Assessment of Climate-related Scenario for Climate-related Risk & Opportunities Disclosure in Indonesia

Yohanes Handoko Aryanto[1]

{yohanes.handoko86@gmail.com[1]}

Pertamina Energy Institute[1]

Abstract. Under the recently issued IFRS-S2 Climate Related Disclosure, climate-related risk & opportunities assessment based on normative scenarios that align with the Paris Agreement does not fit for the developing country situation as Indonesia and poses a negative impact for reporting entities in the region. This paper analyzes the issues related to climate-related risk and opportunities assessment based on scenario analysis according to IFRS-S2 requirement. The analysis uses literature study, case study in oil & gas reporting entities, and scenario simulation specific for Indonesia. Based on the analysis, this paper proposes several recommendations to strengthen developing countries reporting entities in the implementation of IFRS-S2 such as using Net Zero Emission scenarios specific for developing countries, utilization of descriptive climate scenarios, also addressing energy trilemma and just transition in climate-related scenario analysis.

Keywords: Climate-related risk; IFRS S2; Strategic Risk; Scenario Analysis; Sustainability Report

1 Introduction

Since IFRS Foundation officially formed the International Sustainability Standards Board (ISSB) at COP26 in 2021, the ISSB has developed and published 2 Sustainability Standards namely International Financial Reporting Standards (IFRS) S1 and S2. The two sustainability standards are intended to improve trust and confidence in company disclosure about sustainability to inform investment decision, also create a common language for disclosing the effect of climate-related risks and opportunities on a company's prospects[1].

While IFRS S1 laid the foundation and general requirement for sustainability-related disclosure, the IFRS S2 set standards on climate-related disclosure. The IFRS Foundation stated that the principle of IFRS Sustainability standard is climate first not climate only. Therefore, the first issue being tackled is climate related. One of the crucial purposes of the IFRS S2 is to enable users of *general-purpose financial reports* to understand an entity's strategy for managing climate-related risks and opportunities (IFRS S2 par. 8). This includes assessing climate-related risks and opportunities, also stress testing strategy and business model, including financial

[1] *https://www.ifrs.org/news-and-events/news/2023/06/issb-issues-ifrs-s1-ifrs-s2/*

ICONIC-RS 2023, September 21-22, Bali, Indonesia

DOI 10.4108/eai.21-9-2023.2345688

position, financial performance, and cash flows, under climate-related future uncertainties. This requirement could be helpful not only for the users of *general-purpose financial reports* to understand the entity's strategy, but also for the reporting entity to stress test its strategy under different climate-related future scenarios. Therefore, the reporting entities could understand future uncertainties, assess risks and opportunities that arise from the uncertainties and complexity of climate-related dynamics, then ultimately develop robust strategies based on the stress testing and assessment results.

Since scenario analysis is critical in assessing climate-related risks and opportunities, the reporting entity should use proper climate-related scenarios to assess climate-related risks and opportunities. Nevertheless, the IFRS S2 disclosure requirements paragraf 22 b (i) (4) stated that "whether there is scenario that aligned with the latest international agreement on climate change", could hinder the purpose of scenario analysis, potentially misguide the user of the *general-purpose financial reports*, and disadvantaging the reporting entities in developing countries. This is because the international agreement on climate change poses a complex and dynamic interplay. Climate change is closely related to energy and economic development as the source of emissions. With the rise of energy and economic crisis after the Russia-Ukraine conflicts, several developed nations started to develop reshoring policies that strengthen not only energy transition and economic development in the country, but also strategic competitive advantages in green technologies. Examples are the US Inflation Reduction Act and REPowerEU, that will reposition control of clean energy technology and supply chain to the developed country ([1], [2], [3]). These policies show that international agreement on climate change still poses an unjust transition for the developing countries. Moreover, IFRS S2 Industry Based Guidance[2] recommends upstream oil & gas reporting entities to use IEA World Energy Outlook (WEO) oil price trajectories as a normative reference to assess hydrocarbon levels sensitivity. However, the oil price is not merely influenced by supply-demand dynamics caused by energy transition, but economic growth and market factors, as historically oil prices were influenced by OPEC+ response to oversupply or undersupply the market ([4], [5], [6]).

Therefore, under the complex dynamics of international agreement on climate change, this paper will analyze the impact of climate scenarios aligned with the latest international agreement on climate change to reporting entities in developing countries and seek the proper disclosure and scenarios for entities in the developing countries. Section 2 of this paper provides literature review on scenario planning and its typology, section 3 evaluates the implementation of climate-related scenario analysis especially in oil & gas sectors, section 4 analyzes climate-related scenarios in the context of Indonesia, and section 5 summarizes the analysis and concludes the paper.

