Report

TCFD ANALYSIS NICKEL INDUSTRIES

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GLOSSARY

Climate Adaptation	Actions aim for adjusting, reducing the negative effects, and taking advantage of the opportunities of a changing climate
Climate Change	Large-scale shifts in weather patterns driven by human emissions of greenhouse gas emissions
Climate Mitigation	Actions aim for tackling the causes and minimising the possible impacts of climate change, namely greenhouse gas emissions released from the usage of fossil-fuel based activities, deforestation, increased livestock farming, and artificial fertilisers
Climate Scenario	A climate scenario is a plausible representation of future climate that has been constructed for explicit use in investigating the potential impacts of anthropogenic climate change. Climate scenarios often make use of climate projections (descriptions of the modelled response of the climate system to scenarios of greenhouse gas and aerosol concentrations), by manipulating model outputs and combining them with observed climate data (IPCC)
Energy Use Intensity (*Intensitas Konsumsi Energi*—IKE)	Comparison between energy consumption and building area units in a certain period (kWh/m^2/month or kWh/m^2/year) (SNI 6196:2011)

Greenhouse Gas (GHG) Inventory	A GHG inventory quantifies the amount of GHGs a company emits into the atmosphere and are critical management tools. GHG inventories enable companies to identify their emission sources and track changes over time. Information presented in a GHG inventory can help inform corporate strategies and prioritise actions to reduce emissions, as well as provide benchmarks against which the success of these activities can be measured (WRI, 2008)
Physical Risks	Risks arising from the **physical** effects of **climate** change on financial institutions' and/ or businesses' operations. Weather events that have been linked to human-driven climate change include the heatwave and droughts in China in the summer of 2013 and, the following winter, extreme rainfall and flooding in the UK. If these events happen more frequently, people and businesses might be affected financially, especially if insurances are not present
Transition risks	Risks that may occur when moving towards a less polluting, greener economy due to efforts of reducing greenhouse gas emissions. Such transitions could mean that some sectors of the economy face big shifts in asset values or higher costs of doing business. It's not that policies stemming from deals like the Paris Climate Agreement are bad for our economy—in fact, the risk of delaying action altogether would be far worse. Instead, it's about the speed of transition to a greener economy—and how this affects specific sectors and financial stability. For example, it

	might affect companies that produce cars, ships and planes, or use a lot of energy to make raw materials like steel and cement
Science Based Targets Initiative (SBTi)	The Science Based Targets Initiative (SBTi) drives ambitious climate action in the private sector by enabling companies to set science-based **emissions reduction targets.** The SBTi is a partnership between CDP, the United Nations Global Compact (UNGC), World Resources Institute (WRI) and the World Wide Fund for Nature (WWF). The SBTi call to action is one of the We Mean Business Coalition commitments.[1]
Task Force on Climate-related Financial Disclosures (TCFD)	The Financial Stability Board established the TCFD in 2015 to develop recommendations for more effective climate-related disclosures that could promote more informed investment, credit, and insurance underwriting decisions and, in turn, enable stakeholders to understand better the concentrations of carbon-related assets in the financial sector and the financial system's exposures to climate-related risks.[2]

1 https://sciencebasedtargets.org/ (accessed on 25 January 2021)

2 https://www.fsb-tcfd.org/about/ (accessed on 1 February 2021)

EXECUTIVE SUMMARY

The concern of climate change and its impacts for businesses has risen. Nickel Industries is a global player and has set an objective to investigate and get ready for the climate challenges. They engaged with Pertiwi-Consulting to investigate its readiness in regards to disclosure according to the Task Force for Climate Disclosure (TCFD), especially related to governance and risk assessment. Given the current situation, a roadmap was developed to indicate different aspects of a complete climate change strategy.

Table 1. Risks & Opportunities of Reporting Timeframe

Timeframe	Reporting Cycle	Mitigation Risks	Physical and Transition Risks	Opportunities
Short-term	1 year	low	medium	**Getting ready**. Studies on low carbon and impacts. Improvement based on climate related findings
Medium-term	1-5 years	medium	medium	**Strategies.** Set climate reduction targets. Implement 'energy future' Develop offset strategy. Visibility due to good practice
Long-term	5-20 years	high	medium	**Climate resilient NI.** Monitoring system and update with new developments. New markets such as EV

Regarding climate governance, Nickel Industries has announced the newly appointed Sustainability Committee within the organisation which updates the board of directors regularly, including aspects on climate change. With the announcement on the Sustainable Committee, NI shows more commitment towards sustainability and climate change related issues.

Nickel Industries has investigated its business impacts on carbon emissions and ways to decarbonise the nickel ore production process. They engaged with the consultancy firm Hatch and started focusing its effort around a future energy initiative, which focuses on reducing emissions from electricity consumption in their Rotary Kiln-electric Furnace (RKEF) plants. This initiative is critical to ensure that tangible and significant emission reduction can be brought forward. Other measures would be to develop a carbon offset strategy at some point in the future. Overall , NI will set up a climate change roadmap to ensure that all climate related aspects are taken into consideration.

The risk assessment and climate scenario analysis have shown the company faces physical risks from the increase of extreme weather events in the region and faces risk of water scarcity. The company also faces risks from the vast changing Indonesian regulations, especially regarding climate and possible opportunities could arise from the focus in the development of low carbon technology.

Nickel Industries has collected metrics and targets relevant to the climate related issues from the GHG inventory, climate, disaster data, and climate policy development. The GHG inventory needs to be updated with the 2022 data, but this database needs to be integrated into existing data management systems and maintained.

Nickel Industries is still in the beginning phase of climate analysis. Some areas of improvement in current NI climate governance, strategy, risk management, metrics and targets can be summarised as follows.

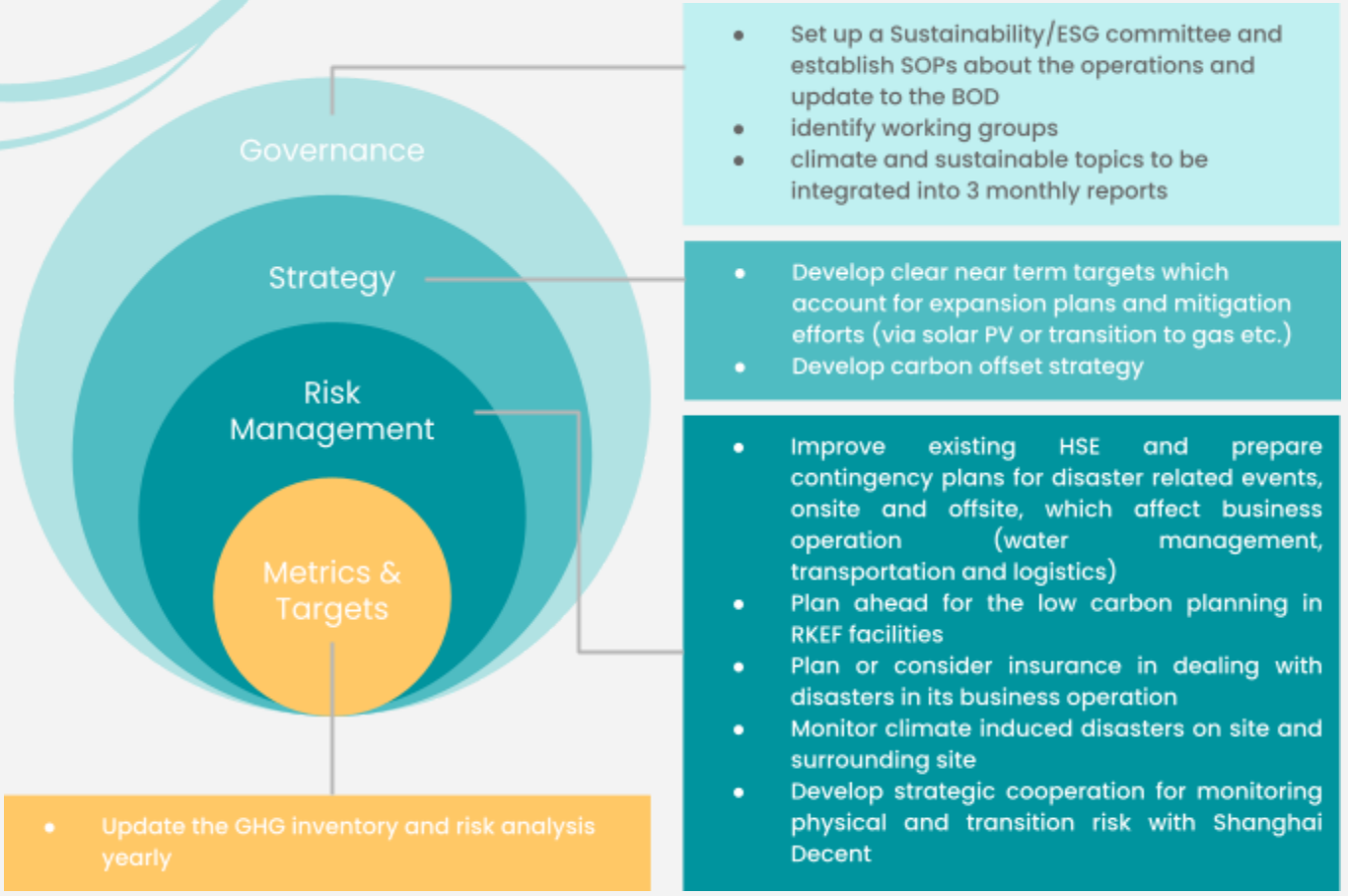

Figure 1. Summary recommendation based on TCFD core elements

INTRODUCTION

Nickel Industries in Indonesia

Nickel is an important material for various application end-use industries, from stainless steel, special steels, batteries, electroplating, alloys, and others. Since 2010, world nickel production has moved east in line with the increased industrialization of Asia.

Nickel global production and consumption is centred in Asia Pacific (China Indonesia and Philippines) (INSG 2021). In 2020, China consumed approximately 1.31 million metric tons, making it the largest nickel consumer. China holds the largest market share due to the country's economic development and its growing stainless steel and (electric) industries (Mordor Intelligence 2022).

Indonesia is the largest nickel producer in the world, with 800,000 tonnes of nickel produced in 2019, up from 606,000 tonnes in 2018. Indonesia produced an estimated one million metric tons in 2021, or 37% of the worldwide nickel production of around 2.7 million metric tons (Statista 2021, Huber 2021). Indonesia is estimated to own 21 million metric tons of nickel ore reserves from 95 million metric ore worldwide (Statista 2021, Huber 2021).

Indonesia witnessed a production growth of 70% in 2020, and has been the second largest producing country since 2017 (INSG 2021). The nickel industry in Indonesia has experienced significant improvement with an increasing number of nickel processing facilities (smelters) since 2014. The rising number of smelters built in Indonesia is due to the ban on nickel policy by the government.

Nickel Industries (NI) is an Australian public company emerging as a globally significant, low cost producer of nickel pig iron (NPI), a key ingredient in the production of stainless steel. The company acquires, explores, and develops

nickel projects. Nickel Industries is one of the global nickel miners and producers based on its operation in Indonesia.

Nickel Industries' principal operations, located in Central Sulawesi, Indonesia, are the Hengjaya Mine, Hengjaya Nickel and Ranger Nickel Rotary which operate two-line Rotary Kiln Electric Furnaces (RKEF) located within the Indonesia Morowali Industrial Park (IMIP). IMIP manages a nickel-based industrial area that is integrated with the main products in nickel, stainless steel, and carbon steel.

Expansion plans include an 80% share in the Angel Nickel project, consisting of four RKEF lines and a 380 MW coal power plant located at the Indonesian Wede Industrial Park (IWIP). Additionally, the company has signed an agreement with Shanghai Decent to acquire a 70% interest in the Oracle Nickel Project (Oracle Nickel), which has another four RKEFs in IMIP. These company assets are valued for 22.7 millions USD by 2021 (NI company report 2021).

This close partnership between NI with Shanghai Decent in Indonesia puts the company and its business into a unique position. The company sits in between policy and regulation between three countries namely Indonesia, Australia, and China.

Objective

NI conducted its first Greenhouse gas (GHG) inventory in 2020 and started mitigation analysis in 2021 and continued to 2022. Some challenges regarding data collection have been identified but good steps have been taken towards setting GHG emission reduction goals. They also prepared its first Sustainability Report for the cooperation. In 2022, NI would like to

strengthen the overall TCFD reporting, especially the aspects of climate risks, climate change governance, and initial stages of strategy development.

NI recognises its responsibility to support the global efforts to transition to a low-carbon economy, while at the same time ensuring that its operations reduce its exposure to climate change risks.

In 2015, the Task Force for Climate-related Financial Disclosures (TCFD) was established and provides guidance to financial institutions and companies on integrating climate change-related aspects into their business operation as well as enable stakeholders to better understand the implications of climate change on any business.

Four (4) main areas of disclosure are identified: 1) Governance; 2) Strategy; 3) Risk management; and 4) Metrics and Targets.

Figure 2. Core Elements of Recommended Climate-Related Financial Disclosure

The report is structured in four sections along the Climate-related financial disclosure categories: Governance, Strategy, Risk Management, Metrics and Targets.

GOVERNANCE

Why is it important?

TCFD has identified that climate governance is critical and it is necessary to demonstrate how a business manages the board oversight of management's role with regard to climate risks. Climate governance is the institutionalisation of climate/ESG matters within their corporate governance. Whether or not the climate is identified as a fiduciary duty in the corporate governance framework, directors have a responsibility to identify, evaluate, manage, or disclose GHG emission, mitigation efforts and material climate change risks.

Climate corporate governance is critical in assisting businesses in adapting to climate prerequisites and contributing to climate goals. An effective climate governance structure and reporting/communication mechanism is essential for ensuring that a company accurately assesses climate-related risks and opportunities, makes appropriate strategic decisions concerning managing those risks and opportunities, as well as defines and reports on relevant goals and targets. A corporation will be inadequate to deal with threats or react accordingly to shareholders if governance is not in place.

Mining companies have started to establish their climate governance and communication internally related to issues. The detailed examples of climate governance from two major mining companies namely BHP and Vale are presented in Box 1 and 2.

Box 1 : BHP Climate Governance

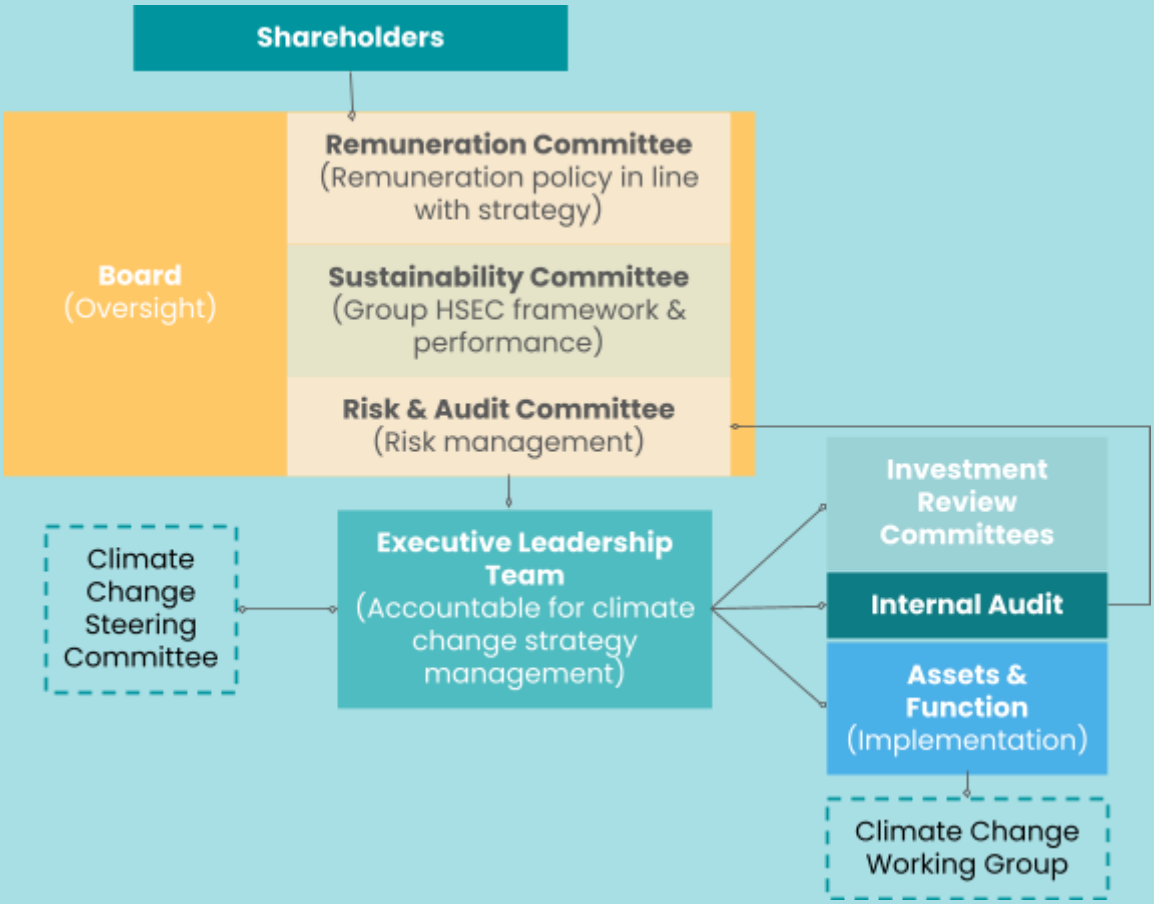

Figure 3. BHP Climate Report 2020

- Climate change is a governance issue at the Board level and is regularly discussed, including during Board strategy discussions, portfolio reviews and investment decisions, and in the context of scenario triggers and signposts.
- Board members have experience in a variety of sectors, including resources, energy, finance, technology, and public policy, which equips them to consider the potential effects of

climate change on BHP and its operational capacity, as well as to comprehend the nature of the debate and the evolving international policy response.

