



Paper 7

Strategic Energy Portfolio Optimization for National Oil Company amidst Uncertainties and Climate Change

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Abstract – Facing oil price volatility, loss profitability during COVID-19 pandemic in the year 2020, technological advancement and the declined cost of renewable energy, countries increasing commitment towards net-zero emission target, ESG investment trend, and oil reserves structural declined projection, Indonesia National Oil Company will require strategy to optimize its energy portfolio to enhance resiliency, agility and flexibility to unlock new value and bigger impact for the stakeholders. Optimizing the company's already-diversified energy portfolio as an adaptive strategy will enhance the company resiliency in facing the uncertainty of oil price volatility, technological advancement in new and renewable energy that can increase disruption risk to the company's current strategy as well as to reduce GHG emission, where the scenario simulation shows that gradually optimizing 10-25% new and renewable energy portfolio will enhance company profitability in the long-run, by building strong-integrated energy network from upstream to downstream to provide low-carbon energy solutions align with government regulations support, demand-side efficiency as well as carbon market price implementation that expected to reach minimum US\$ 50-75/tonCO₂eq to reduce GHG emission as a contribution to climate change mitigation.

Keywords – Strategy, Energy, Optimization Scenario, National Oil Company, Uncertainty, Climate Change.

I. INTRODUCTION

Indonesia as one of the Emerging Market and Development (EMDE) country has high dependency on oil as primary energy source to drive the economy for more than 200 million population. Since the year 2003 Indonesia has been a net oil importer to fulfill its energy demand due to the declining oil production that will posed a great threat to national energy security. Indonesia National Oil Company aims to ensure national energy security resiliency and self-sufficiency. However, the most important source of uncertainty for the company business development is the oil price volatility, where the dynamic will influence its strategic energy portfolio performance.

Demand cut during COVID-19 pandemic in the year 2020 has pushed the oil price to the lowest in history, impacting oil companies' revenue and profitability around the world, including the Indonesia National Oil Company which lost its overall revenue for 24.32% and profitability for 58% compares to the year 2019.

Economic downturn around the world in the year 2020 during COVID-19 pandemic has created opportunity to accelerate the transition towards low-carbon emission, align with the Indonesia updated Nationally Determined Contribution (INDC) to the United Nation Framework Convention on Climate Change (UNFCCC) in the year 2021 that committed to reduce Greenhouse Gas (GHG) emission to 29% unconditionally and 41% conditionally with internal support compared to Business as Usual (BAU) scenario in the year 2030 [20]. Indonesia National Oil Company has committed to reduce GHG emission to 78% from the year 1990 level by the year 2030 [9].

Therefore, Indonesia National Oil Company will require strategy to optimize its energy portfolio to enhance resiliency, agility and flexibility to unlock new value and bigger impact for stakeholders in facing the volatility of oil price, revenue and profit loss during Covid-19 pandemic in year 2020, technological advancement and the declined cost of renewable energy, countries increasing commitment towards net-zero emission target, Environmental, Social and Governance (ESG) investment trend of and oil reserves structural declined projection as an adaptive strategy towards climate change mitigation at corporate level in short, medium and long-term.

II. METHODOLOGY

Primary methodologies used in this research explained below:

- 1) Business performance analysis: Analyzing the company performance including financial, industry attractiveness, business unit competitive strength, current resource allocation, sustainability, innovation, as well as the R&D perspective to identify gaps and improvement opportunities in facing the challenges forward.

Company overall financial performance analysis explained as follows:

Table 1 - COMPANY OVERALL FINANCIAL PERFORMANCE [10]

