Environmental and Social Impact Assessment Report

Project Number: 50182-001
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INO: Riau Natural Gas Power Project
ESIA Vol.1
Introduction

Prepared by ESC for the Asian Development Bank

Riau 275 MW Combined Cycle Gas Power Plant IPP - ESIA

Medco Ratch Power Riau

ESIA Volume 1: Introduction

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Glossary

Acronym	Term	Definition
ESIA	Environmental and Social Impact Assessment	Identifies and assesses the risks and the impacts associated with the project and provides a series of mitigation measures that when implemented will ensure the project complies with the standards and guidelines it has be evaluated against.
ESMP	Environmental and Social Management Plan	Summarises the client's commitments to address and mitigate risks and impacts identified as part of the Assessment, through avoidance, minimisation, and compensation/offset. This may range from a brief description of routine mitigation measures to a series of more comprehensive management plans (e.g. water management plan, waste management plan, livelihood restoration plan, emergency preparedness and response plan, decommissioning plan).
ESMS	Environmental and Social Management System	The ESMS is the overarching environmental, social, health and safety management system which may be applicable at a corporate or Project level. The system is designed to identify, assess and manage risks and impacts in respect to the Project on an ongoing basis.
-	Legal and regulatory framework	The national legal and institutional framework applicable to the project should be defined. This should also include any additional lender requirements and any international agreements or conventions that may also apply.
-	Project Description	A Project Description considers all the project phases from pre-construction, construction, operation and decommissioning and is as detailed as is possible in order to identify the environmental aspects resulting from project activities. A summary of the Project Description is provided in ESIA Volume 1: Introduction.

List of Abbreviations

Acronym	Meaning
ACSR	Aluminium conductor steel-reinforced
ADB	Asian Development Bank
AMDAL	Analisis Mengenai Dampak Lingkungan
CCPP	Combined cycle power plant
CEMS	Continuous emissions monitoring system
CFPP	Coal Fired Power Plant
CPM	PT. Citra Panji Manunggal
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement and Construction
EPFI	Equator Principle Financial Institutions
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
GEP	Good Engineering Practice
GIIP	Good International Industrial Practice
GT	Gas turbine
HP	High pressure
HRSG	Heat recovery steam generators
HV	High voltage
IFC	International Finance Corporation
IMB	Izin Mendirikan Bangunan / Building Construction Permit
IPP	Independent Power Producer
IPPKH	Izin Pinjam Pakai Kawasan Hutan / Borrow Lease Forest Area Permit
MEDCO	PT Medco Power Indonesia
MOEF	Ministry of Environment and Forestry
NCF	Net capacity factor
NTS	Non-Technical Summary
OPGW	Optical ground wire
PLN	PT Perusahaan Listrik Negara (Persero)
PPA	Power Purchase Agreement
RATCH	Ratchaburi Electricity Generating Holding PCL
RoW	Right of Way
RUKN	Indonesian National Electricity Plan
RUPTL	Indonesian Electricity Supply Business Plan
SIA	Social Impact Assessment
ST	Steam turbine
TSS	Total suspended solids
UKL / UPL	Upaya Pengelolaan Lingkungan / Upaya Pemantauan Lingkungan

WBG	World Bank Group

1. Introduction

1.1 Purpose

This Environmental and Social Impact Assessment (ESIA) has been prepared, in accordance with Indonesian environmental and social legislation and international lending institutions environmental and social safeguards, performance standards and guidelines, to assess the environmental and social impacts and risks of the Riau 275 MW Combined Cycle Gas Fired Power Plant Independent Power Producer (IPP) IPP Project (referred to hereafter as the 'Project'). The Project consists of a 275 MW combined cycle power plant and ancillary facilities, a 40 km long 12-inch gas pipeline, a switchyard and a 750 m long 150 kV transmission line. The Project Sponsors being PT Medco Power Indonesia (MEDCO) and Ratchaburi Electricity Generating Holding PCL (RATCH), have formed PT Medco Ratch Power Riau (MRPR) to build, own and operate the plant under the terms of the Power Purchase Agreement (PPA) which has been agreed with PT Perusahaan Listrik Negara (Persero) ("PLN").

1.2 Project Location and Background

The power plant and ancillary features, switchyard and transmission line is located in the Tenayan Industrial Village (previously known as Sail Village), Tenayan Sub District, Pekanbaru City, Province of Riau.

The power plant is located approximately:

- 10 km due east of the city of Pekanbaru in central Sumatra, Indonesia;
- 3 km south of the Siak River; and
- 2 km south of PLN's existing 2 x 110 MW Tenayan Coal Fired Power Station (CFPP).

The power plant and switchyard will be located within the 9.1 ha of privately owned land currently being used as a palm oil plantation. The site is bounded by palm oil plantations to the west, south and east and Road 45 on the North.

MRPR will construct a gas supply pipeline from a connection point at an offtake location known as SV1401 on the main Grissik to Duri gas pipeline which is located north-east of the power plant in the Siak Regency. The gas will be delivered to the power plant by approximately 40 km of pipeline, the majority of which, will be located within the existing road reserve. An overview of the Project area including gas pipeline options is detailed in Figure 1.1 below.

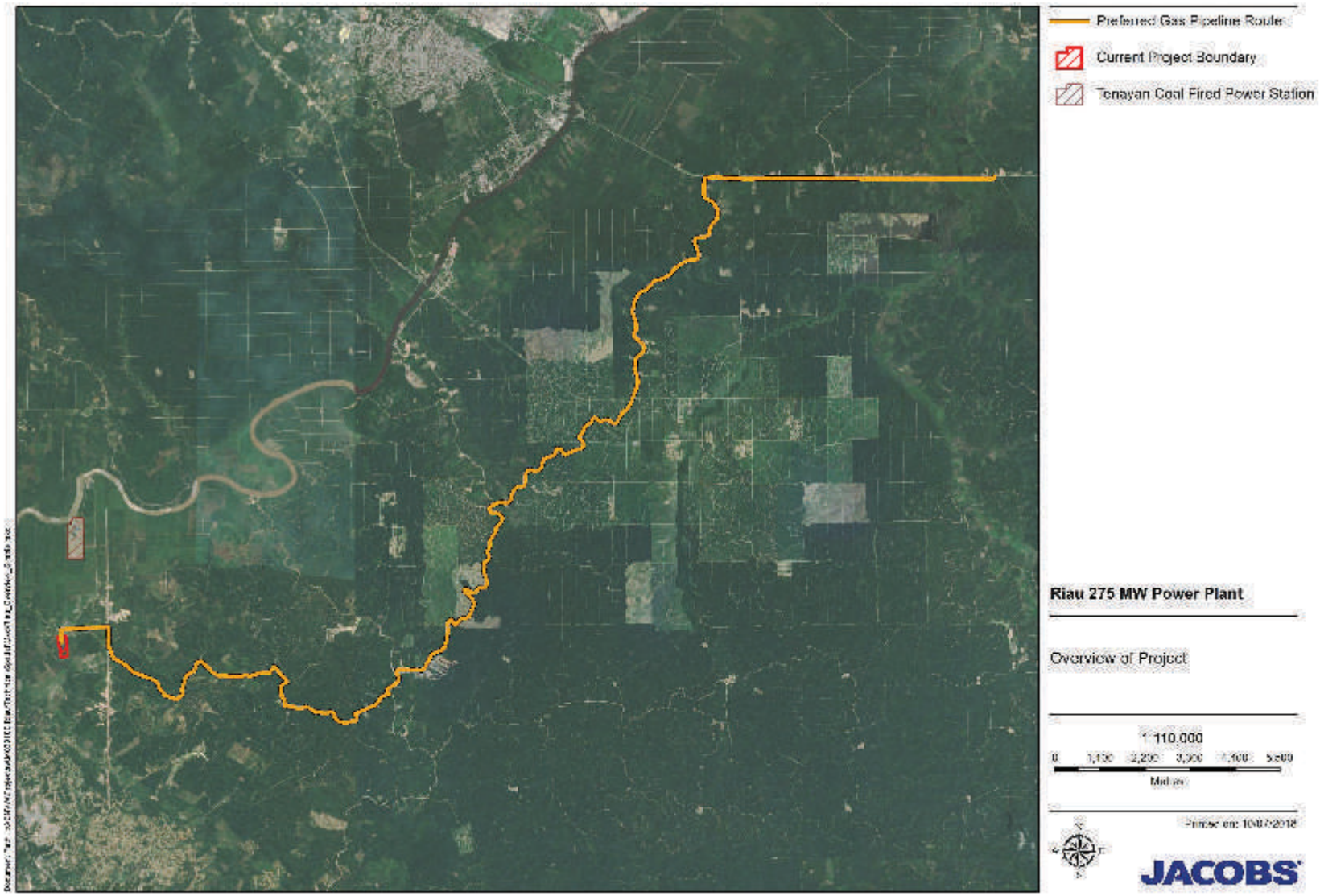


Figure 1.1 : Location Overview

The project will be financed by the Asian Development Bank (ADB), the International Finance Corporation (IFC) and other commercial lenders. Relevant International and National requirements relevant to the proposed development include:

- Asian Development Bank (ADB) Safeguard Policy Statement (2009);
- Equator Principles;
- International Finance Corporation (IFC) Performance Standards;
- World Bank Group (WBG) Environmental, Health and Social (EHS) General and Industry Specific Guidelines; and
- Indonesian regulatory requirements.

1.3 Structure of the ESIA

The ESIA is structured into a Non-Technical Summary (NTS) and five Volumes as described below and in Table 1.1.

Table 1.1 : Structure of the ESIA

ESIA Volume	Description
Non-Technical Summary	Provides a summary of the findings of the ESIA using non-technical language.
Volume 1: Introduction	Presents the policies, legal and administrative frameworks applicable to the Project, provides a detailed Project description, outlines the processes undertaken to assess any alternatives in design and planning for the Project.
Volume 2: Environmental Impact Assessment (EIA) (Terrestrial)	Provides an assessment of potential impacts of the Project on environmental receptors, makes mitigation and monitoring recommendations and provides an assessment of residual impacts.
Volume 3: Social Impact Assessment (SIA)	Provides an assessment of potential impacts of the Project on social receptors, makes mitigation and monitoring recommendations and provides an assessment of residual impacts.
Volume 4: ESMP and Framework ESMS	The Environmental and Social Management Plan (ESMP) summarises the mitigation and monitoring measures that should be employed during the construction and operation of the Project. The Framework Environmental and Social Management System (ESMS) provides a framework of the key elements for developing and implementing an Overarching ESMS which sets out how the mitigation and monitoring will be implemented, checked and reviewed for the life of the Project.
Volume 5: Technical Appendices	Provides the supporting documentation for the ESIA which for specific technical areas include more detailed Technical Reports which provide more information on the baseline conditions and the impact assessment.

2. Policy, Legal and Administrative Framework

This ESIA has been prepared to meet the requirements of the Asian Development Bank (ADB) Safeguards, Equator Principles, International Finance Corporation (IFC) Performance Standards, and World Bank Group (WBG) Environmental, Health and Safety (EHS) Guidelines as well as local Indonesian environmental and social regulations.

2.1 ADB Safeguard Policy Statement

ADB is committed to ensuring the social and environmental sustainability of the projects it supports. This commitment is outlined in the ADB Safeguard Policy Statement (ADB, 2009) which cover the following: Environmental, Involuntary Resettlement and Indigenous Peoples Safeguards, these are discussed further in the sections below.

2.1.1 Environmental Safeguards

The objectives of the Environmental Safeguards are to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. The Environmental Safeguards are triggered if a project is likely to have potential environmental risk and impacts and include 11 Policy Principles outlined in Figure 2.1 below.

Policy Principles:

1. Use a screening process for each proposed project, as early as possible, to determine the appropriate extent and type of environmental assessment so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks.
2. Conduct an environmental assessment for each proposed project to identify potential direct, indirect, cumulative, and induced impacts and risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence. Assess potential transboundary and global impacts, including climate change. Use strategic environmental assessment where appropriate.
3. Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and document the rationale for selecting the particular alternative proposed. Also consider the no project alternative.
4. Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts by means of environmental planning and management. Prepare an environmental management plan (EMP) that includes the proposed mitigation measures, environmental monitoring and reporting requirements, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators. Key considerations for EMP preparation include mitigation of potential adverse impacts to the level of no significant harm to third parties, and the polluter pays principle.
5. Carry out meaningful consultation with affected people and facilitate their informed participation. Ensure women's participation in consultation. Involve stakeholders, including affected people and concerned nongovernment organizations, early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment. Establish a grievance redress mechanism to receive and facilitate resolution of the affected people's concerns and grievances regarding the project's environmental performance.
6. Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders.
7. Implement the EMP and monitor its effectiveness. Document monitoring results, including the development and implementation of corrective actions, and disclose monitoring reports.
8. Do not implement project activities in areas of critical habitats, unless (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function, (ii) there is no reduction in the population of any recognized endangered or critically endangered species, and (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional programs to promote and enhance the conservation aims of the protected area. In an area of natural habitats, there must be no significant conversion or degradation, unless (i) alternatives are not available, (ii) the overall benefits from the project substantially outweigh the environmental costs, and (iii) any conversion or degradation is appropriately mitigated. Use a precautionary approach to the use, development, and management of renewable natural resources.
9. Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines. Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phaseouts. Purchase, use, and manage pesticides based on integrated pest management approaches and reduce reliance on synthetic chemical pesticides.
10. Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities.
11. Conserve physical cultural resources and avoid destroying or damaging them by using field-based surveys that employ qualified and experienced experts during environmental assessment. Provide for the use of "chance find" procedures that include a pre-approved management and conservation approach for materials that may be discovered during project implementation.

Figure 2.1 : ADB Environmental Safeguards Policy Principles (ADB, 2009)

2.1.2 Involuntary Resettlement Safeguards

The objectives of the Involuntary Resettlement Safeguards are to avoid involuntary resettlement wherever possible; to minimise involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups.

The Involuntary Resettlement Safeguards cover physical displacement and economic displacement and are triggered as a result of involuntary acquisition of land, or involuntary restrictions on land use or on access to

legally designated parks and protected areas. It covers them whether such losses and involuntary restrictions are full or partial, permanent or temporary. The Involuntary Resettlement Safeguards includes 12 Policy Principles outlined in Figure 2.2 below.

Policy Principles:

1. Screen the project early on to identify past, present, and future involuntary resettlement impacts and risks. Determine the scope of resettlement planning through a survey and/or census of displaced persons, including a gender analysis, specifically related to resettlement impacts and risks.
2. Carry out meaningful consultations with affected persons, host communities, and concerned nongovernment organizations. Inform all displaced persons of their entitlements and resettlement options. Ensure their participation in planning, implementation, and monitoring and evaluation of resettlement programs. Pay particular attention to the needs of vulnerable groups, especially those below the poverty line, the landless, the elderly, women and children, and Indigenous Peoples, and those without legal title to land, and ensure their participation in consultations. Establish a grievance redress mechanism to receive and facilitate resolution of the affected persons' concerns. Support the social and cultural institutions of displaced persons and their host population. Where involuntary resettlement impacts and risks are highly complex and sensitive, compensation and resettlement decisions should be preceded by a social preparation phase.
3. Improve, or at least restore, the livelihoods of all displaced persons through (i) land-based resettlement strategies when affected livelihoods are land based where possible or cash compensation at replacement value for land when the loss of land does not undermine livelihoods, (ii) prompt replacement of assets with access to assets of equal or higher value, (iii) prompt compensation at full replacement cost for assets that cannot be restored, and (iv) additional revenues and services through benefit sharing schemes where possible.
4. Provide physically and economically displaced persons with needed assistance, including the following: (i) if there is relocation, secured tenure to relocation land, better housing at resettlement sites with comparable access to employment and production opportunities, integration of resettled persons economically and socially into their host communities, and extension of project benefits to host communities; (ii) transitional support and development assistance, such as land development, credit facilities, training, or employment opportunities; and (iii) civic infrastructure and community services, as required.
5. Improve the standards of living of the displaced poor and other vulnerable groups, including women, to at least national minimum standards. In rural areas provide them with legal and affordable access to land and resources, and in urban areas provide them with appropriate income sources and legal and affordable access to adequate housing.
6. Develop procedures in a transparent, consistent, and equitable manner if land acquisition is through negotiated settlement to ensure that those people who enter into negotiated settlements will maintain the same or better income and livelihood status.
7. Ensure that displaced persons without titles to land or any recognizable legal rights to land are eligible for resettlement assistance and compensation for loss of nonland assets.
8. Prepare a resettlement plan elaborating on displaced persons' entitlements, the income and livelihood restoration strategy, institutional arrangements, monitoring and reporting framework, budget, and time-bound implementation schedule.
9. Disclose a draft resettlement plan, including documentation of the consultation process in a timely manner, before project appraisal, in an accessible place and a form and language(s) understandable to affected persons and other stakeholders. Disclose the final resettlement plan and its updates to affected persons and other stakeholders.
10. Conceive and execute involuntary resettlement as part of a development project or program. Include the full costs of resettlement in the presentation of project's costs and benefits. For a project with significant involuntary resettlement impacts, consider implementing the involuntary resettlement component of the project as a stand-alone operation.
11. Pay compensation and provide other resettlement entitlements before physical or economic displacement. Implement the resettlement plan under close supervision throughout project implementation.
12. Monitor and assess resettlement outcomes, their impacts on the standards of living of displaced persons, and whether the objectives of the resettlement plan have been achieved by taking into account the baseline conditions and the results of resettlement monitoring. Disclose monitoring reports.

Figure 2.2 : ADB Involuntary Resettlement Safeguards Policy Principles (ADB, 2009)

2.1.3 Indigenous Peoples Safeguards

The objectives of the Indigenous Peoples Safeguards are to design and implement projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the Indigenous Peoples themselves so that they (i) receive culturally appropriate social and economic benefits, (ii) do not suffer adverse impacts as a result of projects, and (iii) can participate actively in projects that affect them.

The Indigenous Peoples Safeguards are triggered if a project directly or indirectly affects the dignity, human rights, livelihood systems, or culture of Indigenous Peoples or affects the territories or natural or cultural

resources that Indigenous Peoples own, use, occupy, or claim as an ancestral domain or asset. The term Indigenous Peoples is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing a range of characteristics in varying degrees, including:

- Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;
- Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;
- Customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and
- A distinct language, often different from the official language of the country or region.

In considering these characteristics, national legislation, customary law, and any International conventions to which the country is a part will be taken into account. A group that has lost collective attachment to geographically distinct habitats or ancestral territories in the project area because of forced severance remains eligible for coverage under this policy. The Indigenous Peoples Safeguards includes nine Policy Principles outlined in Figure 2.3 below.

Policy Principles:

1. Screen early on to determine (i) whether Indigenous Peoples are present in, or have collective attachment to, the project area; and (ii) whether project impacts on Indigenous Peoples are likely.
2. Undertake a culturally appropriate and gender-sensitive social impact assessment or use similar methods to assess potential project impacts, both positive and adverse, on Indigenous Peoples. Give full consideration to options the affected Indigenous Peoples prefer in relation to the provision of project benefits and the design of mitigation measures. Identify social and economic benefits for affected Indigenous Peoples that are culturally appropriate and gender and intergenerationally inclusive and develop measures to avoid, minimize, and/or mitigate adverse impacts on Indigenous Peoples.
3. Undertake meaningful consultations with affected Indigenous Peoples communities and concerned Indigenous Peoples organizations to solicit their participation (i) in designing, implementing, and monitoring measures to avoid adverse impacts or, when avoidance is not possible, to minimize, mitigate, or compensate for such effects; and (ii) in tailoring project benefits for affected Indigenous Peoples communities in a culturally appropriate manner. To enhance Indigenous Peoples' active participation, projects affecting them will provide for culturally appropriate and gender inclusive capacity development. Establish a culturally appropriate and gender inclusive grievance mechanism to receive and facilitate resolution of the Indigenous Peoples' concerns.
4. Ascertain the consent of affected Indigenous Peoples communities to the following project activities: (i) commercial development of the cultural resources and knowledge of Indigenous Peoples; (ii) physical displacement from traditional or customary lands; and (iii) commercial development of natural resources within customary lands under use that would impact the livelihoods or the cultural, ceremonial, or spiritual uses that define the identity and community of Indigenous Peoples. For the purposes of policy application, the consent of affected Indigenous Peoples communities refers to a collective expression by the affected Indigenous Peoples communities, through individuals and/or their recognized representatives, of broad community support for such project activities. Broad community support may exist even if some individuals or groups object to the project activities.
5. Avoid, to the maximum extent possible, any restricted access to and physical displacement from protected areas and natural resources. Where avoidance is not possible, ensure that the affected Indigenous Peoples communities participate in the design, implementation, and monitoring and evaluation of management arrangements for such areas and natural resources and that their benefits are equitably shared.
6. Prepare an Indigenous Peoples plan (IPP) that is based on the social impact assessment with the assistance of qualified and experienced experts and that draw on indigenous knowledge and participation by the affected Indigenous Peoples communities. The IPP includes a framework for continued consultation with the affected Indigenous Peoples communities during project implementation; specifies measures to ensure that Indigenous Peoples receive culturally appropriate benefits; identifies measures to avoid, minimize, mitigate, or compensate for any adverse project impacts; and includes culturally appropriate grievance procedures, monitoring and evaluation arrangements, and a budget and time-bound actions for implementing the planned measures.
7. Disclose a draft IPP, including documentation of the consultation process and the results of the social impact assessment in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected Indigenous Peoples communities and other stakeholders. The final IPP and its updates will also be disclosed to the affected Indigenous Peoples communities and other stakeholders.
8. Prepare an action plan for legal recognition of customary rights to lands and territories or ancestral domains when the project involves (i) activities that are contingent on establishing legally recognized rights to lands and territories that Indigenous Peoples have traditionally owned or customarily used or occupied, or (ii) involuntary acquisition of such lands.
9. Monitor implementation of the IPP using qualified and experienced experts; adopt a participatory monitoring approach, wherever possible; and assess whether the IPP's objective and desired outcome have been achieved, taking into account the baseline conditions and the results of IPP monitoring. Disclose monitoring reports.

Figure 2.3 : ADB Indigenous Peoples Safeguards Policy Principles (ADB, 2009)

2.1.4 ADB Screening

ADB has carried out project screening and categorisation at the start of project. This process is undertaken in order to:

- Reflect the significance of potential impacts or risk that a project might present;
- Identify the level of assessment and institutional resources required for the safeguard measures; and
- Determine the disclosure requirements.

