, money, energy, techniques and methods of study. Thus, the scope of the study area starts at the space for business and / or activity, later expanded to the wider ecosystem space, social space and administrative space. Further study area boundary is presented in Appendix maps of study activities.

1.7.6. Study Time Limit

Limits of Capacity Building of Bangkanai PLTG of 140 MW, 150 kV Bangkanai SUTT-Muara Teweh and PLTMG Bangkanai 155 MW and CNG Plant Central Kalimantan are in North Barito. While, the time limit of the study was conducted in 3 phases: Pre-Construction, Construction phase and phase operation. Deadline of the studies are as follows:

Table 1.8. Deadline of The Study

No.	Important Impact of Hypothetical	Deadlines of the Study	Reason
1	Public unrest	6 months (Pre-Construction Stage)	The impact of public unrest arising from the pre-construction process started up until these plant operation activities take place. This happens because of the lack of information received by the public about the existence of plants and concerns of the people who think that the existence of this plant can cause interference in public health around the location of activities. However, if in the next five years arising other activities around the location of activities, public unrest against the plant is possible to change to the other activities.
		25 years (Construction Phase)	
		5 years (Operation Phase)	
2	The creation of employment opportunities	25 years (Construction Phase)	The impact of the job opportunities resulting from the mobilization of manpower in the construction phase. This employment opportunities during the construction phase occur during construction activities took place. But as the labor operation of the plant during the plant operation occurs during operating activities.
		During generator operation (Operation Phase)	
3	Decrease of Air Quality	25 years (Construction Phase)	Impact on the Decrease of Air Quality start to arise from the pre-construction phase until plant operation activity takes place. Activities of Mobilization and demobilization of equipment and materials, construction of *access* road, site preparation, construction of the main and supporting building, *commissioning of the* plant and the operation of the plant is the operation phaseof Construction of 150 kV of Bangkanai-Muara Teweh SUTT (i.e. construction phase activities of mobilization and demobilization of equipment
		During generator operation (Operation Phase)	

No.	Important Impact of Hypothetical	Deadlines of the Study	Reason
			and materials, construction and establishment of the foundation of the tower).
4	Improved Noise	25 years (Construction Phase) 5 years (Operation Phase)	Increase of the impact on the occurrence of noise due to construction activities, namely the construction phase of mobilization and demobilization activities which Includes equipment and materials, construction of *access* road, site preparation, construction of the main building and supporting, *commissioning of the* plant and the operation phase the operation of the plant. And at this stage of the construction of 150 kV of Bangkanai-Muara Teweh SUTT (i.e. construction phase activities of mobilization and demobilization of equipment and materials, construction and establishment of the foundation of tower)
5	Flora and fauna disorders	25 years (Construction Phase) 5 years (Operation Phase)	The impact on the flora and fauna is Disturbance due to development activities of *Access road,* land preparation, cleaning tower footprint and free space as well as the maintenance of the transmission network. The existence of replanting / flora around the location of activities after the construction phase ends, the next 5 years the number and type of flora will increase so the amount of fauna will increase as well. Impact of interference on the flora and fauna is expected in 2.5 years in the future where the environment hue may change.
6.	Increase of revenue	25 years (Construction Phase)	The impact on the increase in revenue due to land acquisition activities in which the land owners will receive compensation according to the value that has

No.	Important Impact of Hypothetical	Deadlines of the Study	Reason
			been agreed. Impact on the increase of income is expected in the next 2.5 years, whereby environmental setting may change.
7	Domestic waste generation	25 years (Construction Phase)	Impact on the Generation of domestic waste for job creation and operation of base camp generator. This is because the contractor workers pay less attention to matters relating to environmental hygiene. Impact on the Generation of domestic waste is estimated in 2.5 years, in which the environmental setting may change.
8	Traffic disruption	During the phase of plant construction	The impact of traffic disruptions due to track is caused by mobilization during the construction phase will use a logging road owned by PT. Astra Bina are still used in the transport timber so that the development activities will lead to an increase in the volume of vehicles that have the potential for traffic disruption in the form of accidents.
9	Public health disorders	25 years (Construction Phase)	The impact of the public health problems occur due to an increased amount of dust that would cause the occurrence of ISPA on the implementation of the work activities and supporting the construction of the main building during the construction period. Impact on public health problems is estimated in 2.5 years into the future where the environment hue may change.
10	B3 waste generation	During generator operation (Operation Phase)	The impact of the Generation B3 occurs when the plant operates. This matter is happened because during plant operation will

No.	Important Impact of Hypothetical	Deadlines of the Study	Reason
			generate the rest of the production process in the form of waste.
11	An increase in the magnetic field and electric field	During generator operation (Operation Phase)	Increasing the impact of magnetic field and electric field occur when SUTT of 150 kV of Bangkanai-Muara Teweh operation, wherein during operation of the transmission network would have the potential emergence of a magnetic field and electric field around the wires.
12	Improved Electrical Energy	1 month (Construction Phase) During Operating Activities	The impact of the increase in power generation capacity and electricity