[2]*https://www.ifrs.org/projects/completed-projects/2023/climate-related-disclosures/appendix-b-industry-based-disclosure-requirements/*

2 Literature Review

2.1 Scenario Planning

The principle of climate-related strategic stress testing in IFRS S2 is based on TCFD frameworks[3], which relies on climate-related scenarios to assess future uncertainties. However, compared to TCFD, IFRS S2 does not provide robust guidance on climate-related scenarios. As stated in IFRS S2 paragraf 22 b (i), climate-related scenarios should be in a diverse range, associated with transition and physical risks, and entities shall disclose whether there is a scenario that is aligned with the latest international agreement on climate change.

Meanwhile, TCFD provides several guidance in the technical supplement "The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities". For example, scenarios related to 2°C should be publicly available, peer reviewed, and generally used/referenced. The technical supplement also stated that scenarios should be plausible, distinctive to each other, consistent, relevant and provide specific insights into the future related to strategic and/or financial implications, challenge conventional wisdom and simplistic assumptions about the future, and explore alternatives that significantly will alter business-as-usual assumptions.

The guidance stated in TCFD is aligned with scenario planning methodology, for examples by Lindgren & Banhold [7] which point out that scenario should be challenging existing paradigms and assumptions, since scenario planning is a method used to deal with uncertainties in the future business environment. The concept of scenario planning as a strategic planning method also stated by Chermack [8], although scenario planning is more about strategic thinking than planning ([9], [10], [11]). As a method to induce strategic thinking, scenario planning should be challenging, therefore it could challenges people's mindsets, reduce myopia, and counter overconfidence by bringing to mind possible futures not sufficiently considered yet [12]. This is because strategy and long term planning resides within system complexity and future uncertainty. A challenging scenarios could help to break mental model, unravel unknown future, and increase awareness of multiple plausible future state.

2.2 Scenario Typology and Category

According to Börjeson, et al. [13], there are 3 categories of scenario typology with six types as follows (adapted from Börjeson, et al.):

1. *Predictive Scenarios* (what will happen): Probability & likelihood in foreseeable future (near term horizon).
    a. *Forecasts:* What will happen, on the condition that the likely development unfolds?
    b. *What-if:* What will happen, on the condition of some specified events?
2. *Explorative Scenarios* (what can happen): Explore situations & developments from a variety of perspectives that allow for structural and more profound changes (long term horizon).

[3] *https://www.ifrs.org/news-and-events/news/2023/07/ifrs-foundation-publishes-comparison-of-ifrs-s2-with-the-tcfd-recommendations/*

a. *External:* Focus on factors beyond control of relevant actors, to inform strategy development of a planning entity. Useful to develop robust strategies that will survive several types of external development.
b. *Strategic:* Incorporate policy measures for the intended scenario user to cope with the issue at stake. This scenario focus on internal aspects and incorporate external factors, and describe how the consequences of a decision can vary.

3. *Normative Scenarios* (how can a specific target be reached): Focus on certain future situations or objective and how these could be realized (long term horizon).
a. *Preserving:* how to efficiently met a certain target (optimization).
b. *Transforming:* searching path to achieve goal by backcasting.

Meanwhile, Amer [14] describe scenarios from the perspective of methodologies and type of data which are *quantitative* scenarios which are based on storytelling and *qualitative* scenarios which are based on forecasting techniques such as time series analysis.

IFRS S2 Appendix B paragraph B17, suggest the reporting entity may start from simpler qualitative scenarios narratives, then build capabilities to develop more advanced quantitative climate-related scenario analysis. Unless, the reporting entity with a high degree of exposure to climate-related risks and opportunities, and with access to the necessary skills, capabilities or resources, is required to apply more advanced quantitative approach. However, IFRS S2 does not explain on what type of scenarios should be developed in assessing climate-related risk & opportunities. TCFD [15] stated that descriptive (exploratory) scenarios are useful to test strategic resilience to a wide range of future conditions. This suggestion aligned with concept and previous researches on scenario planning , that exploratory scenarios are useful to unravel the unknown future ([16], [17], [18]).