2.1.5 ADB Categorisation

Through the screening process ADB will categorise whether the project will involve involuntary resettlement or is likely to impact Indigenous Peoples. If either apply, then an involuntary resettlement plan or an Indigenous Peoples plan is required.

For environment, ADB uses a categorisation system to reflect the significance of a projects potential environmental impacts based on the type, location, scale, sensitivity and the magnitude of the potential environmental impacts. The categorisation system comprises four categories:

- **Category A** – A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.
- **Category B** – A proposed project is classified as category B if it potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.
- **Category C** – A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.
- **Category FI** – A proposed project is classified as category FI if it involves investment of ADB funds to or through a FI.

All three ADB Safeguards require the following in relation to the ESIA:

- **Information disclosure** – i.e. displaying the ESIA or IEE on the Project Sponsor/ADB website.
- **Consultation and participation** - The Project Sponsor will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation.
- **Grievance redress mechanism -** borrower/client will establish a mechanism to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance.

2.1.6 Project Categorisation

The Project has been categorised following ADB's Safeguards Categories and these are presented in Table 2.1 below. Based on this categorisation a full ESIA has been prepared.

Table 2.1 : Project Categorisation

Screening Result	Project Justification
Category A - Environmental	The Project has been categorised as Category A for Environmental due to impacts from noise emissions, air and water discharges impacting an area larger than the Project. Refer to ESIA Volume 2 – Environmental Impact Assessment for further information.

Screening Result	Project Justification
Category B – Involuntary Resettlement	The Project has been categorised as B for Involuntary Resettlement due to the temporary economic impacts that will occur along the gas and water pipeline routes. Refer to ESIA Volume 3 – Social Impact Assessment for further information.
Category C – Indigenous Peoples	The Project has been categorised as C for Indigenous Peoples as there are no Indigenous People identified within the Project Area of Influence. Refer to ESIA Volume 3 – Social Impact Assessment for further information.

2.1.7 ADB's Applicable Policy, Legal and Administrative Framework and Standards

ADB's Environment Safeguards - A Good Practice Sourcebook Draft Working Document (ADB, 2012a) outlines requirements for projects to meet national and local standards as well as international. For international standards the WBG EHS Guidelines are to be used. These guideline performance levels and measures are normally acceptable to ADB and are generally considered to be achievable in new facilities at reasonable cost using existing technology. When national regulations differ from the performance levels and measures presented in the WBG EHS Guidelines, project are expected to achieve whichever is more stringent (ADB, 2012). The WBG EHS Guidelines relevant to this Project are discussed further in Section 2.4 below.

The ADB Involuntary Resettlement Safeguards – A Planning and Implementation Good Practice Sourcebook Draft Working Document (ADB, 2012b) outlines technical guidance and good practice recommendations in implementing the Safeguard Policy Statement with respect to involuntary resettlement. The source book uses ADB's own experience in effective planning and implementation of involuntary resettlement programmes and international good practices adopted by multilateral development banks.

The ADB Indigenous Peoples Safeguards – A Planning and Implementation Good Practice Sourcebook Draft Working Document (ADB, 2013) outlines technical guidance and good practice recommendations in implementing the Safeguard Policy Statement with respect to indigenous peoples. The source book uses ADB's own experience in effective planning and implementing indigenous peoples safeguards and international good practices adopted by multilateral development banks.

2.2 Equator Principles

The Equator Principles (Equator Principles, 2013) are guidelines for financial institutions on managing environmental and social risk in project financing. The key points of the Principles for the purposes of this Project are presented below. The Principles apply to new project financing globally where the total project capital cost exceeds US$10m, and to project finance advisory activities. Project financiers who have adopted the Equator Principles require projects to meet the requirements of the principles and the IFC Performance Standards

Equator Principle Financial Institutions (EPFI) will only provide loans to projects that conform to Principles 1 to 9 as outlined below.

Principle 1 (Review and Categorisation)

> *"When a project is proposed for financing, the EPFI will, as part of its internal social and environmental review and due diligence, categorise it based on the magnitude of its potential environmental and social risks and impacts. Such screening is based on the environmental and social categorisation process of the International Finance Corporation (IFC). (Exhibit I)"*

Principle 2 (Social and Environmental Assessment)

> *"For all Category A and Category B Projects, the EPFI will require the client to conduct an Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and impacts of the proposed Project (which may include the illustrative list of issues found in Exhibit II). The Assessment Documentation should propose measures to minimise, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed Project."*

Principle 3 (Applicable Social and Environmental Standards)

"For projects located in non-designated countries, the assessment process evaluates compliance with the then applicable IFC Performance Standards on Environmental and Social Sustainability (Performance Standards) and the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines) (Exhibit III).

The Assessment process should, in the first instance, address compliance with relevant host country laws, regulations and permits that pertain to social and environmental issues."

Principle 4 (Environmental and Social Management System and Equator Principles Action Plan)

"For all Category A and Category B Projects, the EPFI will require the client to develop or maintain an Environmental and Social Management System (ESMS).

Further, an Environmental and Social Management Plan (ESMP) will be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards. Where the applicable standards are not met to the EPFI's satisfaction, the client and the EPFI will agree an Equator Principles Action Plan (AP). The Equator Principles AP is intended to outline gaps and commitments to meet EPFI requirements in line with the applicable standards."

Principle 5 (Consultation and Disclosure)

"For all Category A and Category B Projects, the EPFI will require the client to demonstrate effective Stakeholder Engagement as an ongoing process in a structured and culturally appropriate manner with Affected Communities and, where relevant, Other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. The client will tailor its consultation process to: the risks and impacts of the Project; the Project's phase of development; the language preferences of the Affected Communities; their decision-making processes; and the needs of disadvantaged and vulnerable groups. This process should be free from external manipulation, interference, coercion and intimidation.

To facilitate Stakeholder Engagement, the client will, commensurate to the Project's risks and impacts, make the appropriate Assessment Documentation readily available to the Affected Communities, and where relevant Other Stakeholders, in the local language and in a culturally appropriate manner.

The client will take account of, and document, the results of the Stakeholder Engagement process, including any actions agreed resulting from such process. For Projects with environmental or social risks and adverse impacts, disclosure should occur early in the Assessment process, in any event before the Project construction commences, and on an ongoing basis.

EPFIs recognise that indigenous peoples may represent vulnerable segments of project-affected communities. Projects affecting indigenous peoples will be subject to a process of Informed Consultation and Participation, and will need to comply with the rights and protections for indigenous peoples contained in relevant national law, including those laws implementing host country obligations under international law. Consistent with the special circumstances described in IFC Performance Standard 7 (when relevant as defined in Principle 3), Projects with adverse impacts on indigenous people will require their Free, Prior and Informed Consent (FPIC)."

Principle 6 (Grievance Mechanism)

"For all Category A and, as appropriate, Category B Projects, the EPFI will require the client, as part of the ESMS, to establish a grievance mechanism designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance.

The grievance mechanism is required to be scaled to the risks and impacts of the Project and have Affected Communities as its primary user. It will seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate, readily accessible, at no cost, and without retribution to the party that originated the issue or concern. The mechanism should not impede access to

judicial or administrative remedies. The client will inform the Affected Communities about the mechanism in the course of the Stakeholder Engagement process. "

Principle 7 (Independent Review)

"For all Category A and, as appropriate, Category B Projects, an Independent Environmental and Social Consultant, not directly associated with the client, will carry out an Independent Review of the Assessment Documentation including the ESMPs, the ESMS, and the Stakeholder Engagement process documentation in order to assist the EPFI's due diligence, and assess Equator Principles compliance."

Principle 8 (Covenant)

"For all Projects, the client will covenant in the financing documentation to comply with all relevant host country environmental and social laws, regulations and permits in all material respects.

Furthermore for all Category A and Category B Projects, the client will covenant the financial documentation:

a) to comply with the ESMPs and Equator Principles AP (where applicable) during the construction and operation of the Project in all material respects; and

b) to provide periodic reports in a format agreed with the EPFI (with the frequency of these reports proportionate to the severity of impacts, or as required by law, but not less than annually), prepared by in-house staff or third party experts, that

i) document compliance with the ESMPs and Equator Principles AP (where applicable), and

ii) provide representation of compliance with relevant local, state and host country environmental and social laws, regulations and permits; and

c) to decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan.

Where a client is not in compliance with its environmental and social covenants, the EPFI will work with the client on remedial actions to bring the Project back into compliance to the extent feasible. If the client fails to re-establish compliance within an agreed grace period, the EPFI reserves the right to exercise remedies, as considered appropriate."

Principle 9 (Independent Monitoring and Reporting)

"To assess Project compliance with the Equator Principles and ensure ongoing monitoring and reporting after Financial Close and over the life of the loan, the EPFI will, for all Category A and, as appropriate, Category B Projects, require the appointment of an Independent Environmental and Social Consultant, or require that the client retain qualified and experienced external experts to verify its monitoring information which would be shared with the EPFI."

Principle 10 (EPFI Reporting)

"For all Category A and, as appropriate, Category B Projects:

- *The client will ensure that, at a minimum, a summary of the ESIA is accessible and available online.*
- *The client will publicly report GHG emission levels (combined Scope 1 and Scope 2 Emissions) during the operational phase for Projects emitting over 100,000 tonnes of CO2 equivalent annually. Refer to Annex A for detailed requirements on GHG emissions reporting.*

The EPFI will report publicly, at least annually, on transactions that have reached Financial Close and on its Equator Principles implementation processes and experience, taking into account appropriate."

2.3 IFC Performance Standards

IFC's Performance Standards on Environmental and Social Sustainability (IFC, 2012), define the client's roles and responsibilities for managing their projects and the requirements for receiving and retaining IFC support. They are also relevant to other institutions applying the Equator Principles when making project financing decisions.

The Performance Standards represent the "policy framework" for the ESIA and sustainable social and environmental management for the Project which will be read alongside the ADB Safeguards, whereas the WBG EHS Guidelines provide guidance on general and industry good practice as well as recommended numerical limits for emissions to the atmosphere, noise, liquid and solid wastes, hazardous wastes, health and safety, and other aspects of development projects.

Performance Standard 1 establishes the importance of:

- integrated assessment to identify the social and environmental impacts, risks, and opportunities of projects;
- effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and
- the client's management of social and environmental performance throughout the life of the project.

Performance Standards 2 through 8 establish requirements to avoid, reduce, mitigate or compensate for impacts on people and the environment, and to improve conditions where appropriate. While all relevant social and environmental risks and potential impacts should be considered as part of the assessment, Performance Standards 2 through 8 describe potential social and environmental impacts that require particular attention in emerging markets. Where social or environmental impacts are anticipated, the client is required to manage them through its Social and Environmental Management System consistent with Performance Standard 1.

Table 2.1 provides a brief assessment as it stands to the current state of the project.

Table 2.2 : IFC Performance Standards and Objectives (IFC, 2012)

Performance Standard	Objectives
1 Assessment and Management of Environmental and Social Risks and Impacts	• To identify and evaluate environmental and social risks and impacts of the project. • To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimise, and where residual impacts remain, compensate/ offset for risks and impacts to workers, Affected Communities, and the environment. • To promote improved environmental and social performance of clients through the effective use of management systems. • To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately. • To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.
2 Labour and Working Conditions	• To promote the fair treatment, non-discrimination, and equal opportunity of workers. • To establish, maintain, and improve the worker-management relationship. • To promote compliance with national employment and labour laws. • To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain. • To promote safe and healthy working conditions, and the health of workers. • To avoid the use of forced labour.
3 Resource Efficiency and Pollution Abatement	• To avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from project activities. • To promote more sustainable use of resources, including energy and water. • To reduce project-related GHG emissions.

Performance Standard	Objectives
4 Community Health, Safety and Security	• To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances. • To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimises risks to the Affected Communities.
5 Land Acquisition and Involuntary Resettlement	• To avoid, and when avoidance is not possible, minimise displacement by exploring alternative project designs. • To avoid forced eviction. • To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost4 and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. • To improve, or restore, the livelihoods and standards of living of displaced persons. • To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.
6 Biodiversity Conservation and Sustainable Management of Living Natural Resources	• To protect and conserve biodiversity. • To maintain the benefits from ecosystem services. • To promote the sustainable management of living natural resources through the adoption of practices that integrates conservation needs and development priorities.
7 Indigenous Peoples	• To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples. • To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts. • To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner. • To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle. • To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present. • To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.
8 Cultural Heritage	• To protect cultural heritage from the adverse impacts of project activities and support its preservation. • To promote the equitable sharing of benefits from the use of cultural heritage.

2.4 WBG General and Industry Specific EHS Guidelines

In addition to the performance standards, the WBG has developed EHS Guidelines covering both general and industry specific issues. The WBG EHS Guidelines contain the performance levels and measures that are normally acceptable to WBG and are generally considered to be achievable in new facilities at reasonable costs by existing technology. The environmental assessment process may recommend alternative (higher or lower) levels or measures, which, if acceptable to the financiers, become project or site-specific requirements.

In general, when host country regulations differ from the levels and measures presented in the WBG EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment.

The WBG General EHS Guidelines became available for use in April 2007 (World Bank Group, 2007a) and have been used in the preparation of this ESIA Report and supporting technical analysis. The WBG industry specific EHS Guidelines applicable to this project are as follows:

- Environmental, Health, and Safety Guidelines for Thermal Power Plants (World Bank Group, 2008);

- Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution (World Bank Group, 2007b); and
- Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development (pipeline sections) (World Bank Group, 2007c).

2.4.1 General Environmental, Health and Safety Guidelines (April, 2007) (World Bank Group, 2007a)

The WBG General EHS Guidelines cover the following key areas:

Environmental

The general environmental guidelines are:

- Air Emissions and Ambient Air Quality;
- Energy Conservation;
- Wastewater and Ambient Water Quality;
- Water Conservation;
- Hazardous Materials Management;
- Waste Management; and
- Noise.

Occupational Health and Safety Guidelines

The general occupational health and safety guidelines are:

- General Facility and Design and Operation;
- Communication and Training;
- Physical Hazards;
- Chemical Hazards;
- Biological Hazards;
- Radiological Hazards;
- Personal Protective Equipment;
- Special Hazard Environments; and
- Monitoring.

Community Health and Safety Guidelines

The general community health and safety guidelines are:

- Water Quality and Availability;
- Structural Safety of Project Infrastructure;
- Life and Fire Safety;
- Traffic Safety;
- Transport of Hazardous Materials;
- Disease Prevention; and
- Emergency Preparedness and Response.

Construction and Demolition Guidelines

The general construction and demolition guidelines are:

- Environment;
- Occupational Health and Safety; and
- Community Health and Safety.

2.4.2 WBG EHS Guidelines for Thermal Power Plants (World Bank Group, 2008)

The WBG EHS Guidelines for Thermal Power Plants sets out relevant information that needs to be considered in the environmental and social impact assessments of combustion processes fuelled by gaseous, liquid and solid fossil fuels and biomass and designed to deliver electrical or mechanical power, steam, heat, or any combination of these, regardless of the fuel type, with a total rated heat input capacity above 50 MW thermal input (MWth) on Higher Heating Value basis. Key issues covered include:

Environment

- Air Emissions;
- Energy Efficiency and GHG Emissions;
- Water Consumption and Aquatic Habitat Alteration;
- Effluents;
- Solid Wastes;
- Hazardous Material and Oil; and
- Noise.

Occupational Health and Safety

- Non-ionizing radiation;
- Heat;
- Noise;
- Confined Spaces;
- Electrical Hazards;
- Fire and Explosion Hazards;
- Chemical Hazards; and
- Dust.

Community Health and Safety

- Water Consumption; and
- Traffic Safety.

2.4.3 WBG Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution (World Bank Group, 2007b)

The WBG EHS Guidelines for Electric Power Transmission and Distribution sets out relevant information that needs to be considered in the environmental and social impact assessment of transmission lines between a generation facility and a substation located within an electricity grid. Key issues covered include:

- Construction and maintenance of Right of Way and impacts on terrestrial habitats;
- Electric and magnetic fields;
- Noise;
- Hazardous materials; and
- Occupational health and safety.

2.4.4 WBG Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development (pipeline sections) (World Bank Group, 2007c)

The WBG EHS Guidelines for Onshore Oil and Gas Development sets out relevant information that needs to be considered in the environmental and social impact assessment of seismic exploration, exploration and production drilling, development and production activities, transportation activities including pipelines and other facilities. Key issues covered include:

Environment

- Air emissions;
- Wastewater / effluent discharges;
- Solid and liquid waste management;
- Noise generation;
- Terrestrial impacts and project footprint; and
- Spills.

Occupational Health and Safety

- Fire and explosion;
- Air quality;
- Hazardous materials;
- Transportation.

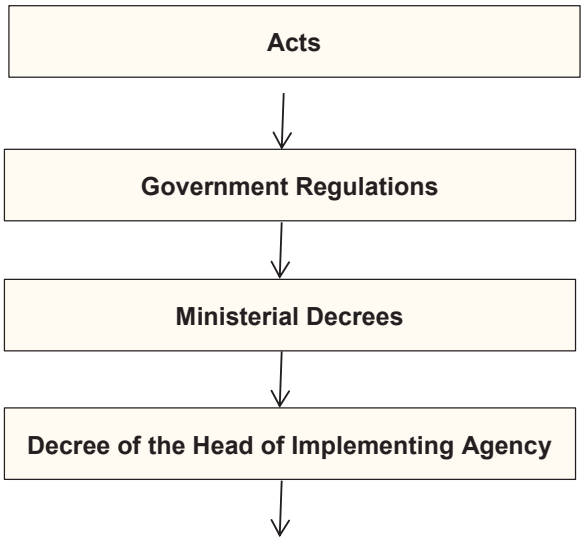
Community Health and Safety

- Physical hazards; and
- Security.

2.5 Indonesian Environmental Regulatory Framework

2.5.1 Overview

The Indonesian legal system is a hierarchal system, where National Regulations (Acts and National Government Regulations) act as the governing regulation, which are translated into implementing regulations and technical standards at lower levels of the government system (as stated on Law No. 12 of 2011 regarding formation of legislation). The requirements and standards in each regulation must be kept consistent at different levels of the government system, but should there be conflicting standards, the higher level regulation takes precedence. Figure 2.4 outlines the hierarchy system of Indonesian legislation.



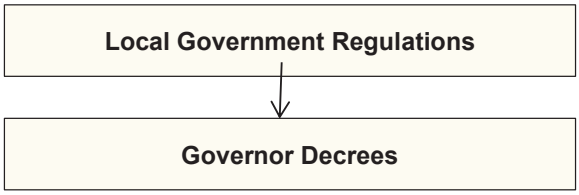


Figure 2.4 : Hierarchy System of Indonesian Legislation

At provincial level, Governor and provincial government can set up local government standards in the form of Governor Decrees and Provincial Local Government Regulations. These regulations apply only within the subject provincial jurisdiction. The Governor and/or provincial local government can set stricter environmental standards than those set at a National level. In such cases, the stricter standards shall be followed.

The various levels of government of Indonesia, including the provincial and local government agencies, that have some jurisdiction or control over the power plant, transmission line and gas pipeline construction and operation activities include:

- National Level: Ministry of Environment and Forestry (MOEF);
- Province Level: The Province of Riau; and
- Regency and City Level: Power plant and transmission line - Environmental Agency of Pekanbaru City (DLH – Kota Pekanbaru) and gas pipeline the Siak Regency and Pekanbaru City.

2.5.2 Relevant Regulations

An overview of regulations relevant to this Project and its specific components are summarised in Table 2.3.