- BHP's approach to engaging and communicating with its shareholders regarding climate change issues demonstrates the Board's commitment to high-quality governance.
- The Sustainability Committee function is to assist the Board in monitoring the Group's health, safety, environment, and community (HSEC) performance and governance responsibilities, as well as the adequacy of the Group's HSEC framework, including climate change.
- The function of the Risk and Audit Committee (RAC) is to assist the Board in its oversight of risk management, although the Board retains ultimate responsibility for BHP's risk profile.
- The function of the Remuneration Committee is to advise the Board on the determination of remuneration policy and its application to senior executives, performance evaluation, the adoption of incentive plans, and other remuneration-related governance responsibilities.
- Below the level of the Board, the CEO and management make key management decisions in accordance with the authority delegated to them.
- The Executive Leadership Team is held accountable for a variety of metrics, including performance related to climate change. The same policies are implemented throughout the organisation.

Box 2 : Vale Climate Governance

Figure 4. Vale's Climate Governance (Source: Climate Report Vale International, 2021)

- The Vale Executive Board provides comprehensive assistance and strategic oversight. It is backed by a Sustainability Committee composed of Board members and an external independent advisor responsible for monitoring Vale's actions.
- The Sustainability Committee advises the Board on issues related to sustainability, such as climate change.
- The Executive Vice President of Sustainability is the highest-ranking management position accountable for global warming. It is responsible for proposing climate change policies, plans, projects, and targets for Executive Board approval, as well as implementing the Executive Board's general policies and guidelines.

- The Chief Sustainability Officer is also responsible for evaluating, monitoring, and reporting to the Executive Board Vale's performance, risks, and opportunities related to climate change.
- At the executive level, the company established the Low Carbon Forum, a group composed of vice presidents and their technical teams and led by the chief executive officer.
- The initiative demonstrates the commitment of Vale's senior leadership to the topic, facilitates the monitoring of performance in upholding Vale's commitments, and drives continuous progress on Vale's climate agenda.
- Monthly meetings are held with the broad leadership and technical teams that deal with the topic on a daily basis in attendance.

Frequency of Meetings

Climate governance includes communication on climate related issues. One can use various formal and informal communication channels to understand and consider the views of the board, working groups, and stakeholders. According to TCFD and other standards it is important to identify the timeframe in which groups meet and report up to higher management.

There are different measures to communicate and report. The figure below presents the type and frequency of meetings between the sustainability teams and the executive and cooperate based on several examples from major mining companies.

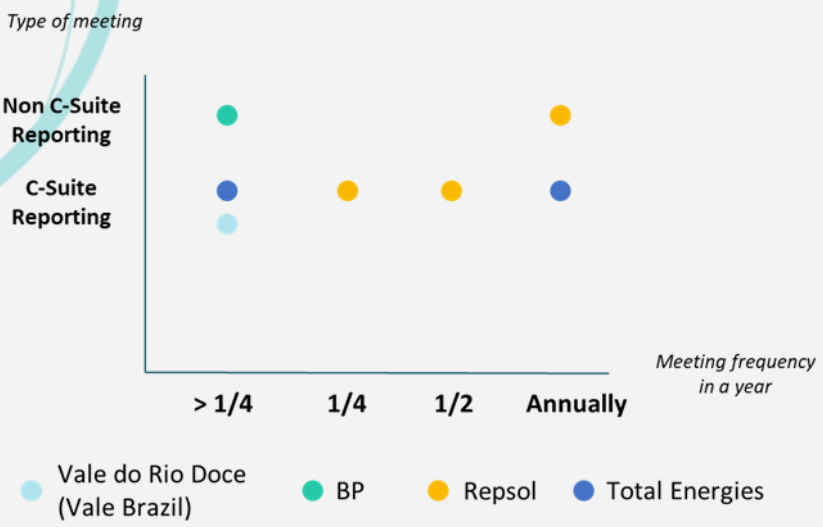

Figure 5. Meeting Frequency of Sustainability Committee Within Mining Companies

The C-suite or C-level, is used to classify an organisation's most senior executives. Members of the C-suite have extensive business experience, a strategic mindset, are capable of making high-quality decisions and managing conflict, and are adaptable. C-suite members include the:

- Chief Executive Officer
- Chief Financial Officer
- Chief Operating Officer
- Chief Compliance Officer
- Chief Commercial Officer
- Chief Data Officer
- Chief Human Resources Officer
- Chief Strategy Officer
- Etc.

Findings Regarding Governance of Climate-Related Issues

NI has appointed a Sustainability Manager who is in charge of implementing and supervising the company's climate action as well as all aspects of the company's Environment Social and Governance (ESG). The Sustainability Manager monitors climate-related aspects by coordinating with related parties in the company's operations to fulfil responsibilities to stakeholders and the company's directors as the highest executive.

NI established a Sustainability Committee this year. The Sustainability Committee will have the authority to conduct or authorise investigation into matters that are within its scope of responsibility. The Sustainable Committee is authorised to:

1. Retain outside counsel, accountants or other experts, at the expense of the Company, to advise the Committee or assist in the conduct of any matter;
2. Seek any information it requires from employees (all of whom are directed to cooperate with the Committee's requests) or external parties; and
3. Meet with company officers, employees, external auditor, internal auditor (if any) or outside counsel, as necessary and without management present.

The Committee will make recommendations to the Board on all matters requiring a decision from the Board. The committee will conduct meetings quarterly.

The Board of Directors as the highest executive in the Company has an important role in implementing the Task Forces on Climate-Related Financial Disclosures (TCFD) to formulate net zero strategies, evaluate recent policies and monitor progress. So far, the BOD is updating ad-hoc when the results of

the climate analysis need inputs. Currently, The Board of NI has determined the current core sustainability policy which is rooted in three realms of influence, being sustainable operations, stimulation of local development and contribution to global sustainability – these realms act as a foundation and will be the guiding principles in developing our sustainability strategy which includes the climate change aspect.

The governance structure of the environmental officers in IMIP and IWIP is still not clear. Both sides have an AMDAL document which is supervised and monitored by an environmental team, but the number of staff and reporting mechanism are so far unclear. This has become a challenge because most of the GHG emissions are produced within the RKEFs of IMIP and IWIP. Thus, a reporting structure is needed to be developed, especially considering the plan for NI to shift their power source to renewable energy.

Currently, there are no regular meetings or platforms between the Sustainability Manager and the Subsidiaries to provide and exchange information regarding climate-related issues.

Recommendation Regarding TCFD-Governance Review

Institutionalisation

In the process, the Sustainability/ESG Committee should establish communication with the Audit and Risk Committee. The Audit and Risk Committee shall then monitor and evaluate the climate risk management and report the result to the Sustainability Committee.

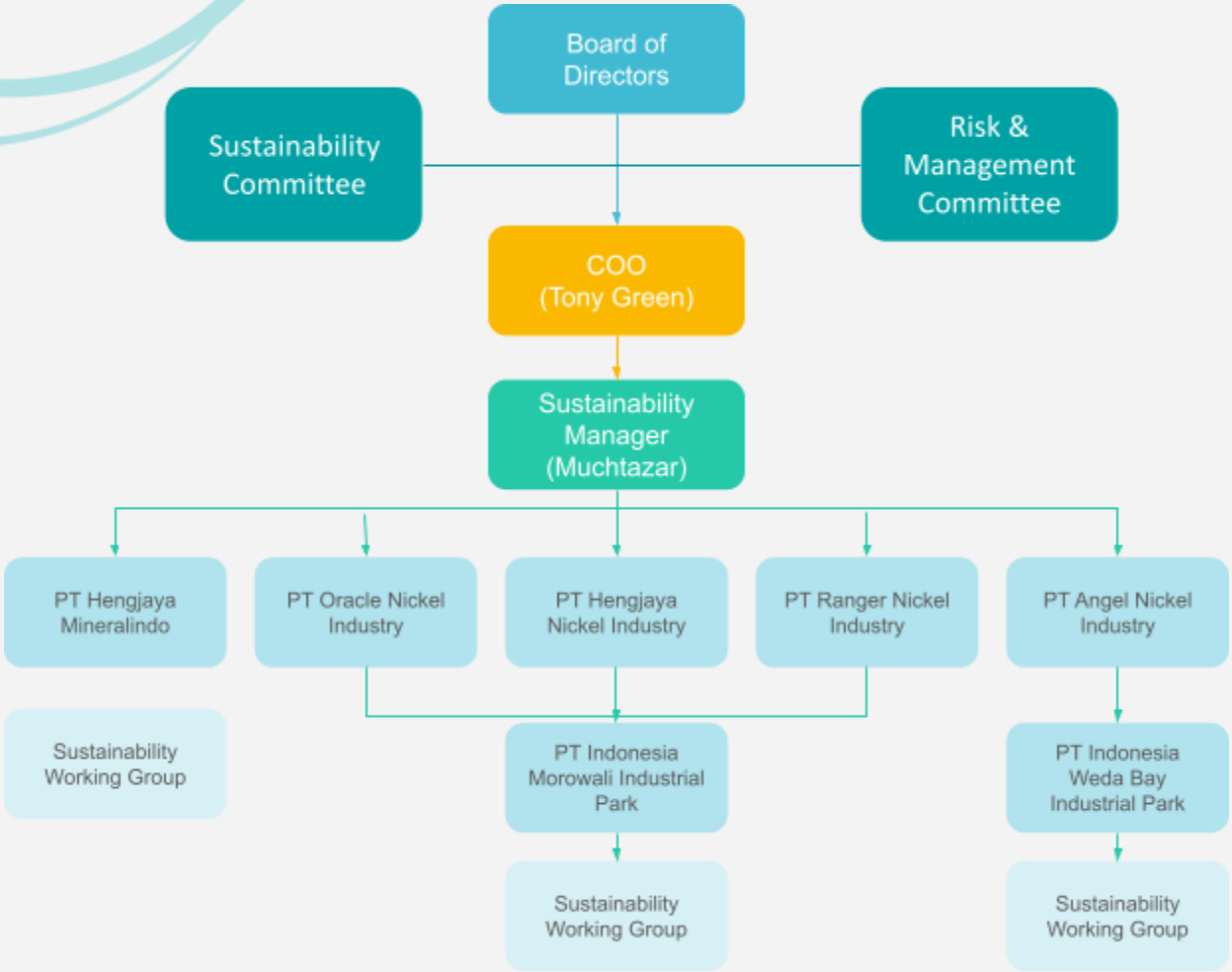

Figure 6. Nickel Industries Sustainability Governance Recommendation

Each subsidiary we proposed has a sustainability/ESG working group that has the responsibility to help oversee the process of implementing the climate strategy in NI. The Sustainability Manager communicates regularly with the working group at NI to find out and monitor the progress of each operational area of the company.

In Hengjaya Mine, the climate working group should have representatives from these divisions:

- KTT Division
- SHEQ Division
- Electrical Division
- Procurement and Logistic division
- Administration Division (HR Team, HRGA Team, ADM Team)
- Mine Plant Engineer
- Survey Team

STRATEGY

Why is it important?

Indonesia is one of the countries that is vulnerable to the impact of climate change. Indonesia has been advancing its climate policy and regulation, however, Indonesia legal and policy situation is fluctuating and unstable leading to uncertainty for business and companies. Therefore companies need to understand how climate-related issues will impact their business, strategy, and financial planning. Furthermore, it has become increasingly important for investors to see a proper reporting of climate strategies and its implementation. The report will help the investors to assess if the company has conducted the necessary strategies to tackle climate change including to reduce GHG impact and to mitigate the climate related risks both physical and transition risks.

Net Zero Wave - Short vs. Long Term Targets

Manifested in the Conference of the Parties (COP) 21 for the United Nations conference on climate change, so far 198 nations pledged reduction targets until 2030 and to reach net zero emissions by 2050. This leads private businesses as well to pledge net zero targets. Initiatives such as the Science Based Targets initiative (SBTi) which aims to ensure that the climate action plans are executed, budgeted, and implementable over time have emerged.

Below is the step by step process for companies to formulate a climate change strategy.

What others have done?

Mining companies have responded to the global commitment to respond to the Paris Agreement, to limit the temperature rise well below 2 and 1.5 degree celsius below pre industrial level by reducing carbon emissions significantly. Herewith the examples of strategies from two major mining companies namely BHP and Vale in Box 3 and 4.

Box 3: BHP's Climate Strategy

To support the BHP's climate change targets and goals, the strategy to achieve is building blocks of decarbonisation. The company's strategy focuses on:

- Directly investing in offset-generating projects that deliver sustainability co-benefits and that can provide a long-term supply of offsets.
- Working with others to support the move toward mature international and sub-national carbon market mechanisms.
- Developing a clear approach to both the voluntary and regulatory use of offsets to meet emission reduction commitments, as well as for structured product offerings to our customer base.

The Company has been reporting in line with the Task Force on Climate-related Financial Disclosures (TCFD) recommendations since the

recommendations were released in 2017. For example, the BHP Climate Change Report 2020 aligns with the TCFD's themes of Governance, Strategy, Risk Management, and Metrics and Targets. BHP strategy can be explained in the figure below:

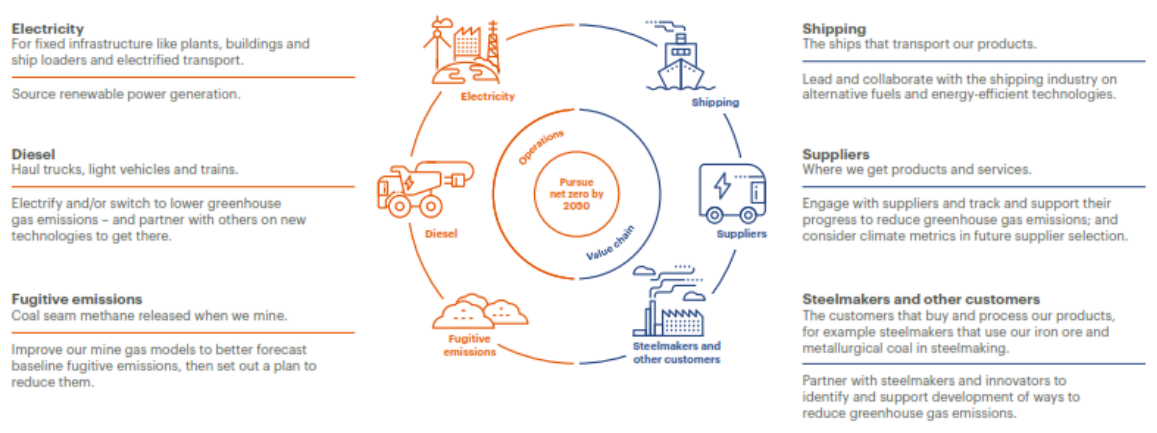

Figure 7. BHP Net-Zero Strategy

Box 4: Vale's Strategy

The company's Sustainability Strategy will be developed by 2025. The strategy will focus on The company's commitments to **reduce climate change**; **energy and water efficiency**; **conserving forests**; and **increasing social contribution**; as a transitional step to **Net Zero Emission** mining.

The explanation of each strategy is:

- Energy: will achieve 100% self-generated clean energy globally;
- Forestry aspect: strategy for conserving forests will recover and protect 500.000 hectares of degraded areas across borders;

- Climate change strategy: Reduce absolute GHG emissions by 33% in compliance with the Paris Agreement in 2030 and reach carbon neutrality by 2050.