3 Climate-related Scenario Analysis

3.1 Climate-related scenarios

Both IFRS S2 and TCFD require climate-related scenarios to assess climate-related risks and opportunities. Although IFRS S2 and TCFD does not define what is climate-related scenarios, the TCFD guidance [19] stated that climate-related scenarios could be divided into two categories, transition scenarios and physical climate scenarios. Transition scenarios are scenarios that articulate different policy outcomes and energy economic pathways that would result in achieving temperature increases. Physical climate scenarios are scenarios that start with a range of atmospheric GHG concentration and articulate the likely resulting temperature to physical impact of climate change. The table below shows examples of globally available climate-related scenarios.

Table 1. Global Climate-related Scenarios (Publication Until 2022)

Scenarios	Publisher	Climate-related scenario type	Scenario Typology	Scenario Methodologies
World Energy Outlook	IEA[4]	Transition Scenario	Normative Scenario	Qualitative & Quantitative
Representative Concentration Pathways (RCP)	IPCC[5]	Physical Climate Scenario	Explorative Scenario	Quantitative
NGFS IIASA Scenario	NGFS[6]	Transition Scenario	Explorative Scenario	Qualitative & Quantitative
NGFS CA Climate Impact	NGFS	Physical Climate Scenario	Explorative Scenario	Quantitative
BP Energy Outlook	BP	Transition & Physical Climate Scenario	Normative Scenario	Qualitative & Quantitative
New Energy Outlook	BNEF[7]	Transition Scenario	Normative Scenario	Qualitative & Quantitative
Energy Perspective	Equinor	Transition Scenario	Normative Scenario	Qualitative & Quantitative

3.2 Reports on Climate-related Scenario Analysis Application

Since being recommended by the TCFD, climate-related scenarios have been utilized by many institutions. However, the application still varies and there are several issues in the implementation. Based on FSB findings on climate scenario analysis undertaken by financial institutions [20], most of the respondents utilize NGFS scenarios with the most common NGFS scenarios being used are Current Policies, Net Zero 2050, and Delayed Transition (3 out of 6 scenarios). This result shows that financial institutions use a balance approach of normative (Net Zero 2050) and explorative scenarios (Current Policies & Delayed Transition). However, the reports highlight two key challenges for climate scenario analysis which are limitations in data availability and consistency/comparability and data accessibility across jurisdictions. This finding is similar to Husikamp et al. [21] and Bingler & Colesanti [22]. Furthermore, Bingler & Colesanti stated that based on the challenge, climate-related scenarios should have 3 attributes which are accountable, inherit depth of risks analysis, and usable.

3.3 Case Study in Oil & Gas Sector

In business, scenario planning was first initiated by Shell in the 1960s. Since then, this methodology is very common in the oil & gas sector ([23], [24], [25]). International Oil Companies (IOC) such as BP, Shell, Equinor, and TotalEnergies, have been developing and publishing scenarios annually. For example, BP Energy Outlook, Shell Scenarios, Equinor Energy Perspectives, and TotalEnergies Energy Outlook. These scenarios all provide

[4] International Energy Agency

[5] Intergovernmental Panel on Climate Change

[6] Network fo Greening the Financial System (group of 66 central banks)

[7] Bloomberg New Energy Finance

perspectives on energy transition and in a long term horizon (up to 2050-2060). Meanwhile, in National Oil Companies (NOC), scenarios are not common. Petrochina, PTT Thailand, Petrobras, and ONGC do not publish any scenarios. Meanwhile, Petronas published Petronas Activity Outlook which provides only 2 scenarios (base and high case) for 2 years forward looking. NOCs that publish long term horizon scenarios are Sinopec with China Energy Outlook and Pertamina with Pertamina Energy Outlook, both horizons are up to 2060.

Although these companies published scenarios from energy transition perspective or energy outlook, it is unclear whether these companies fully integrate their scenarios in strategic planning. Moreover, based on the published sustainability report 2022, IOCs as BP, Shell, Equinor, and TotalEnergies are stress testing its financial resilience (in terms of NPV or EBITDA) based on IEA scenarios.

4 Climate-related Scenario Analysis in Indonesian Context

4.1 Evaluation of Indonesian Climate-related Scenario Publications

According to IFRS-S2, business entities which operate in specific regions such as Indonesia, will require regional level climate-related scenarios. The global scenarios such as from NGFS and IEA provide regional level scenarios which are aligned to global climate-related scenarios. However, both scenarios provide limited qualitative scenarios and granular quantitative data for the specific region. Meanwhile, there are several Indonesian specific climate-related scenarios, although most of the scenarios are normative as seen in table 2.