Table 2.3 : Indonesian Environmental Regulations

Regulation	Summary	Project Component
General Requirements		
Act No. 32 of 2009 regarding Environmental Protection and Management	Overarching environmental law for Indonesia.	All Project components
Act No. 05 of 1990 regarding Natural Resources Conservation and its Ecosystems	Overarching on natural resources conservation with ecosystems on all over Indonesia	All Project components
Act No. 30 of 2009 regarding Electricity	Overarching on Electricity for Indonesia	Power generation business, transmission lines, land compensation,
Environmental Impact Assessment		
Government Regulation No. 27 of 2012 regarding Environmental Permit	Defines requirement to prepare an AMDAL including timeframes. Key components include technical assessments, developing an ongoing monitoring programme and consultation.	All Project components
Ministerial Environment Regulation No. 5 of 2012 regarding Types of Projects and/or Activities which require AMDAL	Defines activities that require an AMDAL including CCPP generation and electricity transmission.	All Project components
Ministerial Environment Regulation No.16 of 2012 regarding guidelines for environmental documentation	Provides guidance of the preparation of environmental documents, including an AMDAL and UKL/UPL.	All Project components

Regulation	Summary	Project Component
Ministerial Environment Regulation No.17 of 2012 regarding community participation in the AMDAL and environmental permit process	Outlines the public involvement requirements in the AMDAL and Environmental Permit process.	All Project components
Ministerial Environment Decree No.45 of 2005 regarding implementation report of the AMDAL and UKL/UPL	Guidelines for preparing implementation report for AMDAL and UKL UPL	All Project components
Ministerial Environment Regulation No. 2 of 2013 regarding sanctions for Environmental Management and Protection	Regulates sanctions for violations in environmental protection and management regulations	All Project components
Ministerial Environment Regulation No. 8 of 2012 regarding Procedures of Assessment and Examination of Environmental Documents	Regulates how to assess and examine an AMDAL or UKL/UPL documents prior to Environmental Permit	Assessment of AMDAL for the power plant and UKL-UPL for the transmission line and gas pipeline.
Water and Wastewater		
Government Regulation No. 82 of 2001 regarding Water Quality Management and Water Pollution Control	Regulates the ambient river water quality standards. PT MRPR as the project proponent must apply for and obtain a discharge permit from the provincial local government for discharging wastewater to river during the power station operation. Once the power station operates, PT MRPR or the assigned operating company must provide three monthly compliance reports to the Pekanbaru Mayor (Walikota Pekanbaru).	Power plant wastewater treatment plant effluent
Ministry of Environment Regulation No. 8 of 2009 regarding wastewater quality standards for thermal power plants	Regulates the minimum effluent quality of thermal power plants.	Power plant wastewater treatment plant effluent
Ministry of Environment Regulation No. 1 of 2010 regarding procedure for water pollution control	Provides guidance for central and local governments to implement water pollution control.	Power plant wastewater treatment plant effluent
Ministry of Environment and Forestry Regulation No. 68 of 2016 regarding standards for domestic wastewater.	Provides the standards for domestic wastewater.	Power plant wastewater treatment plant effluent
Ministry of Health Regulation No. 32 of 2017 regarding groundwater health and hygiene in relation to: pool, solus per aqua and public bath.	Provides the standards for using groundwater for daily activities.	Groundwater use
Natural Protection and Free Zone		
Presidential Decree No. 32 of 1990 regarding Protected Area	Determines environmentally sensitive areas that must be protected and used only for green / natural areas.	Overall project location determination
Ministry of Public Works and Housing Regulation No. 28 of 2015 regarding River and Lake Setback	Determines river areas and uses allowed in such areas, including River Free Zones that can only be used for green / natural areas with no permanent buildings.	Temporary jetty and gas pipeline
Ambient Air Quality and Air Emissions		
Government Regulation No. 41 of 1999 regarding Air Pollution Control	Regulates ambient air quality standards.	Gas turbine operation/exhaust stack emission, motor vehicle emission

Regulation	Summary	Project Component
Ministerial Environment Regulation No. 21 of 2008 regarding Emission Standard of Stationary Sources	Regulates emission standards.	Gas turbine operation/exhaust stack emission.
Noise		
Ministerial Decree of State Minister of Environment No. 48 of 1996 regarding Noise Level Standard	Regulates 55 dBA and 70 dBA as the noise thresholds for residential areas and at the site boundary of the power station respectively.	Project construction activities, power plant operation
Hazardous Waste & Substances		
Government Regulation No. 101 of 2014 regarding classification and management of hazardous materials	Determines characteristics of substances that should be classified as hazardous and toxic goods. Under this regulation, hazardous substances are to be managed in a manner similar to managing hazardous wastes.	Hazardous material use, Hazardous waste temporary storage, handling of hazardous waste by a licensed third-party company
Ministerial Environment Regulation No. 18 of 2009 regarding permit procedure of hazardous waste management	Regulates the hazardous waste management licensing procedure.	Hazardous waste temporary storage, handling of hazardous waste by a licensed third-party company
Ministerial Environment Regulation No. 30 of 2009 regarding the supervision of hazardous waste management	Regulates the supervision of hazardous waste management. This excludes the management of used oils.	Hazardous waste temporary storage, handling of hazardous waste by a licensed third-party company
Head of BAPEDAL Decree No. 1 of 1995 regarding procedures and technical requirements of hazardous waste storage and collection	Determines procedures and technical requirements for hazardous waste storage and collection.	Hazardous waste temporary storage, handling of hazardous waste by a licensed third-party company
Head of BAPEDAL Decree No. 2 of 1995 regarding documentation of hazardous waste	Regulates requirements for documentation of hazardous waste generated from and operation.	Hazardous waste temporary storage, handling of hazardous waste by a licensed third-party company
Head of BAPEDAL Decree No. 3 of 1995 regarding technical requirements for hazardous waste management	Determines technical requirements for hazardous management waste management	Hazardous waste temporary storage, handling of hazardous waste by a licensed third-party company
Solid waste		
Act No. 18 of 2008 regarding the management of waste	Regulates waste management in Indonesia.	Domestic waste
Government Regulation No. 81 of 2012 regarding Management of Domestic Waste	Determines requirements for domestic waste management.	Domestic waste
Ministry of Internal Affair Regulation No. 33 of 2010 regarding Waste Management Guideline	Determines guidelines for management of waste	Domestic waste
Land Acquisition		
Head of National Land Agency (BPN) Regulation No. 5 of 2012 regarding technical guide of land acquisition.	Regulates the procurement phase of the land and the authorities in the implementation of land acquisition.	Land acquisition for CCPP, water intake pipeline and transmission line tower.
Ministry of Mining and Energy Regulation No. 01.P/47/MPE/1992 regarding free space for high voltage and extra high voltage line for electric power distribution	Regulates space requirements for transmission lines, and requires land acquisition to be undertaken prior to construction.	Transmission line

Regulation	Summary	Project Component
Ministry of Energy and Mineral Resources No. 38 of 2013 regarding Compensation for land, building, and crop under high voltage and extra high voltage line	Regulates compensation that must be supplied by business proponent for land acquisition of high voltage and extra high voltage line free space.	Transmission line
Spatial Planning		
Law No. 26 of 2007 regarding spatial planning	Regulates spatial planning and requires the Project to be within the industrial zone determined in the local government strategic planning for land use.	All Project components
Ministry of Environment and Forestry Decree No 903 of 2016 regarding Forestry area in Riau Province.	Decree regarding the forestry status in Riau Province and used as a reference for Riau Province in building their spatial plan.	All Project components
Law No. 13 of 2017 on Amendments to Government Regulation No. 26 of 2008 on The National Spatial Plan	The National Spatial Plan, spatial utilization and control for area which has national strategic value has significant relation to the National Spatial Planning therefore it considered to be covered by the authority of central government and the Government Regulation is set to resolve the problem of inconformity between the implementation of projects with national strategic values and regional regulations on spatial planning. The Riau 275MW CCPP is included Annex VA on Electricity Generation Infrastructure Network letter M Number 3 of Government Regulation No. 13 of 2017 on Amendment to Government Regulation Number 26 Year 2008 on National Spatial Plan and is subject to the requirements of Law No 13.	All Project components
Cultural Heritage		
Law No. 11 of 2010 regarding Cultural Heritage	Regulates the management and procedures for preservation of cultural heritage	All Project components

2.5.3 AMDAL and UKL/UPL Approval Process

The Project will require a number of permits under Indonesian environmental legislation for construction and operation. Applications have been made in parallel with the preparation of this ESIA Report. Permits and approvals that must be obtained prior to construction include:

- Approval Letter of Land Acquisition (SP3L: Surat Persetujuan Prinsip Pembebasan Lokasi/Lahan).
- Land Ownership Certificate/the right to establish construction on land owned by the State or private owner (HGB: Hak Guna Bangunan).
- Land Use Reference Permit / Location Permit / Principal Permit – these are required before construction works can commence. The Principal and Location Permits must be obtained before an AMDAL approval can be issued and in most instances before a KA-ANDAL can be approved.
- An AMDAL (Analisis Mengenai Dampak Lingkungan) complete with approval from DLHK Pekanbaru City is required before an Environmental Permit can be issued for the power plant.

- Separate UKL/UPL approvals are required for the150 kV transmission line (approval from DLHK Pekanbaru City) and for the gas pipeline (approval from DHK Riau Province) before Environmental Permits for these facilities can be issued.

In Indonesia, AMDAL is the primary instrument for planning preventive measures against pollution and environmental damage arising from a business and/or activity. AMDALs are undertaken at the planning stage of a project to provide input to:

- the regional spatial planning;
- the authority as reference to decide on project feasibility;
- provide input to the project's detailed design and plan;
- provide input to the environment management and monitoring plant; and
- consultation with the impacted community and project stakeholders.

Activities under a certain threshold only require the preparation of an Environmental Management and Monitoring Plan known as UKL – UPL (Upaya Pengelolaan Lingkungan – Upaya Pemantauan Lingkungan). The AMDAL and UKL – UPL process is shown in Figure 2.5.

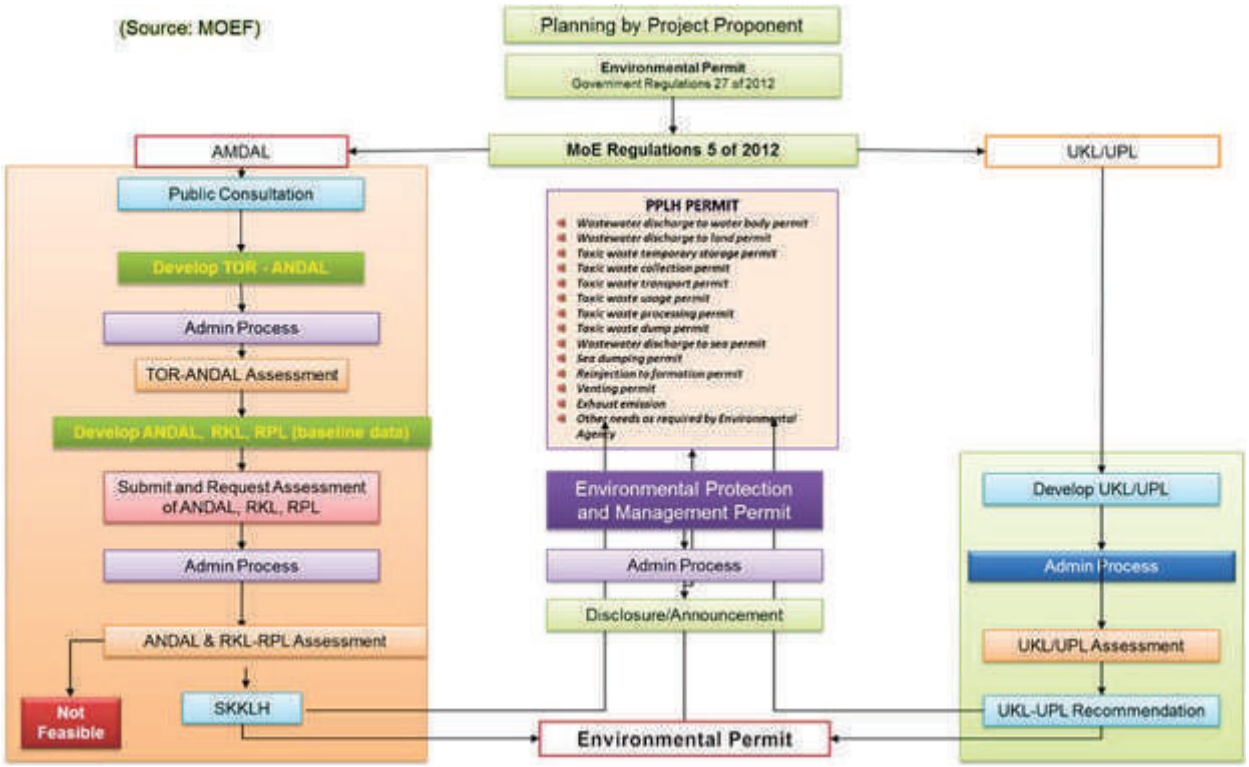


Figure 2.5 : AMDAL and Environmental Permit Process

A full AMDAL process would typically take about 8 to 12 months to complete while the UKL/UPL would typically be only 2-4 months. The minimum time for the development and processing of an AMDAL under the legislation is 8.5 months. KA-ANDAL (ANDAL Terms of Reference) must be approved by the AMDAL Committee before the proponent can move on to developing the ANDAL, RKL and RPL for the development.

AMDAL and UKL/UPL Requirements

The following requirements must be met in order to obtain an AMDAL and/or UKL/UPL:

- A spatial plan and associated description showing the location of the Project;

- Formal evidence stating that the type of business and / or activity can be done in principle, which can be in the form of recommendations from regional authorities stating that the activity and / or business can be done in principle;
- Obtaining the requisite Principal Permit and Location Permit; and
- Applicant to be registered with the MOEF.

The following requirements must be met to obtain an Environmental Permit:

- Compliance with the requirements and obligations contained in the Environmental Permit, and the Protection and Environmental Management permit;
- Preparation of a report on the implementation of the requirements and obligations of the Environmental Permit to authorities every 6 months; and
- Provision of a guarantee fund for the restoration of the environment function in accordance with applicable regulations.

2.5.4 Further Permits Required

A number of permits are required to be obtained prior to construction commencing and an AMDAL approval must be obtained in order to apply for the following permits:

- Building Construction Permit (IMB: Izin Mendirikan Bangunan);
- Permit to Construct Wharf or Jetty (Special Port);
- Hazardous Waste Storage Permit; and
- Borrow Lease Forest Area Permit (IPPKH: Izin Pinjam Pakai Kawasan Hutan) for gas pipeline if in Production Forest.

Operating permits applicable to the proposed facility include, but are not limited to, the following:

- Permit to Use River Water as a Water Source;
- Waste Water Discharge Permit to Watercourse; and
- Industrial Business Licence.

These permits will need to be obtained before the operation commences. Other permits required to operate the facility will be based upon recommendations of the AMDAL report.

2.5.5 Project Permit Status

The current permit status relevant to this project is described below. The status of the land procurement and Right of Way (RoW) for the Project is discussed in ESIA Volume 3 – SIA.

- 6th February 2018 – The Central and Provincial government met to discuss the issue of MRPR's Project site location spatial plan. The outcome of the meeting is as follows:
  - The project site location complies with the national spatial planning regulation;
  - Permitting process for the project may resume based on a recommendation issued by the Spatial Plan/Land Title Agency; and
  - Provincial government of Riau shall expedite the provincial spatial plan regulation to accommodate the planned location of the Project.
- 27th March 2018 – The Ministry of Agraria and Spatial Planning has issued the Recommendation Letter on the National Planning Regulation (A copy of this letter is provided in ESIA Volume 5: Technical Appendices);
- 6th May 2018 – Riau Province government issued the Regional Regulation No. 10 Year 2018 regarding the Spatial Plan of Riau Province for 2018 – 2038 period that accommodated the Riau 275 MW Gas Fired Power Plant Project at the Project location;

- The KA (kerangka Acuan) ANDAL was approved on the 28th June 2018 and subsequently the ANDAL process is now being commenced to apply the scope and methodologies agreed with the AMDAL Committee in the approved KA-ANDAL;
- A hearing session with the Technical Team of DLHK Pekanbaru City and the AMDAL Appraisal Committee of the Draft ANDAL and RKL-RPL document was held on 27th September 2018 at Pekanbaru. Comments raised in the session and list of review comments were issued by DLHK Pekanbaru City on 3rd October 2018;
- Submission of Final ANDAL and RKL-RPL document to DLHK Pekanbaru City for review and approval is expected in the week of 5th November 2018;
- The UKL/UPL for the Special Facilities (150 kV transmission line and switchyard) was submitted to DLHK Pekanbaru City on 31st July 2018 and was subsequently approved by DLHK Pekanbaru City on 17th September 2018;
- Environmental Permit for the construction and operation of the Special Facilities (150 kV transmission line and switchyard) was issued on 17 September 2018;
- The UKL/UPL for gas pipeline was submitted to DLHK Riau Province for review and approval on 15 October 2018.
- A hearing session with DLHK Riau Province on the initial version of the gas pipeline UKL/UPL document was held on 1 November 2018, resulting in a number of comments for revision into the final version of the UKL/UPL document.
- Submission of final version of the gas pipeline UKL/UPL document to DLHK Riau Province for review and approval is expected in the week of 19th November 2018.

2.5.6 Summary of Standards Contained in the Regulations Pertaining to Riau CCPP Development

A summary of standards relevant to the Project are detailed in the following sections. These standards are as follows:

- Government Regulation No. 82 of 2001 regarding water quality management and water pollution control;

Ministry of Health Regulation No. 32 of 2017 regarding standard for groundwater health and hygiene in relation to: pool, solus per aqua and public bath;

- Government Regulation No. 41 of 1999 regarding Air Pollution Control;
- Ministry of Environmental No. 21 of 2008 regarding emission quality standard from static source for thermal plant; and
- Ministry of Environmental Decree No. 48 of 1996 regarding noise level standard and Ministry of Manpower Affair Regulation No. 13 of 2011 regarding threshold limit of physical factor at workplace.
- Ministry of Environment Regulation No. 08 of 2009 regarding wastewater quality standards for thermal power plants; and
- Ministry of Environment and Forestry Regulation No. 68 of 2016 regarding standards for domestic wastewater.

Government Regulation No. 82 of 2001 regarding water quality management and water pollution control

This regulation regulates water quality and water pollution to rivers. Table 2.3 below highlights the water quality threshold criteria relevant for this Project.

Table 2.4 : River Water Quality Standards

Parameters	Unit	Class I	Class II	Class III	Class IV	Comments
PHYSICS						
Temperature	°C	Deviation 3	Deviation 3	Deviation 3	Deviation 5	Temperature deviation from water natural condition
Dissolved material	mg/L	1000	1000	1000	2000	
Suspended material	mg/L	50	50	400	400	If the water is to be used as raw water in a conventional water treatment, the limit is ≤5000 mg/L
INORGANIC CHEMISTRY						
pH		6-9	6-9	6-9	5-9	If the natural pH of the water is beyond the limit range, the natural pH is to be referred to.
BOD	mg/L	2	3	6	12	
COD	mg/L	10	25	50	100	
DO	mg/L	6	4	3	0	Minimum limits
Total phosphate as P	mg/L	0.2	0.2	1	5	
NO_3 as N	mg/L	10	10	20	20	
NH_3-N	mg/L	0.5	-	-	-	For fishery, the limit is ≤0.02 mg/L as NH_3
Arsenic	mg/L	0.05	1	1	1	
Cobalt	mg/L	0.2	0.2	0.2	0.2	
Barium	mg/L	1	-	-	-	
Boron	mg/L	1	1	1	1	
Selenium	mg/L	0.01	0.05	0.05	0.05	
Cadmium	mg/L	0.01	0.01	0.01	0.01	
Chrom (VI)	mg/L	0.05	0.05	0.05	1	
Copper	mg/L	0.02	0.02	0.02	0.2	If the water is to be used as raw water in a conventional water treatment, Cu ≤ 1 mg/L
Iron	mg/L	0.3	-	-	-	If the water is to be used as raw water in a conventional water treatment, Fe ≤ 5 mg/L
Lead	mg/L	0.03	0.03	0.03	1	If the water is to be used as raw water in a conventional water treatment, Pb ≤ 0.1 mg/L
PHYSICS						
Manganese	mg/L	0.1	-	-	-	
Mercury	mg/L	0.001	0.002	0.002	0.005	
Zinc	mg/L	0.05	0.05	0.05	2	If the water is to be used as raw water in a conventional water treatment, Zn ≤ 5 mg/L
Chloride	mg/L	600	-	-	-	
Cyanide	mg/L	0.02	0.02	0.02	-	
Fluoride	mg/L	0.5	1.5	1.5	-	
Nitrite as N	mg/L	0.06	0.06	0.06	-	

Parameters	Unit	Class I	Class II	Class III	Class IV	Comments
Sulphate	mg/L	400	-	-	-	
Free chloride	mg/L	0.03	0.03	0.03	-	
Sulphur as H_2S	mg/L	0.002	0.002	0.002	-	
MICROBIOLOGY						
Fecal coliform	Ind/100 mL	100	1000	2000	2000	If the water is to be used as raw water in a conventional water treatment, faecal coliform ≤ 2000 Ind/100mL and total coliform ≤ 10000 Ind/100mL
Total coliform	Ind/100 mL	1000	5000	10000	10000	
RADIOACTIVITY						
Gross-A	Bq/L	0.1	0.1	0.1	0.1	
Gross-B	Bq/L	1	1	1	1	
ORGANIC CHEMISTRY						
Oil and grease	µg/L	1000	1000	1000	-	
Detergent as MBAS	µg/L	200	200	200	-	
Phenols	µg/L	1	1	1	-	
BHC	µg/L	210	210	210	-	
Aldrine/Dieldrine	µg/L	17	-	-	-	
Chlordane	µg/L	3	-	-	-	
DDT	µg/L	2	2	2	2	
PHYSICS						
Heptachlor and heptachlor epoxide	µg/L	18	-	-	-	
Lindane	µg/L	56	-	-	-	
Methoxychlor	µg/L	35	-	-	-	
Endrine	µg/L	1	4	4	-	
Toxaphane	µg/L	5	-	-	-	

Ministry of Health Regulation No. 32 of 2017 Regarding Standards for Groundwater Health and Hygiene in Relation to Pool, Solus per Aqua and Public Bath

This regulation regulates groundwater health and hygiene relating to pool, solus per aqua and public health. Table 2.4 below highlights the threshold criteria relevant for this Project.

Table 2.5 : Water Quality Standard for Sanitation and Hygiene

Parameter	Unit	Emission Limit
PHYSICS		
Turbidity	NTU	25
Color	TCU	50
Total Dissolved Solid	mg/L	1000
Temperature	°C	Room temperature ±3
Taste/flavour		No taste
Smell		No smell
BIOLOGY		
Total coliform	CFU/100ml	50
E.Coli	CFU/100ml	0
CHEMICAL (COMPLUSORY)		
pH	mg/L	6.5 – 8.5
Iron (Fe)	mg/L	1
Fluoride (F)	mg/L	1.5
Hardness ($CaCO_3$)	mg/L	500
Manganese (Mn)	mg/L	0.5
Nitrate (NO_3 - N)	mg/L	10
Nitrite (NO_2 - N)	mg/L	1
Cyanide (Cn)	mg/L	0.1
Detergent	mg/L	0.05
Total pesticide	mg/L	0.1
CHEMICAL ADDITIONAL*		
Mercury (Hg)	mg/L	0.001
Arsenic (As)	mg/L	0.05
Cadmium (Cd)	mg/L	0.005
Chromium Hexavalent (Cr_{6+})	mg/L	0.05
Selenium (Se)	mg/L	0.01
Zinc (Zn)	mg/L	15
Sulphate	mg/L	400
Lead (Pb)	mg/L	0.05
Benzene	mg/L	0.01
Organic matter ($KMNO_4$)	mg/L	10

** Chemical (additional) is determined by local government and airport/port authority*

Government Regulation No. 41 of 1999 regarding Air Pollution Control

This regulation regulates ambient air quality standards. Table 2.5 below highlights the ambient air threshold criteria relevant for this Project.

Table 2.6 : Ambient Air Quality Standard

Parameter	Exposure Period	Threshold Limit
SO_2 (Sulphur dioxide)	1 hour	900 µg/Nm^3
	24 hours	365 µg/Nm^3
	1 year	60 µg/Nm^3
CO (Carbon monoxide)	1 hour	30,000 µg/Nm^3
	24 hours	10,000 µg/Nm^3
NO_2 (Nitrogen dioxide)	1 hour	400 µg/Nm^3
	24 hours	150 µg/Nm^3
	1 year	100 µg/Nm^3
O_3 (Oxidant)	1 hour	235 µg/Nm^3
	1 year	50 µg/Nm^3
HC (Hydro carbon)	3 hours	160 µg/Nm^3
PM_{10} (Particulate Matter <10µm)	24 hours	150 µg/Nm^3
$PM_{2.5}$ (Particulate Matter 2.5µm)*	24 hours	65 µg/Nm^3
	1 year	15 µg/Nm^3
TSP	24 hours	230 µg/Nm^3
	1 year	90 µg/Nm^3
Pb (Lead)	24 hours	2 µg/Nm^3
	1 year	1 µg/Nm^3
Dust fall	30 days	10 tonnes/km^2/month (for residential area)
		20 tonnes/km^2/month (for industrial area)

**Applicable since 2002*

The local environmental agency, through AMDAL, can also set stricter air emissions. Where AMDAL requirements are stricter than the national standards, the Project Sponsor is obliged to comply with the stricter limits.