Findings Regarding Strategy Aspects of Climate Related Issues

We have identified short-term, medium-term and long term strategies for NI. We also have identified possible mitigation measures which will be formulated as a comprehensive strategy in the near future.

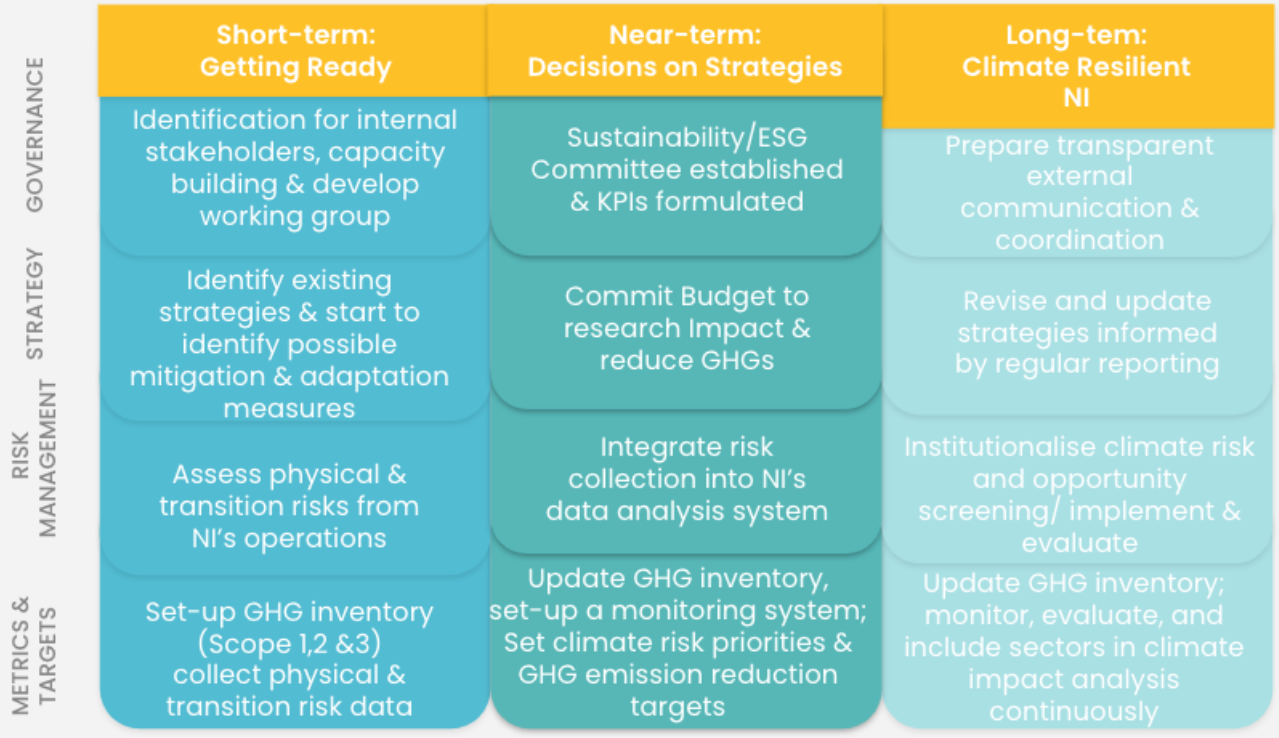

Figure 8. Climate Change Strategy Roadmap for Nickel Industries Limited

Reminder of 2021 GHG Inventory Results

NI's total GHG emissions in 2021 was 2,101,051 tCO_2e, which places NI's emissions in the middle range compared to other Nickel-producing companies.

Description	Unit	2020	2021
Total Emissions	tCO_2e	2,774,153	2,626,314
Nickel Metal Production	t Ni eq.	43,621	40,410
Carbon Intensity of the nickel production	tCO_2e / t Ni eq.	63.60	64.99

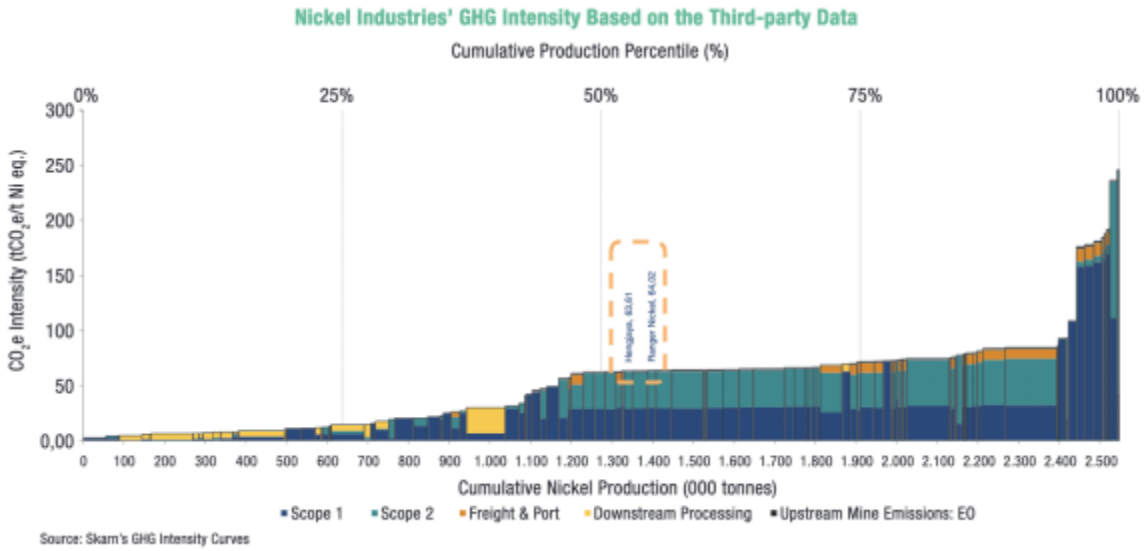

Figure 9. Nickel Industries Emissions in Comparison to Other Nickel-producing Companies

As can be seen in Figure 9 below, the GHG emissions are dominated by the combustion of coal and consumption of electricity (respectively 45.7% and 53.6% of the total).

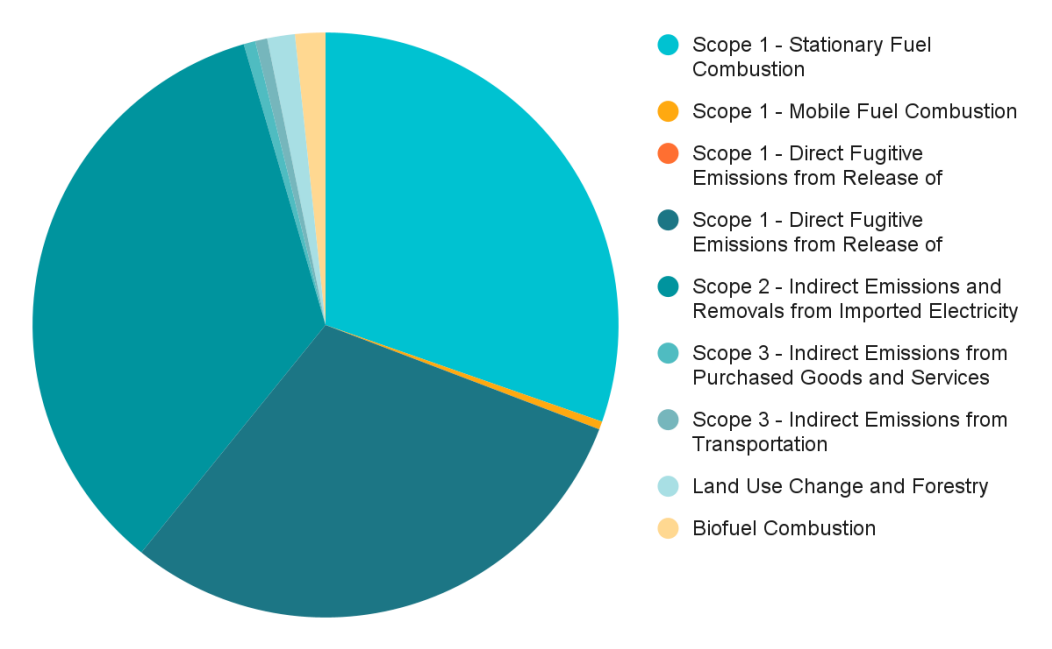

Figure 10. Source of Nickel Industries Limited GHG Emissions in 2021

Further, 97% of the total GHG emissions are attributable to the RKEF processes of HNI and RNI.

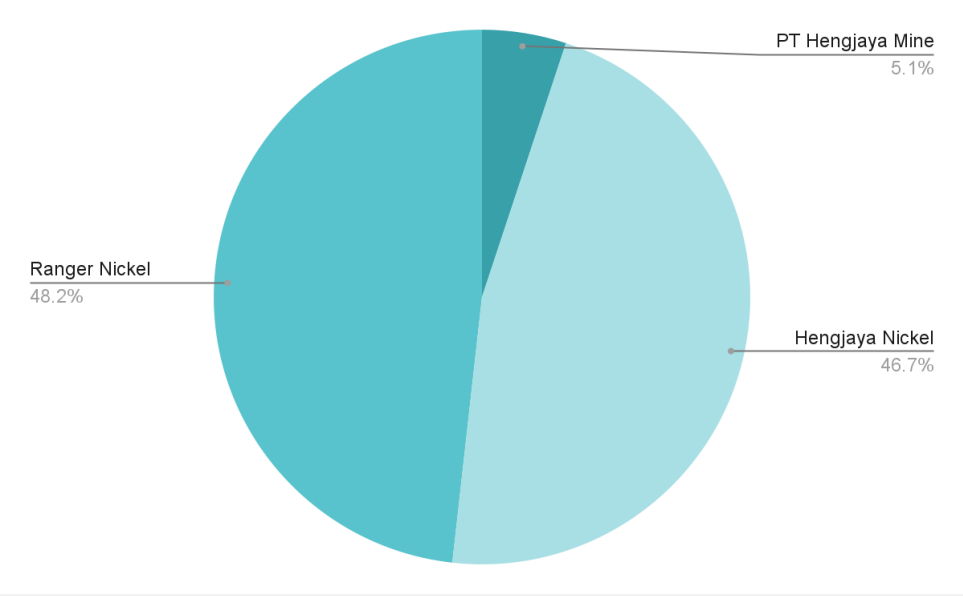

Figure 11. Percentage of GHG Emissions and Removals Based on Business Unit in 2021

Based on the risk analysis, NIis projected to face an increase in the business expense partly due to the technology transition and carbon tax. Therefore, adopting low carbon technology and energy efficiency measures as early as possible will serve two goals namely preparing for a low carbon technology transition, and building a reputation as a green nickel producer.

Strategy- Roadmap Development

Short-term Strategy

NI has started to **'get ready'** and develop a GHG inventory and also looked into possible mitigation strategies. For example, they hired two independent consultant firms to conduct the GHG inventory and to develop a decarbonisation roadmap.

Given that NI's emissions are dominated by the combustion of coal and consumption of electricity, the most prominent short-term action is to optimise fuel and energy consumption.

Some initial actions are to improve the usage of fuel at Hengjaya Mine and install a small PV plant for the operations at the Hengjaya Mine camp.

Medium-term Strategy

Considering the current state of GHG emission Scope 1 & 2 emissions, climate scenario analysis, and progression of climate policy on coal, carbon-related regulation might come into power for the medium term. Such regulations could result in significant financial impact of the company's organisation. For example, if a carbon tax is introduced, penalty fees might apply and capital expenditures would be expected to reduce emissions.

Therefore, NI is focusing on energy transition. The company can invest in renewable or lower emissions energy options and technology at HM, and especially RNI and HNI. So far the solar power project with 400 MW is in discussion for HM and IMIP. [3] If these plants come online **emissions could be reduced by up to 30%, excluding expansion plans**. Also, feasibility studies are conducted on switching from coal to gas consumption at IMIP, which would be a feasible option. As transportation is another area of emissions at HM, switching to biodiesel for the subcontractors is studied in addition to driver training.

Longer-term Strategy

Scenario analysis showed that international and national regulations expected to put more pressure on GHG reduction.

Rather than waiting NI should move proactively towards a zero or low carbon strategy. This means besides operational reduction measures they should look into **carbon offset mechanisms.**

Based on the risk analysis, NI responds to transition risk toward implementation of low-carbon technology, by implementing renewable energy sources on sites. Furthermore, further studies are still ongoing. The implementation of low carbon technology requires a long process. Therefore, alongside the gradual carbon reduction through its operation, an offset mechanism can be considered to compensate for carbon emissions during the transition process.

The company has identified the opportunity to advance into low carbon technologies as an outcome of the nickel mining, e.g. battery production, etc.

[3] With the company SESNA an MoU was signed to produce 220 MW solar at IMIP and discussions are ongoing with Quantum to produce 200 MW of solar power at HM.

RISK MANAGEMENT

Why is it important?

NI has recognised the impacts of climate risks, which entail two main risks, namely physical and transition risks.

NI has acknowledged that physical risks, extreme weather events and longer-term changes in weather patterns may impact operations (Nickel Industries, 2021). These risks may lead to:

- production delays,
- loss of productivity days,
- increased costs and increased liabilities.

To understand and test the current and future risks, climate scenarios are used. The physical risks were projected with IPCC RCP[4] 4.5 and 8.5.

The world has transitioned towards low-carbon development to achieve the Paris Agreement. This can be identified by the increasing number of governments, public and private institutions committing toward net zero carbon practice to limit 1.5 C temperature increase. This transition impacts company business in the future, especially for mining and metal producer companies often associated as major GHG contributors due to their high energy intensity users. Therefore understand transition risks IEA WEO 2021[5]

[4] The Representative Concentration Pathway (RCP) is a scenario developed by Intergovernmental Panel on Climate Change (IPCC) which describes greenhouse gas concentration trajectory based on radiative forcing.
RCP 4.5 is a moderate scenario in which emissions peak around 2040 and then decline. RCP 8.5 is the highest baseline emissions scenario in which emissions continue to rise throughout the twenty-first century.

[5] World Energy Outlook (WEO) 2021 is a scenario developed by the International Energy Agency (IEA), which illustrates how the course of the energy system might be affected by changing some of the critical variables. The IEA WEO 2021 Announced Policy is a scenario based on climate commitments made by governments, including the Nationally Determined

Announced Policy and Sustainable Development Scenarios for the duration 2021 -2050 are taken to examine possible risks in the future. The risk is assessed qualitatively based on the historical data and scenario projection in the future.

What have others done?

Mining companies have disclosed their climate risks using climate scenarios ranging from business as usual to scenarios aligned with projections of 1.5 or 2°C scenarios. Many mining companies have analysed their transition risks, but not many companies cover the analysis of their physical risks.

BHP analysed transition risk and reported in the Climate Change Report 2021 using energy scenarios for 2020-2050, namely Central Energy View, Lower Carbon View, Climate Crisis Scenario and 1.5°C Scenario, which describe the energy projection in the future.

Vale analysed its transition risks in 2020 for 2018-2040 utilising IEA WEO 2019, IEA Current Policies Scenarios (CPS), IEA Stated Policies Scenario (STEPS) and IEA Sustainable Development Scenario (SDS).

Newcrest is one of few mining companies incorporating climate scenarios for physical and transition risks. Based on Newcrest Climate Report 2021, the

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Contributions (NDC) and longer-term net zero targets, and assumes that they will be met in full and on time. This report is mainly based on Indonesia NDC. The global trends in this scenario represent the cumulative extent of the world's ambition to tackle climate change by mid-2021.

In contrast, IEA WEO 2021 Sustainable Development is the scenario that is aligned with SDG 2030. a "well below 2 °C" pathway, and represents a gateway to achieving the outcomes targeted by the Paris Agreement. The SDS assumes all energy-related SDGs are met, all current net-zero pledges are achieved in full, and there are increased efforts to realise near-term emissions reductions; advanced economies reach net zero emissions by 2050, China around 2060, and all other countries by 2070 at the latest.

company used IPCC RCP 4.5 and RCP 8.5 for physical risk analysis and IEA WEO Stated Policies Scenario (STEPS) and IEA WEO Sustainable Development Scenario (SDS) for transition risk analysis.

BHP and Vale used climate scenario analysis to test company resilience and examine possible future expectations and impacts concerning the assets or financial conditions under selected climate scenarios. Whereas, Newcrest used climate scenario analysis to identify potential risks and opportunities.

Physical Risks

Indonesia has a tropical rainforest climate. The temperature in Indonesia is constant daily throughout the year. The nation's average annual temperature is roughly 28°C for the coastal plains, 26°C for the mountain regions, and 23°C for higher elevations. Lowland rainfall ranges from 1800 to 3200 mm, but increases with elevation, reaching as high as 6,000 mm in some mountainous regions. Indonesia has two main seasons: rainy and dry seasons which are influenced by the monsoon.