Table 2. Climate-related scenarios for Indonesian Region (Publication Until 2022)

Scenarios	Publisher	Climate-related scenario type	Scenario Typology	Scenario Methodologies
Outlook Energi Indonesia	NEC[8]	Transition Scenario	Normative Scenario	Qualitative & Quantitative
An Energy Sector Roadmap to Net Zero Emissions in Indonesia	IEA & MEMR[9]	Transition Scenario	Normative Scenario	Qualitative & Quantitative
Indonesia Energy Transition Outlook	IRENA[10] & MEMR	Transition Scenario	Normative Scenario	Qualitative & Quantitative
Indonesia LTS-LCCR 2050	MEF[11]	Physical Climate Scenario	Normative Scenario	Qualitative & Quantitative
Pertamina Energy Outlook	Pertamina	Transition & Physical Climate Scenario	Normative Scenario	Qualitative & Quantitative

[8] National Energy Council

[9] International Energy Agency, & Ministry of Energy & Mineral Resources

[10] International Renewable Energy Agency

[11] Ministry of Environment & Forestry

The biggest challenge in implementing climate-related risk & opportunity assessment in Indonesia is in the availability of climate-related scenarios and data. The available normative scenario in Indonesia mostly does not provide valuable insight or breaking mental models, since these types of scenarios are back-casted and utilized as tools for advocacy. For example, the IEA and MEMR An Energy Sector Roadmap to Net Zero Emissions in Indonesia, is stated as a comprehensive roadmap to Net Zero Emission in Indonesia[12]. The document focuses on the Announced Pledge Scenario (APS) and compares this scenario with business as usual scenario (slower transition compared to APS) and accelerated energy transition scenario (accelerated transition compared to APS to achieve NZE). These set of scenarios, which basically are business as usual – reference case – accelerated, are common in energy outlook. Pertamina Energy Outlook, National Energy Council Outlook Energi Indonesia, and IRENA Indonesian Energy Transition Outlook, have similar set of scenarios. These set of scenarios tend to see energy transition from the perspective of optimizing energy mix and timing or speed of the development of energy mix, then suggest several policy support to achieve the energy mix. These scenarios, aside from its similar perspective, are less useful for the purpose of strategy stress testing, breaking mental models for strategic thinking, and assessing climate-related risks and opportunities as suggested in the literature.

For comparison, NGFS Climate-related Scenarios provide explorative scenarios, which explore potential problems that could arise along with and from energy transition, see **Figure 1**.

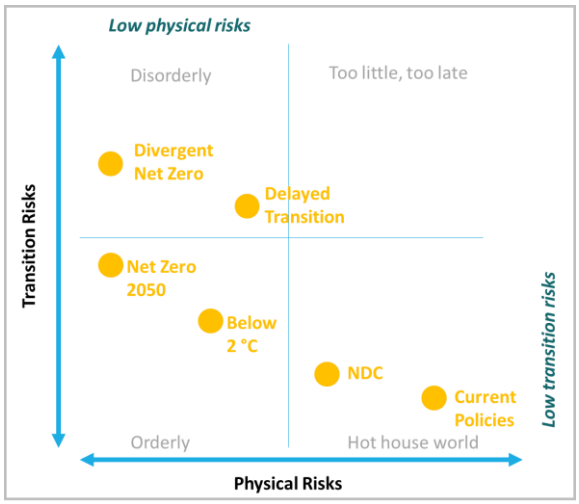

Fig. 1. NGFS Climate-related Scenarios (adapted from NGFS)

Since energy transition is historically a time-consuming process, and it happens within the complexity of the energy-economy system ([26], [27]), there are many combinations of challenges in energy transition. NGFS provides several what-if scenarios, such as Divergent Net Zero in which climate policies are more stringent in the transportation and building sector, or delayed transition when new climate policies are not introduced until 2030 and there are

[12] *https://www.iea.org/reports/an-energy-sector-roadmap-to-net-zero-emissions-in-indonesia*

different levels of action across countries and regions. These what-if scenarios show plausible interaction and complexity of energy transition going forward. However, although NGFS climate-related scenarios shows global level complexity of energy transition and provides granular level of scenario detail up to national level, it does not cover specific national level energy transition complexity.

4.2 Indonesian Climate-related Scenario

Climate-related risks and opportunities could be divided into transitional and physical as suggested by TCFD. However, the complexity of transitional and physical risks and opportunities are bound to regional level. Specific to developing countries, this paper suggests that climate-related risks and opportunities should address the challenges of energy transition in developing countries which are just energy transitions and balancing the energy trilemma. Just energy transition is about inclusive and equitable distribution in the energy transition [28], [29], [30]). Specific for climate-related scenarios, it should address the just energy transition from the perspective of developed-developing countries. Meanwhile, balancing the energy trilemma which are energy security, affordability, and sustainability has become a central issue of energy transition related to economic growth, and preserving the environment ([31], [32], [33]). Therefore, both are relevant for developing countries that need economic growth, and these regional specific challenges should be addressed accordingly in climate-related scenarios to show relevant risks and opportunities for business entities.