Ministry of Environmental No. 21 of 2008 regarding emission quality standard from static source for thermal plant

Regulation No. 21 appendix IIIA regulates the air emission standards stationary sources resulting from the thermal power plant. Management of Riau thermal power plant must manage air emissions generated in order not to exceed the quality standards that have been set as show in Table 2.6.

Table 2.7 : Emission Quality Standard from Static Source for Thermal Power Plant (CCPP)

No.	Parameter	Unit	Standard
1.	SO_2	mg/Nm^3	150
2.	NOx as NO_2	mg/Nm^3	400
3.	Total Particulate	mg/Nm^3	30
4.	Opacity	%	-

Ministry of Environmental Decree No. 48 of 1996 regarding noise level standard and Ministry of Manpower Affair Regulation No. 13 of 2011 regarding threshold limit of physical factor at workplace

Regulation No. 48 of 1996, regulates noise levels and requires 55 dBA and 70 dBA as the noise thresholds for residential areas and at the site boundary of the power station respectively. These limits as shown in Table 2.7

below are applicable during day and night and apply to the construction and operational phases of the power station.

Table 2.8 : Noise Thresholds Applicable to the Project

Parameter	Threshold Limit
Industrial boundary limit	70 dBA
Point source noise limit in plant (Occupational health noise level)	85 dBA*
Residential area	55 dBA

* *The Ministerial Decree of Manpower Affairs No. 51 of 1999 regulates the noise limit at the workplace to 85 dBA for 8 hour day maximum exposure.*

Ministry of Environment Regulation No. 08 of 2009 regarding Wastewater Quality Standards for Thermal Power Plants

Regulation No. 08 of 2009, regulates the minimum effluent quality of thermal power plants, as applicable depending on the source of the wastewater.

Table 2.9 : Wastewater Sourced from Main Process

No.	Parameter	Unit	Standard
1.	pH	-	6 – 9
2.	TSS	mg/L	100
3.	Oil & Grease	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 (PO4-) **	mg/L	10

*Note: * If cooling tower blowdown directed to WWTP*
*** If phosphate injection undertaken*

Table 2.10 : Wastewater Sourced from Blowdown Boiler

No.	Parameter	Unit	Standard
1.	pH	-	6 – 9
2.	Copper (Cu)	mg/L	1
3.	Iron (Fe)	mg/L	3

Note: If wastewater from Blowdown Boiler not directed to WWTP

Table 2.11 : Wastewater Sourced from Blowdown Cooling Tower

No.	Parameter	Unit	Standard
1.	pH	-	6 – 9
2.	Free Chlorine (Cl2) *	mg/L	1
3.	Zinc (Zn)	mg/L	1
4.	Phosphate (PO4-) **	mg/L	10

Note: If wastewater from Blowdown Cooling Tower not directed to WWTP

Table 2.12 : Wastewater Sourced from Demineralisation Plant

No.	Parameter	Unit	Standard
1.	pH	-	6 – 9
2.	TSS	Mg/L	100

Note: If wastewater from Demineralisation plant not directed to WWTP

Ministry of Environment and Forestry Regulation No. 68 of 2016 regarding Standards for Domestic Wastewater

Regulation No. 68 of 2016, provides the standards for domestic wastewater.

Table 2.13 : Domestic Wastewater Threshold for Standalone Facility Applicable to the Project

Parameter	Unit	Threshold Limit*
pH	-	6 – 9
BOD	Mg/L	30
COD	Mg/L	100
TSS	Mg/L	30
Oil & Grease	Mg/L	5
Ammonia	Mg/L	10
Total Coliform	Amount/100mL	3000
Debit	L/person/day	100

** Apartment/flats, lodging, dormitories, health services, education institution, offices, commerce, markets, restaurants, meeting halls, recreation arena, settlement, industry, WWTP (for industrial area), WWTP (for settlements), WWTP (municipal), ports, airports, train stations, public transportation stations, correctional institutions*

3. Project Description

The purpose of this Section is to provide an overview of the construction, commissioning, operating and decommissioning of the Project. The full technical details used to inform the assessments of impacts are provided in ESIA Volume 5: Technical Appendices, Technical Report – Process Description. The information detailed within this Section is based on preliminary engineering work, involving the EPC Contractor's preliminary design of the power plant. The construction of the project will use two EPC Contractor's, one for the power plant and the other for the gas pipeline. The EPC Contractor's involved are as follows:

- Lotte Engineering & Construction (Lotte E&C) of South Korea – Power plant, switchyard, transmission line and water supply and discharge pipeline.
- PT. Citra Panji Manunggal (CPM) of Indonesia – Gas pipeline

The process description covers the following major elements:

- Overview;
- Site Location;
- Land Requirements;
- Schedule;
- Construction – power plant, transmission line and switchyard, water supply and discharge pipelines, gas pipeline, local access and temporary facilities;
- Commissioning – power plant, transmission line and gas pipeline;
- Operation – general operating arrangements, power plant, use of water, road network, electrical equipment and interconnection, hazardous substances; and
- Decommissioning.

3.1 Overview

The key components of the project include:

- 275 MW combined cycle power plant (CCPP) burning natural gas fuel only;
- 40 km long gas supply pipeline which will bring fuel to the site;
- 150 kV switchyard;
- Approximately 750 m long overhead 150 kV transmission line to connect the power plant to the PLN grid via interception with the existing Tenayan – Pasir Putih 150 kV transmission line;
- 400 m access road;
- Temporary jetty for transportation of heavy equipment to site during construction; and
- Water supply and discharge pipelines to and from the Siak River.

Once constructed, ownership of the switchyard and transmission line collectively known as the special facilities will be transferred to PLN. At the end of the 20-year term of the PPA, PLN will take ownership of the power plant and gas supply pipeline. The power plant is a 2 x 1 combined cycle plant, designed to deliver up to 275 MW over the 20-year term of the PPA.

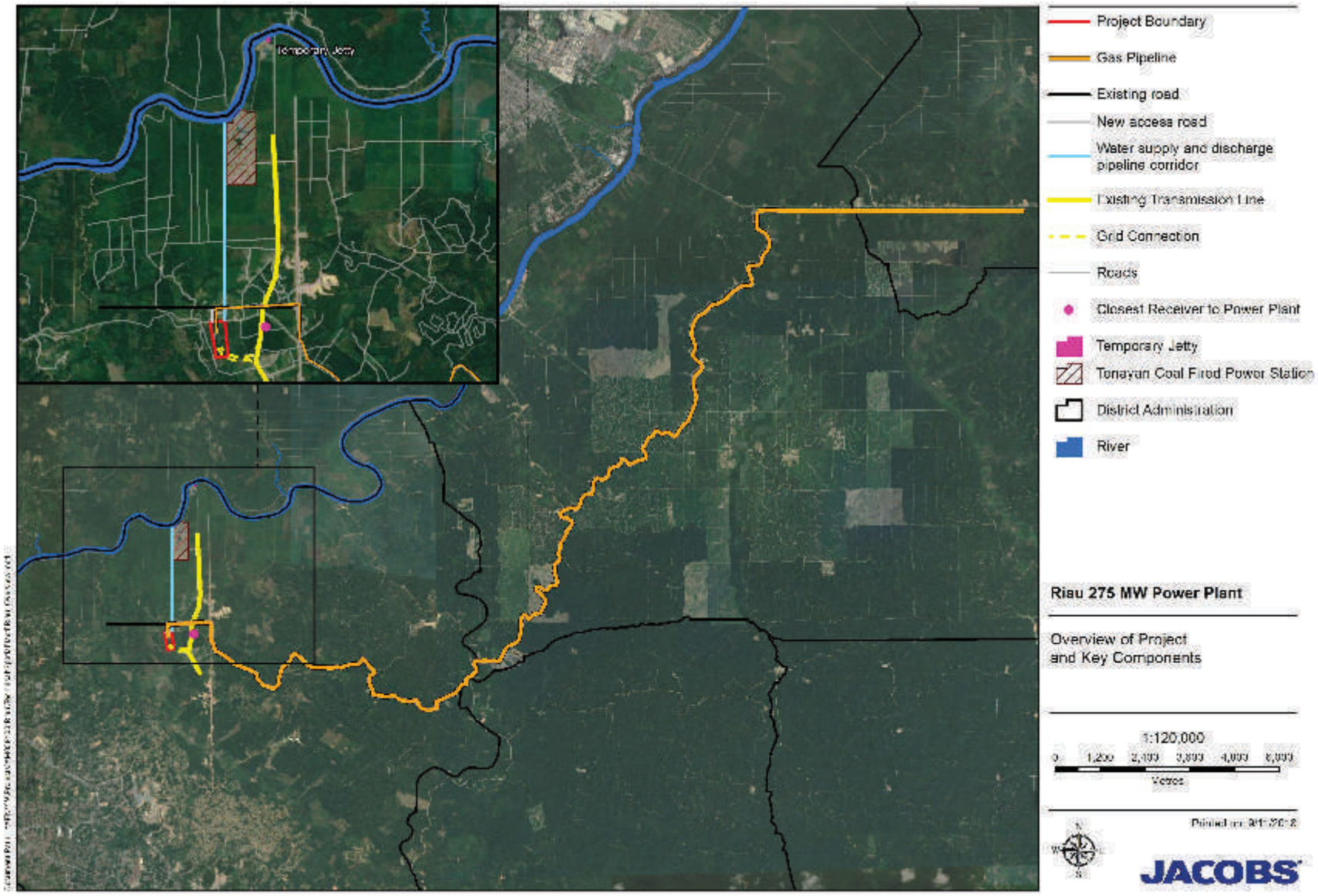


Figure 3.1 : Overview of Project and Key Components

3.2 Site Location

The power plant and special facilities is located in the Tenayan Industrial Village (previously known as Sail Village), Tenayan Sub District, Pekanbaru City, Province of Riau. According to Pekanbaru City's Spatial Plan, the land is in a zone allocated for Industrial and Warehousing use. The power plant site is located approximately:

- 10 km due east of the city of Pekanbaru in central Sumatra, Indonesia;
- 3 km south of the Siak River; and
- 2 km south of PLN's existing Tenayan CFPP.

The power plant site and switchyard is located in an area comprising predominantly of palm oil plantations. The site is bounded by palm oil plantations to the west, south and east and Road 45 on the North. The closest residential receptor to the power plant site is 560 m to the east as noted in Figure 3.1.

The 40 km gas pipeline route mainly follows along the easement of existing roadways although it does at points intersect several roads, two rivers and a small creek.

Figure 3.1 above provides an overview of the setting of the Site and gas pipeline route relative to Pekanbaru City and PLN's existing Tenayan CFPP, the existing road network and Siak River.

Co-ordinates for key project features are detailed in Table 3.1 below.

Table 3.1 : Co-ordinates of Project Features

Project Feature	Coordinates (WGS 84)	
	Latitude	Longitude
Power plant	0° 32' 15"	101° 31' 18"
	0° 32' 15"	101° 31' 12"
	0° 32' 31"	101° 31' 10"
	0° 32' 31"	101° 31' 17"
Water intake and discharge pipeline	0° 32' 31"	101° 31' 12"
	0° 34' 00"	101° 31' 11"
Transmission line	0° 31' 57"	101° 31' 36"
	0° 33' 53"	101° 31' 36"
Access Road	0° 32' 31"	101° 31' 11"
	0° 32' 37"	101° 31' 11"
Gas Pipeline	0° 32' 25"	101° 31' 13"
	0° 38' 38"	101° 43' 34"
Temporary Jetty	0° 34' 38"	101° 31' 36"

3.3 Land Requirements

MRPR plan is to construct the power plant and switchyard on a 9.1 ha plot of privately owned land. The total land requirements for the power plant and switchyard (excluding temporary laydown areas and offices for the construction workforce) are estimated at approximately 5.4 ha as outlined in Table 3.2. Preliminary Site layout plans are provided in the Appendix A.

Table 3.2 : Power Plant Land Requirements

Riau 275MW CCPP Power Plant Land Area Requirements	Approximate Area (ha)
Power plant and main plant buildings (GTGs, HRSGs, STG & Control Room)	1.2
Cooling tower	0.2
Balance of plant area	2.5
Switchyard (150 kV) (part of the Special Facilities to be owned by PLN)	1.5
Total	**5.4**

During construction, there will be further land requirements for the construction workforce including temporary laydown areas and offices. The additional area, estimated at a further 3.7 ha, will be within the site area (total of 9.1 ha). The area currently allocated for the future expansion of the switchyard will be available for laydown purposes during construction.

There will also likely be a need for a temporary jetty to be built on or on the banks of the Siak River and is expected to be located close to PLN's existing Tenayan CFPP. This will be used for transportation of materials and equipment during the construction phase of the power plant.

In addition, the Project will have land requirements for the water abstraction point at the Siak River, water supply pipelines to and from the power plant site, the gas supply pipeline, and the 150 kV transmission line, as outlined in Table 3.3.

Table 3.3 : Off-Site Land Requirements

Equipment Item	Approximate Dimensions (m x m)	Approximate Area (ha)
River Water Pump House plus Local Building	50 x 40	0.2
Water Supply and Discharge Pipeline Corridor	6 x 3,000	1.8
Gas Supply Pipeline	2 x 40,000	8
Transmission Line (including 4 towers) – normally via an easement.	75 x 750	5.6
Transmission Line Towers (straddled by transmission line)	4 x 40 x 40	0.64
Access Road	8 x 400	0.32
Temporary Jetty	100 x 70	0.7
Total		**17.26**

MRPR intend to purchase the land associated with the power plant and special facilities by a willing seller/willing buyer transaction. Land associated with the water intake and pumphouse will be leased. A 4.5 km section of the gas pipeline will be purchased by a willing seller/willing buyer transaction otherwise, the gas pipeline will run along the road reserve on land that will be leased from the government. Land will also be leased from the government for the water supply and wastewater discharge pipelines. Further details on the land acquisition process and number of landowners is detailed in ESIA Volume 3 – Social Impact Assessment.

3.4 Schedule

The construction of the project is anticipated to take 24 months with six months for commissioning, as outlined in the indicative schedule in Table 3.4 below. It should be noted that the timings are on the basis of all construction activities occurring in parallel. The PPA term is 20 years after which the ownership of the development will be passed to PLN.

Table 3.4 : Construction and Commissioning Schedule

Activity	Estimated Duration (months)
Site clearance and levelling (may commence before financial close)	6
Gas pipeline construction	12
Power plant and switchyard engineering, procurement and construction	24
Construction of water intake and discharge pipelines	8
Transmission line construction	8
Commissioning	6

3.5 Construction

3.5.1 Power Plant

Site Clearance and Levelling

The power plant and special facilities area will need to be cleared of vegetation and debris prior to levelling. Site clearance will include felling, trimming and cutting of trees. Vegetation, roots, debris, stones and other materials will be stripped using a combination of mowing, grubbing and raking.

Topsoil will be stripped and transported to a designated onsite storage area. Prior to being filled, any sub-grade surfaces will be freed of standing water and unsatisfactory soil materials will be removed. All vegetation and unsatisfactory soil material will be transported and disposed of at an off-site facility approved by municipal authorities.

Site levelling will aim to utilise existing cut fill where possible to minimise the need for disposal and import of new material. It is estimated that cut and fill / backfilling volumes will be well balanced at 165,000 m^3 and therefore import of fill material is not anticipated. However, it is estimated that 45,000 m^3 of unsatisfactory soil will need to be disposed of either onsite if possible or off-site at an approved disposal area. MRPR have instructed the EPC Contractor to investigate whether further storage of cut material on-site is achievable in order to reduce the volume being disposed of offsite. MRPR will strive for on-site disposal and if this is not possible, then off-site disposal will have to be used for the remaining material that cannot be disposed off on-site.

Currently there are two options for offsite disposal, one located 350 m from site which comprises of scrubby bush and bare land not used for plantation purposes. The second option is located 2.6 km from site and is a pre-existing borrow pit area (Figure 3.2). At 20 m^3 per truck, this will require 2,250 truck movements over approximately 3 months. Both proposed soil disposal areas are within the overall area designated for industrial and commercial uses. For the selected disposal site additional environmental studies will need to be conducted to ensure that the Safeguard and Performance Standards requirements will be met..

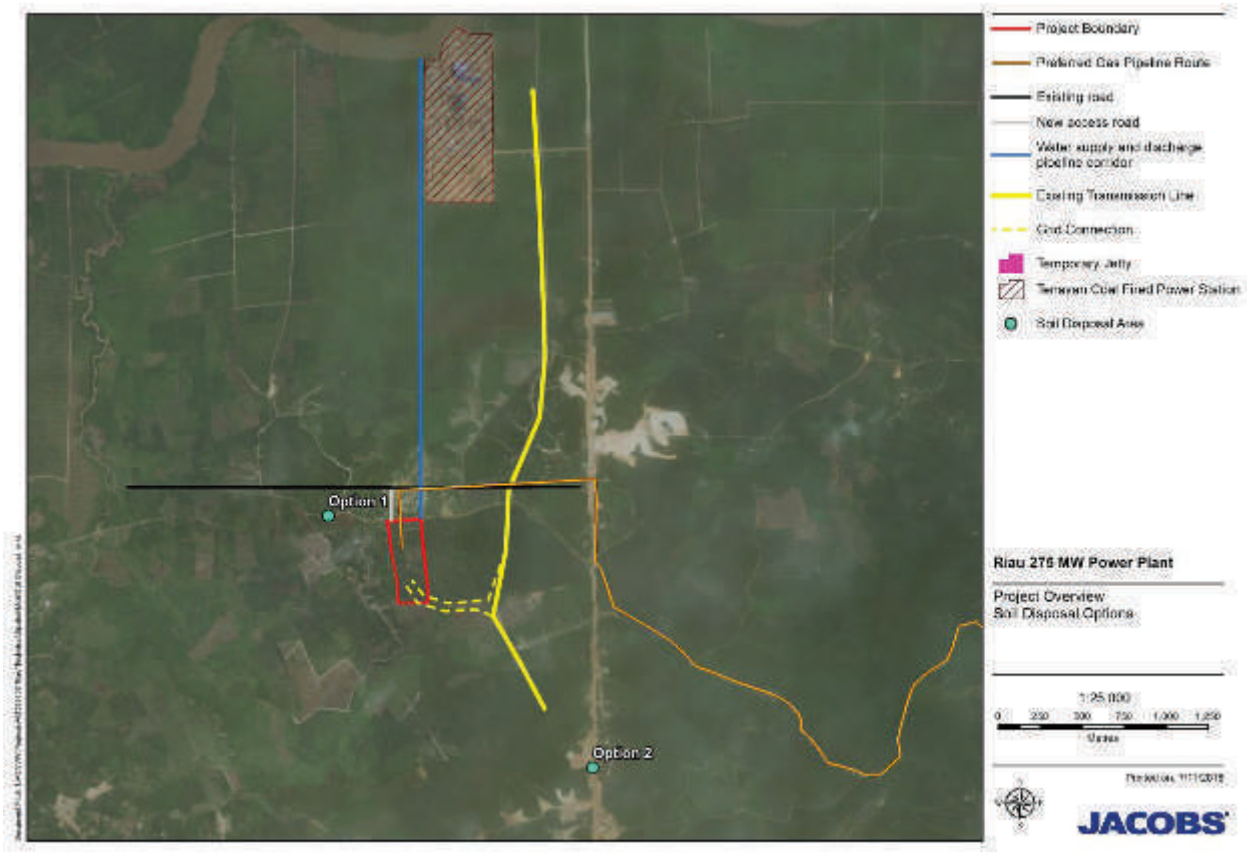


Figure 3.2 : Soil Disposal Sites

Excavations

A range of excavations will be carried out including:

- Excavation for structures (footings and foundations);
- Excavation of ditches, gutters, and channels;
- Excavation for drainage structures; and
- Trench excavation.

Soil on the power plant site will be deposited and compacted, and the slopes will be trimmed to ensure that the soil is stable and free of surface depressions, and the slopes drain freely and do not interfere with natural drainage to or from the surrounding area.

Piling

Piling will be required as part of construction activities and will likely include the following methods:

- Pile driving – Pile driving will be used to pile the main power station foundations. Driving shall be done with fixed leads to hold the pile firmly in position and in axial alignment with the hammer. Piles will be driven continuously and without interruption to or below the calculated tip elevation to reach a driving resistance based on load test results; and
- Bored cast-in-place – Bored, cast-in place piles may be used for lighter structures. With this technique, the pile hole is bored out, a steel cast is placed in the hole and the pile is formed using reinforcing steel and concrete.

Sheet piling may be used to protect shallow excavations which are normally backfilled once the equipment is installed. All pile driving will be carried out during day time only.

Foundations

Reinforced concrete foundations and base building slabs will be prepared prior to the installation of power plant infrastructure. The required volume of concrete will depend on the final design. However, it has been estimated that between 20,000 to 30,000 m^3 of concrete will be required. Concrete for the foundations and building slabs will be brought on to the site in a ready-mixed form by concrete trucks. It has been estimated that between 2,000 to 3,000 deliveries will be required.

Equipment and Building Installation

Following placement of foundations, power plant infrastructure will be installed. Infrastructure comprises a combination of standalone units (e.g. gas turbine sets, heat recovery steam generators (HRSG) and step-up transformers) or units contained within housing (e.g. steam turbine generator set and the condenser). Infrastructure requiring house will be installed in purpose built structures.

The majority of equipment will be pre-fabricated off site in order to minimise site work. However, the workforce on site will still require a range of equipment as detailed in Table 3.5 below.

Table 3.5 : Construction Equipment Details

Equipment	Estimated No. units
Backhoe	5
Bulldozer	3
Trailer	2
Dump truck / Mixer truck	28
Cranes	12
Crane barge	1
Pile driver	6
Forklift	7
Welding machines	111
Electricity generators	8

A truck wheel wash facility will be constructed to clean truck wheels prior to exiting the site in order to prevent dust and spoil being transported on to the public road. The wheel wash facility will be used through-out the construction phase of the power plant. The washing facility (pit) will not connect to a drain or watercourse and therefore will not filter the water; it will be manually cleaned out as required.

Construction of Access Road

A 400 m access road between the main road and the north of the site will be constructed. The access road will comprise a permanently sealed two lane eight metre wide road. Road traffic to site will comprise the local workforce and delivery of equipment and material. It is anticipated that delivery of equipment and material will be in the order of 10 light trucks and 50 to go heavy trucks per day. Truck deliveries to site will avoid peak travel times for local residents and in particular school start and end.