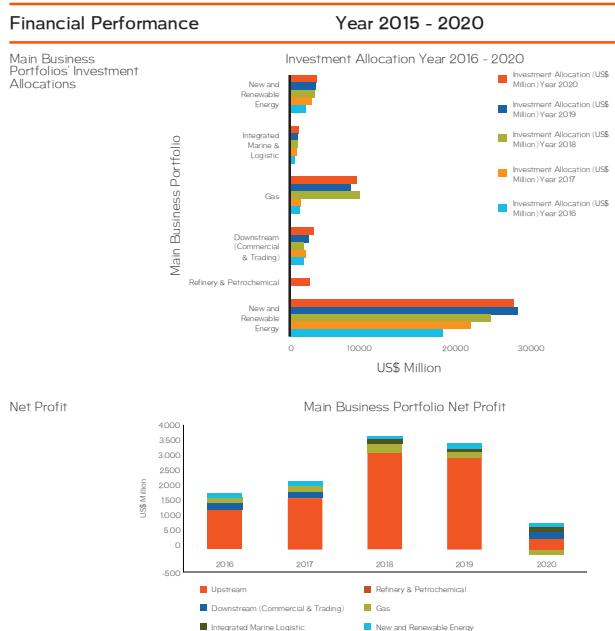
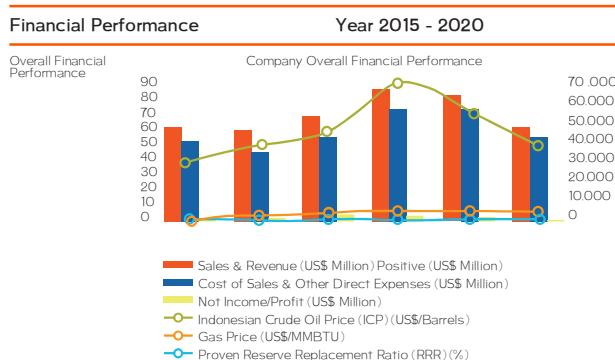


Table I shows that company financial performance was highly sensitive to oil price volatility, since oil contributes as the biggest share for 71% from the overall energy portfolio investment allocations, followed by 22% gas, and 7% of power, new and renewable energy, whereas cost-cutting was a reactive strategy to maintain profitability when oil price fall. Financial historical performance also showed that the company performed ideal when the oil price reached US\$60-70/barrel, however surging oil price > US\$100/barrel caused by energy supply disruption since the current unstable geopolitical condition will create greater risk of demand destruction in the long run that can put the company into the decline stage as the consumers tend to shift to the lower energy cost.

Evaluating industry-attractiveness of the overall main business portfolios as a whole business group to assess long-term performance prospect by calculating industry attractiveness scores as follows:

Table 2 - COMPANY INDUSTRY-ATTRACTIVENESS EVALUATION [17]

Industry-Attractiveness Measure	Importance Weight	Attractiveness Rating (1-10)*	Weighted Score
Market size and Projected Growth Rate	0.10	7	0.70
Intensity Competition	0.25	8	2.00
Emerging Opportunities and Threats	0.10	7	0.70
Cross-Industry Strategic Fit	0.25	8	2.00
Resources Requirements	0.10	7	0.70
Social, Political, Regulatory and Environmental Factors	0.10	5	0.50
Industry Profitability	0.10	7	0.70
Sum of Importance Weight	1.00		
Weighted Industry-Attractiveness			
Scores (Min. Acceptance = 5)			7.30

*) Given by respondents; 1: Very Unattractive; 10: Very Attractive

Table II shows that weighted industry-attractiveness score is 7.30, indicates that the company is attractive as a whole business group since the presence of cross-industry strategic fit with attractive degree intensity level of competition as a potential competitive advantage to create added-value to stakeholders. However, there are social, political, regulatory, environmental factors, emerging opportunities and threats that potentially reduce the company industry-attractiveness as a whole business group that can affect its profitability, resource requirements, market size and projected growth rate in the future.

Evaluating the company main business portfolios' competitive-strength to determine current strong performance by calculating weighted competitive-strength as follows:

Table 3 - MAIN BUSINESS PORTFOLIOS WEIGHTED COMPETITIVE-STRENGTH SCORE [18]

Competitive-Strength Measures	Weight	Upstream		Refining & Petrochemical	
		Rating (1-10)*	Score	Rating (1-10)*	Score
Market Share	0.15	9	1.35	8	1.20
Cost relative to competitors	0.20	8	1.67	8	1.50
Ability beat rivals on key products attributes	0.05	8	0.40	9	0.43
Strategic-fit benefit	0.20	8	1.60	8	1.60
Bargaining leverage with suppliers/customers	0.05	9	0.45	8	0.40
Brand image & reputation	0.10	9	0.93	8	0.80
Other valuable resources/capabilities	0.15	9	1.35	7	0.98
Profitability to Competitors	0.10	8	0.83	7	0.70
Sum of Importance Weight	1.00		8.58		
Weighted Overall Industry Competitive-Strength Scores**					7.60

