PERTAMINA
KILANG PERTAMINA
BALIKPAPAN

- Summary -

Climate Change Risk Assesment

RDMP RU V Balikpapan & Lawe-Lawe Project
PT Kilang Pertamina Balikpapan

1. Introduction

The Balikpapan Refinery Unit V currently has a capacity of 260,000 barrels per day (bpd), processing crude oil from domestic sources and imports. Pertamina plans to upgrade and supplement the existing Balikpapan refinery units and capacities to meet the growing Indonesian demand for fuels. The overall planned investment at Balikpapan Refinery ("RDMP Balikpapan") aims at expanding refining capacity to 360,000 bpd includes addition of several new major process units such as Naphtha Hydrotreating Unit, Isomerization Unit, two Distillate Hydrotreating Units, a Residue Fluid Catalytic Cracker (RFCC) and several other supplementary units including associated utility and offsite facilities whilst increasing the yield of transportation fuels by converting heavier crude oil fractions, increasing feedstock flexibility to process higher sulphur crude feed, and meet increasingly stringent product quality specifications.

2. Methodology

International Financial Institutions (IFIs) are committed towards the contrast of climate change and the reduction of GHG emissions. For this reason, their covenants for project loans include requirements to adopt best practices to carry out GHG analyses and climate change risk assessments.

According to the UNFCCC9, climate-related risks include different hazards, some of which occur gradually (e.g.: change in temperature and precipitations) and some suddenly (e.g.: extreme events like storms and floods). The same concepts are presented by the World Economic Forum (WEF) Global Risks Report 202010, which includes weather and climate risks among the top global risks, especially regarding the potential "failure of climate-change mitigation and adaptation" and "extreme weather events".

In order to increasingly account for climate-related aspects in the realization of new projects, the Equator Principles IV11 published on July 2020 introduced the requirement to carry out a CCRA aligned with Climate Physical Risk and Climate Transition Risk categories as outlined in the Recommendations of the Task Force on Climate-related Financial Disclosures (TCFD)12. Furthermore, this CCRA is based on the Equator Principles' Guidance Note on Climate Change Risk Assessment (EP IV) issued in October 2020 and the latest update released in May 2023. Specifically, the Equator Principles state that a CCRA is required:

- for all Category A and - as appropriate - Category B Projects, to cover physical risks;
- for all Projects having combined Scope 1 and Scope 2 emissions greater than 100,000 tCO2e/y, to cover climate transition risks and carry out a Climate Change Alternatives Analysis (which evaluates lower GHG alternatives).

Scope 1 indicates the direct emissions from owned or controlled sources. Scope 2 covers indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed. Whereas Scope 3 includes all other indirect emissions that might occur due to the project.

3. Expected Climate Change in East Kalimantan Province

With reference to the RDMP Project, a focus is made on the expected climate changes in the in the East Kalimantan Province. The following charts present the outcomes of simulations carried out for in the East Kalimantan Province extracted from the World Bank Climate Change Knowledge Portal (CCKP) with reference to SSP 4.5 and SSP8.5 scenarios are as follow:

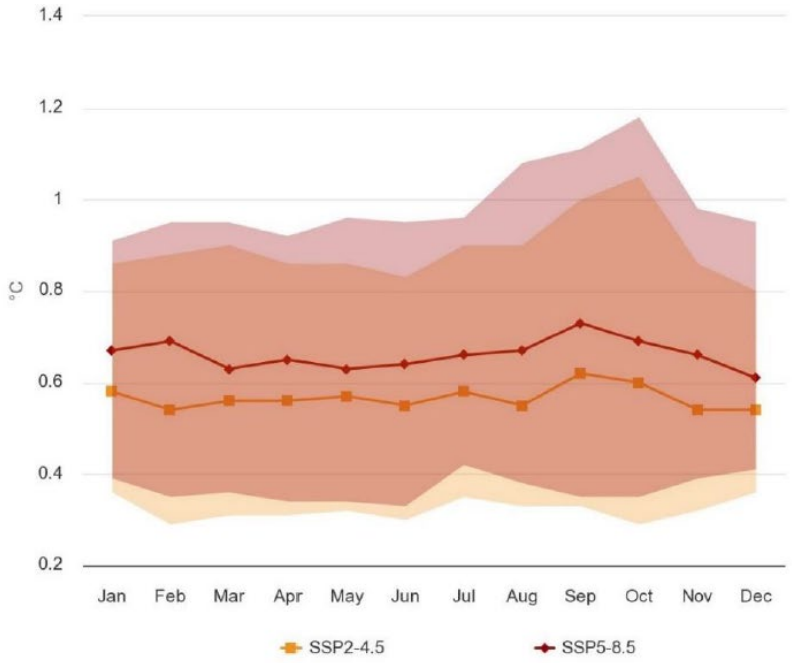

Figure 5.6: Projected Variation of Temperature in the East Kalimantan Province, 2020-2039

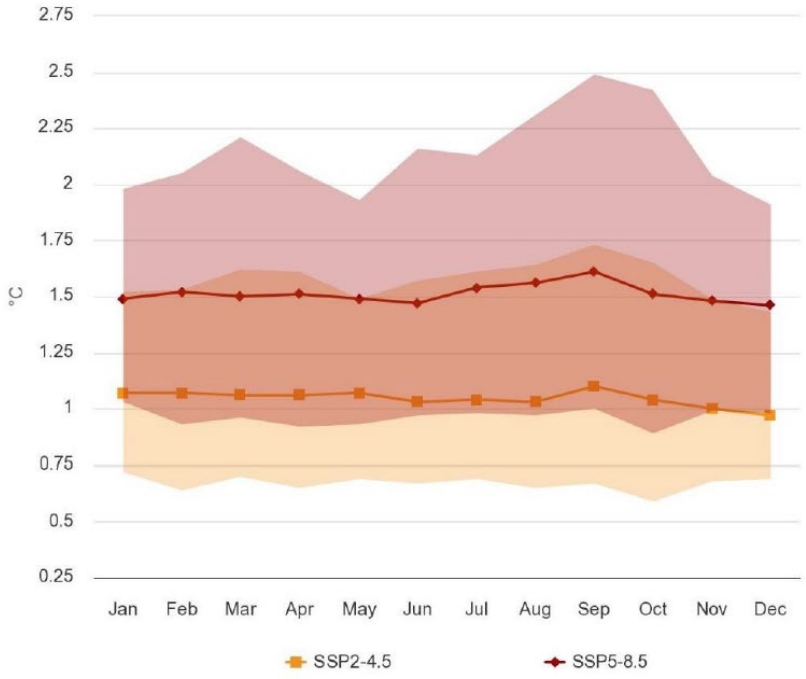

Figure 5.7: Projected Variation of Temperature in the East Kalimantan Province, 2040-2059