Landscaping

Following completion of construction work, the power plant site will be landscaped for visual appearance and to limit erosion from surface water during heavy rains. The topsoil removed and stored during site clearance and levelling, will be reused where possible.

3.5.2 Water Intake and Discharge Pipelines

A 200 mm water intake pipeline and a 100 mm water discharge pipeline will be constructed between the power plant site and the Siak River, a distance of approximately 3 km. Work associated with the construction of water intake and discharge pipelines for the power plant includes the following:

- Construction of the water intake structure at the Siak River and associated pipeline to deliver water to site;
- Construction of the water discharge pipeline and discharge structure which will run parallel to the water supply pipeline; and

Construction of the water pipelines will comprise the following:

- 2 m wide trench will be excavated for both pipelines as well as a power and control cable;
- A working corridor of 6 m will be required over the 3 km route; and
- The pipelines will be constructed up to 30 m distance from the banks of the Siak River at which point a water intake structure will be constructed which will require a 50 m x 40 m area.

Preliminary engineering details of the proposed water intake structure and associated pipelines for delivery to site and discharge to the Siak River are included in Volume 5 Technical Appendices: Technical Report – Process Description. The EPC specification requires a maximum water intake velocity of 150 mm/sec (0.03 ft/sec) and for the intake to be screened.

3.5.3 Temporary Jetty

A temporary jetty is required to serve as a berth for ships or barges delivering plant items and construction materials and equipment e.g. the gas and steam turbines, generators, transformers, HRSG modules.

The temporary jetty will be 70 m x 100 m and is located approximately 3 km to the north of the power plant site, close to the existing Tenayan CFPP. The preliminary temporary jetty design is detailed in Figure 3.3 below.

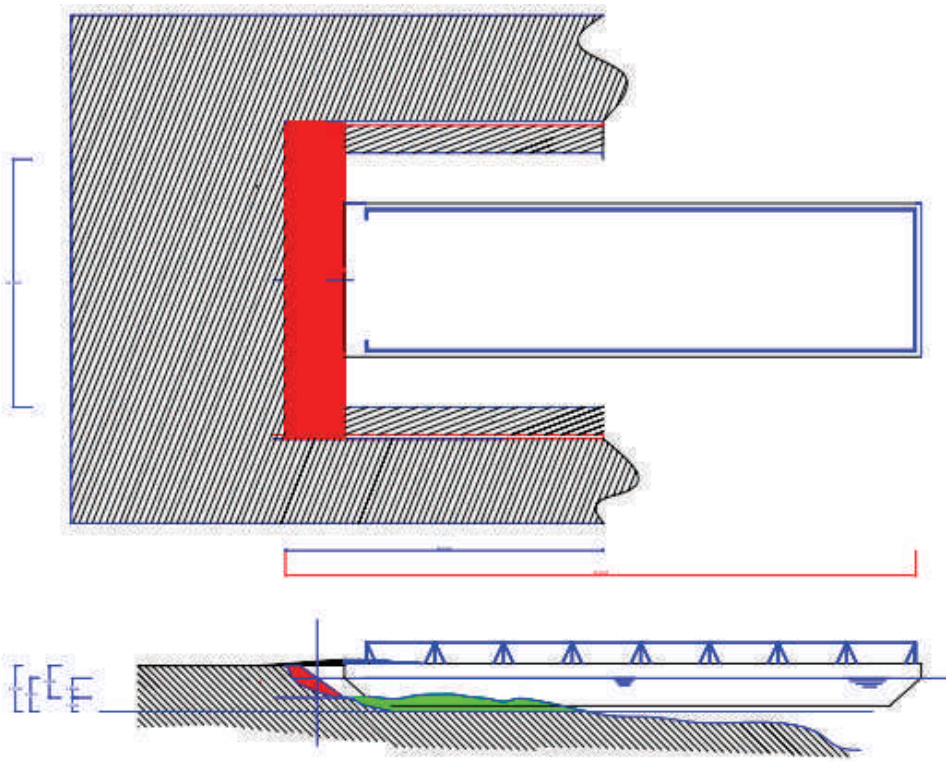


Figure 3.3 : Preliminary Design of Temporary Jetty

Construction of the jetty will involve sheet piling for the “tunnel”, while rock and sandbagging will be used for the head area. Construction of the jetty will predominantly require excavation of the river bank and a small amount of dredging of the river bed (anticipated to be 1,440 m^3). The scope of dredging will depend on the exact temporary jetty location, the water depth at this location and hydrodynamic conditions. All sediment excavated or dredged during construction will be disposed of either on-site or off-site at the same approved disposal areas discussed in Section 3.5.1. Following completion of all construction activities of the project it is anticipated that the jetty structure will be dismantled and removed. This will take approximately one month. The method of excavation is yet to be finalised and it will be by long arm excavator either from land or from a barge.

The existing access road running from the temporary jetty, past the existing Tenayan CFPP, to the power plant site, is narrow in places and some widening or improvements to the route may be required. It should not be necessary to acquire any land for these improvements as the widened road would still be within the current road reserve. See Figure 3.1 for an overview of the temporary jetty location.

3.5.4 Transmission Line

The transmission line will include eight transmission towers and will intercept the existing transmission line between Tenayan Switchyard and the Pasir Putih Switchyard via a double phi connection. See Figure 3.4 below for the for the proposed transmission line route and connection.

The key elements of transmission line construction include:

- Survey and tower staking;
- Construction of foundations (typically cast in place);
- Erection of towers (i.e. assembly of tower members);
- Conductor, shieldwire, and optical ground wire (OPGW) stringing;
- Clean up; and
- Testing and commissioning.

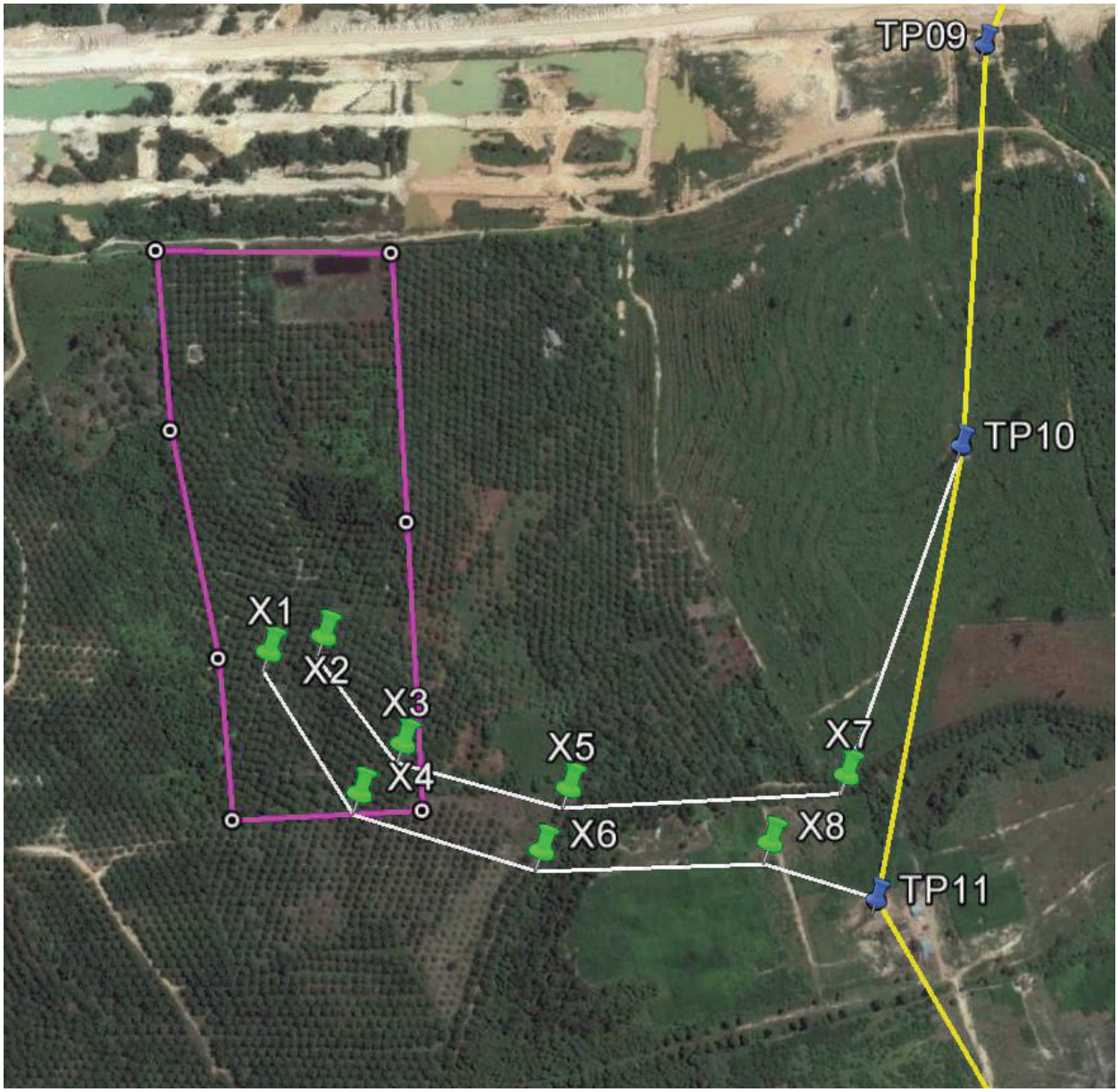


Figure 3.4 : 150 kV Double Phi Connection (source MRPR)

The estimated co-ordinates of the towers, the number of circuits and ownership details are provided in Table 3.6 below.

Table 3.6 : Preliminary Details for the Towers

Tower Number	Co-ordinates	Number of circuits	Ownership
X1	780,535 m E 59,583 m N	2	MRPR
X2	780,582 m E 59,594 m N	2	MRPR
X3	780,651 m E 59,504 m N	2	MRPR

Tower Number	Co-ordinates	Number of circuits	Ownership
X4	780,615 m E	2	MRPR
	59,459 m N		
X5	780,795 m E	2	Private
	59,456 m N		
X6	780,774 m E	2	Private
	59,411 m N		
X7	781,036 m E	2	Private
	59,477 m N		
X8	780,970 m E	2	Private
	59,417 m N		

Notes: TP.9, TP.10 and TP.11 noted in Figure 3.2 above already exist and may be modified as part of the project.

The RoW for the transmission line will be approximately 75 m wide. The towers will require footings covering approximately 40 m x 40 m each. Any tall vegetation within the RoW will be trimmed to obtain the necessary conductor clearance of 8.5 m. Vegetation removal and any soil levelling requirements will be carried out in parallel with the power plant. All vegetation and unsatisfactory soil material will be transported and disposed of at an off-site facility approved by municipal authorities.

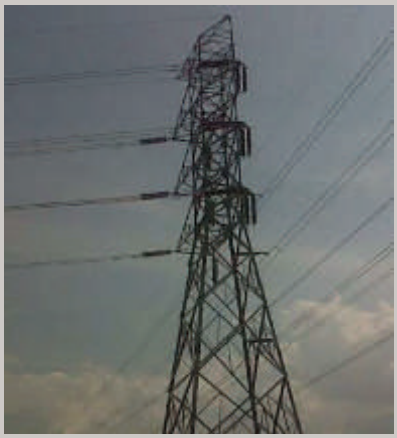
Erection of Towers

Transmission towers consist of the following general components:

- Stub: the foot of the tower, mounted in conjunction with the installation of the foundation and fastened to the foundation.
- Leg: tower foot which is connected between the stub and the tower body.
- Common body: the bottom of the tower body which is connected between the leg and the top of the tower body (super structure).
- Super structure: tower upper body connected to the common body and the cross arm phase wire and lightning wire.
- Cross arm: the part of the tower which supports the insulators and conductors.

Typical 2-circuit transmission tower designs are presented in Figure 3.5.

Typical 2-circuit dead-end tower interfaced to the plant gantry



Typical 2 circuit lattice tower for intercepting existing line

Figure 3.5 : 2-circuit tower designs

The proposed transmission towers will be lattice type, with the following preliminary technical specifications:

- Voltage: 150 kV (Max = 170 kV);
- Path length: approximately 750 m;
- Line configuration: double circuit, twin conductor;
- Tower type: lattice / tower steel frame;
- High of 4-circuit towers: 32 – 40 m;
- Conductor / phase: 2 x 250 mm^2 aluminium conductor steel-reinforced (ACSR) cable;
- Insulator / insulator: Ceramics; and
- Carrying capacity: 300 MVA / circuit.

Each tower will require reinforced concrete foundations. Concrete will be supplied as per the power plant, either batched at the power plant site or brought on to the site in a ready-mixed form by concrete trucks. Once foundations are complete, erection of lattice towers will commence as follows:

- Installation of the stub gradually section-by-section;
- Installation of a criss-cross (diagonal) tower; and
- Installation of cross arms on the tower.

Given the small connection, simultaneous installation of towers is not anticipated to be necessary. Smaller vehicles will be used to transport materials (e.g. steel members) to and from each tower location in order to avoid the need for large access tracks or roads.

Conductor Wire Stringing

Conductor wire stringing will be conducted as follows:

- Installation of insulators and equipment;
- Stringing of the wire conductors, wire retaining lightning and ground wire; and
- Setting sag and tension.

Stringing the conductor wires between the towers will be carried out using pullies and winches. Stringing is undertaken once the insulators are mounted in place on the towers.

3.5.5 Gas Pipeline

Overview and Specification

The fuel for the power plant will be dry natural gas which is supplied via a buried 40 km pipeline which will connect to the Grissik-Duri transmission pipeline (operated by PT. TGI) at an offtake location known as SV1401. A custody gas metering facility (associated infrastructure) will be constructed by PT. TGI just upstream of the point of interconnection, the approximate location of which is shown in Figure 3.6 below. The final location will be determined by PT. TGI. The gas metering facility will be approximately 15 m x 30 m (0.045 ha) and will comprise: pipework, valves, pig launcher, meters and possibly a control hut. It is anticipated that the gas metering facility will be unmanned.

Figure 3.6 : Location of Gas Metering Facility

The technical specification of the gas pipeline is detailed in Table 3.7 below.

Table 3.7 : Gas Pipeline Technical Specification

Parameter	Unit	Value
Length	km	Approximately 40
Diameter	inch	12
Gross Heating Value	Btu/SCF	950 – 1,250
Flowrate	MMSCFD	Up to 46
Pipeline design pressure	barg	79.3
Supply pressure at tie-in point	barg	Approximately 50
Delivery Pressure	barg	Estimated between 24 and 50

The gas arrival pressure at the power plant will depend on the delivery pressure and the flowrate. The flow rate will depend on the level of dispatch of the power plant, as determined by PLN.

The gas pipeline will be equipped with a pigging facility, mainly intended for pipe cleaning and integrity checking. A Pig launcher will be installed at the tie-in point to the Grissik–Duri pipeline, and the receiver will be at the power station site. Sectional valves will be installed to allow pipeline isolation for maintenance or during an emergency. At the power plant, the gas will enter at the gas reception area.

General Construction Methodology

Construction of the gas pipeline involves the following:

- Preparing the pipeline route by clearing vegetation and grading the immediate area;
- Transporting the pipe sections to the work area;
- Welding the pipeline sections together, followed by non-destructive testing of the welds to check for flaws. Any flaws will be repaired.
- Digging and preparing the trench
  - The maximum open trench at any time is likely to be 500 m.
  - The trench will typically be 2 m deep by 1 m wide however for road and river crossings it will be 2.5 m deep
- Lowering the pipe into the trench.
  - The will be carried out ensuring 150 mm clearance between pipe and trench wall is maintained.
  - For any rocky areas, the trench will be padded with loose soil to a depth of 150 mm.
- Backfilling the trench and compaction:
  - Back fill material will consist of sand, soil and coarse aggregate, re-using where possible material previously excavated.
  - The type and layer arrangement will vary depending on the ground the pipeline is being buried in.
  - Compaction will be performed once the backfill reaches 30 cm below the natural grade level.
  - Backfilled material will be protected from washing away during rainfall by excavation of a small drain. In sloping areas, trench erosion breakers (sand and/or cement bag) will be installed inside the trench prior to backfilling.
- General area reinstatement.
- Eventually, after the pipeline is complete and has been cleaned, the entire length will undergo a hydro test to check the integrity of the pipeline. Cleaning will include:
  - Pigging - no chemicals are used in this process;
  - Flushing with clean water. Depending on the quality of the water available, some pre-treatment of the water may be required. No chemicals are used in the flushing process. The water discharged from the pipeline after cleaning will be filtered of debris; and
  - For the hydro-test, typically, potable water is used. As with the cleaning water, some pre-treatment of the water may be required. No chemicals are used. The water discharged from the pipeline after cleaning will be filtered of debris.
- Once complete, the pipeline will be dried and then preserved until the power plant is ready to accept gas. Drying is achieved by blowing air into the pipeline. Preservation will be by filling the pipeline with an inert substance, likely Nitrogen.

The construction team will include:

- Pipefitters;
- Welders;
- Crane operators;

- Riggers; and
- General labourers.

Construction equipment will include:

- Excavators;
- Bulldozers;
- Dump trucks;
- Cranes;
- Welding machines; and
- Water pumps for temporary drainage systems.

Construction activities at night time will be limited insofar as possible, to reduce any potential impacts on local residents and fauna. Construction work shall be managed so that noise and light emissions do not cause annoyance to neighbours and fauna unless it:

- is associated with an emergency; or
- is carried out with the prior written approval of the relevant authorities, or
- does not cause existing ambient noise levels to be exceeded.

Road Crossing Methodology

- The pipeline route intersects a number of roads. In order to cross these roads a boring technique using an auger bit will be used. This estimated to be required at three locations along the pipeline route;
- To assist with the boring process, two pits will be excavated one for starting and one for arrival. The approximately dimensions of these are: 20 m x 3.5 m x 2.5 m (starting pit) and 14 m x 3.5 m x 3.8 m (arrival pit);
- Where boring methodology is not required road crossing will be carried out by open cut methodology. Location of the road crossings requiring open cut methodology is still to be confirmed; and
- When open cut methodology is to be used, a wooden temporary access road will be installed. Sand bags would be placed by excavators to create a working area in the watercourse. This would be pumped dry to the downstream side of the waterway.

River Crossing Methodology

- The pipeline route will cross two rivers and one creek;
- Surveyors will note water depth and if necessary a pontoon will be prepared to assist in performing the survey;
- Spill berms will be installed upstream and downstream of the crossing point; and
- A trench will be excavated and the pipe laid using sandbags to reduce water flow velocity as required. Trench dimensions will be the same as the general methodology discussed above.

Swamp Areas

- The pipeline route will pass through a swamp area located approximately 6.5 km east of the SV1401 gas metering facility.
- Push pull construction methodology will be used for this section.

3.5.6 Construction Waste Management

Whilst the EPC Contractors will minimise waste where possible, construction activities will inevitably generate waste streams. Table 3.8 below provides an overview of the expected waste streams and likely disposal methods.

Table 3.8 : Waste Management

Waste type	Management Method
Stormwater	Temporary or permanent storm water system, depending on location and stage of the work
Effluents from cleaning and flushing	Temporary or permanent waste water treatment plant system, depending on stage of the work
Process effluents during commissioning	Permanent systems
HRSG chemical clean waste effluents	Permanent waste water treatment plant or off-site disposal via licensed facility at either Pekanbaru City waste disposal or PT Sumatera Environmental Management for any hazardous or toxic substances.
Metals – e.g. off-cuts of pipework and structural steel Cable – e.g. off-cuts of electrical cables	Recycle where possible – as these represent a potential revenue stream for the contractor – or dispose to local landfill or via licensed facility at either Pekanbaru City waste disposal or PT Sumatera Environmental Management for any hazardous or toxic substances.
Consumable items e.g. oil and air filters;	Via licensed facility at either Pekanbaru City waste disposal or PT Sumatera Environmental Management for any hazardous or toxic substances.
Other miscellaneous wastes – e.g. rags, containers for paints or chemicals, office waste	at either Pekanbaru City waste disposal or PT Sumatera Environmental Management for any hazardous or toxic substances.

3.6 Commissioning

3.6.1 Power Plant

After construction of the power plant is complete, the plant and equipment will be commissioned and set to work. The commissioning process involves the following:

- Calibrating and setting control and protection devices to ensure the safety of plant, equipment and personnel;
- Energising equipment for the first time;
- Checking individual components work correctly;
- Checking individual systems work correctly;
- Checking that the systems are properly integrated and work together as designed; and
- Testing the plant for compliance with the EPC Contract, including for compliance with the Grid Code and environmental requirements.

3.6.2 Transmission Line

Once the electrical installation work has been completed, it will be tested prior to operation. The scope of testing activities is as follows:

a. Visual Examination:

- Check the condition of the tower (e.g. everything is in good condition, no parts are rusty, including its nuts and bolts);
- Check the condition of the insulators (e.g. whether everything is in good condition and clean, nothing is broken or cracked, no deformation); and
- Check the condition of conductors, ground wires and joint sleeves.

b. Construction inspection:

- Examine all components installed and compare them with specifications and regulations.

c. *For certain work items that cannot be seen by naked eye, then testing using equipment or measuring devices will need to be undertaken:*

- Testing isolation insulators, insulation resistance between phase to phase and phase insulation resistance between the neutral wire. Test equipment includes Mega Ohm Meter / Megger / Insulation Resistance Tester.
- Ground earthing, using test equipment or measuring devices such as Earth Resistance Tester.

After the inspection and testing activities have been carried out and the lines are certified safe for operation they will be energised for operation.

3.6.3 Gas Pipeline

Following construction of the gas pipeline, it will be cleaned and the entire length will undergo hydrostatic testing to check the integrity of the pipeline. Once complete, the pipeline will be dried and preserved until the power plant is ready to receive first gas.