Since energy transition is related to reducing emission generated from the energy system, the climate-related scenarios should address the complexity related to the energy system. Based on the energy model, energy demand is usually modeled based on socio-economic drivers such as GDP (Gross Domestic Product) and demography ([34], [35], [36]). Then, to achieve climate targets, the energy demand should be met using clean energy and increasing energy efficiency, through policy, technology improvement/breakthrough, and or behavioral change. The interaction of socio-economic drivers, policy, technology, and behavioral issues in Indonesia brings specific challenges as shown in table 3.

Table 3. Examples of Indonesia Transition Challenges for Climate-related Scenarios Input

Factors		Challenges
Socio-economy	GDP (based on draft of RPJPN 2025-2045[13])	● Historical GDP Growth average 4.71% (2009-2022), aspires to achieve a high income economy country with annual GDP growth average 6-7% to 2045. ● Negative historical Total Factor Productivity (TFP) Index -0.66 (2005-2019, compared to China 1.6 in respective years). Higher TFP above 1 required to push economic growth. ● Low R&D, Technology & Innovation capacity (% budget compared to GDP 0.28%, South Korea 4.81%, Thailand 1.31%, Malaysia 1.04%).
	Sectoral	Premature deindustrialization with industrial sector contribution to GDP in declining trend, from 21% in 2013 to 17% in 2022 (Central Agency of Statistics).

[13]Draft of National Long Term Development Plan, available at https://drive.google.com/file/d/1R4qezewihYoCR60mKKjgEfnCcEok2GbQ/view, accessed August 2023

Factors		Challenges
Primary Energy	Demography	In 2023, Indonesia is the 4th most populous country in the world, with 69.25% of the population in the productive age (Center Agency of Statistics).
	Behavior	As South East Asia country, transportation is dominated by motorcycle [37]
	Oil & Gas	Net oil importer since 2002 with growing fuel demand.
	Coal	Supports Indonesia economic growth [38] with reserves life approximately 65 years.
	RES	● Indonesia wind speed is 3-6 m/s and not suitable for all types of wind turbine blades [39]. ● Geothermal capacity number 2 in the world but challenges in derisking investment & development.
Green Infrastructure	Battery Swapping & Charging Station	● Indonesia is in the development stage of battery swapping & charging station [41]. ● Battery technology is still developing, there are many battery technologies and battery swapping dedicated to battery type.
Global Landscape	Geopolitical	Post Russia-Ukraine crisis, the world experience decoupling and reshoring [42]. This situation raises the issue of just energy transition, since reshoring will increase developed countries' strategic advantage in the clean technology value chain.
	Macro-economy	The world face slow economic recovery going forward[14].

Based on table 3, there are several combinations of challenges in Indonesia energy transition which could be divided into scenario-impact matrix as illustrated in **Figure 2**.

[14]https://www.oecd.org/newsroom/global-economic-outlook-improving-albeit-to-a-low-growth-recovery.htm

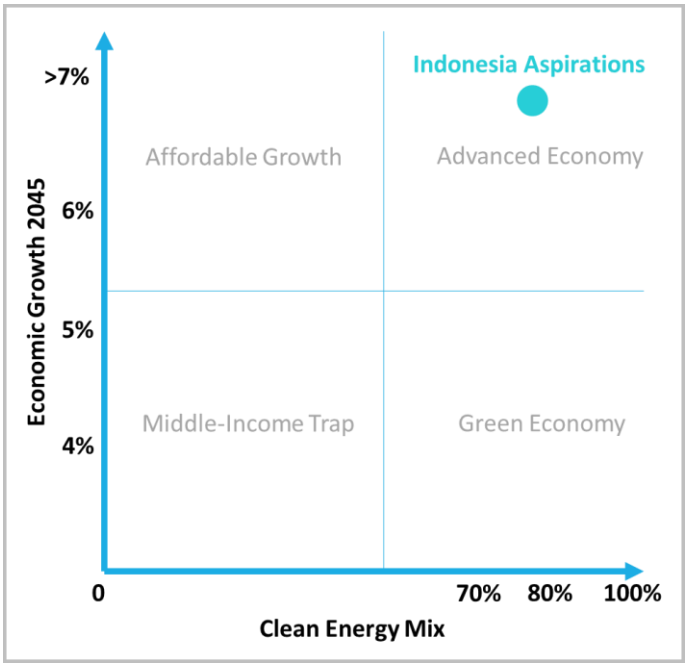

Fig. 2. Indonesia Climate-related Scenario Matrix

The scenario matrix as illustrated in **Figure 2** can be described as follows:

Affordable Growth

- Indonesia focuses on economic growth, leveraging cheap and abundant energy sources.
- The energy trilemma focuses on energy security and affordability.
- Lower transitional risks, higher physical climate risks.