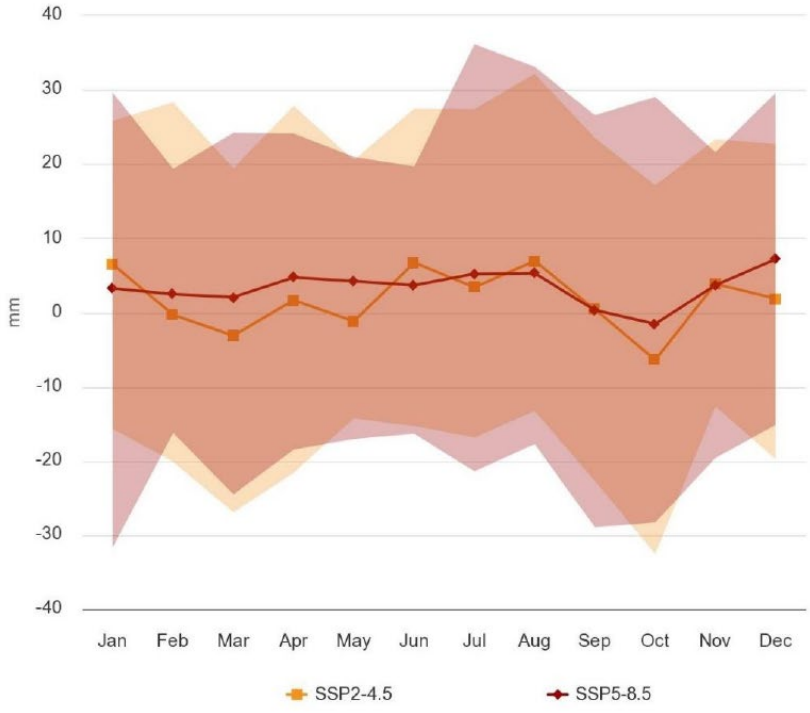

Figure 5.8: Projected Variation of Precipitation in the East Kalimantan Province, 2020-2039

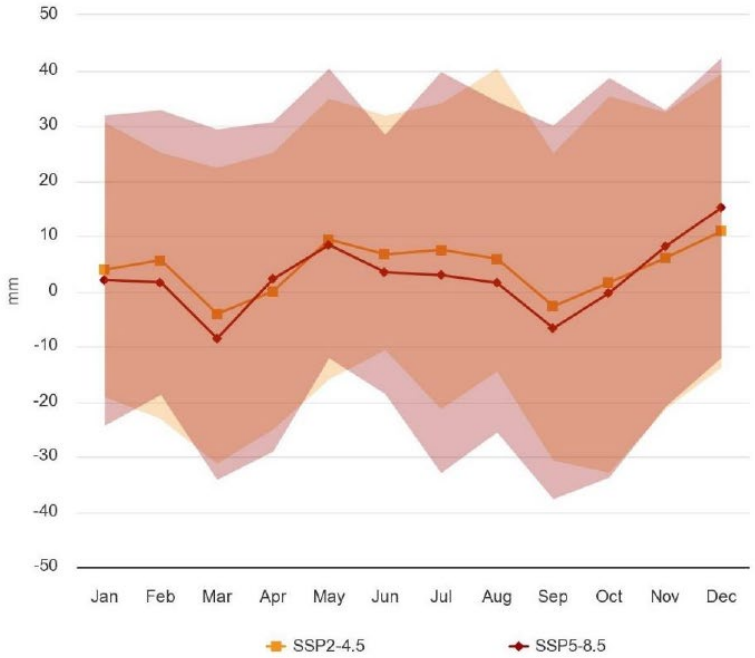

Figure 5.9: Projected Variation of Precipitation in the East Kalimantan Province, 2040-2059

- The analysis of the observed historical weather data and of the climate projections indicate that the changes in the climate pattern in the area under consideration are significant, in line with the average worldwide trends. These projected changes are an increase in temperatures, significant decrease of rainfall, and an increase in extreme weather event such as wildfire and flooding episodes.
- In relation to physical risks, it has been found out that in the long-term the Project may be affected by the expected increase in average annual temperatures as well as by the increase in the number and intensity of extreme weather events (all events with medium-low risk factor) and by a reduction precipitation.
- These changes may impact negatively on the project mainly in terms of accelerated material degradation and potential damage to the infrastructures.

4. Physical Risk

Physical risks are related to physical changes of climate, which can be acute (due to a short-term extreme event) or chronic (due to slowly evolving climate patterns). According to TCFD, acute physical risks refer to those that are event-driven, including increased severity of extreme weather events, such as cyclones, hurricanes, or floods. While chronic physical risks refer to longer-term shifts in climate patterns (e.g.: sustained higher temperatures) that may cause sea level rise or chronic heat waves. The physical risks are identified for Project, including their hazardous, exposure and vulnerability measures, and adaptation measures are recommended in Table below:

Table 5-1: Climate Change Physical Risks and Adaptation Measures[1]