Competitive-Strength Measures	Weight	Commercial & Trading		Gas	
		Rating (1-10)*	Score	Rating (1-10)*	Score
Market Share	0.15	5	0.75	10	1.50
Cost relative to competitors	0.20	10	2.00	10	2.00
Ability beat rivals on key products attributes	0.05	10	0.50	10	0.50
Strategic-fit benefit	0.20	9	1.80	8	1.60
Bargaining leverage with suppliers/customers	0.05	9	0.45	6	0.30
Brand image & reputation	0.10	9	0.90	8	0.80
Other valuable resources/capabilities	0.15	9	1.35	9	1.35
Profitability to Competitors	0.10	8	0.80	7	0.70
Sum of Importance Weight	1.00				
Weighted Overall Industry Competitive-Strength Scores**			8.55		8.75

Competitive-Strength Measures	Weight	Integrated Marine & Logistics		Power, New & Renewables	
		Rating (1-10)*	Score	Rating (1-10)*	Score
Market Share	0.15	8	125	3	0.45
Cost relative to competitors	0.20	8	153	5	1.00
Ability beat rivals on key products attributes	0.05	8	0.40	8	0.40
Strategic-fit benefit	0.20	8	153	8	1.60
Bargaining leverage with suppliers/customers	0.05	8	0.40	8	0.40
Brand image & reputation	0.10	7	0.70	8	0.80
Other valuable resources/capabilities	0.15	8	120	8	1.20
Profitability to Competitors	0.10	8	0.80	8	0.80
Sum of Importance Weight	1.00				
Weighted Overall Industry Competitive-Strength Scores**			7.82		6.65

*) Given by respondents; 1: Very Unattractive; 10: Very Attractive

**) Score > 6.7 (Strong); 3.3-6.7 (Moderate); 5 (Fair); 3 (Questionable); 3.3 (Weak)

Table III shows that gas portfolio currently is the strongest market contender in the industry with competitive-strength score > 6.7, whereas power, new and renewable energy portfolio considered as fairly-strong market contender in their respective industry with the competitive strength score below the strong and moderate competitive-strength acceptance score.

Industry-attractiveness and competitive-strength score plotted on nine-cell matrix [18] to determine strategic position of each main business portfolio's priority for resource allocations as follows:

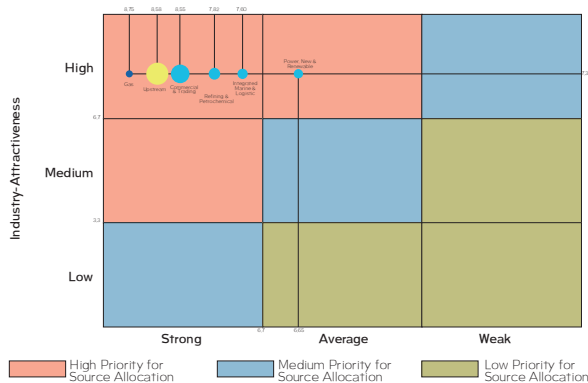


Fig. 1. Nine-Cell Attractiveness-Strength Matrix

Fig.1 shows that the overall main business portfolios currently positioned in the three cell in upper left position, which means that all have both favorable industry-attractiveness and competitive strength, where the bubbles are scaled to the percentage of the latest revenue generated to the total corporate revenue [18]. Although power, new and renewable energy portfolio competitive-strength is average compares to the others, it is generated positive revenue and profit during COVID-19 crisis, therefore company should consider to expand since its greater potential for profit growth.

Therefore, the company consider to have greater value of cross-business strategic fit resulting the more competitively powerful the company diversification strategy that creates opportunity to exploit competitive valuable in cross-business strategic fit [18]:

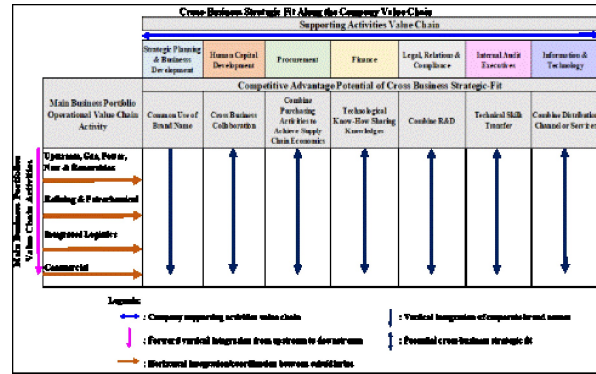


Fig. 2 shows that the company conducts forward vertical integration from upstream to downstream as corporate strategy, with main business portfolios as a whole business group conduct horizontal integration strategy to conduct coordination between its subsidiaries in the value chain, where each owned profit and loss responsibility with guidelines received from the corporate. According to cross strategic-fit along the value chain analysis, the company exhibit resources-fit since its represent adequate resources including parenting and general resources to generate value, where each main business portfolio has different ability to generate cash flow from its operations, profitability and investment characteristic or financial-fit.