The country is already affected by many natural disasters, from floods, droughts, earthquakes, tsunamis, and volcanic eruptions. It is ranked in the top third of countries regarding climate risk, with high exposure to all types of flooding and extreme heat (WB and ADB 2021).

NI operations in Indonesia are in Morowali - Central Sulawesi Province (Sulawesi Island), Hengjaya Mine and IMIP, and Halmahera -North Maluku Province (Halmahera Island) IWIP. IMIP and IWIP cover industrial areas upstream to downstream, from mining to smelter plants and supporting facilities, such as coal power plants. The average temperature at the locations ranges 27°C-28°C, and the average rainfall is 2093 - 2155 mm/year.

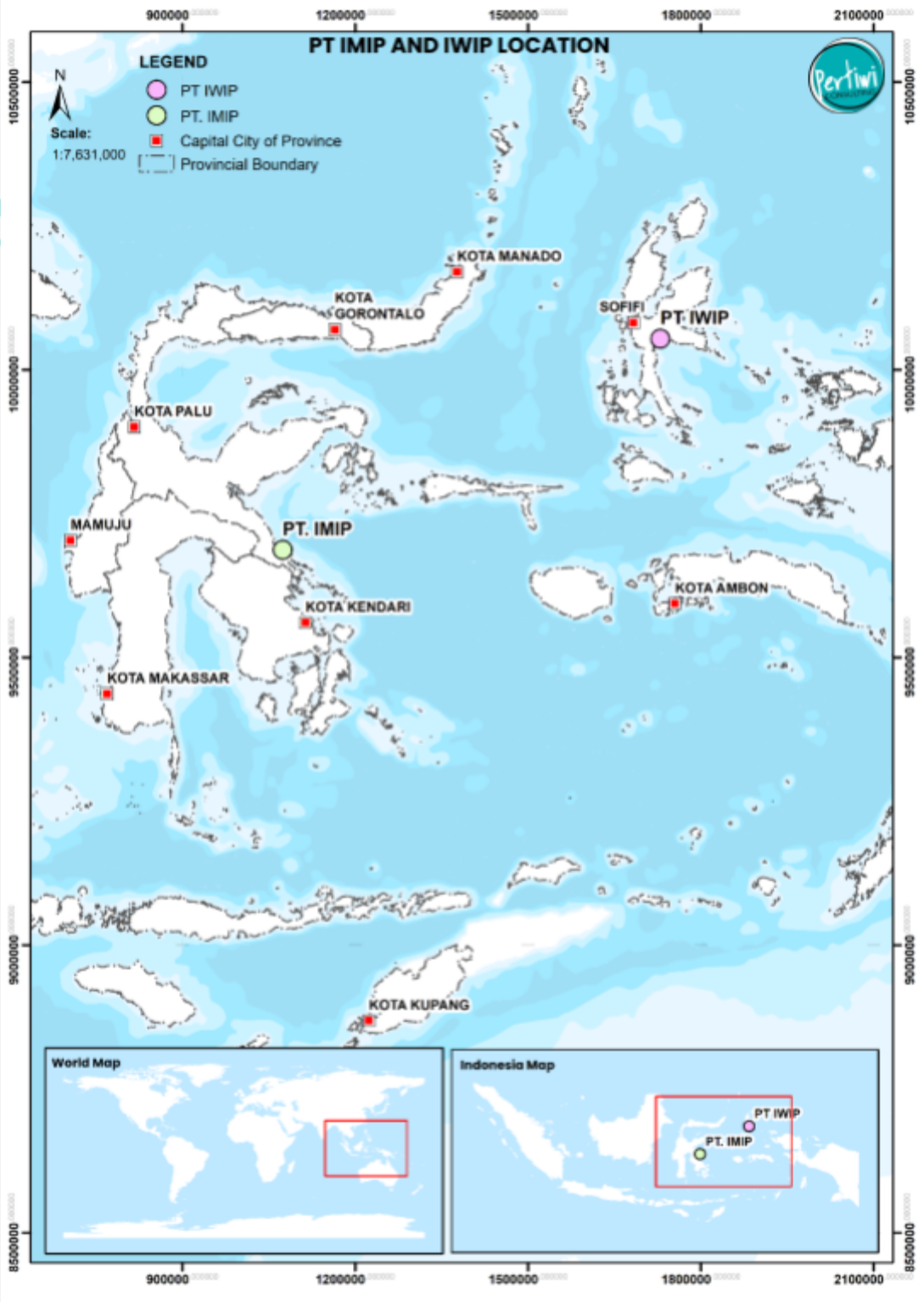

Figure 12. Nickel Industries asset and facilities in Morowali - Central Sulawesi Province (Sulawesi Island), Hengjaya Mine and IMIP, and Halmahera -North Maluku Province (Halmahera Island) IWIP

Temperature

Based on RCP 4.5 and 8.5 scenarios, both IMIP and IWIP experience temperature rises, where in both scenarios range 28-29°C (approximately 0.6 °C increase). The additional temperature increase means that working conditions can be harsher in the field. The increased temperature may also lead to increased water demand.

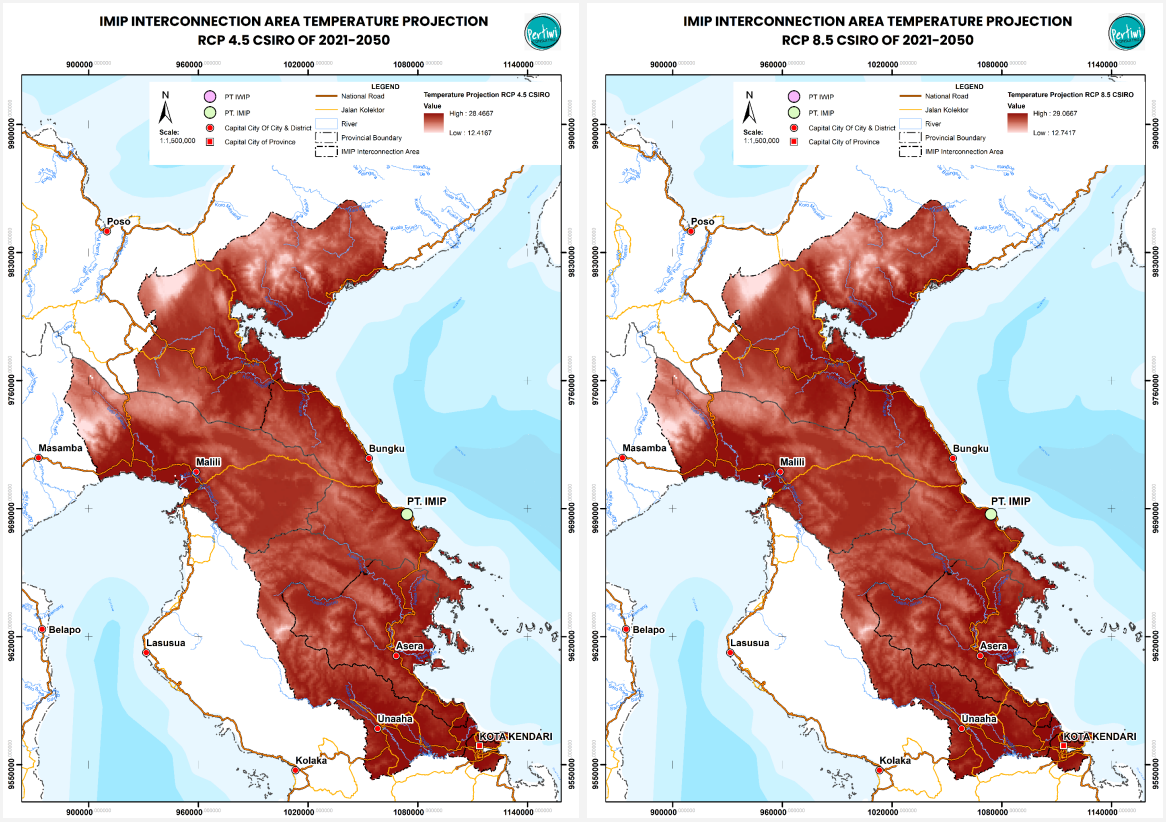

Figure 13a. IMIP Temperature Map - RCP 4.5 and RCP 8.5

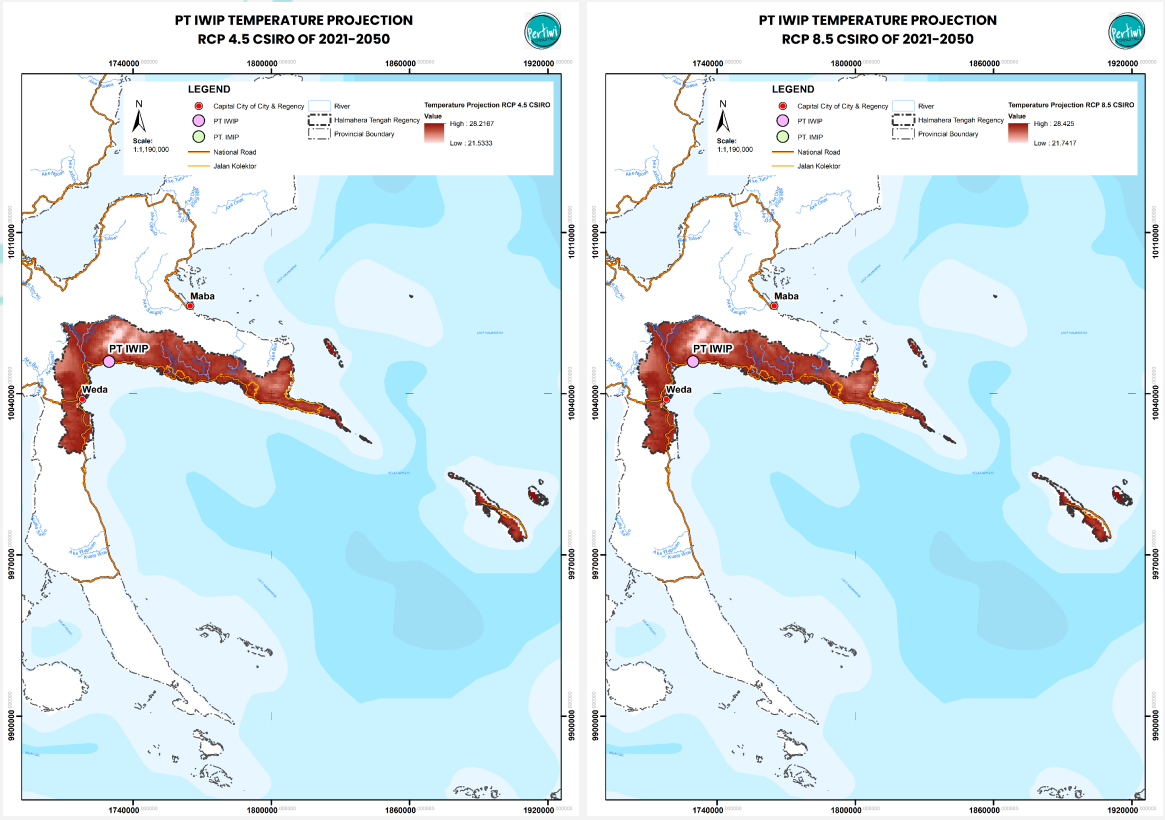

Figure 13b. IWIP Temperature Map - RCP 4.5 and RCP 8.5

Precipitation

Climate change is expected to cause more frequent droughts and floods, altering the supply of water to mining sites and disrupting operations. In both scenarios, IWIP is predicted to experience increased average precipitation 2500 - 2700 mm whereas precipitation around IMIP is slightly reduced from 2300 - 1900 mm. Despite increased precipitation in IWIP, based on a study by Suryadi (2016) using scenario RCP 8.5, North Maluku Province has a tendency for longer dry days duration (6 months) in comparison to Central Maluku Province (3 months).

At Halmahera Tengah, where IWIP is located, surface water quality is already a problem. Some research suggests that the surface water reserves might

not be enough to accommodate the high demand. As can be seen water supply is already compromised with all of the water being of low water quality.

Table 2. Water Availability Classes in Halmahera Tengah (PT IWIP) of 2021

Criteria	Area (km2)	Percentage (%)
Low Water Availability	1.280,34	52%
Very Low Water Availability	725,26	29%
Lowest Water Availability	480,18	19%
Halmahera Tengah Total Area	**2.485, 79**	**100%**

Source: Zanuddin, R. et al. (2021)

Because of the limited water supply in Halmahera Tengah, the impact of nickel production that consumes large amounts of water can worsen water availability in the future. At IMIP, no data or research on water supply and quality could be found. But given the predicted precipitation decrease, actions could be taken to start conserving and preserving water for the mining activities in the IMIP area. As seen in the figures below CSIRO's rainfall projection analysis IMIP will experience reduced precipitation and IWIP will experience increased precipitation.

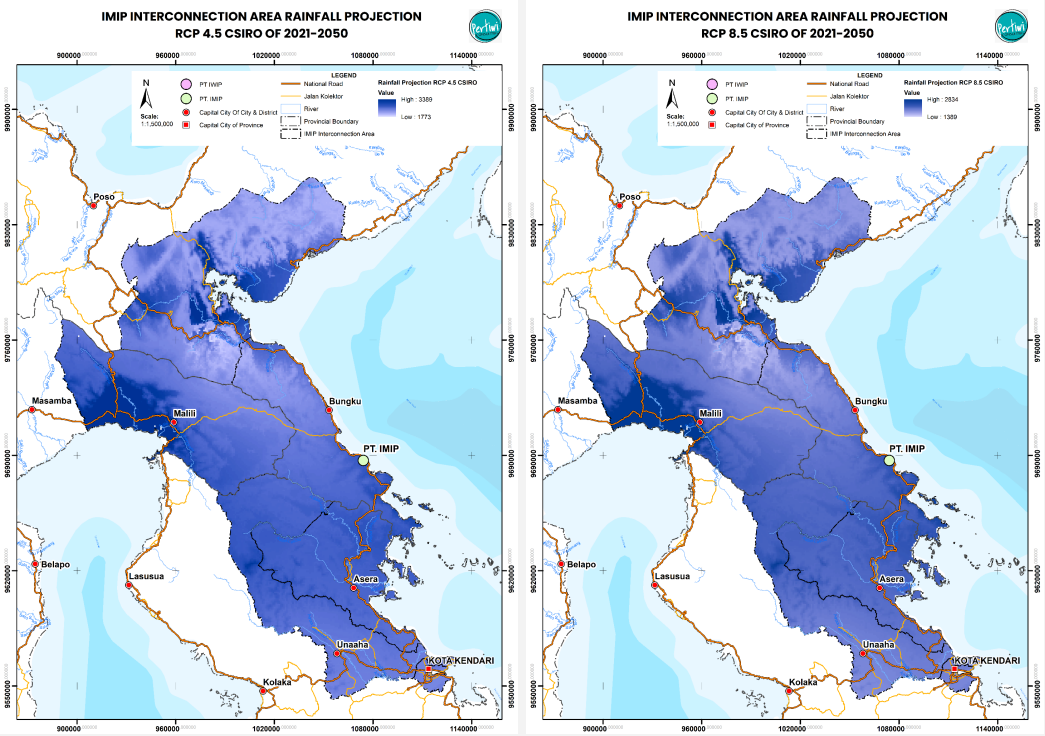

Figure 14a. IMIP Reduced Precipitation Map - RCP 4.5 and RCP 8.5

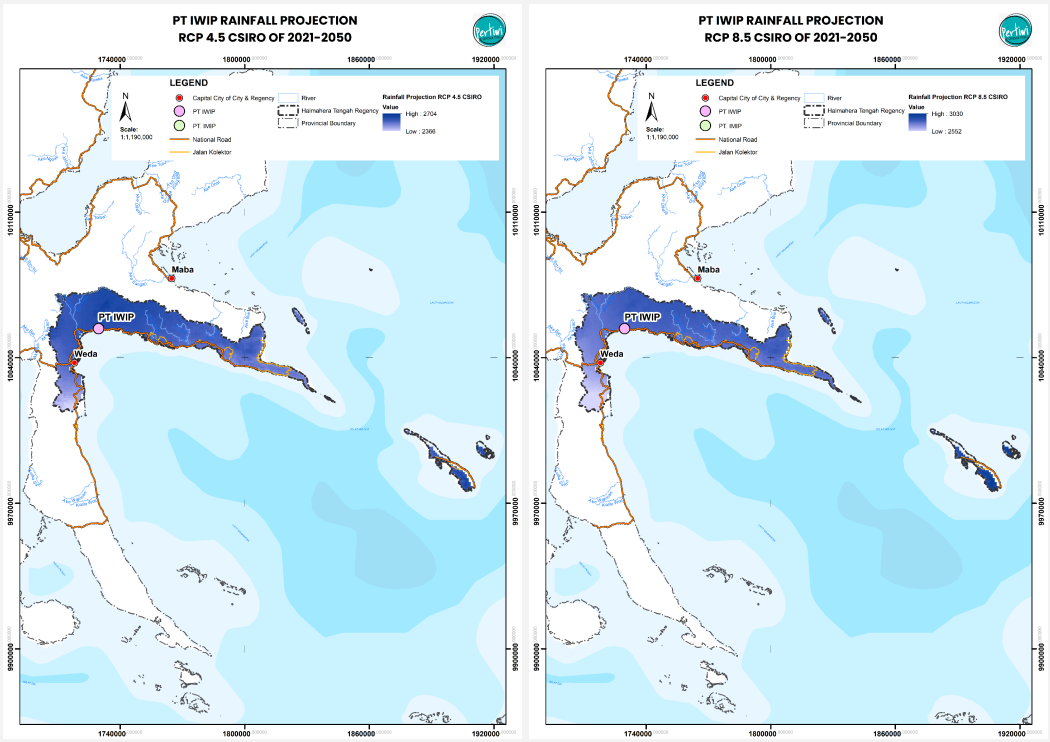

Figure 14b. IWIP Increased Precipitation Map - RCP 4.5 and RCP 8.5

Sea level rise

Both IMIP and IWIP are located in coastal areas, and so far the data shown no increase in terms of the sea level rise. However, the data on sea level rise is limited. The high tide was recorded in Central Sulawesi Province in 2015 and 2018, but so far has had no significant impact on the IMIP operations.