Category of climate hazard	Hazards	Effect on the Project	Physical Risk		Adaptation Measure	Residual Physical Risk	
			SSP4.5	SSP8.5		SSP4.5	SSP8.5
Temperature related	Extreme heat event[2]	Accelerated material degradation.	**M**	**M**	•Use protective surface coatings and barriers. •Improve quality of concrete (strength grade). •Increase in concrete cover thickness.	**L**	**L**
		Increased energy demand due to increased cooling requirements and air conditioning	**M**	**H**	·Install energy efficient facilities (especially for chillers and air conditioning system) ·Set energy efficiency strategies for continuous improvement in energy saving	**L**	**M**
		Higher thermal induced stresses.	**L**	**M**	Use of stainless steel, galvanized reinforcement, corrosion inhibitors, electrochemical chloride extraction.	**VL**	**L**
		Increased heat stress of workers working outdoor.	**L**	**M**	Implementing a worker health awareness program to educate workers (and contractors) about the importance of drinking water and identifying the early signs of heat stroke/dehydration.	**VL**	**L**
		Increase of thermal loading on concrete components	**M**	**M**	·Increase in concrete cover thickness.	**L**	**L**

[1] The rating levels have been divided in the following table into High (H), Medium (M), Low (L), and very low (VL).

[2] https://thinkhazard.org/static/documents/thinkhazard-methodology-report_v2_0.pdf

Category of climate hazard	Hazards	Effect on the Project	Physical Risk		Adaptation Measure	Residual Physical Risk	
			SSP4.5	SSP8.5		SSP4.5	SSP8.5
		causing expansion, breaking, and cracking.			·Improve quality of concrete (strength grade). ·Use protective surface coatings and barriers.		
Water related	Extreme precipitation events	Reduced accessibility to the project site for maintenance	**M**	**M**	·Protection by design, preservative treatment. ·Availability of spare parts / components in sufficient amount	**L**	**L**
		Weakening of structures with the presence of mold, due to the water accumulation on the rooftops	**M**	**M**	·Install an adequate roof drainage system, preferably an integrated rainwater harvesting and stormwater management system ·Regular inspection and cleaning of mold on the rooftops	**L**	**L**
		Increase in risk of contamination leaching on soils from precipitation	**L**	**M**	·Install impermeable base or surfaces for chemical and hazardous and toxic materials and waste storage area. ·Cover the materials and waste storage area to avoid contamination with precipitation ·Install adequate stormwater management system	**VL**	**L**
	Drought	Decreased water resource availability for production processes	**L**	**L**	Procedures to minimize water consumption	**VL**	**VL**

Category of climate hazard	Hazards	Effect on the Project	Physical Risk		Adaptation Measure	Residual Physical Risk	
			SSP4.5	SSP8.5		SSP4.5	SSP8.5
	Flood	·Damage to assets due to coastal flooding ·Disruption to operations; workers unable to get to site; disrupted supply	**M**	**H**	Development of flood alarm systems in coastal area and prepare emergency response plan for coastal flooding event. nsurance covering weather-related damages (including extreme events)	**L**	**M**
	Tsunami hazard	·Damage to the project components	**M**	**H**	·Prepare emergency response plan for extreme events like tsunami during operation period.	**L**	**M**
		·Disruption to operations; workers unable to get to site; disrupted supply			·Ensure that emergency services receive adequate training on responding to Tsunami.		
		•Reduced accessibility to the project site for maintenance			·Protection by design, preservative treatment.		
					·Insurance covering weather-related damages (including extreme events)		
Wind related	Extreme wind events	·Reduced accessibility to the project site for maintenance	**VL**	**VL**	Coordination with local agency of disaster management to understand local extreme wind events including cyclones and warning and evacuations during the event	**VL**	**VL**
	Storms, hurricanes, cyclones	·Damages to the local electricity grid leading to temporary disruption of the exchange of electricity with the national grid					
Solid mass related	Extreme mass movement	•Damage to the project components leads to lower	**L**	**L**	Increased use of sonar to monitor soil movements.	**VL**	**VL**