Based on the evaluation of diversified company strategy from industry-attractiveness, competitive-strength, strategic-fit and resource-fit, ranking main business portfolios' current priority for resources allocations as follows:

Table 4 - MAIN BUSINESS PORTFOLIOS CURRENT PRIORITY FOR RESOURCES ALLOCATIONS [18]

Main Business Portfolio	Operating Revenue Yr. 2020 (US\$ Million)	Net Profit Yr. 2020 (US\$ Million)	Competitive-Strength Score	Nine-Cell Position Matrix (H/M/L)*	Priority Rank for Resources Allocation
Upstream	7,728	321	8.58	H	1
Refining & Petrochemical	-	0.65	7.60	H	6
Commercial & Trading	4,517	263.53	8.55	H	2
Gas	3,292	(193.67)	8.75	H	3
Integrated Marine & Logistics	356	113	7.82	H	4
Power, New & Renewable Energy	356	87	6.65	H	5

*) H: High Priority; M: Medium Priority; L: Low Priority

Table IV shows that upstream oil and gas portfolio considered as the top priority for current resources allocation. However, since past performance is not always a reliable predictor to the future business performance, external and internal business environment analysis are required to improve the existing portfolio strategy, where there are possibilities to conduct trade-offs between each main business portfolio since the company's financial resources are limited, divesting or allocate minimum resources to the business with the weakest future prospect and lack of adequate strategic-fit and/or resource-fit is required to allocate the best of available fund to strengthen company's position and grow existing businesses.

Analyzing company sustainability [10] performance across main business portfolios and its interaction towards the company's economic activity as follows:

Table 5 - COMPANY SUSTAINABILITY PERFORMANCE YEAR 2018-2020 [11]

Sustainability Indicator [11]	SDG Transformation (COVID-19 Recovery) [19]	Interaction in Economic Activity (Trade-offs) [24] Score*	
		(+)	(-)
Environmental (E)	Energy Decarbonization and Sustainable Industry	17	-10
Social (S)	Education, Gender and Inequality, Health, Well-Being and Demography	15	-4
Governance (G)	Digital Solution for Sustainable Development; Education, Gender and Inequality, Health, Well-Being and Demography; Energy Decarbonization and Sustainable Industry; Sustainable Food, Land, Water and Oceans; Sustainable Cities and Communities	22	-8

*) Qualitative-quantitative analysis; 1 Point: (+) interaction; -1 Point: (-) interaction

Table V shows that the company ESG implementation across its main business portfolios align with the company sustainable policy [9] as the contribution to Sustainable Development Goals [19] has positive economic interaction where the governance indicator has higher economic interaction. However, the company needs to concern about ESG or SDG washing [21] since it potentially reduce value-delivered to stakeholders, therefore, good governance align with carefully calculated economic and benefit analysis in the implementation is strongly required.

According to the industrial life cycle stages [14], company's innovation current position is in the maturity [14] stage, with the composition represent below:

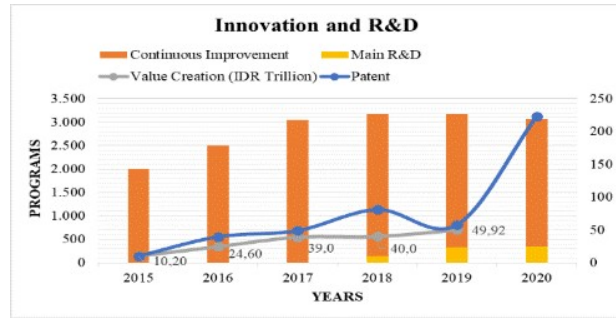


Fig. 3. Company Innovation and R&D [10]

Fig. 3 shows that continuous improvement programs were higher than the company's current main R&D programs. However, company require to consider in expanding and promoting R&D programs since the increasing uncertainties and climate change can create disruption that potentially change the whole company business strategy and model. Although the company already conduct digital transformation and mandatory human capital skill development of big data analytics, predictive maintenance and artificial intelligence as the extensive range of future business prospect and investment readiness, it is important for the company to develop data management awareness culture to enhance data quality across the organization, since data management and quality are fundamental in the big data analytics and artificial intelligence development.