Disasters

Climate-related disasters have been recorded in both islands. Based on the historical data in both areas have experienced climate-related disasters despite its not yet affecting NI operation sites. From 2015-2021, Central Sulawesi Province has experienced disasters such as flooding, landslides, storms, and forest fires. From 2015-2021, North Maluku Province recorded disasters such as flooding, landslides, storms, droughts, and forest fires.

According to the data and interview from the technical team of Nickel Industries both operation sites have not experienced any severe impact due to acute and chronic climate change leading to significant financial loss. So far only one extreme event, flooding in 2019 in North Konawe Regency Southeast Sulawesi Province affected HM operation indirectly, and it has had an impact on decreasing nickel production and disruption in mining operation and logistics. In June 2019 due to early rain season & flooding, Nickel Industries experienced reduction in mine production in comparison to March 2019 (127,000 - 78,000 wmt). The reason was because the heavy rain led to flooding in the North Konawe Regency which recorded damage to public facilities in the form of 3 broken bridges, which disrupted staff movement and logistics on HM site (Pati, 2019).

Disasters are commonly linked to El Niño[6] and La Niña[7]. Indonesian rainfall is more sensitive to El Niño than to La Niña events (Aldrian et al 2003, 2006). In Indonesia the tendency of delayed (earlier) rainy season onset compared to existing climatology during El Niño (La Niña) years, particularly at stations in south-eastern Indonesia (Hamada et al 2002). Based on the study by Suyadi (2016, 2017), both provinces are identified as high risk areas affected by the El Niño event and have the possibility to reduce rainfall up to normal conditions seen from the number of anomalies of dry days. Based on the same studies, La Niña events have more chances to occur in the Halmahera Province due to a longer anomaly of wet days in comparison to the Central Sulawesi province. However, other factors such as natural, built environment and human condition also play roles in leading to extreme events leading to flooding, landslides, and droughts.

Conclusion and Recommendation

The physical risk identified in Nickel Industries internally comes from water management issues, and externally comes from the extreme disasters that occur in the region. Until now, there aren't any climate related disasters that have occurred that impacted NI's business and operation that could have

NI may experience disruption in its operation due to increased disasters in its surrounding sites. This may lead to an increase in business cost due to possible delay.

[6] El Niño is an climate extreme event characterised with drier conditions (below normal rainfall) especially over the monsoonal region, rainfall reductions over some regions is more than 100% or totally dry and can lead to drought, commonly intensifies during the dry season (Suyadi 2016).

[7] La Niña is a climate event opposite of El Niño, commonly intensifies in the rainy season.

led to major financial loss. In 2019, a flooding occurred that cut off supply to Hengjaya Mine, fortunately this disaster can be tackled and managed immediately.

Future projection shows that NI will face low to medium physical risks. The assets of Hengjaya Mine, IMIP and IWIP are not directly exposed to chronic and acute risks under climate scenarios IPCC RCP 4.5 and 8.5 from 2020-2050. From historical data, NI has not experienced any significant financial impacts from disasters that are classified as climate physical risks.

NI may experience disruption in its operation due to increased disasters in the region. This may cause an increase in business cost due to possible delay. The company is also projected to be exposed to the risk of operation disruption due to water scarcity.

Therefore, NI should continue to monitor the development of acute and chronic physical risks by collecting yearly data at their sites of operations. Furthermore, NI can record disasters that affect not only its sites, but also other areas and

Recommendations:

- continue to monitor the development of acute and chronic physical risks by collecting yearly data
- develop water management plans
- monitor water usage and analysis
- recycle used water and lessen water loss due to waste, leakage, and evaporation
- develop a contingency plan whenever such climate extreme disasters arise both onsite and offsite
- consider to have insurance plans related to its business and operation when disasters arise in the future

routes that are often used for logistics and transportation operations.

NI can develop a contingency plan whenever such climate extreme disasters arise, both on site or off site. This plan can be part of current HSE policy in order to mitigate these impacts. Depending on the frequency of the disasters, acquiring insurance plans related to its business and operation should be considered as a mitigation action.

Regarding water management, NI should develop water management plans for their sites. This means the company should monitor the water usage and contingency actions when drought occurs. At a strategic level, this also means to possibly discuss with Tsingshan water management at IWIP where water scarcity might become a problem.

Some water conservation options might be to lessen the water intensity of their mining processes to increase resilience. Additionally, they can recycle used water and lessen water loss due to waste, leakage, and evaporation. Long-term strategies with higher investment in technology should also be explored. Dams and desalination facilities are examples of new water infrastructure that might be expensive but would be an effective measure.

Transition Risks

NI may face an increase in business and operational cost due to the changing of Indonesian Government's policies in the area of climate, energy, mineral, and trade/economic, as well as pressure from investors for more transparency in ESG and climate change related issues. Based on the IEA

WEO 2021 *Announced Pledges* and *Sustainable Development* scenarios and the risk projection are as follows.

Policy

NI faces medium risks in terms of policy changes in the IEA WEO 2021 '*Announced Pledges*' and '*Sustainable Development*' Scenario. NI may face challenges due to regulatory changes that promote low carbon in the energy and power sector. Indonesian regulations are changing rapidly and lately demonstrate a clear direction towards low carbon development.

The Indonesian Government continuously develops its climate consideration in various policy areas to realise its Nationally Determined Contribution (NDC) target which is considered as the IEA WEO 2021 '*Announced Pledges*' scenario from power generation to industry.

According to the National Electricity Supply Business Plan (RUPTL) 2019 -2028, the Indonesian Government has announced that by 2030 no new coal power plants should be built. Also, in 2030 the energy mix should consist of 14% natural gas and 30% renewable energy sources. Coal will still be part of the energy supply, because the Indonesian Government plans to apply clean coal technology.

The market for mineral and mining products fluctuates with the shift of the minerals application in the low carbon technology. It has just been recently announced that the Indonesian government aims to be a player in the electric vehicle (EV) battery market.

In 2019 the Indonesian government has launched the Presidential Regulation on Battery Electric Vehicles, and the Battery Electric Vehicle Roadmap sets targets for the share of low-carbon emission vehicles including battery EVs, plug-in hybrid vehicles, flex-fuel engines and low-cost green cars in local

production. The roadmap sets targets for low-carbon emission vehicles to reach 20% of domestic car production in 2025 and 30% in 2035. The government has also promoted the establishment of the Indonesia Battery Corporation, a partnership of four state-owned companies (Pertamina, PLN, Mind.Id and ANTAM) with 25% shares (Huber 2021).

Considering the development of policy related to the nickel ban in 2014 and the government's plan to develop its EV market, it can be concluded that the Indonesian government may decide and implement policy measures at any time.

Under the *'Sustainable Development'* scenario, policies shifted towards supporting the deployment of Carbon Capture Storage (CCS)/ Carbon Capture Utilisation, and Storage (CCUS) and hydrogen in industries and fuel transformation. In both scenarios, policy measures for carbon, energy efficiency and management are also encouraged with different time targets.

Indonesian and Chinese are considered less ambitious in their climate goals than, for example, Australia in terms of target setting. This can be seen from the target setting for net zero. Indonesian and Chinese Governments set net zero emissions goals to be achieved by 2060, whereas the Australian government wants to be carbon neutral by 2050. Most of the efforts to reduce GHG emissions relied on technological advances, whereas at the moment the technology is still expensive, planning and pilot phase, and commercially limited.

Hydrogen has potential to become an important renewable resource and already has a major role in significant industrial processes including in fuel cell batteries with ability to store excess wind and solar energy. Until recently researchers just found a cheap way to produce hydrogen and in the process of patent for commercial use (Lee at al 2021). Whereas in Indonesia, hydrogen use is just starting in the study and planning phase. It has been

reported that the potential of green hydrogen production in Indonesia was 1,895 kT/year in 2021, as concluded by a study from the Ministry of Energy and Mineral Resources of the Republic of Indonesia and the German Agency for International Cooperation (GIZ) (HBD EKONID 2022). Indonesia's state-owned energy firm Pertamina will explore the development of green hydrogen and ammonia projects in the country, along with Singapore-based Keppel Infrastructure and global oil major Chevron in November this year (Reuters 2022).

The technology of Carbon Capture Storage (CCS) and Carbon Capture Utilisation, and Storage (CCUS) has been available since the 1980s in European oil and gas industries. The Indonesian government intends to adopt and develop the technology, but it has not yet commercialised. The Indonesian government established initiatives such as the cooperation between the Ministry of Research, Technology and Higher Education and ITB with the establishment of the Indonesia Center of Excellence for CCS and CCUS in 2017 and cooperation of national oil companies for commercialising the technology. Indonesia's national oil company Pertamina and Mitsui of Japan have launched a joint feasibility study on carbon capture, utilisation and storage (CCUS) commercialisation in Indonesia (Battersby 2022).

Furthermore, the Indonesian government is preparing a regulation draft on carbon capture storage (CCS) and carbon capture utilisation and storage (CCUS) as the country seeks to push its adoption to reduce carbon emissions from hard-to-abate industries. However, overall, experts remain sceptical of the wide application of CCS technology in Indonesia (Karyza 2022 The Jakarta Post).

Technology

Nickel Industries face medium to long term risks due to additional costs in their operations due to the technology shift which mostly derives from the policy shift in energy and power plants sectors.

Nickel Industries may face additional costs from technology shifts. The IEA WEO 2021 *'Announced Policy'* and *'Sustainable Development'* scenarios project more low-carbon technologies across the energy sector – including key renewable electricity production and storage technologies. Both scenarios project that technology will progressively become cheaper over time, but this technology transition requires major capital. Two scenarios have different speeds at which the technology costs are lowering, where the *'Sustainable Development'* scenario adopted it earlier than *Announced Policy*. In the *Announced Policy scenario,* the technology's cost and its adoption depend on policy development. So, when policy measures are taking more time, it means that the technology cost remains high. Therefore, Nickel Industries shall approach this matter proactively, rather than waiting for the Indonesian government push because both scenarios go in the same direction.

Another additional business cost comes from the carbon tax due to high intensity of carbon emissions coming from fossil fuel -technology. The IEA WEO 2021 'Sustainable Development' scenario predicts that the carbon price starts at 40 USD/tonnes CO^2 in 2030, becomes 110 USD/tonnes CO^2 in 2040 and increases to 160 USD/tonnes CO^2 in 2050 .

Since 2022, the Indonesian government is implementing the pilot of carbon tax and further developing the implementation system, whereas Australian and Chinese governments have not announced a carbon tax as a means to achieve their net zero targets of 2050 and 2060 respectively. So far Indonesian government plans to apply for 21 from 80 public and private

power plants to participate in the initial ETS, with a cap and trade system (ICAP 2022). However, due to the global energy crisis the Indonesian government has announced to postpone the implementation to 2024. This development of the Indonesian carbon tax policy needs to be continuously monitored.

NI has started the transition toward low carbon technology. The company has already implemented a small solar PV system at their mining site (160KwH) and are in discussion to introduce larger schemes at the mining site and IMIP (200MW). So these efforts will support climate resilience for NI and demonstrate initial steps for the long vision of Nickel Industries to be the global player for clean nickel producers. NI have conducted several studies with expert consulting to increase efficiency and carbon emission reduction.

Market

NI faces low risk in terms of market. Nickel Industries find less challenges in the market on both IEA WEO 2021 *'Announced Pledges'* and *'Sustainable Development'* Scenarios. Nickel is an important material for various future industries and will continue to be in demand.

NI has positioned itself as the second producer, or as middle producer which largely caters for the Chinese stainless steel market, from its nickel pig iron production (low-grade nickel). In October 2022 the company announced its transition from nickel pig iron production to nickel matte (high-grade nickel). The company considered new markets and diversified its operations to produce nickel matte for battery components for the Chinese market. Rising demand of EV vehicles in China has a direct impact on demand for the material, which is aligned with the trajectory for both the 'Announced *Pledges'* and *'Sustainable Development' scenario*. Also, the increased interest in the EV batteries industries worldwide, including in China and

Indonesia, provide new opportunities for Nickel Industries to take part. Considering product diversification, therefore, no specific market risks are foreseen in the near future for the Company.

However, as climate change and ESG criteria increasingly attract investors and financial institutions' attention, pressure for more transparency regarding ESG criteria is foreseen. Investors and financial institutions are increasingly aware of ESG, and climate change issues. They want to make sure that company products and operations are aligned with the new transition towards a low carbon economy.

Reputation

NI faces medium risks in terms of reputation. Mining and processing industries are often associated with negative contributions to climate change, environmental destruction and social conflicts**.** Globally the trend has shifted towards low carbon development to be able to achieve the target of Paris Agreement not to exceed 1.5 degrees increase with an increasing commitment of countries to net zero by 2050. Investors watch closely the climate policy trend and financial institutions include climate change consideration in its lending.

NI has developed measures to tackle these issues. Nickel Industries makes sure that its mining operation fulfils national standards (PROPER) and voluntarily joins sustainable related initiatives and awards. Furthermore, Nickel Industries has regular programs for water treatment, land rehabilitation, and water pollution monitoring so far in HM sites and IMIP. Based on media analysis, it has been reported of water pollution in IWIP but this needs to be further investigated (Balseran, 2022). Furthermore, in the long term NI aims as clean nickel producers and some renewable energy projects have been implemented and in the planning process.

Conclusion and Recommendation

The transition risks for NI largely come from policy, technology, and reputation. Probability of these changes are high, ranging from short, medium to long term. Depending on the regulation, the consequences and impacts of these changes for NI are high and it might cause an increased in business cost.

Despite lagging in implementation, Indonesian policy is changing fast in favor of low carbon development. Indonesian climate policy also showed a trend for adoption of new low carbon technology for industries. Considering the fast development of low carbon technology, it is recommended to monitor technology development and transition towards low carbon fuel and technology for the company as soon as possible. Proactive approach by planning ahead for greening RKEF.

NI does not have comprehensive transition risk management at the moment. NI's main partner, Shanghai

The consequences and impacts of transition risks for NI can be severe, leading to increased business costs. Comprehensive transition risk management does not yet exist. This should be followed by strategic plans and actions that should be conducted together with NI strategic partners. The goal is to increase climate resilience and reduce emissions.

Recommendations:

- continue with its 'Energy Future' Initiative to substitute coal with renewable energy or less fossil fuel intensive alternatives
- early planning and actions for greening the NI operation and facilities, will help avoid upcoming carbon tax
- building the reputation as the clean nickel producer to gain trust from investors and the public

decent, has formed a joint management in dealing with sustainability issues (see governance). This shall be followed up further in more strategic plans and actions for joint efforts in reducing emissions, and monitoring physical and transition risks with Shanghai Decent.

- expanding market for high-grade nickel brings NI into sustainable transition-oriented businesses as one of the leading producers of clean EV batteries in the future
- continuously monitor the evolution of Indonesian and global climate policy and explore opportunities for technology collaboration.

Until 2022, NI and its operations in IWIP/IMIP are not following their own low carbon planning. NI should continue its plan for renewable energy subsidies. NI can initiate a joint comprehensive roadmap in greening both facilities with Shanghai Decent as early as possible which can reduce risks that come from policy and technology change.