Category of climate hazard	Hazards	Effect on the Project	Physical Risk		Adaptation Measure	Residual Physical Risk	
			SSP4.5	SSP8.5		SSP4.5	SSP8.5
	Landslids and subsidence.	productivity or out-of-service of the facility.					
Wildfires	Extreme wildfires events	·Human health problems. ·Damage to structures and equipment due to wildfires	**M**	**M**	·Prepare emergency response plan for wildfire events during operation period. ·Ensure that emergency services receive adequate training on responding to wildfires. ·Coordination with local fire department on emergency response related to wildfires	**L**	**L**
Temperature related	Mean temperature change	·Accelerated material degradation. ·Increased heat stress/heat exhaustion of workers working outdoor. ·Increase of thermal loading on concrete components causing expansion, breaking and cracking. ·Higher thermal induced stresses. ·Overheating of equipment/machinery/storage tanks and safety risks associated with flammable equipment and materials	**L**	**M**	·Increase in concrete cover thickness, improve quality of concrete (strength grade), protective surface coatings and barriers, ·use of stainless steel, galvanized reinforcement, corrosion inhibitors, electrochemical chloride extraction.	**VL**	**L**
Water related	Mean precipitation change	·Weakening of structures with the presence of mold, due to the water accumulation on the rooftops	**M**	**M**	·Move to more efficient and less resource consuming technologies as soon as they are	**L**	**L**

Category of climate hazard	Hazards	Effect on the Project	Physical Risk		Adaptation Measure	Residual Physical Risk	
			SSP4.5	SSP8.5		SSP4.5	SSP8.5
					available on the market.		
		·Disruption to operation such as unforeseen shutdowns of unitary or refinery processes			·Regular inspection and cleaning of mold on the rooftops		
		·Decreased water resource availability to cool the plant.					
Wind related	Mean wind change	·Damages to the plant components leading to lower production or out-of-service of the plant.	**VL**	**VL**	·Protection by design, preservative treatment.	**VL**	**VL**
		·Reduced accessibility to the plant site for maintenance			·Insurance covering weather-related damages (including extreme events)		
Solid mass related	Erosion	Erosion of surface and subsurface layers, and damage to the infrastructure.	**VL**	**L**	·Availability of spare parts / components in sufficient amount	**VL**	**VL**

5. Transition Risk

The Climate Change Risk Assessment shall cover physical risks for all Category A and - as appropriate -Category B Projects, whereas transition risks shall be covered only for Projects having combined Scope 1 and Scope 2 emissions higher than 100,000 tCO2e/y.

Since the plant emissions estimated in the ESIA are more than 100,000 tons of CO2 equivalent annually, the evaluation of transition risks is required.
In accordance with TCFD recommendations, transition risks shall be evaluated under four main aspects: Policy and Legal, Technology, Market, Reputation.

The transition risk assessment is conducted based on the climate change scenarios under future mid-term horizons (until 2060), considering as ‘favourable case scenario’ the Net Zero 2050 scenario in alignment with the objectives of the Paris Agreement and the recommendations by the IPCC, and as ‘Reasonable worst-case scenario’ the Nationally Determined Contributions Scenario.

Specifically, the Net Zero 2050 scenario assumes that ambitious climate policies are introduced immediately. Carbon Dioxide Removal (CDR) is used to

accelerate decarbonization but kept to the minimum possible and broadly in line with sustainable levels of bioenergy production. Net CO_2 emissions reach zero around 2050, giving at least a 50 % chance of limiting global warming to below 1.5 °C by the end of the century, with no or low overshoot (< 0.1 °C) of 1.5 °C in earlier years. Physical risks are relatively low, but transition risks are high.