2) Company characteristics: According to business performance analysis, company characteristics summarized below:

Table 6 - COMPANY CHARACTERISTICS

Market Type Characteristic [6]		Monopoly [6]	
· Number and size of firms · Type of product · Market entry and exit · Non-price competition		- One Unique - Very difficult or impossible - Not Necessary	
Life Cycle Stages [14]		Maturity [14]	
- Number and size of firms - Type of product - Market entry and exit - Non-price competition	Manufacturing process engineering, marketing	- Numbers of Competitors - Mode of Competitions	Moderate, but large
	Product innovation low; process innovation high	- Type of Buyers - Business-Level Strategy - Strategic Objectives	Price
	None-Moderate Largest Low		Late Majority Cost-Leadership / Integration Strategy Maintain strong strategic position
Corporate Diversification Strategy [14]			
Type of Diversification	Revenue from Primary Businesses	Competencies (in products, services, technology or distribution)	
Dominant business	70%-95%	Dominant and minor businesses share competencies.	
Source of Value Creation and Cost [14]			
Corporate Strategy	Sources of Value Creation (V)	Source of Cost (C)	
Vertical Integration	- Lower costs - Improve quality - Facilitate scheduling and planning - Facilitate investments in specialized assets - Securing critical supplies and distribution	- Increase cost - Reduce quality - Reduce flexibility - Increasing potential for legal repercussion	

Risk Management Three Lines of Defense – Risk Profile and Mitigation [11]		
Risk Profile	Monopoly [6]	Monopoly [6]
Strategic Planning	- Risk related to corporate strategy and planning, e.g. achievement of oil and gas production.	- New reserve explorations, discovery, crude oil product diversification, new and renewable energy development
Financial	- Risk related to financial activities, market, planning & budgeting, e.g. global bond, corporate loan.	- Foreign exchange hedging transaction, attempt competitive loan interest rate and market risks analysis
Operational & Infrastructure	- Risk related to company operational & infrastructure activity.	- Increase employee safety awareness, asset optimization, rejuvenation and renewed technologies
Governance	- Risk related to compliance in corporate governance & business ethics	- Optimization, adjustment and top-down approach in the implementation
Compliance	- Risk related to Good Corporate Governance (GCG) and fraudulent act	- Whistle blowing, audit ISO 37001 of Anti-Bribery Management System Certification and Implementation
Reporting	- Risk related to company performance report submission to the concerned stakeholders	- Periodic data reconciliation, business control implementation improvement

3) Business environment analysis: Analyzing recent external and internal business environment and its impact both pros and cons to the current company business activities as well as to influence the company's business strategy in the future, explained as follows:

Table 7 - EXTERNAL ENVIRONMENT ANALYSIS [18]

Political Forces (P)	Impacts to Current Strategy
- Constitution of Republic Indonesia No. 19 year 2003 Article 66 concerning Public Service Obligation (PSO) for State-Owned Enterprise (SOE)	- Unbalance between PSO funds and the obligations potentially creates deficit for company cash flows and reduce its profitability and creditworthiness, and vice versa.
- Republic of Indonesia Presidential Regulation No.55 Year 2019 concerning the acceleration of Battery Electric Vehicle (BEV) for road transportation.	- Increasing risk of business portfolio disruption, particularly in upstream, refining and petrochemical and fuel retail business.
- Appendix Presidential Regulation No. 18 year 2020 concerning the National Medium-Term Development Plan year 2020-2024.	- Refinery Development Master Plan (RDMP), city gas network and the sustainable electricity creating business opportunities for refining and petrochemical, gas, power, new and renewable energy portfolio development.
- Law of the Republic Indonesia No. 7 year 2021 concerning the tax harmonization.	- Carbon tax payment on business activities that produce carbon emission for IDR 30.00 per kgCO ₂ e started on July 2022 (coal-powered generation as pilot project implementation)
- Government of Indonesia Regulation No. 25 year 2021 concerning the implementation of energy and mineral resources.	- Energy mix utilization for power generation activity such as fossil fuels and new and renewables, including battery energy storage system, geothermal activities, including: exploration, exploitation, etc.
- Ministry of Energy and Mineral Resources Regulation No. 8 year 2020 concerning the determination of the US\$ 6/mmbtu gas pricing for certain industry.	- Increase the revenue stream particularly for gas portfolio. However, the utilization of gas price for US\$ 6/mmbtu for certain industries mentioned currently still below 100% target (81%), prolonged by demand cut during COVID-19 pandemic recovery that can put company's profitability at risk.
- Ministry of Energy and Mineral Resources Regulation No. 10 year 2020 concerning the utilization of natural gas utilization for electricity generation.	- Increase the revenue stream particularly for gas portfolio. However, prolonged demand cut during COVID-19 pandemic can put company's profitability at risk since decreasing utilization.
- Updated Nationally Determined Contribution (NDC) Republic of Indonesia year 2021 concerning the 29% reduction on GHG emission and 41% conditionally by international support in the year 2030.	- Establishment of GHG emission reduction target for 29% from 2020 level in the year 2030, thus, creating investment gap to reduce GHG emission below targeted level that potentially increase company's expenditure.
Economic Forces (E)	Impacts to Current Strategy
- Bank Indonesia projected domestic economic growth to increase between 4.7-5.2% in the year 2022-2023, assumed faster COVID-19 recovery, between 5-6% in the year 2045, 2.8% in the year 2050 and 2.17% in the year 2060 [12].	- Increase buyers' purchasing power that increase company profitability to fund business development, expansion, investment, innovations, R&D and vice versa.