Advanced Economy

- Indonesia is able to escape the middle-income trap using a green economy structure.
- Achieving balance in energy trilemmas.
- Higher transitional risks, lower physical climate risks.

Middle-Income Trap

- Indonesia's economy is challenging, unable to escape the middle-income trap, and using cheap and abundant energy sources to support the economy.
- The energy trilemma focuses on energy security and affordability.
- Lower transitional risks, higher physical climate risks.

Green Economy

- Indonesia focuses on energy sustainability. Economy focused on transforming the energy system, which required heavy funding and investment.
- The energy trilemma focuses on energy sustainability.
- Higher transitional risks, lower physical climate risks.

The scenario matrix described above shows the interaction between energy-economic systems and its impact on climate-related risks. The energy-economic scenario matrix captures specific

challenges for Indonesia going forward in the perspective of transforming the economy and transitioning the energy. Each quadrant has its own transitional and physical challenges attributed to the green economy transformation. A greener economy will increase transition risks and reduce physical risks. Therefore, the explorative scenarios could be developed anywhere within the matrix. To strengthen scenario narrative, the explorative scenario could be combined with global macro challenges such as how the developed country strengthens its clean technology value chain and increases its strategic advantages, or how the global power-play dynamic is going forward.

Aside from explorative scenarios, the matrix also shows normative scenarios in the upper right quadrant. Based on the draft of RPJPN as stated in Table 3, Indonesia aspires to achieve the upper right quadrant. To develop the normative scenario, Indonesian aspiration should then be back casted to create a green economy pathway. Another normative scenario could also be developed from two bottom quadrants. Based on Table 2, the most common Indonesia climate-related scenarios are focused on energy transition. Therefore, the normative scenarios are about plausible pathways to achieve clean energy mix or to decarbonize the energy system.

Based on the scenario matrix, the upper right quadrant poses the risks of delayed energy transition. This is because Indonesia requires high economic growth to achieve a high income country in 2045, from its current state which is still supported by fossil energies for both energy consumption and economic growth. Therefore, after achieving a high income economy in 2045, Indonesia should immediately reduce emissions which plausibly related to fossil energy system abandonment or immediate shift, to achieve Net Zero Emissions in 2060 or sooner. This situation will pose higher transition risks and shows the challenges of achieving both economic growth and Net Zero Emissions in a relatively short period.

5 Conclusion & Recommendations

Climate-related scenarios are crucial for strategy stress-testing and assessing climate-related risks and opportunities as regulated by IFRS S2. However, the implementation challenges revolve around data accountability, availability, and the depth of risk analysis. Since most of currently available climate-related scenarios are either in global perspectives, therefore lacking national specific challenges, or in national perspectives but less explorative, this paper suggests Indonesia should develop its own national specific climate-related scenarios.

Indonesia has specific challenges as developing country aspires to become high-economic income in 2045. This aspiration requires high energy demand and sudden emission reduction to achieve NZE, which increases the risks of delayed transition. Meanwhile, within global context, Indonesia faces the risks of unjust energy transition as a developing country. This specific situation should be elaborated properly in the disclosure as required by IFRS S2, therefore the users of general purpose financial statements could understand the context and situation faced by business entities in Indonesia energy transition.

Since the purpose of scenario analysis as stated in the literature is to break mental models and increase awareness of multiple unknown futures in the strategic planning process. Therefore, developing explorative scenarios are critical. The currently available Indonesia level scenarios lack diversity, since most are normative scenarios and revolve around energy transition.

Therefore, this paper suggests developing diverse explorative scenarios as a complement for currently convergent scenario perspectives.

This paper evaluates fundamental issues of climate-related scenarios for the purpose of climate-related risks and opportunities assessment according to IFRS S2 requirement. However, considering the limitations of the study, there are many detailed and granular factors that should be considered in scenario analysis such as the impact of sectoral growth to electricity demand, or the impact of electric vehicles to fuel demand reduction. For future study, it is recommended to develop a scenario modeling based on the scenario matrix developed in this paper, to analyze the quantitative impact of the scenarios.