Early planning and actions for greening NI operation and facilities might help NI to avoid carbon tax. The application of carbon will cause an increase in business and operational cost. Carbon tax may hamper the company's ability to expand further. Starting 2030, both scenarios projected that carbon tax will increase gradually.

NI needs more investment from investors to expand its business. NI also aims to build the reputation as the green nickel producer. Thus, gaining trust from investors and the public is paramount. Early planning and actions in greening its operation need to take place gradually.

From the year 2022 the company has taken steps to expand its market. NI aims to play a bigger role in the EV battery markets and to be involved in both low and high-grade nickel. Furthermore, NI started shifting towards renewable energy in its operation. Despite the company is still in the early stages, NI has been going towards the right direction in aligning operations and business with the transition to a low carbon economy. The expanding market in high-grade nickel brings NI into sustainable transition-oriented businesses as one of the leading producers of a clean EV battery in the future.

Additionally, NI needs to monitor the development of Indonesian and global climate policy to always be ahead in taking actions and measures to lower the negative impacts for NI. NI should also consider possible technology cooperations for greening its facilities.

METRICS AND TARGETS

Why is it important?

Metric and targets used to assess and manage relevant climate related risks and opportunities.

GHG Emissions

Table 2. Emissions and Removals of NML by Category and Business Unit—year 2021 - IMIP part

Emissions Category	Hengjaya Nickel	Ranger Nickel	Total (tCO_2-e)	% emissions
Direct emissions from stationary fuel combustion—Scope 1				
Anthracite coal (reductant)	70,709	70,840	**141,549**	7%
Sub-bituminous coal (thermal)	278,126	294,684	**572,810**	28%
Semi-coking coal (reductant)	112,421	116,996	**229,417**	11%
Electrode paste	4,030	3,180	**7,211**	<1%
Subtotal (tCO_2-e)	*465,286*	*485,700*	***950,987***	*46%*
***Direct* emissions from mobile fuel combustion—Scope 1**				
Diesel	6,506	7,277	**13,783**	<1%
Subtotal (tCO_2-e)	*6,506*	*7,277*	***13,783***	*<1%*

Direct removals from industrial processes—Scope 1				
Carbon fraction in the NPI	-12,460	-12,482	**-24,942**	
Subtotal (tCO_2-e)	*-12,460*	*-12,482*	***-24,942***	
Total Scope 1 (tCO2-e)	**459,333**	**480,495**	**939,828**	**46%**
Indirect emissions and removals from imported electricity—Scope 2				
Electricity	540,626	546,317	**1,086,944**	54%
Subtotal (tCO_2-e)	*540,626*	*546,317*	***1,086,944***	*54%*
Total Scope 2 (tCO_2-e)	**540,626**	**546,317**	**1,086,944**	**54%**
Total emissions and removals (tCO_2-e)	**999,959**	**1,026,813**	**2,026,772**	**100%**
% Total emissions	**49%**	**51%**	**100%**	

Risk Related Data

Temperature (Celcius)

Table 3. Temperature Trend Last 5 years (2017-2021)

Morowali Regency	2017	2018	2019	2020	2021
Average	NA	NA	NA	NA	NA
Minimum	NA	NA	NA	NA	NA
Maximum	NA	NA	NA	NA	NA
Halmahera regency	**2017**	**2018**	**2019**	**2020**	**2021**
Average	NA	NA	NA	NA	NA
Minimum	NA	NA	NA	NA	NA
Maximum	NA	NA	NA	NA	NA

Detailed data monthly also recommended

Source: BPS, 2018-2022

Table 4. Temperature Baseline and Projection using RCP 4.5 and 8.5 CSIRO

Morowali Regency	Baseline 1991-2020	RCP 4.5 CSIRO 2021-2050	RCP 8.5 CSIRO 2021-2050
Average	25.00	25.49	25.99
Minimum	0.00	17.96	18.41
Maximum	27.51	28.08	28.52
Halmahera regency	**Baseline 1991-2020**	**RCP 4.5 CSIRO 2021-2050**	**RCP 8.5 CSIRO 2021-2050**

Average	26.11	26.71	26.90
Minimum	0.00	21.53	21.74
Maximum	27.38	28.22	28.43

Source: BPS, 2018-2022 and BMKG, 2022

Precipitation (mm)

Table 5. Precipitation Past 5 years (2017-2021)

Morowali Regency	**2017**	**2018**	**2019**	**2020**	**2021**
Average	2956	2872	2356	NA	2443,3
Minimum	NA	NA	NA	NA	NA
Maximum	NA	NA	NA	NA	NA
Halmahera regency	**2017**	**2018**	**2019**	**2020**	**2021**
Average	NA	NA	NA	NA	NA
Minimum	NA	NA	NA	NA	NA
Maximum	NA	NA	NA	NA	NA

Detailed data monthly also recommended

Source: BPS, 2018-2022

Table 6. Precipitation Baseline and Projection using RCP 4.5 and 8.5 CSIRO

Morowali Regency	**Baseline 1991-2020**	**RCP 4.5 CSIRO 2021-2050**	**RCP 8.5 CSIRO 2021-2050**
Average	1921,83	2371,84	1957,15
Minimum	1921,83	2082,50	1680,83

Maximum	2479,17	2902,00	2436,17
Halmahera regency	**Baseline 1991-2020**	**RCP 4.5 CSIRO 2021-2050**	**RCP 8.5 CSIRO 2021-2050**
Average	2155,42	2569,23	2792,32
Minimum	2005,00	2366,00	2552,00
Maximum	2218,00	2704,00	3030,00

Source: BPS, 2018-2022 and BMKG, 2022

Disaster events (frequency and month)

Table 7. Disaster Events Last 5 years (2017-2021)

Morowali Regency	**2017**	**2018**	**2019**	**2020**	**2021**
Flooding	0	0	1	1	0
Landslide	0	0	0	0	0
Storm	0	0	0	0	5
High tide	0	0	0	0	0
Forest and land fires	0	0	0	0	0
Tornado	0	0	0	0	1
Halmahera Regency	**2017**	**2018**	**2019**	**2020**	**2021**
Flooding	0	0	2	2	1
Landslide	0	0	0	0	0
Storm	0	0	0	0	0
High tide	0	0	0	0	0
Forest and	0	0	1	0	0

land fires					
Tornado	0	0	0	0	0

Detailed information can be added per disaster such as physical impacts, financial loss and casualties

Morowali Regency	**2017**	**2018**	**2019**	**2020**	**2021**
Flooding	-	-	Damaged house: 7 Drowned house: 114 Death: 1	Damaged house: 0 Drowned house: 164 Death: 0	-
Landslide	-	-	-	-	-
Storm	-	-	-	-	
High tide	-	-	-	-	-
Forest and land fires	-	-	-	-	-
Tornado	-	-	-	-	Damaged house: 22 Death: 0
Halmahera Regency	**2017**	**2018**	**2019**	**2020**	**2021**
Flooding	-	-	Damaged house: 0 Drowned house: 343 Death: 0	Damaged house: 50 Drowned house: 397 Death: 0	Damaged house: 0 Drowned house: 78 Death: 0
Landslide	-	-	-	-	-
Storm	-	-	-	-	-
High tide	-	-	-	-	-

Forest and land fires	-	-	Burnt house: 0 Death: 0	-	-
Tornado	-	-	-	-	-

Detailed information can be added per disaster such as physical impacts, financial loss and casualties

Source: BMKG, 2018-2022

Policy and Legislation Monitoring 2022

Table 8. Policy and Legislation Monitoring

Crosscutting policies	Indonesia	Australia	China
Net zero target	2060	2050	2060
Power and utilities	National Electricity Supply Business Plan (RUPTL) 2019-2028, 30% of capacity additions from new and renewable energy 23% share of renewable energy in primary energy supply by 2025 and 31% by 2050.		Indicative target of 26% of electricity consumption from non-hydro renewables and 40% from total renewables sources by 2030. Over 1 200 GW solar and wind installed capacity by 2030. 70 GW nuclear generation by 2025 under the 14th Five-Year Plan.
Carbon tax	Law Number 7 of 2021 Harmonization of Tax Regulations (UU HPP), especially in Article 13 Paragraph (1).1 Jul 2022 Indonesian	On July 1, 2012, Australia introduced a carbon price of AU$23 (USD$16.92) per tonne, with a plan to transition to	China did not have an explicit carbon tax. China priced about 19% of its carbon emissions from energy use and about 4% were

	authorities launched rate of its proposed carbon tax, at 30,000 rupiah ($2.02) per ton of CO2 equivalent	a cap-and-trade emissions trading scheme three years later. But just two years later, on July 17th 2014, the tax was repealed	priced at an ECR above EUR 60 per tonne of CO2. Emissions priced at this level originated primarily from the road transport sector. The majority of unpriced emissions were from the industry sector and the electricity sector.
Industry (specific related to Nickel)	Presidential Regulation (PERPRES) Number 55 of 2019 Acceleration of the Battery Electric Vehicle Program for Road Transportation	Investments from the Modern Manufacturing Initiative.	"Made in China 2025" transition from heavy industry to higher value-added manufacturing. 14th Five-Year Plan: Reduce CO2 intensity of economy by 18% from 2021 to 2025. Reduce energy intensity of the economy by 13.5% from 2021 to 2025. 20% non-fossil share of energy mix by 2025. 25% non-fossil share of energy mix by 2030.
Others	Long-Term Strategy for Low Carbon and Climate Resilience 2050 (Indonesia LTS-LCCR 2050) The plan to apply CCS/CCUS	NA	NA

CLOSING

NI is still in the beginning phase in responding to climate related issues. The company has recognised that climate related issues become increasingly important. Climate analysis based on TCFD guidelines provides insights into the company's preparedness in dealing with climate change.

Starting from governance, the company has started to incorporate climate related issues into the existing structure by ad-hoc. NI has set up a Sustainability/ESG committee and working groups. Apart from these, the line of reporting and communication are also crucial in making sure that necessary decisions related to climate change can be informed and decided in a timely manner.

NI has identified actions and initiatives for energy and emission reduction. NI recognised the direction towards low carbon operation through company climate and energy studies, renewable energy initiatives, and fuel transition. So far, NI has not yet committed to a net zero target like many governments and corporations. The company has set the goal to be a leader and clean nickel producer in the future. Therefore, the company needs to clear targets and milestones.

Climate change brings new challenges for the company. NI faces risks from the physical impact of climate change. Based on the historical data and climate scenario projection, NI faces the low and medium risks largely from the disasters surrounding its operation site and water scarcity. Additionally, the company faces uncertainty and increased business costs due to fast changes in Indonesian climate policy and technology. Despite the implementation of the Indonesian climate policy may still take time and often be ineffective, addressing risk proactively by transition to low carbon operation will underpin company reputation for global and leading clean nickel producer.

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ANNEXES

ANNEX 1 : Climate Scenario Assumptions

IPCC RCP 4.5 and 8.5

Climate scenario assumptions*

IPCC RCP 4.5 and 8.5

Table 9. Climate Scenario Assumptions IPCC RCP 4.5 & 8.5 for Nickel Industries

IPCC RCP	4.5	8.5
Temperature	2-3.3 C from 2040 onwards	2-5 C from 2040 onwards
	1.1 in 2050 + (anomaly temperature) 1.9 in 2100 + (anomaly temperature)	1.6 from 2050 + (anomaly temperature) 3.9 from 2100 + (anomaly temperature)
Precipitation	Increased at northern equator	decrease precipitation
	- 0.1% in 2050 precipitation anomaly + 2.9% in 2100 precipitation anomaly	- 6.8% in 2050 precipitation anomaly + 3% in 2100 precipitation anomaly
Sea temperature	- 1.2% in 2050 + 2% in 2100	- 1.5% in 2050 + 3.3% in 2100

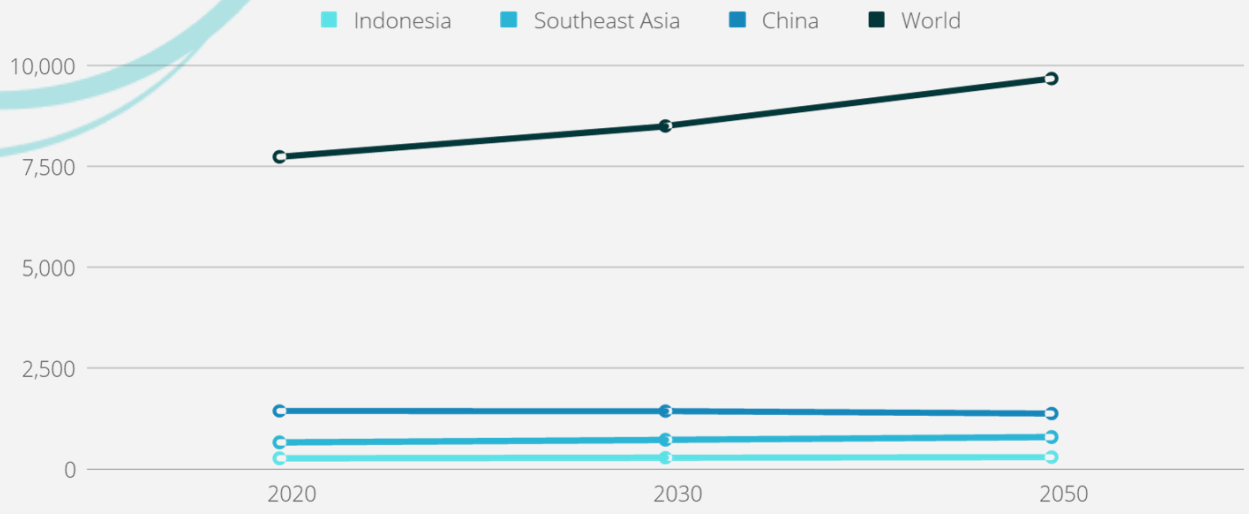
IEA WEO 2021 Announced Pledges and Sustainable Development

Table 10. IEA WEO 2021 Announced Pledges and Sustainable Development on Power Sectors Policy

Announced Pledges Indonesia NDC	Sustainable Development
Final energy consumption efficiency	Increased deployment of renewables.
Implementation CCT (clean coal technology) in the power plant BAU 0%/not efficient CM 1 75% CM 2 100%	Lifetime extensions of nuclear power plants and some new builds, where applicable and with public acceptance.
New and renewable energy in power generation BAU power plant using coal CM 1 19.6% (committed 7.4 Gigawatt) CM 2 132.74 TWH	Expanded support for the deployment of CCUS.
Use of biofuels-BBN (Mandatory B30) in transportation sector BAU CM 1 90% CM 2 100%	Efficiency and emissions standards that prevent the refurbishment of old inefficient fossil fuel plants.
	Stringent pollution emissions limits for industrial facilities above 50 MWth input using solid fuels set at 200 mg/m3 for SO2 and NOX, and 30 mg/m3 for PM2.5.