- Bank Indonesia maintained interest rates at 3.5% in the year 2022 before gradually raising rates as inflation emerges.
- Ministry of Finance projected inflation rate to increase from 16% in the year 2021 to become approximately 22% to 3% with 1% deviation in the year 2022-2025.
- Indonesia National Development Agency projected per capita income to reach US\$ 6,305/year in 2025 and US\$ 8,804/year in 2035.
- Domestic unemployment rate decrease from 6.26% in the year 2021 to become 5.83% in February 2022 and projected to decrease approximately from 7% in the year 2020 to become 6% in the year 2022 [2].
- Indonesia Rupiah's exchange rates projected to ranged 14,600 – 15,600/ US\$ in the year 2022-2023. In January 2022, Indonesia Rupiah value depreciated by 0.77% and 0.01% on average according to NDF.
- Domestic trade balance surplus for US\$ 0.93 million in January 2022, with the biggest contributor came from non-oil and gas sectors for US\$226 million, whereas oil and gas sectors contributed to the trade balance deficit for US\$133 million [2].
- Cutback on company expenditures as the cost of goods and services increase, reduce company earnings, since consumers purchasing power are also reduce and vice versa.
- Rise in cost of goods and services that will increase company expenditures, reduce consumers purchasing power that will reduce company earnings, increase in interest rates, lowers the value of pensions, savings, treasury notes, and vice versa.
- Increase in buyers' purchasing power, therefore increase company earnings, and vice versa.
- Decrease in the unemployment rate indicates growth and rising outputs or productivity as the economy expands and vice versa.
- Burden the company borrowings in foreign currency and inflation risk that can increase cost of goods and services leads to the increase in company expenditures and affecting company investment performance.
- Reduce domestic economic growth, as the reliance on imported products higher than domestic productions and weakens national currency exchange rates that contributes to the increase in company expenditures as the cost of goods and services increase, reducing consumers purchasing power and threatens company profitability, and vice versa.