References

[1] Kleimann, D., Poitiers, N., Sapir, A., Tagliapietra, S., Véron, N., Veugelers, R., & Zettelmeyer, J. (2023). How Europe should answer the US Inflation Reduction Act. Bruegel.

[2] Htun, N. (2023). Holistic and integrated systemic policies and practices for decarbonization. Environmental Progress & Sustainable Energy, e14102.

[3] Lonergan, K., Gabrielli, P., & Sansavini, G. (2022). Energy justice analysis of the European Commission REPowerEU plan.

[4] Nan, Y., Sun, R., Zhen, Z., & Fangjing, C. (2022). Measurement of international crude oil price cyclical fluctuations and correlation with the world economic cyclical changes. Energy, 260, 124946.

[5] Zhao, J. (2022). Exploring the influence of the main factors on the crude oil price volatility: An analysis based on GARCH-MIDAS model with Lasso approach. Resources Policy, 79, 103031.

[6] Cai, Y., Zhang, D., Chang, T., & Lee, C. C. (2022). Macroeconomic outcomes of OPEC and non-OPEC oil supply shocks in the euro area. Energy Economics, 109, 105975.

[7] Lindgren, M., & Bandhold, H. (2003). Scenario planning. London: Palgrave.

[8] Chermack, T. J. (2005). Studying scenario planning: Theory, research suggestions, and hypotheses. Technological forecasting and social change, 72(1), 59-73.

[9] Graetz, F. (2002). Strategic thinking versus strategic planning: towards understanding the complementarities. Management decision, 40(5), 456-462.

[10] Grant, R.M., 2003. Strategic planning in a turbulent environment: Evidence from the oil majors. Strategic management journal, 24(6), pp.491-517.

[11] Meissner, P. and Wulf, T., 2013. Cognitive benefits of scenario planning: Its impact on biases and decision quality. Technological Forecasting and Social Change, 80(4), pp.801-814.

[12] Schoemaker, P. J. (2020). How historical analysis can enrich scenario planning. Futures & Foresight Science, 2(3-4), e35.

[13] Börjeson, L., Höjer, M., Dreborg, K. H., Finnveden, G., & Ekvall, T. (2005). Towards a user's guide to scenarios-a report on scenario types and scenario techniques.

[14] Amer, M., Daim, T. U., & Jetter, A. (2013). A review of scenario planning. Futures, 46, 23-40.

[15] TCFD. (2020, October). Guidance on Scenario Analysis for Non-Financial Companies. https://assets.bbhub.io/company/sites/60/2020/09/2020-TCFD_Guidance-Scenario-Analysis-Guidance.pdf

[16] Avin, U., Goodspeed, R., & Murnen, L. (2022). From exploratory scenarios to plans: Bridging the gap. Planning Theory & Practice, 23(4), 637-646.

[17] Marlow, J., Oliver, H., Quay, R., & Marra, R. (2015). Integrating exploratory scenario planning into a municipal general plan update. Lincoln Institute of Land Policy.

[18] Machiels, T., Goodspeed, R., Compernolle, T., & Coppens, T. (2023). Creating Flexible Plans for an Uncertain Future: From Exploratory Scenarios to Adaptive Plans With Real Options. Planning Theory & Practice, 1-20.

[19] TCFD. (2017, June). The Use of Scenario Analysis in Disclosure of Climate-related Risks and Opportunities. https://assets.bbhub.io/company/sites/60/2020/10/FINAL-TCFD-Technical-Supplement-062917.pdf

[20] Climate Scenario Analysis by Jurisdictions: Initial findings and lessons. (2022, November). Financial Stability Board. https://www.fsb.org/wp-content/uploads/P151122.pdf

[21] Huiskamp, U., ten Brinke, B., & Kramer, G. J. (2022). The climate resilience cycle: Using scenario analysis to inform climate-resilient business strategies. Business Strategy and the Environment, 31(4), 1763-1775.

[22] Bingler, J. A., & Colesanti Senni, C. (2022). Taming the Green Swan: a criteria-based analysis to improve the understanding of climate-related financial risk assessment tools. Climate Policy, 22(3), 356-370.