The Nationally Determined Contributions scenario assumes that the moderate and heterogeneous climate ambition reflected in the conditional NDCs at the beginning of 2021 continues over the 21st century (low transition risks). Emissions decline but lead nonetheless to 2.6 °C of warming associated with moderate to severe physical risks

The transition risks are identified for the RDMP of Balikpapan RU V & Lawe-Lawe Project, including their potential impacts, effect, rank, and adaptation measures are recommended in Table below:

Transition trend	Potential Risk	Potential financial impacts for the Project	Adaptation Measure and Management Actions	Residual Financial			
				Favourable case scenario		Reasonable worst-case scenario	
				2024-2040	2040-2060	2024-2040	2040-2060
Policy and legal risks							
Increasingly stringent efficiency mandates, emission limits and circularity requirements along with higher carbon prices	High tax on GHG emissions	•Increased operational costs (e.g., higher compliance costs). •Increased insurance costs. •Increased refined oil and gas products. •Falling demand for electricity from non-renewable sources. •Decline in the Company's revenues. •New cost associated with GHG reporting	•Strategic planning and adequate control of GHG emissions at all stages of the Project (using all reasonable tools). •Regular preparation, verification and disclosure of GHG emission reports. •Consult with national government (Minister of Energy and Mineral Resources), relevant local agency, and lenders to frequently update the requirement on emissions reporting obligations.	VL	L	L	M
	Potential legal suits for high GHG emissions			VL	L	M	M
	Regulation upon electricity dispatchment			L	M	M	H
	Reporting obligations			VL	L	L	L
	Substitution of existing products and services with lower emissions options			VL	L	L	M
	Need for transition to technologies with lower GHG emissions			L	M	L	M

Transition trend	Potential Risk	Potential financial impacts for the Project	Adaptation Measure and Management Actions	Residual Financial			
				Favourable case scenario		Reasonable worst-case scenario	
				2024-2040	2040-2060	2024-2040	2040-2060
	Failed investments in new technologies	preparation, verification and disclosure requirements.		VL	L	M	M
Reputation risks							
Growing expectations for responsible conduct from stakeholders, including investors, lenders, consumers and workers	Negative attitude of stakeholders at unchanged level of GHG emissions	Tough requirements for disclosure of the Company's GHG management reporting Limited access to external investments Increased requirements for GHG emissions if external investments are involved	•Planning and assessment of effective external investments. •Strategic planning and adequate control of GHG emissions (using all reasonable tools). •Regular preparation, verification, and disclosure of GHG reports. •Disclose climate-related risks and impacts on business and project's pathway and strategies to support low carbon transition.	VL	L	L	M
	Negative public perception of oil and gas industry	Difficulties in recruiting personnel		VL	L	L	M

6. CONCLUSION

The CCRA is elaborated considering Physical and Transitional Risks in line with the Equator Principles' Guidance Note on Climate Change Risk Assessment (EP IV) issued in October 2020 and the latest update released in May 2023, as well as the Recommendations of the Task Force on Climate-related Financial Disclosures.

Moreover, within the present report, the past trends for temperature, solar radiation, precipitations, wind, drought, and hazardous weather events likely to occur in the East Kalimantan Province in Indonesia are evaluated and the projected changes for the future decades, up to 2060, are considered.

The analysis of the observed historical weather data and of the climate projections indicate that the changes in the climate pattern in the area under consideration are

significant, in line with the average worldwide trends. These projected changes are an increase in temperatures, significant decrease of rainfall, and an increase in extreme weather event such as wildfire and flooding episodes

In relation to physical risks, it has been found out that in the long-term the Project may be affected by the expected increase in average annual temperatures as well as by the increase in the number and intensity of extreme weather events (all events with medium-low risk factor) and by a reduction precipitation this CCRA is carried out detailing the potential transition risks.

The main potential areas for transition risks mentioned by TCFD recommendations (Policy and Legal, Technology, Market, Reputation) have been screened and a low climate-related transition risk has been identified for the Project due to the expected decrease of fossil fuels consumption. Therefore, the overall climate change risk assessment results show a low risk level of the project.