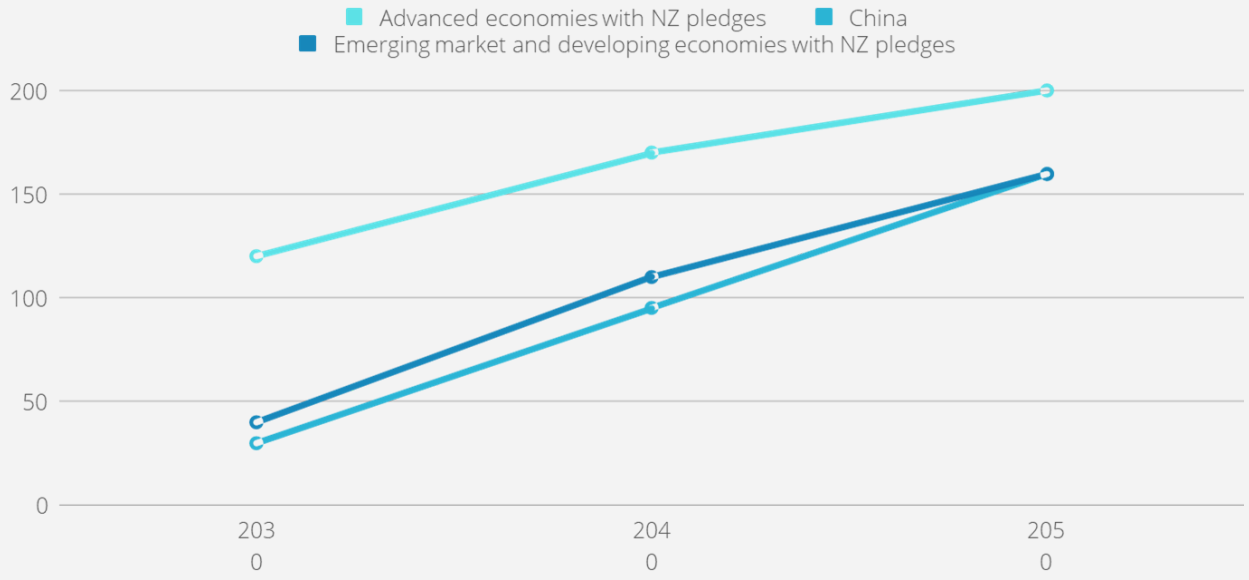
Scenario overview

Figure 14. Population in Indonesia, Southeast Asia, China, and Total World by Assumptions



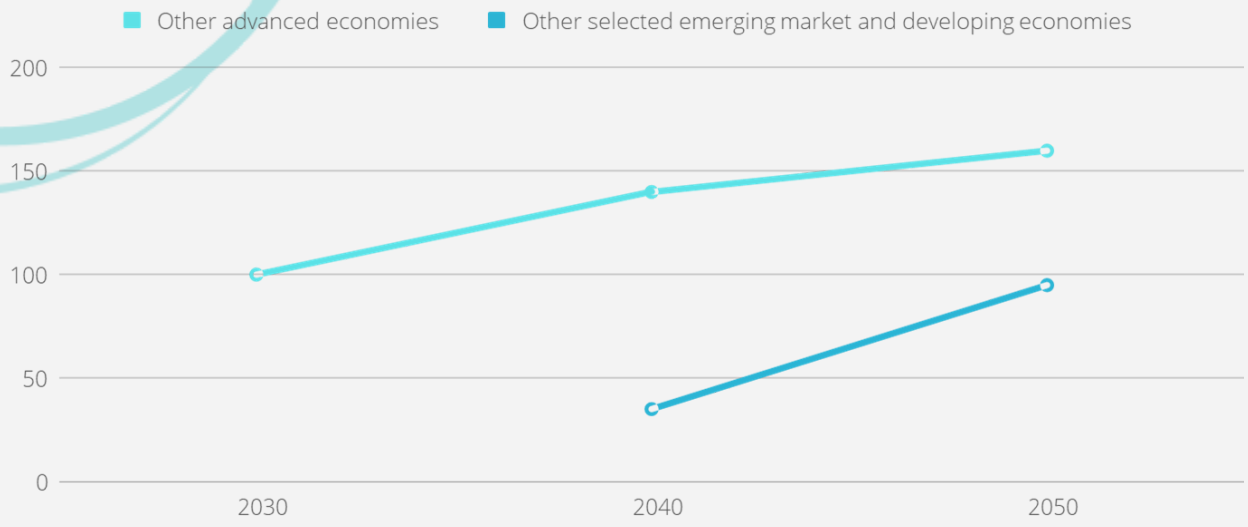
Source: IEA WEO, 2021

Figure 15. CO_2 Prices for Electricity, Industry and Energy Production in Selected Regions by Announced Pledges Scenario



Source: IEA WEO, 2021

Figure 16. CO_2 Prices for Electricity, Industry and Energy Production in Selected Regions by Sustainable Development Scenario



Source: IEA WEO, 2021

Table 11. Technology Costs in China in the Announced Pledges Scenario

CHINA	Capital costs (USD/kw)			Capacity factor (%)			Fuel CO2 and O&M (USD/MWh)			LCOE (USD/MWh)		
	2020	2030	2050	2020	2030	2050	2020	2030	2050	2020	2030	2050
Nuclear	2800	2800	2500	80	80	80	25	25	25	65	65	60
Coal	800	800	800	55	45	5	45	95	150	60	115	290
Gas CCGT	560	560	560	25	25	25	80	105	115	100	125	135
Solar PV	650	400	270	17	18	19	10	5	5	35	20	15
Wind onshore	1260	1180	1110	26	27	27	15	15	10	50	45	40
Wind offshore	2960	1820	1120	34	40	43	25	15	10	100	55	30

Source: IEA WEO, 2021

Table 12. Technology Costs in China in the Announced Pledges Scenario

CHINA	Capital costs (USD/kw)			Capacity factor (%)			Fuel CO2 and O&M (USD/MWh)			LCOE (USD/MWh)		
	2020	2030	2050	2020	2030	2050	2020	2030	2050	2020	2030	2050
Nuclear	2800	2800	2500	80	80	80	25	25	25	65	65	60
Coal	800	800	800	55	45	5	65	115	150	80	135	290
Gas CCGT	560	560	560	30	30	30	80	100	115	100	120	135
Solar PV	650	380	260	17	18	19	10	5	5	35	20	15
Wind onshore	1260	1160	1090	34	27	27	15	15	10	50	45	40
Wind offshore	2960	1760	1100	34	40	43	25	15	10	100	55	30

Source: IEA WEO, 2021

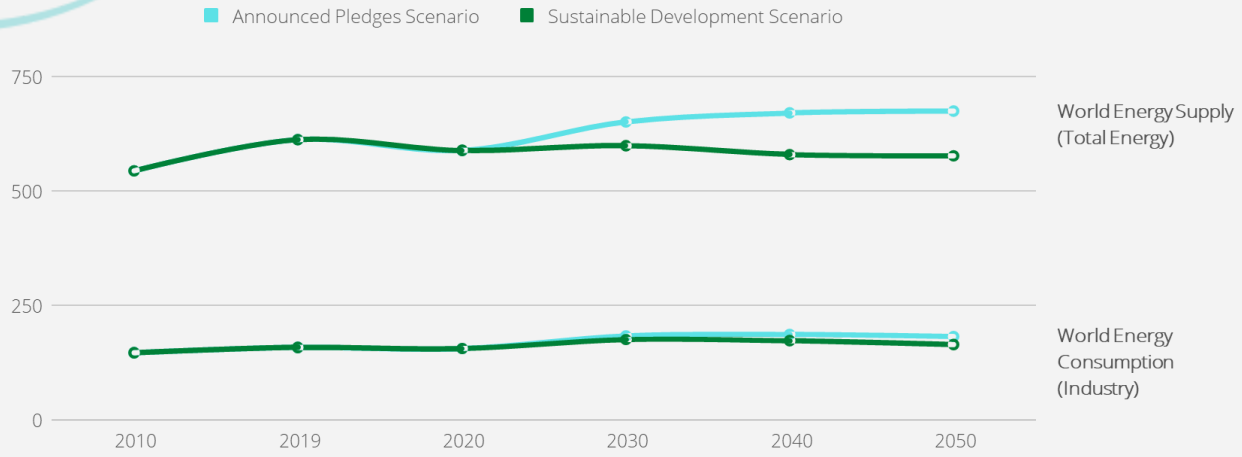
Table 13. Capital Costs for Selected Technology by Scenario for Industry, Vehicles, and Batteries and Hydrogen based on Announced Pledges Scenario and Sustainable Development

	Announced Pledges		Sustainable Development	
	2030	2050	2030	2050
Industry				
Primary steel production				
Conventional	650	670	650	680
Innovative	1330	980	1020	910
Vehicles (USD/vehicle)				
Hybrid cars	14100	11750	13150	12100
Battery electric cars	14920	13010	14740	12680
Batteries and hydrogen				
Hydrogen electrolysers (USD/kW)	590	430	560	410
Utility-scale stationary batteries (USD/kWh)	170	120	170	115
Fuel cells (USD/kW)	50	32	49	31

Source: IEA WEO, 2021

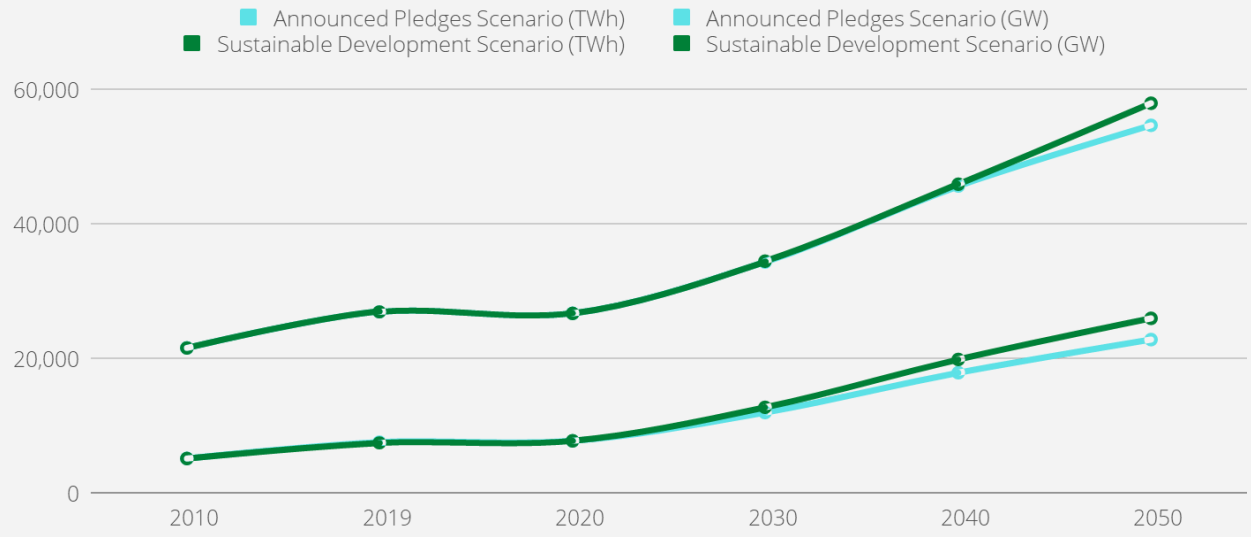
Scenario Detail comparison AP vs SD

Figure 17. Total World Energy Supply and Total Industry Energy Consumption by the Announced Pledges and Sustainable Development Scenarios



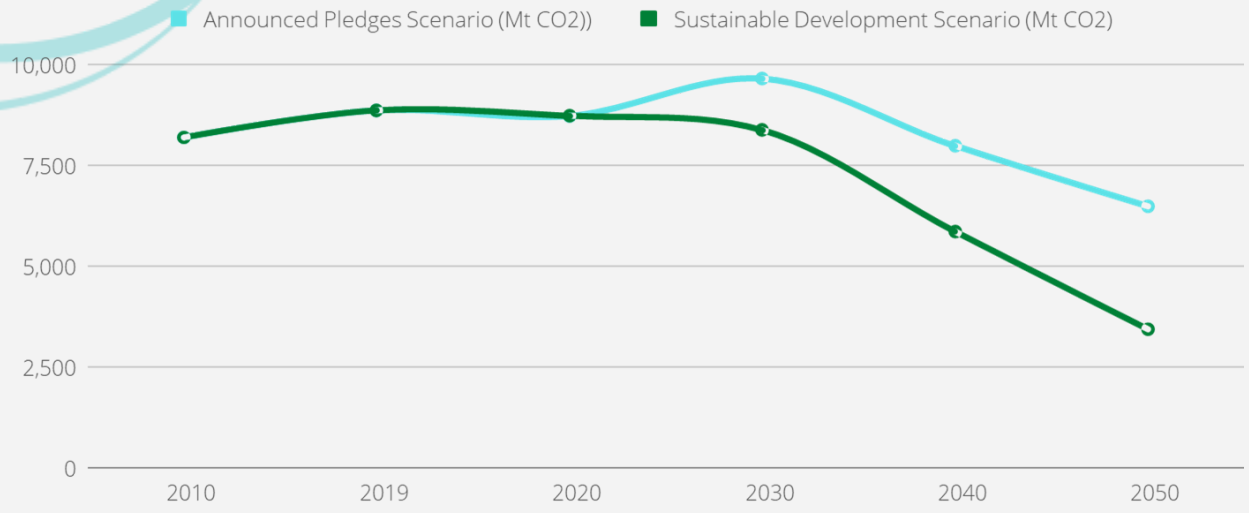
Source: IEA WEO, 2021

Figure 18. World Electricity Sector TWH and GW by the Announced Pledges and Sustainable Development Scenarios



Source: IEA WEO, 2021

Figure 19. World Industry CO_2 Emission by the Announced Pledges and Sustainable Development Scenarios



Source: IEA WEO, 2021

ANNEX 2 : Climate Baseline (Historical Data)