3.7 Operation

3.7.1 Power Plant Operation

The power plant is a 2 x 1 combined cycle plant, designed to deliver up to 275 MW over the 20-year term of the PPA. The plant will consist of:

- 2 x GE 6F.03 gas turbine (GT) generator sets;
- 2 x supplementary fired HRSGs;
- 1 x steam turbine (ST) generator set;
- A wet mechanical draft cooling tower;
- Gas reception area; and
- All normal balance of plant systems will be provided, including:
  - Gas compression (if required) and conditioning system;
  - Demineralised water treatment plant to treat raw water before it is added to the water steam cycle to make up for water lost from the cycle;
  - Closed cycle cooling water system to cool plant and equipment such as lubricating oil coolers, generator coolers, boiler feed pumps;
  - Systems to dose and sample the water and steam;
  - Compressed air system;
  - Fire protection system, in accordance with local requirements with scope and design generally in accordance with NFPA 850;
  - Emissions monitoring system;
  - Drainage systems;
  - Overall plant distributed control system;
  - Metering and protection systems;
  - Enclosures to house the plant and equipment as required;
  - Control room and office space for the operation and maintenance staff;
  - Black start diesel generators and system; and
  - High voltage (HV) switchyard.

A plot plan of the power plant is detailed in Figure 3.7 below.

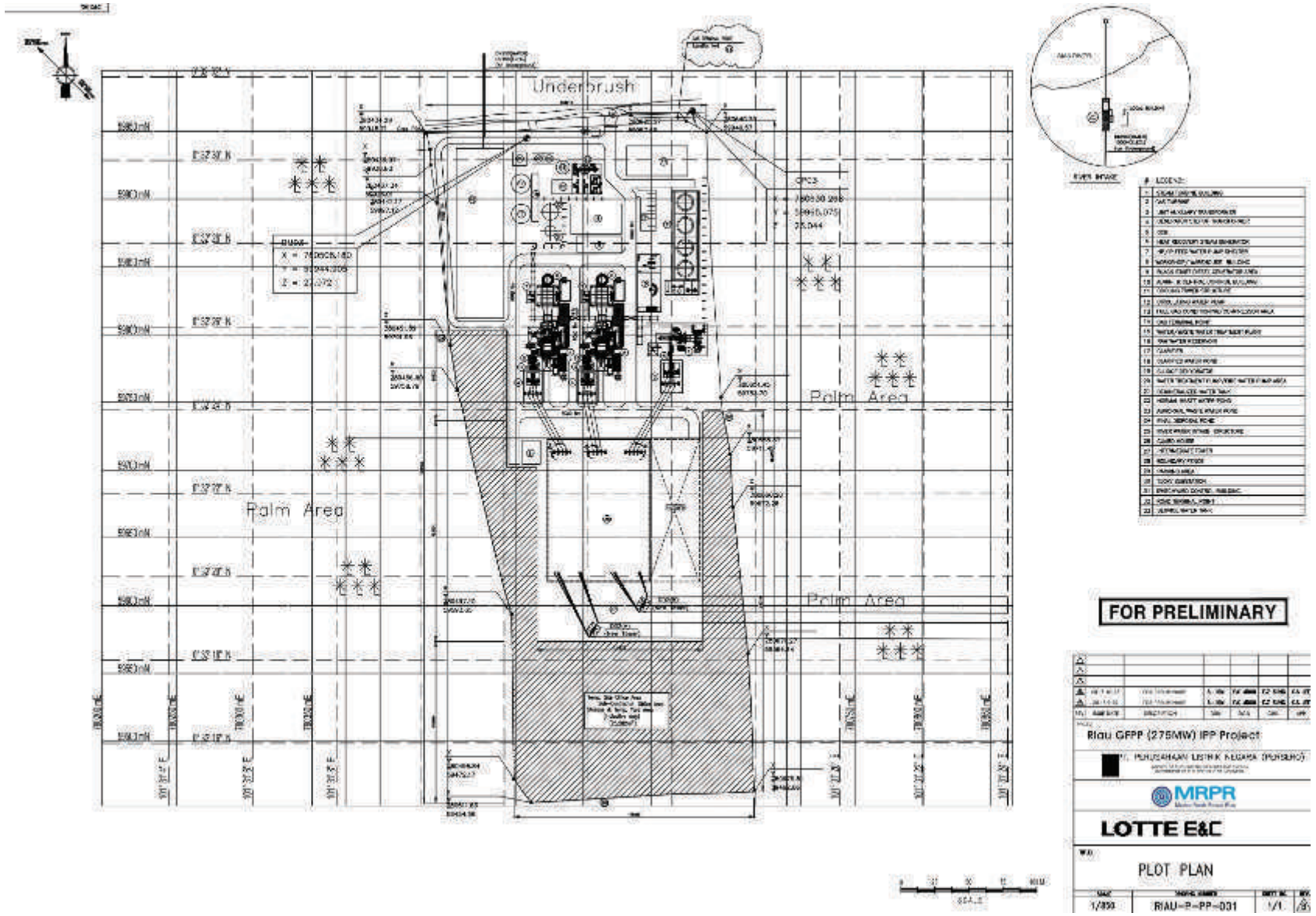


Figure 3.7 : Plot Plan of Power Plant

3.7.2 General Operating Arrangements

In a combined cycle plant, ambient air is filtered and led to the compressor of the gas turbine, where it is compressed. Fuel is added and combusted in the combustors and the hot gas is fed to the turbine which drives the generator which in turn produces electricity.

The exhaust gas leaving the turbine may be in the order of 600°C. In an open cycle (or simple cycle) plant, the exhaust gas flows back to the atmosphere and useful energy is lost. However, in a combined cycle plant, the exhaust gas is fed to a HRSG and is used to generate steam.

From the HRSG the superheated high pressure (HP) steam is fed to the high pressure section of the steam turbine where it expands before being returned to the HRSG for re-heating. The reheated steam is mixed with intermediate pressure steam also generated in the HRSG and fed to the intermediate pressure section of the steam turbine. Steam leaving this section is fed to the low pressure section of the turbine where it is supplemented with further low pressure steam from the HRSG. All steam exhausts to the condenser where it is condensed to water before returning to the HRSG to be converted to steam once again.

A schematic diagram of the process is provided in Figure 3.8 below.

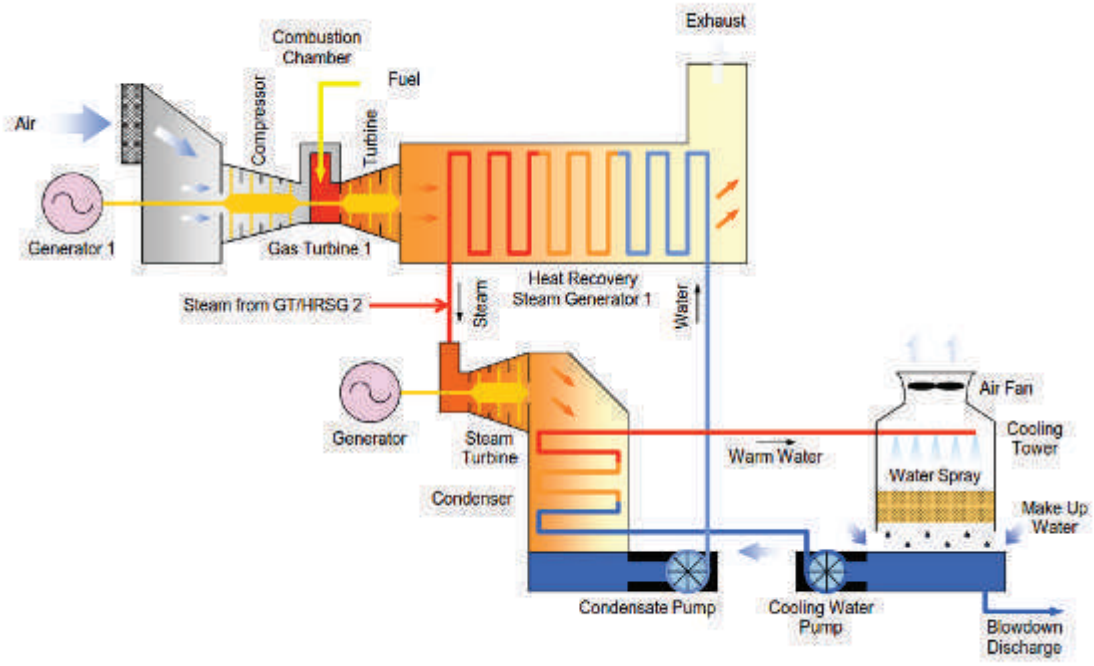


Figure 3.8 : Schematic of General Process

3.7.3 Gas Turbine Generators

The power plant will comprise two gas turbine generators sets that will be a 6F.03 model supplied by GE. This is an “F” Class, heavy duty, single shaft, industrial type of gas turbine, of proven design. Each unit will have a capacity of approximately 81 MW and will fire natural gas only.

The gas turbines will be equipped with lean-premix dry low NOx combustion systems. No water or diluent injection will be necessary to control NOx emissions.

The gas turbine generators will be installed outdoors within acoustic, ventilated enclosures incorporating fire detection and protection facilities. They will be provided with all associated ancillary and auxiliary equipment and systems for safe, efficient, and reliable operation.

3.7.4 HRSG

The power plant will comprise two HRSGs which will be designed for triple pressure with reheat. Like the gas turbine generators, they will be installed outdoors and will be subject to the same precautionary procedures.

In order to generate additional steam to boost power from the steam turbine from time to time, as desired by PLN, the HRSGs will be fitted with low NOx duct burners.

The HRSGs will include economiser, evaporator, and super-heater tube bank sections with finned tubing, as appropriate, to maximise heat transfer. The thermal cycle will be designed to suit the specific requirements of this Project.

Pressure parts will be designed, manufactured and tested in accordance with "ASME Boiler and Pressure Vessel Code, Section 1, Power Boilers" or equivalent. The HRSG stack height and the flue gas exit temperature will be sufficient to ensure adequate dispersion of the flue gases in accordance with the relevant environmental standards and requirements. At present, a stack height of 45 m is anticipated.

The design steam conditions at full load are detailed in Table 3.9 below.

Table 3.9 : HRSG Design Steam Conditions

Design Parameter	Unit	HP	IP	HRH	LP
Steam pressure at HRSG outlet	Bar	142.0	27.9	22.0	5.3
Steam pressure at steam turbine	Bar	136.7		21.3	4.8
Steam temperature at HRSG outlet	°C	571	298	576	295
Steam temperature at steam turbine	°C	569	314 (CRH)	574	290
Steam flow per HRSG	kg/s	37.7	2	39.5	2

3.7.5 Steam Turbine Generator and Condenser

Steam from the two HRSGs will be combined, and fed to the steam turbine generator set to generate more electricity. The steam turbine generator and condenser will be installed within a building and will be provided with all associated ancillary and auxiliary equipment and systems for safe, efficient, and reliable operation. The steam turbine will be designed to produce approximately 126 MW.

Steam will be condensed in the condenser which will be cooled using water fed from a wet mechanical draught cooling tower. Preliminary condenser design conditions are detailed in Table 3.10 below.

Table 3.10 : Steam Turbine and Condenser

Design Parameter	Unit	Value
Steam pressure at inlet	bar	0.0949
Steam temperature	°C	44.8
Steam flow	Kg/s	83.9
Cooling water temperature increase across condenser	°C	10.3
Cooling water flow	Kg/s	4,756

3.7.6 Power Plant Fuel Requirements

The amount of natural gas required from day to day will vary depending on ambient condition and the level of generation requested by PLN. Estimated maximum daily fuel demand is detailed in Table 3.11 below.

Table 3.11 : Maximum Fuel Demand

Item	Unit	Value
Heat rate at 100% load	Btu/kWh, HHV	6,920
Net output at full load	kW	275,000
Fuel flow per hour at full load	Btu/h	1,903,000,000
CV of fuel, HHV	Btu/scf	1,039
Hours per day	h	24
Use per day	mmscf/d	44

PLN have a nominal target annual net capacity factor (NCF) of 60%. The fuel needed to achieve this annual NCF will depend on the load mix used to deliver the energy. If the 60% availability factor is achieved using the load mix PLN used during the IPP selection process, then fuel use over the term of the PPA is estimated as detailed in Table 3.12 below.

Table 3.12 : Fuel use details

Item	Unit	Value
Capacity at base load	kW	275,000
Hours per normal year	h	8,760
AF	%	0.6
Generation required per year	kWh	1,445,400,000
Average heat rate at evaluation load mix	Btu/kWh, HHV	6,942
Fuel use per year	Btu, HHV	10,033,966,800,000
Fuel use per year	PJ, HHV	10.5
Fuel use over PPA	PJ, HHV	211.7

3.7.7 Stack and Cooling Tower and Associated Air Emissions

The majority of air emissions (flue gas) from the power plant will be via the two exhaust stacks and to a lesser extent the cooling tower and will therefore be the focus of this section. The following also contribute air emissions although in trace amounts:

- Condenser: Very small quantities from the air ejectors - equivalent to the dissolved gases in the steam cycle make-up -of steam and dissolved air from water.
- Heat: from generator, oil and other cooling systems.
- Steam, gas and air from vents and drains;
- Intermittent steam from emergency relief valves, CO_2 if released for fire protection;
- Intermittent combustion gases from the Black Start Diesel Generator and the Fire Water Diesel Driven Pump.
- Minor discharges (e.g. SF6 from electrical equipment) during maintenance.

Air emissions from the above will be managed through good utility practice.

Power Plant Stack

The power plant will comprise two stacks estimated to be 45 m in height and 3.8m in diameter. Air will be discharged from the two stacks during the operation of the power plant also referred to as exhaust stack emissions. The type of emissions and quantity based on 100% load of the power plant is detailed in Table 3.13 below.

Table 3.13 : Exhaust Stack Emissions – Per Stack

Stack Emissions	Basis		100% Load
Number of Stacks			2
NOx	51 mg/Nm^3 = 25 ppmvd	g/s per stack	12.1
CO	30 mg/Nm^3 = 23 ppm	g/s per stack	6.5
SOx	30 ppm by weight, sulphur in fuel	g/s per stack	0.47
PM	30 mg/Nm^3	g/s per stack	7.4
CO_2	Heat Balances, Design Fuel composition, and 52.5 TCO2/TJ, HHV	g/kWh	383
Temperature	Heat Balances	°C	82.4
Exhaust Gas Velocity	Based on 3.8 m diameter stack	m/s	20 m/s

Stack concentrations (mg/Nm^3 and ppm) and are based on 15% O_2, dry gas. Each stack will have a continuous emissions monitoring system (CEMS) in order to monitor emissions during plant operation.

The maximum possible annual emissions, in tonnes/year, based on a Net Capacity Factor (NCF) of 93% is detailed in Table 3.14 below.

Table 3.14 : Estimated Maximum Annual Exhaust Stack Emissions

Stack Emissions		100% Load and 93% NCF
NOx	t/year	355
CO	t/year	191
SOx	t/year	499
PM, based on PM content in gas	t/year	217
PM, based on PM concentration allowed	t/year	355
CO_2	t/year	860,000

Power Plant Cooling Tower

The cooling tower is anticipated to be 73 m in length, 18 m in diameter and 10.1 m in height (from top deck) with an air discharge height of 13 m. Expected conditions at the top of the cooling tower are detailed in Table 3.15 below.

Table 3.15 : Cooling Tower Conditions

Parameter	Value
exhaust temperature	35.8°C
exhaust flow	3,800 kg/s
volumetric flow rate	3,500 m^3/s
Exhaust velocity	10.4 m/s

Estimated air emissions and quantities from the cooling tower is detailed in Table 3.16 below.

Table 3.16 : Cooling Tower Air Emissions

Parameter	Value
Hot humid air	3,000 kg/s of air heated by about 9.7C above ambient at 100% relative humidity
Drift	Less than 1 kg/s

The cooling tower will be fitted with a drift eliminator. As such, the emission of water droplets from the top of the cooling towers (drift) will be reduced. However, because the drift droplets will contain the same chemical impurities as the water circulating through the tower (concentrated salts from the incoming supply plus traces of chemicals added for process control) the particulate matter constituent of the drift droplets may be classified as an emission. The magnitude of the drift loss will be influenced by the number and size of droplets produced within the tower, which are determined by the tower fill design, tower design, the air and water patterns, and design of the drift eliminators.

3.7.8 Major Balance of Plant Systems

Cooling Water Systems

The condenser will be cooled by a closed cycle cooling system with a wet (evaporative) mechanical draught cooling tower. In a wet tower, the cooling effect is obtained by presenting a large surface of the heated water returning from the condenser to the atmosphere, allowing heat loss to occur predominantly by evaporation. For this Project, the mechanical draft tower will comprise a number of "cells" arranged in a line above a basin. The large surface area for the water will be obtained by the use of "fill", likely to consist of a plastic honeycomb or slats installed in each cell. The heated water will descend from upper trays through the fill. Some of it (approximately 2%) will be evaporated, and in the process, the temperature of the remaining water will be reduced. The remaining water will be collected in a concrete basin below, and then pumped back to the condenser to condense steam once again.

The water lost to evaporation and blowdown will be replaced with make-up water extracted from the Siak River via water intake pipeline. Ventilation through the fill to allow effective evaporation will be obtained by installing large fans at the top of each cell. The preliminary cooling tower design parameters are detailed in Table 3.17 below.

Table 3.17 : Cooling Tower

Design Parameter	Unit	Value
Cold water temperature (to the condenser)	°C	31.6
Cold water temperature (from the condenser)	°C	41
Water flow	kg/s	5,114

A chemical dosing system will be provided to control the water quality in the cooling water system to prevent fouling, scaling or corrosion. The cooling water treatment will include:

- Addition of an acid to the makeup water to reduce the carbonate concentration in the makeup water in order to prevent deposition of calcium carbonate scale particularly on the condenser tubes. Alternatively, the addition of a dispersant along with acid dosing may be used.
- Dosing with organic biocide or NaOCl (sodium hypochlorite) to control organic growth in the cooling system. A system capable of dosing both continuously and via shock treatment (approximately 20 minutes every 8 hours) will be installed.

Gas Reception Area

The pressure of the gas supplied to the gas turbines will be controlled within a set range. On arriving at the site, the gas may be above, within or below the correct range. Therefore, the following facilities will be installed in order to ensure the gas pressure at the gas turbines is correct:

- Gas compressors will be installed, to boost the gas pressure if it is too low. If it is confirmed that the gas pressure at the supply point (SV1401) will never be so low as require gas compression on site, then these may be removed from the scope of the project.
- Pressure regulators to reduce the pressure when it is too high. Depending on the design, this system may need to incorporate a system to heat the gas before the pressure is reduced. Any such temperature control system is likely to use natural gas to heat water to heat the gas flowing to the plant.

Other equipment in the gas reception area will include:

- An emergency shut down valve, to isolate the plant in the event of a problem;
- A pig receiver station which will be used to help maintain the cleanliness of the gas pipeline;
- A gas chromatograph to check the composition of the gas arriving at the site; and
- A system to control the pressure of the gas to be used by the HRSG supplementary firing system.

Water Requirements and Treatment Systems

The plant will abstract raw water from the Siak River for use on site. Refer to the water balance diagram in Figure 3.9 below and refer to Volume 5 Technical Appendices – Technical Report: Process Description (Appendix B) for further details. Table 3.18 provides an estimate of water use and discharge over an annual period based on 100% load and 93% AF.

Table 3.18 : Annual water use and discharge details

Type	Rate	100% Load and 93% AF
Water Use	m^3/year	2,6000,000
Effluent	m^3/year	650,000

The main water consumption will be for the following:

- Cooling water to cooling towers;
- Demineralised water makeup for the steam cycle;
- Potable water for plant use; and
- Firewater.

The raw water requirements when the plant is at full load are predicted to be approximately 370 m^3/h with the predominant usage being for the cooling system. Maximum demand will be in the order of 400 m^3/h. Most of the losses from the cooling system will be due to evaporation from the cooling tower. Evaporation losses will vary with steam turbine load and ambient conditions. With the evaporation of water from the cooling water system, the concentration of the salts and impurities in the circulating water increases. In order to control these, additional water is drained from the cooling water system. Such drained water is referred to as blowdown. The blowdown rate depends on the quality of the water and the design of the cooling tower fill. Table 3.19 below presents anticipated raw water demands based on the power plant operating at full load.

Table 3.19 : Raw water demand details

System	Nominal demand at full load (m^3/h)
Cooling tower evaporation and blowdown	340
Water steam cycle	10
Other users and losses	20
Total	**370**

To minimise use of water from the Siak River, where possible, water will be recycled from clean stormwater collected and some process wastes can go to the cooling tower basin.

Water abstracted from the Siak River, on arrival at site, will enter a raw water reservoir / settling pond to be clarified and filtered, and then stored in a filtered water tank. This initial system will be sized to store approximately 17,700 m^3 of water, enough to allow the plant to run at full load for two days without any make-up. The filtration process will involve dosing with caustic soda and alum. Preliminary water treatment details are presented in Table 3.20 below.

Table 3.20 : Water Treatment System

Treatment Type	Description
Clarification and filtration technologies	Clarifier+ Gravity Filter or Sand filter
Number of streams	Clarifier 50% x 2 Gravity Filter 100% x 2 or Sand filter 100% x 2
Rated capacity of each stream	160 m^3/h
Raw Water storage capacity	17,700 m^3
Potable Water System	2 m^3/h, Activated carbon filter + NaOCl dosing

Following arrival at site, the raw river water may also be dosed with chlorine (as a biocide) in order to prevent biological growth while the water is stored in the raw water reservoir – especially during outages.

Filtered water will be used

- As make-up for the cooling tower (see above);
- As make-up to the demineralised water treatment plant;
- To generate potable water; and
- As a fire water supply.

It is expected that the demineralisation plant will be a conventional ion exchange based plant with a mixed bed polisher. Preliminary details of the filtered water and potable water systems are presented in Table 3.21 and Table 3.22 below.