Economic Forces (E)	Impacts to Current Strategy
- Indonesia population number projected to increase between 292.5 – 311.6 million people in the year 2030-2045 with growth rates 0.57% in year 2030-2035 and 0.28% in year 2040-2045 [2].	- Increasing company productivity resulting higher scale of production, reduce cost of production, and market expansion by providing enough labor force. However, population growth's rapid increase may increase energy consumption, leads to the increase in natural resources scarcity, decreasing environmental aspect, e.g. pollutions, uncontrolled urbanization, and deforestation.
- Population migration from rural to urban area or urbanization level projected to increase to become 66.6% in the year 2035, reaching 203 million [2] [21].	- Ease production inputs, facilitating information exchanges that stimulate innovations, business and market expansion. However, market development in rural areas require bigger capital since limited infrastructures.
- Increasing urbanization caused work patterns changed from agrarian to industrial based, where the working population in urban areas currently reached 54.09%, with 36.37% categorized as laborers/employees from the total population [2] that may contributes to the shift in transportation and households sectors as well as the increase in infrastructures and industrialization that increase energy demand.	- Wider business and market opportunities, development and expansion to increase company revenue and profitability. However, rapid urbanization can potentially increase environmental problems, therefore, demand-side efficiency, particularly in urban areas.
- Transportation sector currently contributes to the biggest share of final energy consumption for 43.11%, particularly in fuel products [2].	- Business opportunities to increase company revenue. However, the increase in fuels consumptions lead to the increase in crude oil imports and GHG emission. Therefore, demand-side efficiency align cleaner energy technologies development in transportation sector are required.
- Industrial sector contribute as the 2nd biggest share of final energy consumption by 34.07%, where gas contributes by 33.47% from total power generation that gradually decrease compared to coal-powered generation according to Ministry of Energy and Mineral Resources.	- Business opportunities to increase company revenue, particularly for gas portfolio. However, increasing energy consumption in the industrial sectors also contributes to the increase in GHG emission and the carbon tax implementation, therefore company requires to consider developing cleaner energy technologies along with demand-side efficiency.
- Households sector currently contributes as the 3rd biggest share of final energy consumption by 16.80%, where electricity generation contribute by 50.80%, followed by LPG for 47.01%, whereas gas only contributes for 0.19% [8].	- Business opportunities to increase company revenue, e.g. gas-powered electricity generation and gas transmission network for households align with government medium-term agendas in reducing GHG emission by reducing LPG import and subsidies along with demand-side efficiency.
- Commercial sector currently contributes as the 4th biggest share of final energy consumption by 4.79%, where the share of electricity is 80.59% with coal-steam powered generation contributes by 45.8% from the total electricity generation [8].	- Business opportunity to increase company revenue particularly for power, new and renewables, as well as gas portfolio, e.g. gas powered generation for commercials align with government medium-term agendas in reducing GHG emission.
- Rural area population currently contribute by 45.91% from the total populations, where the government currently developing new market for renewables through Renewable Based Economic Development Program aiming to accelerate renewable energy utilization, particularly in local economic zone in remote, outer rural areas [2].	- Business opportunity to increase company revenue, particularly for power, new and renewable energy portfolio. However, providing energy in rural areas often challenged by grid reliability and energy distribution since its complicated geographical conditions, therefore, decentralized energy solution might be suitable for rural areas.
Technological Forces (T)	Impacts to Current Strategy
- Digital technologies currently widely used in all energy end-use sectors, offering large improvement in energy efficiency, where	- Improve company performance in terms of operational efficiency, demand-side management to increase energy savings, and

- Digital technologies currently widely used in all energy end-use sectors, offering large improvement in energy efficiency, where the investment projected to increase between the years 2021-2023 [4].
- Biofuels currently being able to produce from the existing petroleum refinery facilities around the world [4], where Indonesia currently conduct feasibility study and business plan of Industrial Vegetable Oil/Industrial Lauric Oil (IVOILO) as raw material for Green Fuel/B100 according to Ministry of Industry.
- Global electric cars stock increase 43%, followed by more than 10 largest global manufacturers plan to reconfigure their product lines to produce and sell only electric vehicles started from the year 2030 [4].
- Weighted-average renewables power generation LCOE are projected to gradually fall since the technological advancement, declining learning curves and decreasing O&M cost and debt are already very low in mature markets according to International Renewable Energy Agency (IRENA).
- Battery storage technology capital cost evolved rapidly in the past few years which projected to reduce by approximately between 6%-48% in year 2025, 26%-63% in the year 2030 and 44%-78% in the year 2050. However, fossil-fuels powered generators in various industrial sectors' sales market size expected to grow at 5.79% during the year 2021-2028 since demand for renewables and electricity increase [4].
- More than 30 new integrated CCUS facilities that have been announced since 2017 around the world, represent total investment for > US\$ 27 billion almost doubled than 2010 level, where at least 7 large-scale integrated CCUS projects have been at early stages of planning in Southeast Asia, particularly related to enhanced gas recovery projects (EGR) in Gundih/Sukowati and Tangguh, Indonesia [4].
- Global capacity of electrolyzer that produce hydrogen from electricity doubled for the past five years to reach 300 MW by 2021 with under 350 projects under development that could increase global capacity up to 34 GW by the year 2030. Significant production cost-cutting through technology innovations and increasing development that projected to fall as low as US\$ 1-3/kg in countries with excellent renewable resources compares to the production cost of hydrogen from natural gas with CCUS in the year 2030, making hydrogen production from solar-PV getting more cost-competitive [4].
- Improve company performance in terms of operational efficiency, demand-side management to increase energy savings, and the fastest way to reduce GHG emission in the short-term.
- Green refinery development projected to on-stream in the year 2024 to increase biodiesel-fuel blending production capacity and green diesel (D100) planned on-stream in the year 2022 in refining and petrochemical portfolio. However, increasing palm oil plantation as biofuel feedstock leads to the increase of deforestation in medium-long term. Therefore, company requires to consider other cleaner fuel technologies R&D as an alternative to biodiesel blending in the long-run.
- Major shift in fuel demands in transportation sectors that potentially disrupt the entire company business model, strategy, value chain and profitability from upstream to downstream that threaten company position as the market leader. Hence, demand-side efficiency align with other cleaner energy technologies as an alternative is required since rapid increase of battery electric vehicles raw materials' mining can increase environmental degradation.
- Increase revenue stream for power, new and renewable energy portfolio in medium-long term. However there are main barriers, including: investor's sentiment towards the company new and renewable energy portfolio since the newly established (5 years) technologies requirement for stabilized new and renewable energy supply, e.g. energy storage, centralized electrification system creates uncompetitive tariffs from monopoly power-off taker.
- Increase revenue stream for downstream, power, new and renewable energy portfolio in the long-run, but potentially reduce the revenue in upstream oil and gas portfolio that affects company profitability. However, upstream oil and gas potentially generates higher revenue stream in short-medium term, but, declining RRR, capital-intensive investments, oil price volatility, GHG emission and ESG investment trend will put the upstream investment in higher risk, therefore, disciplined capital allocation align with carefully calculated cost and benefit analysis, good governance, innovations, operational efficiency, and asset optimization (potentially combined between divest and invest) are required.
- Achieve GHG emission reduction target particularly in natural gas processing activities. However, CCUS development is capital and energy-intensive, so that carefully calculated economic and benefit analysis are strongly required to determine the economic feasibility in accordance to the carbon market implementation. Integrated CCUS development that captured CO₂ and transformed it into useful commodity material and chemicals will increase the economic feasibility as well as reduce GHG emission.
- Increase revenue stream and reduce GHG emission, particularly for natural gas processing, downstream, refining and petrochemical power, new and renewables portfolio e.g. by establishing integrated hydrogen hub in the long-run. However, rapid technological advancement align with the decreasing hydrogen production cost will creates major shift in fuel demands, that can disrupt the entire company business model, strategy and value chain from upstream to downstream that can put company profitability at risk in the long-run. Therefore, company established research and technology center that focused on R&D, particularly in hydrogen utilization roadmap.