[23] Grant, R. M. (2003). Strategic planning in a turbulent environment: Evidence from the oil majors. Strategic management journal, 24(6), 491-517.
[24] Vecchiato, R. (2019). Scenario planning, cognition, and strategic investment decisions in a turbulent environment. Long Range Planning, 52(5), 101865.
[25] Schoemaker, P. J. (2022). Advanced introduction to scenario planning. Edward Elgar Publishing.
[26] Solomon, B. D., & Krishna, K. (2011). The coming sustainable energy transition: History, strategies, and outlook. Energy Policy, 39(11), 7422-7431.
[27] Fouquet, R. (2016). Historical energy transitions: Speed, prices and system transformation. Energy Research & Social Science, 22, 7-12.
[28] Siciliano, G., Wallbott, L., Urban, F., Dang, A. N., & Lederer, M. (2021). Low-carbon energy, sustainable development, and justice: Towards a just energy transition for the society and the environment. Sustainable development, 29(6), 1049-1061.
[29] Hirsch, T., Mattheß, M., & Fünfgelt, J. (Eds.). (2017). Guiding principles & lessons learnt for a just energy transition in the global south. Friedrich-Ebert-Stiftung, Global Policy and Development.
[30] Ha-Duong, M. (2023, July). Implementing a Just Energy Transition. In Fourteenth Vietnam Economist Annual Meeting (VEAM 2023).
[31] Liu, H., Khan, I., Zakari, A., & Alharthi, M. (2022). Roles of trilemma in the world energy sector and transition towards sustainable energy: A study of economic growth and the environment. Energy Policy, 170, 113238.
[32] Khan, I., Zakari, A., Zhang, J., Dagar, V., & Singh, S. (2022). A study of trilemma energy balance, clean energy transitions, and economic expansion in the midst of environmental sustainability: New insights from three trilemma leadership. Energy, 248, 123619.
[33] Shirazi, M. (2022). Assessing energy trilemma-related policies: the world's large energy user evidence. Energy Policy, 167, 113082.
[34] Vaillancourt, K., Alcocer, Y., Bahn, O., Fertel, C., Frenette, E., Garbouj, H., ... & Waaub, J. P. (2014). A Canadian 2050 energy outlook: Analysis with the multi-regional model TIMES-Canada. Applied energy, 132, 56-65.
[35] Conti, J., Holtberg, P., Diefenderfer, J., LaRose, A., Turnure, J. T., & Westfall, L. (2016). International energy outlook 2016 with projections to 2040 (No. DOE/EIA-0484 (2016)). USDOE Energy Information Administration (EIA), Washington, DC (United States). Office of Energy Analysis.
[36] Liu, Y., & Feng, C. (2020). Decouple transport CO2 emissions from China's economic expansion: a temporal-spatial analysis. Transportation Research Part D: Transport and Environment, 79, 102225.
[37] Chalermpong, S., Kato, H., Thaithatkul, P., Ratanawaraha, A., Fillone, A., Hoang-Tung, N., & Jittrapirom, P. (2023). Ride-hailing applications in Southeast Asia: A literature review. International Journal of Sustainable Transportation, 17(3), 298-318.
[38] Kurniawan, R., & Managi, S. (2018). Coal consumption, urbanization, and trade openness linkage in Indonesia. Energy Policy, 121, 576-583.
[39] Hidayat, T. (2022). Wind Power in Indonesia: Potential, challenges, and current technology overview. In H. Ardiansyah, & P. Ekadewi (Eds.), Indonesia post-pandemic outlook: Strategy towards net-zero emissions by 2060 from the renewables and carbon-neutral energy perspectives (109–132). BRIN Publishing. DOI: 10.55981/brin.562.c7 ISBN: 978-623-7425-83-0 E-ISBN: 978-623-7425-87-8
[40] Dipayana, G. F. & Ramadhan, R. A. (2022). Geothermal energy in Indonesia. In H. Ardiansyah, & P. Ekadewi (Eds.), Indonesia post-pandemic outlook: Strategy towards net-zero emissions by 2060 from the renewables and carbon-neutral energy perspectives (159–180). BRIN Publishing. DOI: 10.55981/brin.562.c9 ISBN: 978-623-7425-83-0 E-ISBN: 978-623-7425-87-8
[41] Asian Development Bank. (2022, October). Electric Motorcycle Charging Infrastructure Road Map for Indonesia. ADB. Retrieved August 15, 2023, from

https://www.adb.org/sites/default/files/publication/830831/electric-motorcycle-charging-infrastructure-indonesia.pdf
[42] Deutsche Bank. (2023, July). CIO Special The great decoupling? Rethinking sustainable globalisation. Deutschewealth. Retrieved August 14, 2023, from https://www.deutschewealth.com/content/dam/deutschewealth/cio-perspectives/cio-special-assets/global-decoupling/cio-special-the-great-decoupling.pdf