Table 3.21 : Filtered Water System

Treatment Type	Description
Type	Ion Exchanger
Stages of treatment	Activated carbon + 2B3T ion exchange + Mixed Bed Polisher
Number of Streams	2
Rated Capacity of Each Stream	12 m^3/h
Demineralised water storage tank capacity	500 m^3

Table 3.22 : Potable Water System

Treatment Type	Description
Type	Ion Exchanger
Stages of treatment	Activated carbon filtration plus NaOCl dosing
Capacity	2 m^3/h

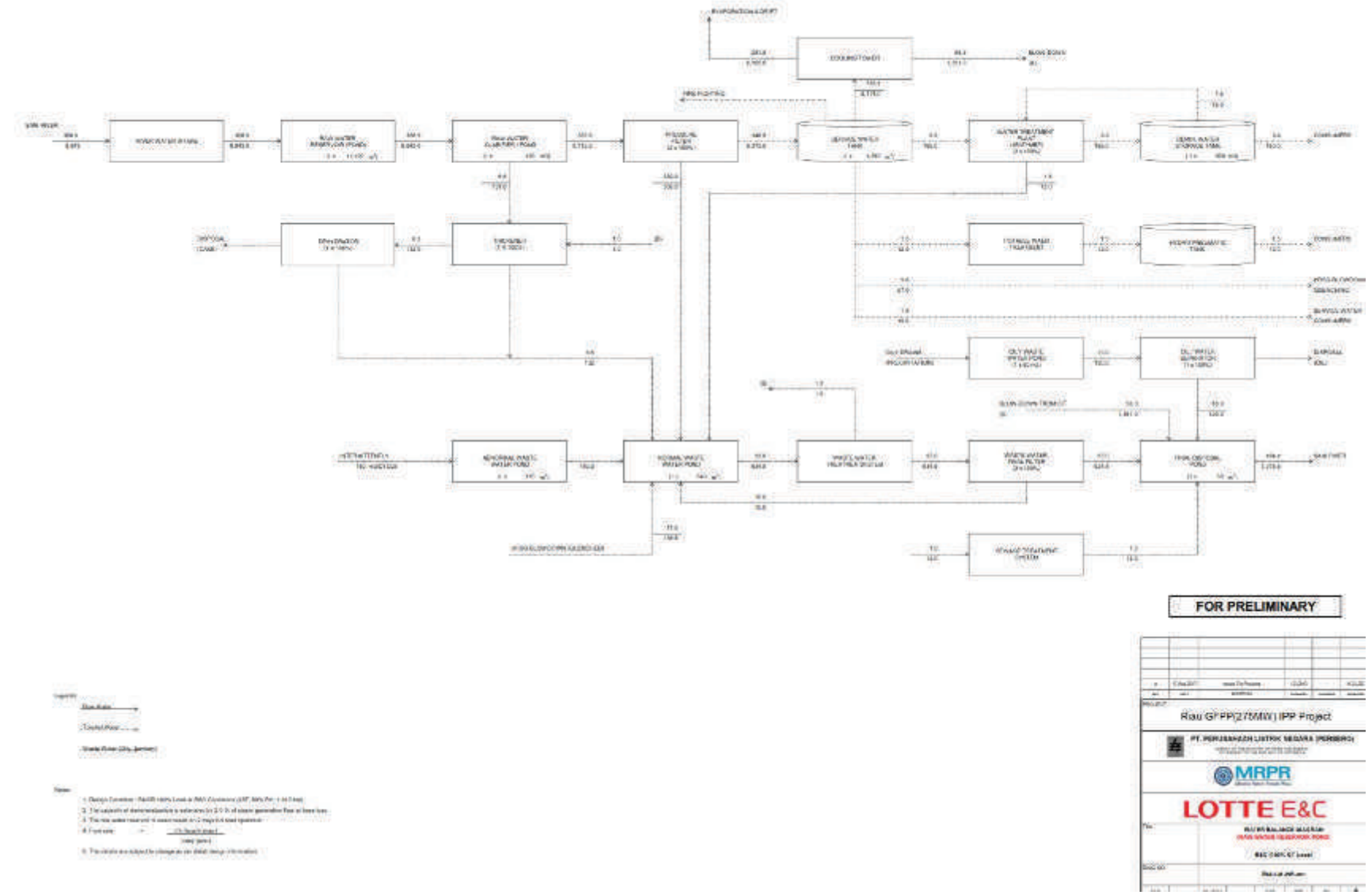


Figure 3.9 : Water Balance Diagram

Water Steam Cycle Chemical Treatment

Chemicals will also be used to help control the chemistry of the water and steam in the water/steam cycle. Preliminary details of the water steam cycle chemical treatment are detailed in Table 3.23 below.

Table 3.23 : Chemical Treatment

Treatment Type	Treatment
HRSG chemical treatment programme	Ammonia, Phosphate, Carbohydrazide
Ammonia	
Injection point	CEP discharge & HP/IP feed pump suction (provision
Chemical strength	1% wt/vol
Dosage per litre of product water	3 mL/L
Phosphate	
Injection location	HRSG HP and IP drums
Chemical strength	1% wt/vol
Dosage per litre of product water	3 mL/L
Carbohydrazide or equivalent	
Injection location	Deaerator outlet & provision for dosing at CEP discharge
Chemical strength	1~2% wt/vol
Usage per litre of product water	0.1 mL/L

The water will be sampled to monitor the quality of the water and steam in the system. The station staff will use the sample results to adjust the dosing systems, so that the chemistry is acceptable while minimising chemical usage.

Wastewater Treatment

The power plant will not produce any hazardous liquid wastes however certain streams of liquid waste will require treatment prior to being discharged into the Siak River via the discharge pipeline. The primary liquid waste streams to be treated include:

- Clean stormwater will be collected and sent to the cooling tower basin or discharged from site to the Siak River;
- Stormwater which could be contaminated with oil will be collected and sent to a separator before being discharged to the Siak River;
- Stormwater which could be contaminated with chemicals will be collected and sent to the wastewater treatment plant;
- Effluent from the raw water settling and filtration process will be thickened and dehydrated. The solids will be disposed of off-site via truck. Liquid effluents will be discharged to the wastewater treatment plant;
- Effluents from the water treatment plant (the demineralised water plant) will be discharged to the wastewater treatment plant;
- Blowdown from the cooling tower if it is not possible to maintain the chemistry of the water within effluent discharge limits. In the event treatment is necessary, it will be carried out in the wastewater treatment plant prior to discharge to the Siak River;
- Areas storing oils and chemicals will be bunded and drained to an operational wastewater pit for treatment before discharge to the Siak River; and
- Compressor wash water will be collected in a dedicated tank and then trucked off site for disposal.

All liquid waste streams discharging to the Siak River via the discharge pipeline will pass through the final disposal pond first. The expected wastewater discharge volumes are detailed in Table 3.24 below.

Table 3.24 : Discharge volume details

User	Nominal discharge at full load (m^3/h)
Cooling tower	56
Water steam cycle	2
Other users including losses from water filtration and treatment	22
Total	80

The volume of solids removed in the raw water settling and filtration process will depend on the level of total suspended solids (TSS) in the incoming water from the Siak River. Based on sampling and analysis detailed further in Volume 5 Technical Appendices – Technical Report: Process Description (Appendix B), the maximum TSS level in the River is 56 mg/L. At an average intake flowrate of 370 m^3/h, approximately 21 kg/h of solids will be removed and will be disposed of at an approved offsite facility.

The plant's onsite wastewater treatment systems will include systems for contaminated stormwater, normal wastewater, abnormal wastewater, oily wastewater and sanitary water. Volume 5 Technical Appendices – Technical Report: Process Description (Appendix B) for further details. The preliminary wastewater treatment details are presented in Table 3.25 below.

Table 3.25 : Wastewater Treatment System

Wastewater System	Treatment
Stormwater	Oily or potentially oily stormwater will drain to the oily water pond where the oil will be separated in a corrugated plate interceptor type separator, after which the clean water may be discharged from site.
	The design will avoid or minimise the potential for stormwater to become contaminated with chemicals other than oil. Where this is not possible, stormwater from those areas will be collected and sent to the normal waste water pond.
	Clean stormwater will be collected and either re-used in the cooling water system, to reduce make-up water requirements or discharged from site with the other effluents.
Oily Drains	Oily drains will be sent to the oil water separator.
Process drains – e.g. from the water steam cycle, the demineralisation water treatment plant, blowdown from the cooling tower	Process drains will be sent to the waste water pond for pH adjustment and further treatment before being discharged off site.
Compressor water wash effluents	Effluents from the compressor water washing systems will be collected in a dedicated tank to be emptied via road tanker and disposed of separately.
Sanitary wastewater	These effluents will be treated in a package sewage treatment plant

The quality of blowdown effluent from the cooling tower will depend on the following:

- Incoming water quality. Salts in the raw river water will likely be concentrated approximately 6 times.
- Chemicals added to the cooling water system to control biocides, scaling, and (perhaps, if necessary from time to time) deposits.

Table 3.26 details the predicted parameters of raw water (based on water samples and analysis detailed in Volume 5 Technical Appendices – Technical Report: Process Description (Appendix B)) coming into the cooling tower and the likely blowdown discharge parameters based on the cooling tower operating at six cycles of concentration. No allowance is made for chemicals added in the raw water treatment process or cooling water

system dosing. These are normally dosed in small quantities (compared with the circulating water flow rate), and are chosen or controlled so that they cannot cause discharges to exceed environmental limits.

Table 3.26 : Estimated Cooling Tower Blowdown quality based on incoming water quality

Parameter	Unit	Water Quality of Raw Water	Water Quality of Blowdown
pH value	-	6.88	controlled
Suspended Solids	mg/L	56	Removed in filtration system
Chromium (Total)	mg/L	<0.002	< 0.012
Copper (Cu)	mg/L	<0.01	< 0.06
Zinc (Zn)	mg/L	0.05	< 0.3
Iron (Fe)	mg/L	1.168	< 1
Free Chlorine (Cl2)	mg/L		controllable
Oil and grease	mg/L	2.4	Removed in separator
Phosphate (PO4-)**	mg/L	0.862	5.172
Lead (Pb)	mg/L	<0.005	< 0.03
Cadmium (Cd)	mg/L	<0.002	< 0.012
Mercury (Hg)	mg/L	<0.0005	< 0.003
Arsenic (As)	mg/L	<0.005	< 0.03
Temperature	°C		Raw blowdown temperature will be 31.6 at design case, and temperature will drop between site and river

It should be noted that the non-soluble iron content will be removed by filtration. The soluble content will be removed by aeration, clarifying (coagulation / flocculation / sedimentation) and filtration. It is expected that the iron level entering the cooling tower basin will be between 0.05 ~ 0.10 ppm. Even after concentrating 6 times, the iron content in any discharge will be lower than 1.0 mg/L as Fe. The iron level will be monitored and if discharge limits may be exceeded, effluent will be routed to the wastewater treatment system. The wastewater treatment system also has aeration, clarifying and filtration facilities and these would reduce the iron content to an acceptable discharge limit.

The blowdown will be taken from the cold water stream leaving the cooling tower rather than the hot water stream flowing to it from the power plant. The temperature of the blowdown will depend on several factors including:

- The thermal load on the condenser. This which will depend on the steam flow which is a function of the power plant output at the time.
- Ambient wet bulb temperature at the time. The ambient wet bulb temperature sets the absolute lower limit for the cold water temperature. The temperature by which the cold water will exceed this is known as the 'approach' and this is normally in the order of 5 to 8°C. The preliminary design of the Project is based on an approach of approximately 6.3°C. As ambient conditions vary so will the wet bulb but the approach remains constant.

At design conditions (power plant operating at full load, at 28°C and 85% RH) the wet bulb temperature is 25.2°C and it is estimated the blowdown will be 31.6°C. At the hottest ambient conditions (estimated to be 35°C and 50% RH), the wet bulb will drop to 26.2°C and it is estimated the blowdown will be 32.2°C.

Solid Waste Management

The power plant will not produce any bulk solid wastes such as ash or sludge as are generated in a coal fired power station or some industrial processing facilities. Solid wastes produced will be minimal and will generally be as the result of maintenance or housekeeping activities which may include items such as:

- Old pipework, steel work, cabling, instrumentation etc., replaced due to upgrades or modifications;

- Consumable items e.g. oil and air filters; and
- Maintenance items, e.g. rags, containers for paints or chemicals etc.

Where possible, items will be recycled. Otherwise, solid wastes will be disposed to Pekanbaru City waste disposal licensed facility located at Muara Fajar, Rumbai, Kota Pekanbaru, approximately 14 km north-east of the power plant site.

Hazardous and Toxic Substances

The use of hazardous substances at the power plant is limited to chemicals used in general maintenance. All chemicals and hazardous substances will be stored in secure locations on site and waste materials will be trucked from site for disposal at a licensed facility, PT Sumatera Environmental Management. A description of typical chemicals and their storage quantities for the Project is detailed in Table 3.27 below.

Table 3.27 : Sample list of Chemicals Stored Onsite for a Typical Combined Cycle Plant

Chemical/Product	Storage Quantity	General Use of Chemical
Sulphuric acid	10,000 L	Demineralisation system
Hydrochloric acid	10,000 L	Demineralisation and cooling water systems
Scale inhibitor	10,000 L	Cooling water systems
Caustic (e.g. NaOH)	10,000 L	Demineralisation system
Turbine oils (e.g. Terrestic 32 or 68, Exxon)	5,000 L	Turbines, pumps, air compressor, lubrication
SAE 15 W - 40 Oil	600 L	Diesel fire pumps
Hydraulic fluid	1,000 L	Steam turbine electrohydraulic fluid
Ammonia (NH_3)		Boiler water treatment
Trisodium Phosphate	100 kg	Boiler water treatment
Sodium Hypochlorite	100 L	Water treatment biocide for raw water and possible for cooling water
Insulating Oil (non PCB)	1,000 L	Transformers
O_2 Scavenger	500 L	Deaerator tanks
Misc. Chemical Reagents for Water Laboratory	50 kg	Water testing lab chemicals
Water Wash Liquid	1,000 L	GT water wash
CO_2	4,000 kg	Fire protection
Miscellaneous oils, reagents, chemicals, thinners etc. used for operation and maintenance activities		

Fire Detection and Protection System

The plant fire detection and protection system will be designed in accordance with the local fire codes and the requirements of NFPA 850. Table 3.28 and Table 3.29 provides an overview of the proposed fire detection and protection systems and where they will be located on site.

Table 3.28 : Fire Detection Systems

Fire Detection System	Location of System
Flame Detectors	GT enclosure
Pilot Operated Sprinkler Heads	ST building
	Transformers
Heat Detectors	GT enclosure
	Diesel generators
Smoke Detectors	Offices

Fire Detection System	Location of System
Multi-sensor Detectors	Buildings including admin and control, workshop and stores and water intake

Table 3.29 : Fire Protection System

Fire Protection System	Location of System
Deluge System	GT – Generator Step Up Transformer
	ST – Generator Step Up Transformer
	Main oil tank for Black Start Diesel Generator
	Unit Aux Transformer
Sprinkler System	Cable room
	Workshop
Gaseous System	Electronic room
	Control Room
	Switchgear Room
	Gas turbine enclosures

In addition to these systems, there will also be a ring main with hydrants and portable fire extinguishers located strategically around the power plant.

Lighting

Outdoor artificial lighting including flood lights will be installed at suitable locations. Pole mounted, high pressure sodium vapour lamp fixtures will be used for the approach and work roads. A combination of high pressure sodium vapour, fluorescent, and incandescent fixtures will be used for the turbine hall, HRSG platforms and galleries as necessary. The illumination levels at the various locations will be maintained as stipulated in internationally accepted codes.

A suitable number of lighting panels will be supplied and installed at the convenient locations throughout the Plant. In addition to the normal illumination scheme, an emergency AC and DC lighting scheme will be provided.

Aircraft warning lights will be provided on the chimney stack in accordance with local regulations and/or FAA standards. The uppermost set of lamp fittings will be located as close as practicable to the top of the chimney and further sets of twin lamp fittings will be located on the chimney as required by the applicable regulation / standard.

Site Security

The site will be enclosed by a security fence. Security guards will be employed undertaking regular security patrols of the boundary fence. A gatehouse will be provided and this will be located on the access road prior to entering the site.

Labour Requirements

The operation of the plant will require approximately 60 full time employees sourced locally where possible. The anticipated organisational chart is detailed in Volume 5 Technical Appendices – Technical Report: Process Description (Appendix G).

Staff will receive comprehensive training during the construction phase and ongoing training over the lifetime of the Project.

During scheduled maintenance there will be additional temporary workers on site which can increase the total staff on site to approximately 200.

3.8 Transmission Line Operation

Once constructed and operational, the transmission line will be transferred as an asset for PLN to own and operate. Maintenance activities will be carried out to ensure the line and equipment are functioning properly, this includes maintaining the space under the transmission line by trimming any vegetation growth.

3.9 Gas Pipeline Operation

MRPR will operate the pipeline over the term of the PPA. The pipeline is anticipated to be in service at all times. The timing of any shutdowns will be co-ordinated carefully with the gas supplier and PLN as any shutdown will result in the cessation of power plant operations. Routine maintenance of the pipeline will involve pigging to clean the pipeline. The pig receiver station will be located in the gas reception area.

3.10 Decommissioning

At the end of the 20 year PPA term, the ownership of the development will be passed to PLN. It is uncertain whether PLN will continue to run the development at this stage or pursue decommissioning options. However, PLN will ensure that a Decommissioning Plan is put in place a year in advance of ceasing power plant operation.

4. Project Justification and Assessment of Alternatives

4.1 Project Justification

The Indonesian Government developed and maintains the National Electricity Plan (RUKN), which is a key policy document that guides electricity and energy infrastructure in Indonesia. The plan sets out, amongst other things, a ten-year estimate for electricity demand and supply, as well an approach for meeting demand. The state-owned electricity corporation PT Perusahaan Listrik Negara (Persero) ("PLN") is actively encouraging the private sector to develop generation capability to meet current and expected electricity demand.

The Electricity Supply Business Plan (RUPTL) for 2017 – 2026 is based on RUKN and provides a ten-year development plan for electricity in Indonesia. RUPTL serves as a guidance document to streamline the development of power infrastructure to meet electricity demand within PLN business areas. Under the 2017 – 2026 RUPTL, it aims to achieve 100% electrification across Indonesia with population growth expected to increase at 1% per year and PLN customers currently increasing at a rate of 8% per annum. In order to meet this objective RUPTL indicates at least 77.8 GW of power plants will need to be constructed.

Consistent with the RUKN, RUPTL 2016 – 2025 proposes a number of energy sources to achieve the electricity generation target, these energy sources include renewable energy such as geothermal, hydroelectric, wind and solar as well as developing conventional thermal power plants utilising coal and natural gas. New coal-fired power plants are expected to dominate the generation capacity, producing 50.3% of energy. This is followed by natural gas (29.4%), hydroelectric (10.4%), geothermal (8%), and oil and other fuels (1.9%) (PwC 2016a). Although this refers to the RUPTL 2016 – 2025, the percentages of energy sources planned is still applicable in RUPTL 2017 – 2026.

The high proportion of generation capacity expected from natural gas power plants is also as a result of the following contributing factors (PwC, 2016b):

- Relatively low carbon, medium cost fuel which provides a suitable alternative in the event of shortfalls in renewable generation; and
- Extensive gas reserves within Indonesia and importing of Liquefied Natural Gas from the Asian and global market.

In this context, the Project is consistent with the direction provided by Indonesia's long-term electricity plan. PLN is promoting the Project as part of a broader initiative to encourage private sector Build-Own-Operate-Transfer projects.

PLN specified the fuel as natural gas and the station to be a load follower. Solar and wind are not suitable for load following. There is no hydropower capability in the area. Nor are there any geothermal opportunities. PLN have dictated to MRPR through the tender process the fuel type to be used and therefore MRPR have no control over consideration of alternative fuel source options. A discussion of PLNs power strategy has been included in the project justification section.

4.2 Assessment of Alternatives

4.2.1 Power Plant Siting Options

PLN's Request for Proposal outlined the following three options to connect to the grid:

- Option 1 – Radial Connection to PLN‟s 150 kV Tenayan Substation
- Option 2 – Double-phi Connection to Tenayan – Teluk Lembu 150 kV transmission line
- Option 3 – Double-phi Connection to Tenayan – Pasir Putih 150 kV transmission line

In addition, PLN advised that the gas fuel for the project would be provided at a location known as SV1401.1 in Perawang which is approximately 45 km from the Tenayan Substation.

Considering the fact that it is generally less expensive and easier to permit and construct a gas pipeline than an overhead transmission line, MRPR sought sites for the power plant which are close to the Tenayan Substation rather than sites close to the gas pipeline connection point.

MRPR did not identify any locations which suited connection Option 1 offered by PLN. MRPR did identify two further sites for the power plant, these are:

- Site 1: This was selected for the IPP proposal to PLN and is located at the edge of the Tenayan Industrial zone, close to Pekanbaru City, directly on the banks of the Siak River. The grid connection would have been via Option 2 offered by PLN.
- Site 2 (preferred): This site is located in the Tenayan Industrial Zone. The grid connection will be via option 3 offered by PLN.

Figure 4.1 below shows the two site options.

Figure 4.1 : Power Plant Site Options

Table 4.1 below, presents a summary of the attributes, advantages and disadvantages of the two sites:

Table 4.1 : Comparison of Power Plant Site Options

Item	Site 1	Site 2	Comment
Area available	6.5 ha	9.1 ha	Site 2 preferred
Topography	flat	uneven	Site 1 preferred
Risk of flooding from Siak River	Low lying site; elevation would have to be raised to be above 100 year flood level.	Negligible flood risk as the site is at least 20 m above the level of the Siak River.	Site 2 preferred
Proximity to residents	Close to habited areas. Less than 500 m from nearest residences. Potentially higher noise impact on residents.	In the middle of the Tenayan Industrial Zone. No residents nearby. Low risk of noise impacts.	Site 2 preferred
Proximity to transmission line	Approximately 500 m to existing transmission line.	Approximately 750 m to existing transmission line.	Site 1 connection would be shorter, but closer to residents

Item	Site 1	Site 2	Comment
			so greater visual impact. Either option acceptable.
Proximity to gas supply	Further from connection point.	Approximately 5 km closer to the gas supply connection point.	Site 2 preferred
Elevation above sea level	Approximately 3 m above sea level.	Approximately 25 m above sea level. Minor loss in GT capacity at higher elevation.	Site 1 preferred
Proximity to river for make-up water supply	Beside the River.	Approximately 3 km from Siak River.	Site 1 preferred.
Visual impact	Closer to residents so relatively larger impact.	In the middle of the industrial zone.	Site 2 preferred
Emissions	Closer to residents so relatively larger impact.	In the middle of the industrial zone.	Site 2 preferred
Cost	Higher cost.	Lower cost.	Site 2 preferred
Ease of acquisition	High risk of claimants and disputes due to there being no local land certificates (Surat Keterangan Tanah).	Low risk of claimants and disputes due as there is existing local land certificates (Surat Keterangan Ganti Rugi/SKGR).	Site 2 preferred
Land ownership title	Surat Keterangan Tanah (lowest local land certificates registered in Kelurahan/Village office, and are still required to be converted into SKGR). However, when MRPR attempted to convert SKT into SKGR, the village head postponed the process due to several claimants with various SKT having different years of issuance.	Surat Keterangan Ganti Rugi/SKGR. Note - for land owners with less than 1 hectare, local land certificates only need to be registered in Kelurahan/Village Office rather than at central level.	Site 2 preferred

Overall, Site 2 was preferred, the key reasons being:

- It is further away from residential areas; and
- The land acquisition process is clearer and will minimise claimants and disputes.