Temperature

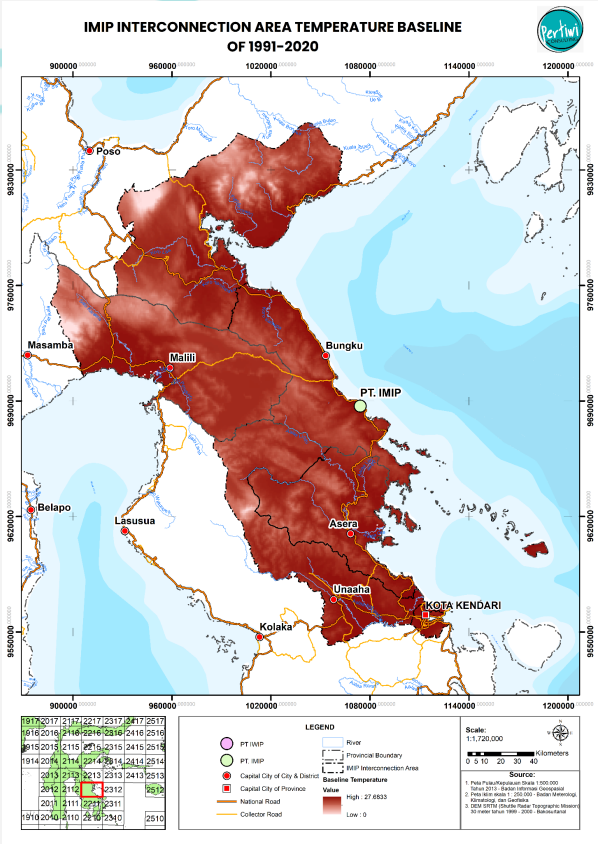


Figure 20. IMIP Baseline Temperature 1991-2020

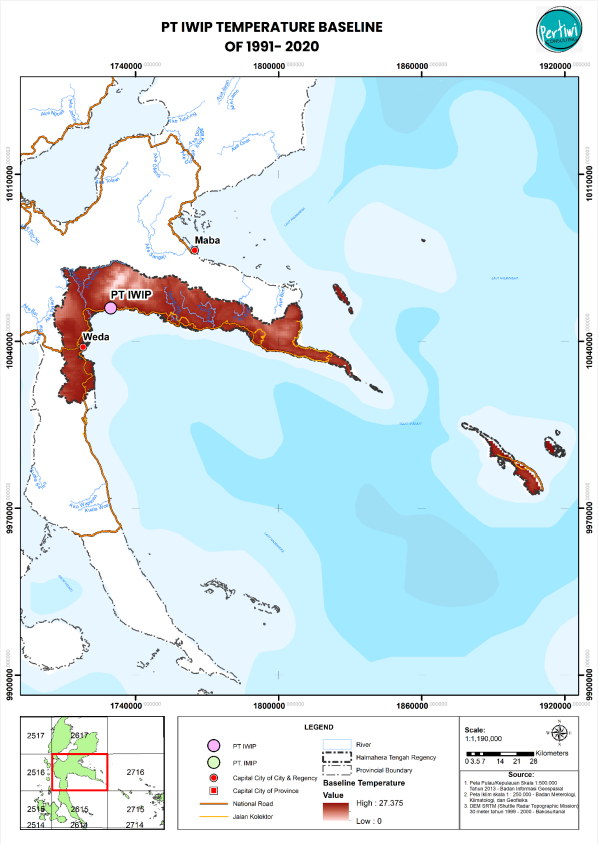


Figure 21. IWIP Baseline Temperature 1991-2020

Precipitation

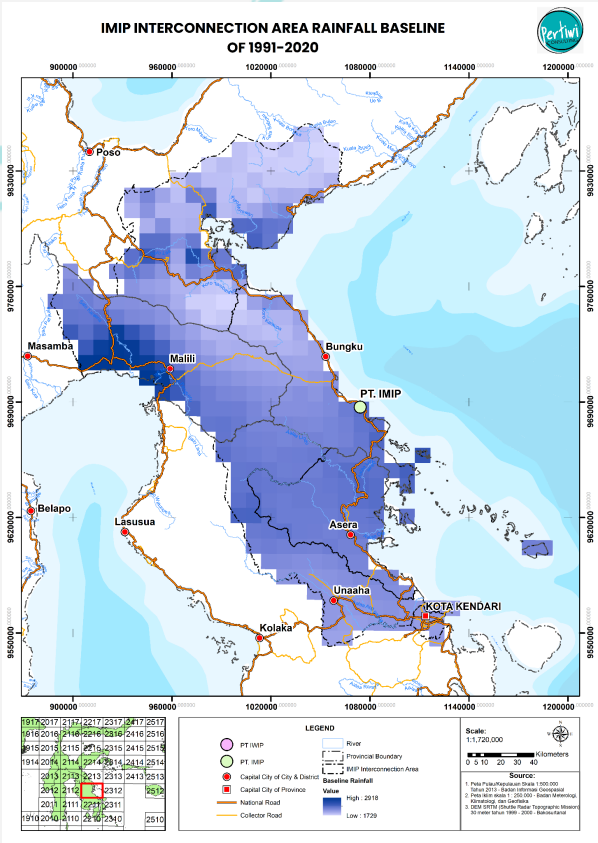


Figure 22. IMIP Baseline Precipitation 1991-2020

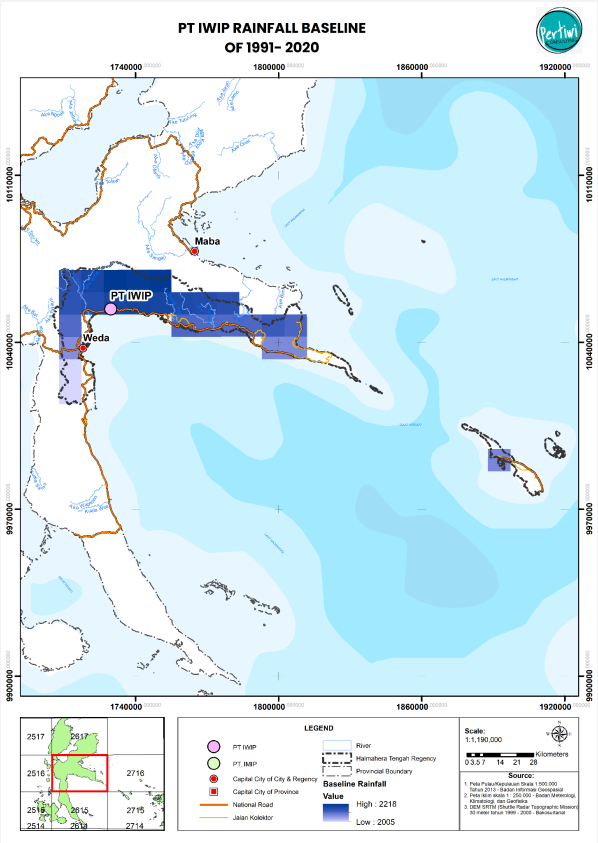


Figure 23. IWIP Baseline Precipitation 1991-2020

ANNEX 3 : Nickel Industries under IPCC RCP 4.5

Temperature

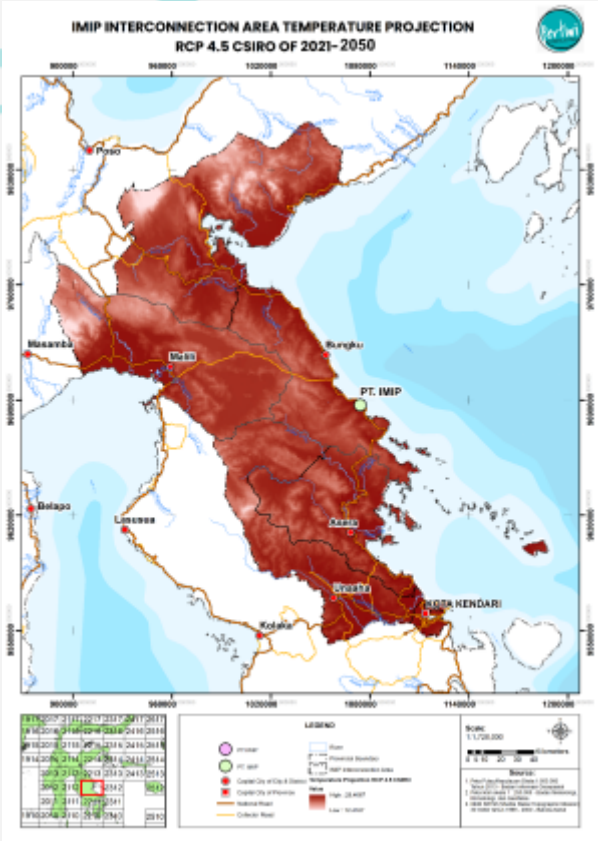


Figure 24. IMIP IPCC RCP 4.5 Temperature 2021-2050

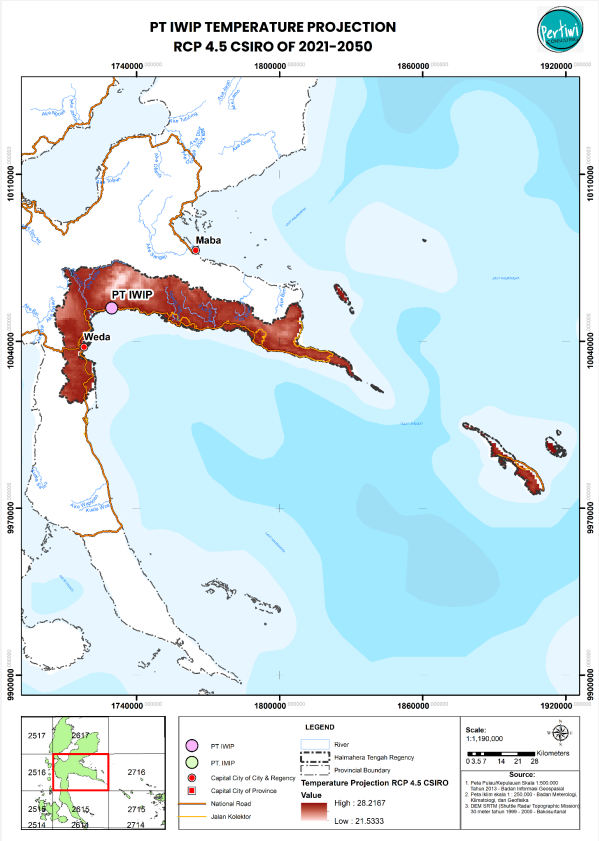


Figure 25. IWIP IPCC RCP 4.5 Temperature 2021-2050

Precipitation

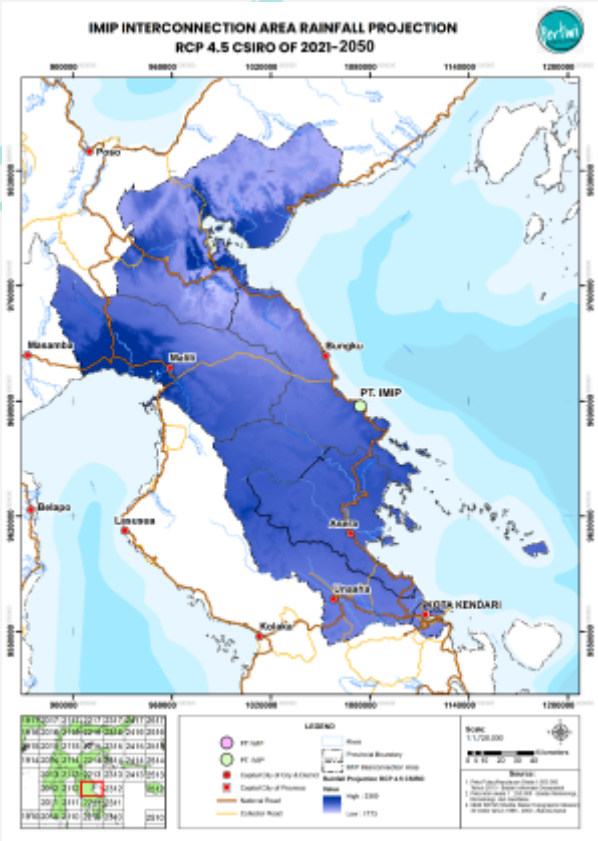


Figure 26. IMIP IPCC RCP 4.5 Precipitation 2021-2050

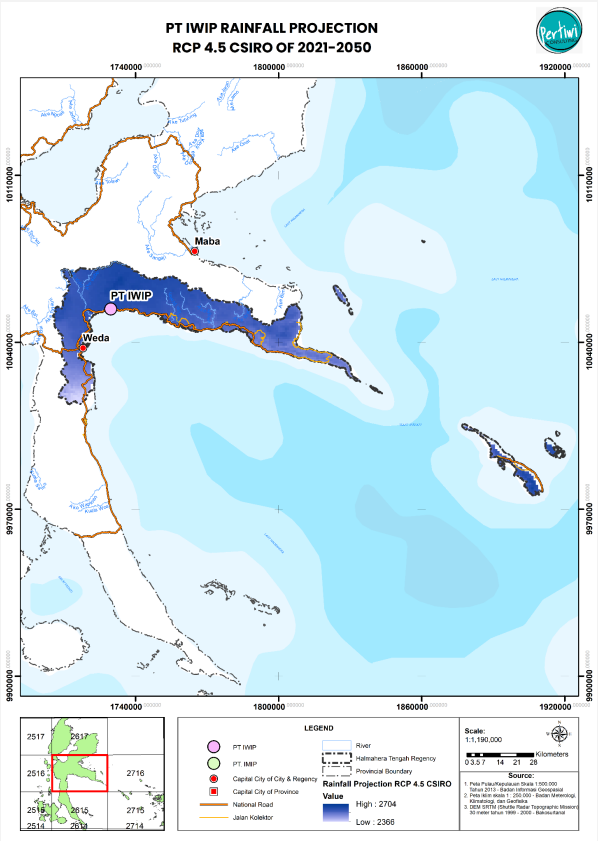


Figure 27. IWIP IPCC RCP 4.5 Precipitation 2021-2050

ANNEX 4 : IPCC RCP 8.5

Temperature

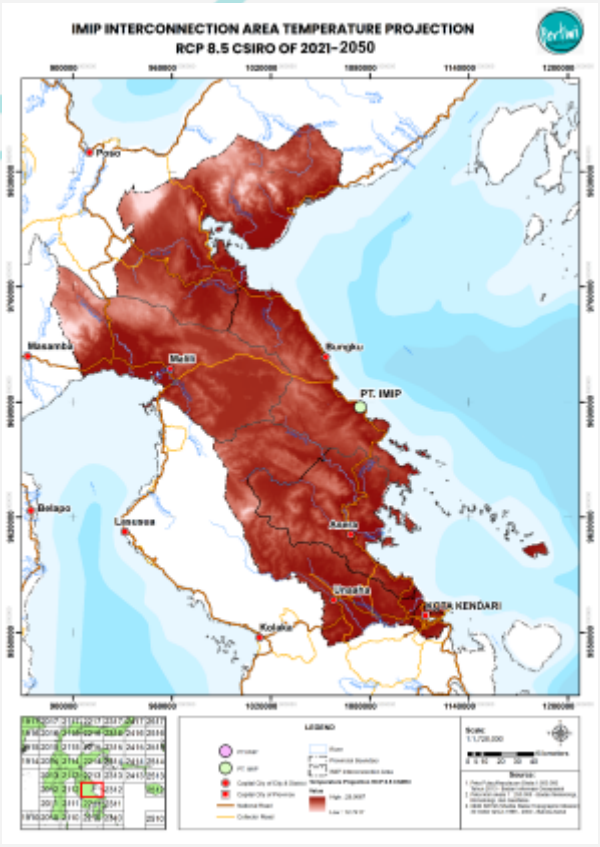


Figure 28. IMIP IPCC RCP 8.5 Temperature 2021-2050

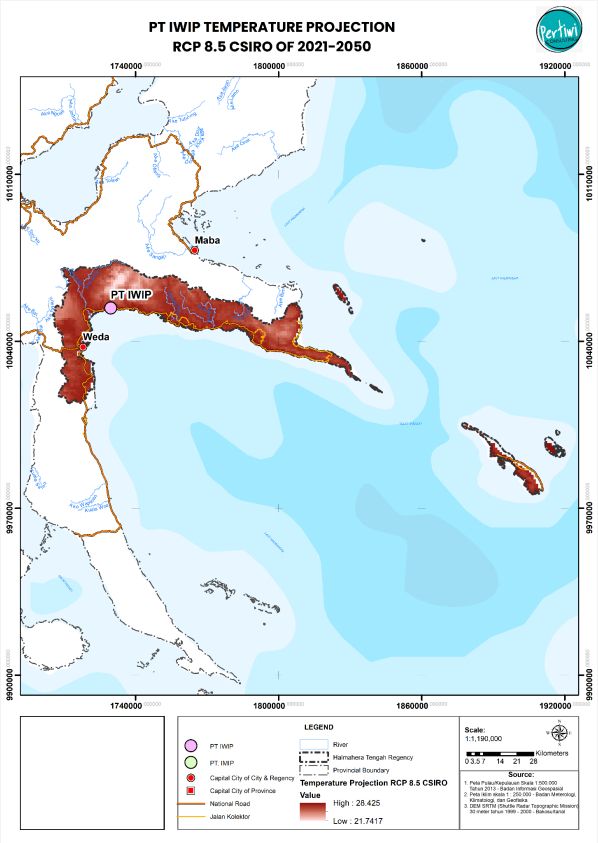


Figure 29. IWIP IPCC RCP 8.5 Temperature 2021-2050

Precipitation

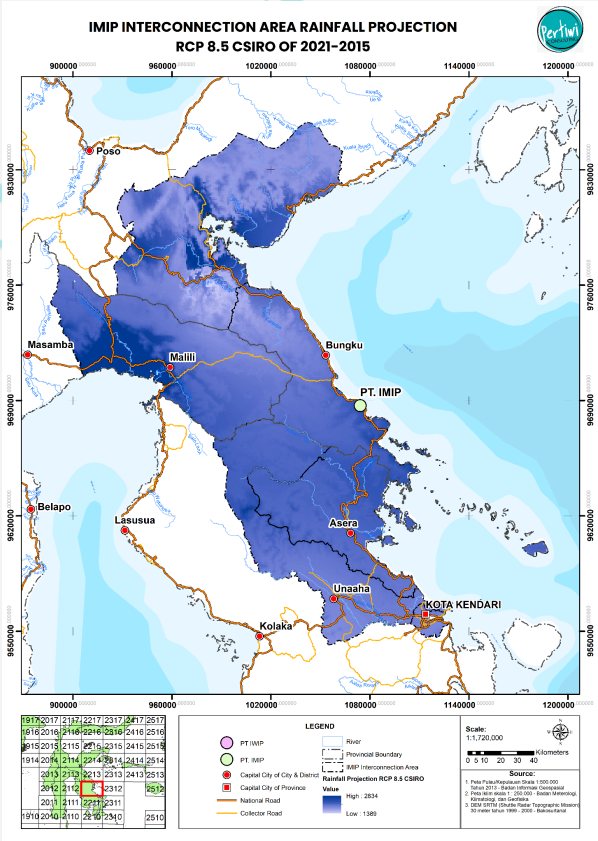


Figure 30. IMIP IPCC RCP 8.5 Precipitation 2021-2050

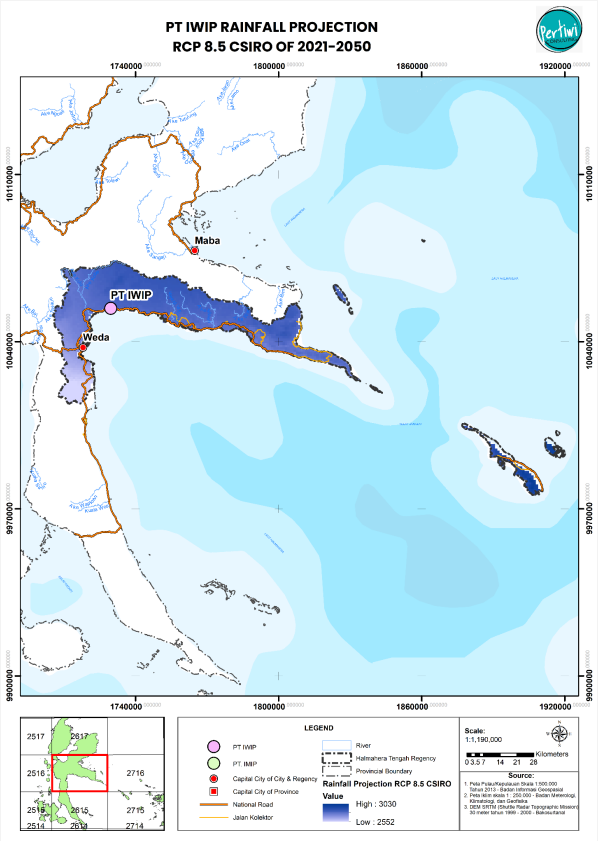


Figure 31. IWIP IPCC RCP 8.5 Precipitation 2021-2050