4.2.2 Gas Pipeline Route Options

In the Request for Proposal issued by PLN, it was stated that gas would be made available to the project at SV1401.1 in Perawang and MRPR's original proposal to PLN was based on this. The route option considered as part of this proposal to PLN is shown in Figure 4.2 below (referred to as Route 3). After signing the PPA, PLN's Gas Transporter requested that the supply point be changed to a location known as SV1401 in Koto Gasib. This supply point was selected to improve the operability and safety requirements of the Gas Transporter. Both PLN and MRPR agreed to this request.

The preferred route from SV1401 to the site was chosen as it offers the shortest route that minimises the number of residents it passes and avoids the risks associated with horizontal directional drilling (HDD) which would have been necessary in order to cross the Siak River to tie in at SV1401.1. The pipeline route falls within the boundary of:

- The road reserve for 30 km; and
- Palm oil plantaton for the reaming 10 km to the power plant site.

Apart from the 10 km stretch in the palm oil plantation, the pipeline will be within road reserve. This means that for that length at least, MRPR does not have to procure any land. MRPR will pay a retribution fee to the government for using the road reserve.

For the 10 km stretch of pipeline through palm oil plantation, MRPR will secure an easement from the landowners to build the pipeline along this route either by procuring the land or paying a retribution fee.

In consideration of routing the pipeline to SV1401, MRPR have identified a preferred route with two alternate options for the northern and southern sections of the pipeline. These options are shown in Figure 4.2 below and comprise the following:

- Route 1: Located in Pekanbaru City, Tenayan Raya District, Siak Regency (Preferred Route);
- Route 2: Located in Pekanbaru City, Tenayan Raya District, Melebung Sub-District (Alternate 2 Route 1);
- Route 3: Located in Siak Regency, Koto Gasib Sub-District (Alternate 1 Route 1); and
- Route 4: Located in Pekanbaru City/Siak Regency and it crosses the Siak River (discarded);

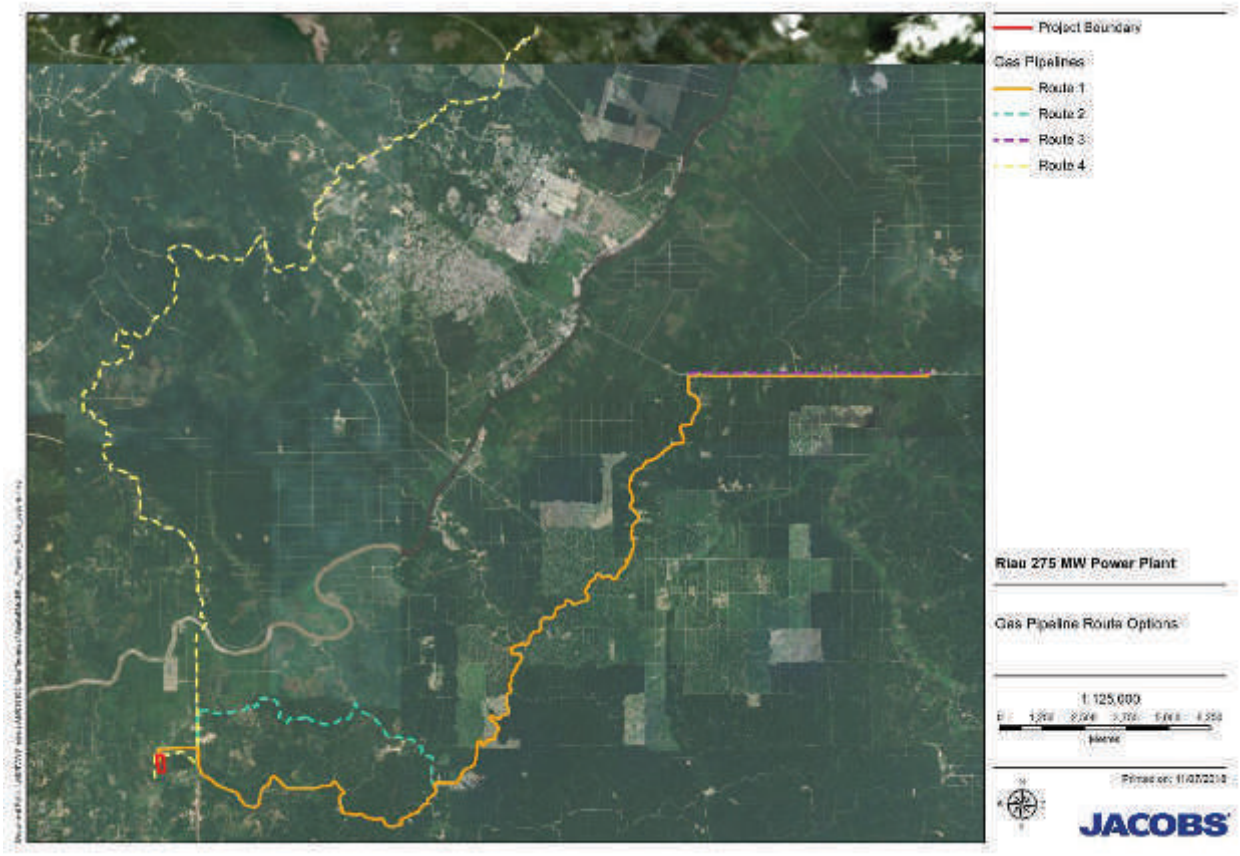


Figure 4.2 : Gas Pipeline Route Options

Table 4.2 below presents a summary of the attributes, advantages and disadvantages of all routes considered.

Table 4.2 : Comparison of Pipeline Route Options

Item	Route 1	Route 2	Route 3	Route 4	Comment
Length	Further from SV1401	Approximately 20 m closer to SV1401	Slightly closer to SV1401	Based on previous connection point SV1401.1	Route 2 preferred

Item	Route 1	Route 2	Route 3	Route 4	Comment
Topography	Average existing road 5 m	Average existing road 3 m	-	-	Route 1 preferred (CPM require minimum of 7 m from existing road for construction)
Ease of Acquisition	• Landowner already has experience dealing with gas pipeline construction. • Landowner considerably easier to contact, as the plantation area belongs to private company.	• Landowner has no experience dealing with gas pipeline construction. • Landowner considerably more difficult to contact as the plantation area belongs to the local community.	Pipeline will through or near a number of residents and food stalls	The pipeline will pass through or near a number of residents.	Route 1 preferred
Engineering	Trenched and buried with only small rivers / creeks to be crossed. No HDD required.	Trenched and buried with only small rivers / creeks to be crossed. No HDD required.	Trenched and buried with only small rivers / creeks to be crossed. No HDD required.	Trench and buried but requires crossing the Siak River by HDD which presents engineering risks.	Route 1,2 and 3 preferred.

Based on details outlined in Table 4.2, the preferred option was Route 1, this is primarily due to it presenting a more straightforward land acquisition process. However, the final route options will be confirmed following engagement with plantation land owners.

4.2.3 Water Intake and Discharge Pipeline Route Options

In determining route options for the water intake and discharge pipeline, MRPR took into consideration that the land owner to the north of the power plant site area belongs to Pekanbaru City government and that the government have plans to develop an industrial area in this land. Based on this, MRPR proposed three route options from the power plant site boundary up to the Siak River.

The three route options identified are:

- Route 1: Starts from north-west of the power plant site boundary, approximately 400 m west of existing Tenayan CFPP; and
- Route 2: Start from north-east of the power plant site boundary, approximately 130 m to the west of existing Tenayan CFPP.
- Route 3: Start from north-east of the power plant site boundary, 30 m to the west of existing Tenayan CFPP.

Figure 4.3 below shows the three pipeline route options.

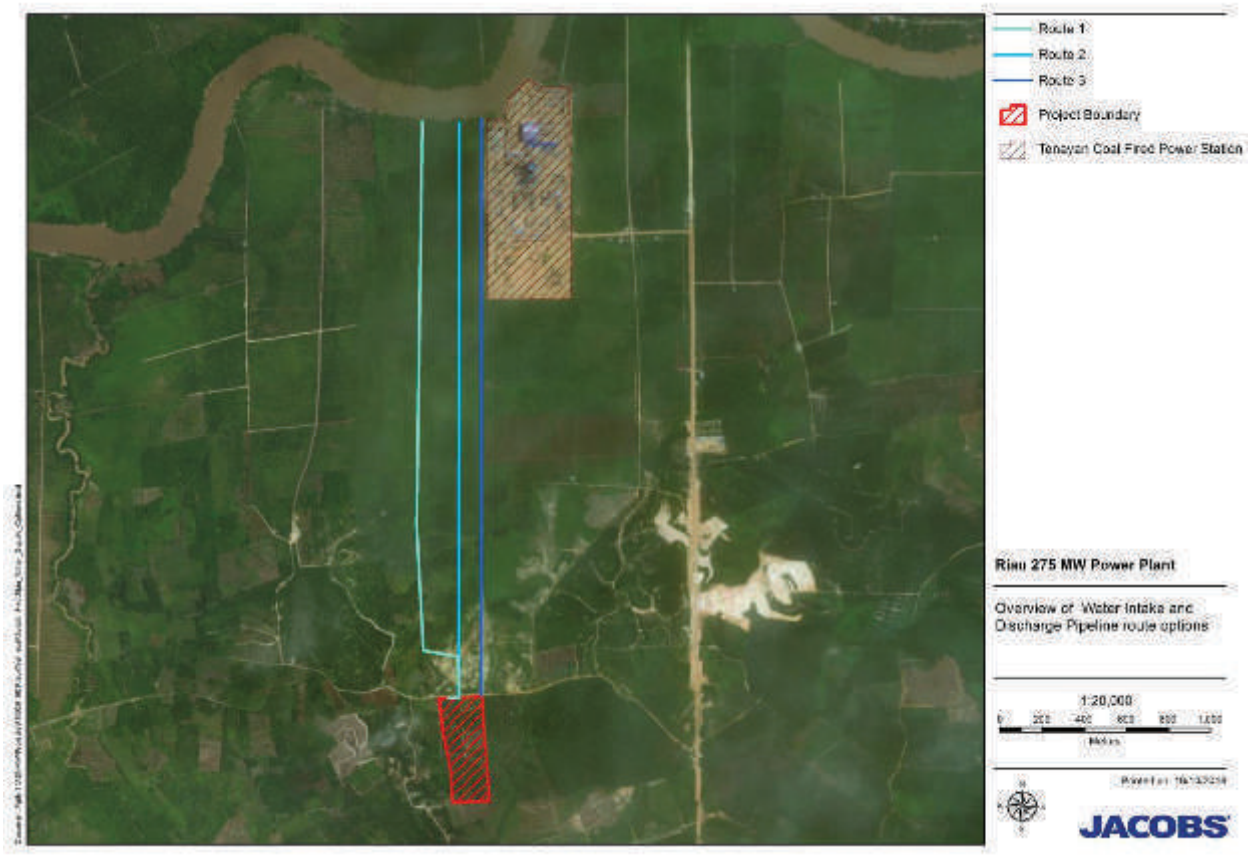


Figure 4.3 : Water Intake and Discharge Pipeline Route Options

Table 4.3 below presents a summary of the attributes, advantages and disadvantages of all routes considered.

Table 4.3 : Comparison of Water Intake and Discharge Pipeline Route Options

Item	Route 1	Route 2	Route 3	Comment
Length	Longer distance to the Siak River.	Approximately 30 m closer to the Siak River.	Distance to river is the same as route 2	Route 3 preferred
Topography	No existing road.	No existing road	Existing road 3 m in width	Route 3 preferred
Ease of acquisition	High risk of claimants as the route is on the boundary of government land.	Low risk of claimants as the route is in the middle of government land.	Low risk of claimants as the route is in the middle of government land.	Route 3 preferred
Visual impact	No nearby residents.	Several food shops that need to be permanently relocated.	Several food shops that need to be permanently relocated.	Route 1 preferred

Based on details outlined in Table 4.3, the preferred option was Route 3, this is primarily due to it presenting a more straightforward land acquisition process.

4.2.4 Power Plant Technology Options

A range of technologies currently exist for combined cycle power plants. Each technology has advantages and disadvantages from a financial, reliability, efficiency and environmental perspective.

4.2.4.1 Natural Gas CCPP Technology

Natural gas as a resource provides more efficiency than coal due to high operating temperatures and when natural gas use is paired with a combined-cycle plant, this results in even better efficiencies.

Total CO_2 emissions from natural gas-fired plants are around only 25% of those from coal, despite the fact that they generate nearly half as much electricity (International Energy Agency, 2010). This is due to the lower carbon content of gas per unit of energy delivered, as well as the higher efficiency of gas-fired electricity generation compared to coal plants.

With regards to the selection of a combined cycle gas turbine power plant, electricity generation efficiency is further enhanced by waste heat from the gas turbine being used as the heat source in the HRSG boiler to generate steam. This drives a turbine to generate further electricity, significantly increasing the amount of megawatt (MW) output produced per terrajoule (TJ) of gas.

The technology of the Project is therefore a very efficient form of power generation; this was designed for high reliability and efficiency operation with a lower environmental impact, as compared to generating power with a straight gas turbine unit fired on natural gas.

4.2.4.2 Water Cooling Technology

In a combined cycle plant, condenser cooling is one of the most significant design issues to consider. Water cooling technology is required to cool steam used to power the turbine back into water before it can be discharged. The main methods of water cooling include one-through systems and closed-circuit systems:

- Once-through systems take water from nearby sources, circulate it through pipes to absorb head from the steam in condensers, and discharge the now warmer water to a local source. Once-through systems were previously popular because of their simplicity and low cost. However, these systems can potentially cause significant disruptions to local ecosystems due to the significant water withdrawals involved and the increase in temperature for the receiving waterbody.
- Closed-loop systems reuse cooling water rather than immediately discharging it back to the water source. Closed-loop systems use cooling towers to expose water to the ambient air. Some water evaporates and the rest is sent to the condenser. As such, the system only withdraws water required to place water that has evaporated. This reduces the volume of water required as well as the thermal shock on the environment.

Early in the development of the project, MRPR assessed the options for condenser cooling. The thermal load from the plant at 275 MW is approximately 200 MW. The water demand for once through cooling would have been in the order of 5 m^3/s – or approximately half of the river flow at times of low flow. As the actual demand for make-up water for the cooling tower is modest – approximately 1% of the river flow at times of lowest flows, MRPR considered it would not be necessary to use an air cooled condenser. Therefore, given the water efficiency and reduced environmental impact, the Project will include a closed-loop system, with a cooling tower and blowdown.

4.2.4.3 Chimney Heights

WBG Environmental, Health and Safety (EHS) General Guidelines recommends that the chimney height for all point source emissions, whether significant or not, be designed according to Good International Industrial Practice (GIIP)[1]. The GIIP is based on United States 40 CFR, part 51.100 (ii), which used the following technical document, "Guideline for Determination of Good Engineering Practice (GEP) Chimney Height (Technical Support Document for the Chimney Height Regulations)", EPA 450/4-80-023R, June 1985.

The GEP Chimney Height is determined using the following equations

$$H_G = H + 1.5L$$

[1] GIIP is defined as the exercise of professional skill, diligence, prudence, and foresight that would reasonably be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally or regionally. The outcome of such exercise should be that the project employs the most appropriate technologies in the project-specific circumstances.

where:

H_G = GEP chimney height measured from the ground level elevation at the base of the chimney

H = Height of nearby structure(s) above the base of the chimney

L = Lesser dimension, height (h) or width (w), of nearby structure(s)

"Nearby structure(s)" = Structures within/touching a radius of 5L.

It should be noted that while GEP heights represent the stack height required to avoid building downwash effects, the GEP heights are maximums under US Federal Law and are not necessarily required where the contaminant emission rates are sufficiently low as to have acceptable environmental effects. For the case of gas-fired power plants, contaminant emission rates are generally considered to be sufficiently low that higher stacks are not required. Given that the tallest nearby structure is the Steam Turbine (ST) building, which is 25 m high and 24 m wide, the GEP calculates at stack height of 61 m. The GEP procedure allows for a lower stack height to be used if it does not result in excessive ground level concentrations and as such the effects of building downwash on the plume are assessed.

A stack height of 45 m for the Project was assumed for the air modelling assessment, which was based on experience from other CCGT plants of a similar size. The highest predicted maximum ground level concentration of NO_2 as a 1-hour average (99.9th percentile) from the Project is 43 µg/m^3, which is approximately 21% of the WHO guideline of 200 µg/m^3 (Refer to Volume 5: Technical Appendices – Technical Report – Air Quality Assessment for further details on modelling results). The dispersion modelling found that there were no excessive ground level concentrations for a 45 m chimney height and as such conforms to GIIP and GEP.

A sensitivity analysis was also undertaken of the effects of different stack heights on the model predictions from the CCGT, with stack heights of 40, 50, and 61 m being modelled for comparison with the currently proposed 45 m stack height. The model was set up to account for the potential downwash impact of the ST building. Table 4.4 provides the results of the dispersion modelling for the four scenarios.

Table 4.4 : High Predicted Dispersion Modelling Results at Varying Stack Heights

Averaging Period	CCGT only (µg/m^3 NO_2)				CCGT + CFPP (µg/m^3 NO_2)			
	40 m stacks	45 m stacks	50 m stacks	61 m stacks	40 m stacks	45 m stacks	50 m stacks	61 m stacks
1-hour (100th %-ile)	86.5	86.5	80.7	60.6	110	110	110	108
1-hour (99.9th %-ile)	44.0	43.0	42.1	40.0	54.1	53.4	51.7	51.6
24-hour	13.4	12.8	9.9	9.4	16.2	15.7	12.2	11.7
Annual	3.4	3.4	3.2	2.9	4.6	4.6	4.4	4.1

The national and international ambient air guidelines and emission limits along with the principle of the development meeting GIIP are used to assess the potential environmental impacts on air quality from the proposed power station

As before, the accepted approach for evaluating the results is to compare the predicted contribution of the project on its own with the national guideline. This contribution should be less than 25% of the national ambient air standard.

The modelling predicts that even for the 100th %-ile case, the plant will comply with the Indonesian ambient air standard for NO_2 of 400 µg/m^3 as a one-hour average even with a 40 m high stack.

If considering the 99.9th %-ile figures, the predicted 1-hour contribution from the project is well below 25% of the local ambient air standard and WHO guidelines. Increasing the stack height above 45 m will provide no material benefit to the ground level concentrations in the surrounding area, but will increase the visual impact of the plant and the project cost associated with the construction of the stacks.

The only case where there appears to be more than a marginal benefit for the 61m stack is the 100th %-ile 1h case, but as this is not the recognised yardstick used to evaluate the results, it is considered of academic interest.

The proposed stack height of 45 m also, when compared to chimney heights used for similar sized CCGT plants in developed countries, was found to be consistent with the stack heights used again demonstrating that for this type of plant the stack height is appropriate and conforms to GIIP.

4.2.5 Transmission Line Options

Identifying the appropriate transmission route includes seeking a balance between the potential impacts of the locality of the transmission line, as well as the technical requirements for the transmission line, such as dependability.

For the connection from the site to the existing grid, two routes were investigated:

- Lines exiting the site to the north, then turning east and running in the road reserve and across some privately owned land before connecting to the existing PLN owned line running from Tenayan to Pasir Putih; and
- Lines exiting the site to the south, then turning east and running across the privately owned land/palm oil plantation areas to connect to the existing PLN owned line running from Tenayan to Pasir Putih and

A range of selection criteria is normally used to consider route options, and the following table compares the two routes against these.

Criterion	Route 1	Route 2	Comment
Minimising the length of the line where possible to reduce costs and impact area;	About 750m	About 750m	Same
Reducing impacts on existing network during construction;	Same	Same	Same
Sharing the RoW with existing transmission lines;	Not applicable	Not applicable	Same
Avoiding existing and planned high-density residential areas leaving sufficient margin for growth in these areas;	Not applicable	Not applicable	same
Avoiding agricultural areas where centre pivot irrigation systems are used;	Not applicable	Not applicable	Same
Avoiding areas where horizontal clearances are limited because of trees or nearby structures;	Marginally better as there is less vegetation on this route		Route 1 marginally better than route 2
Avoiding environmentally sensitive sites, such as protected forest areas as well as wild life sanctuaries, archaeologically significant sites, areas with threatened or endangered species or species of special concern, areas of significant biological or cultural significance, government lands etc;	Not applicable	Not applicable	Same
Identifying sites with easy access for construction and maintenance;	Access is marginally better, but construction would impact on road traffic and pose greater risk to public		Route 2 preferred
Avoiding areas subject to floods, gushing stream during rainy seasons, tanks, ponds and lakes;	Same	Same	Same
Avoiding areas that may involve risk to human life and damage to public and private properties;	Construction would pose greater risk to the public		Route 2 preferred
Considering the requirement for future loads near the proposed route for easy connection; and	Not applicable	Not applicable	Same

Criterion	Route 1	Route 2	Comment
ease of gaining access to the land required for the towers	More landowners who were less willing to consent to		Route 2 preferred

Considering the above, MRPR selected Route 2 for the grid connection.

4.3 Do-Nothing Option

The “do-nothing” option involves not developing the Project and the associated pipeline and transmission line. In the do-nothing scenario, potential adverse environmental and social impacts associated with the Project would not occur, however, nor would the beneficial economic impacts, particularly those associated with contributing towards meeting the future demands for power in Indonesia in accordance with RUPTL.

As discussed above, the population growth in Indonesia is increasing and with continued electrification across Indonesia, additional electricity generation capacity is essential to meet this demand.

Additional generation capacity is therefore essential to meet the growing power demand. PLN has identified that natural gas will contribute to 30% of generation capacity.

The do-nothing option would likely result in production of alternative power source to meet electrification targets and given the percentage target (50.3%) afforded to coal power which in comparison is more environmentally impacting in terms of GHG and other contaminants than Natural Gas the do-nothing option is not considered. This is particularly the case given the energy efficient technology to be utilised by the proposed project and the fact it has been sited to minimise environmental impact and optimise routing to existing infrastructure tie-ins. The “do-nothing” option is therefore not considered viable.

If the alternative power source is a renewable source such as geothermal, solar, wind or hydropower the level of GHG emissions is lower than the proposed power development, however, each of these have their own environmental impacts which in some instances are more detrimental to the environment due to the larger project footprint required to generate the same level of electricity produced by the proposed development. The “do-nothing” option is therefore not considered viable.

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