Technological Forces (T)	Impacts to Current Strategy
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- Global warming could likely to reach 15C between 2030 and 2052 [23].
- Indonesia belongs to the top 30 emitters in the world, with total CO₂ emission approximately 590 MtCO₂ [21] where the energy supply sector as the biggest GHG emitters contributes for 43.83% dominated by 90% CO₂ [8], and have to reduce its GHG emission for 314-398 MtCO₂ in the year 2030 [12].
- Transportation sector GHG emission increase by 7.17%/year align with the increase in fuel consumption by 7.56%/year and projected to increase [8].
- Investment gap to reduce GHG emission below 15C level where the company has established GHG Emission reduction roadmap, plan to cut down GHG Emission by 29% in the year 2030 compared to year 2020 level.
- Upstream oil and gas, refineries and petrochemical currently are the biggest GHG emitters that represent for more than 50% of company main business portfolio, investments, expenditures and innovations are required to reduce GHG emission.
- Establishment of higher RON and biodiesel blending in fuel products diversification, battery swap and EV charging facilities development in downstream portfolio to cut

down GHG emission. However, since the rapid growth of cleaner energy technology, company must accelerate its R&D amidst disruption risk align with demand-side efficiency.

- Global pandemic slow recovery, since China announced lockdown, appearance of new cases of new variants also contributes to slow down the global economic growth, where forecast to drop between 3.1-3.6% in the year 2022-2023 according to Health Ministry.
- Indonesia average air temperature increase 0.3C in March 2022, the 9th highest anomaly since the year 1981 according to Indonesia Meteorology, Climatology and Geophysics Agency.
- Rainfall intensity of 20 mm/day category tends to increase by 0.624% every decades according to Indonesia Meteorology, Climatology and Geophysics Agency.
- Prolonged demand cut during pandemic recovery will put company revenue and profitability at risk in short-medium term, since it also slowed down the economic activities as well as company operational activities.
- Increasing air temperature would cause drought that can put operational activities at risk, particularly in upstream, refining and petrochemical portfolio as the biggest contributor of water usage.
- Increasing rainfall intensity would create higher risk of flood, landslide and lighting intensity that put operating facilities at risk (damage) and the projects delay that can reduce company performance e.g. increasing emergency or unexpected expenditures.

Legal Forces (L)	Impacts to Current Strategy
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- Law of the Republic Indonesia No. 22 year 2001 concerning the implementation of oil and gas business activities also the establishment of the company as limited corporation state-owned enterprise.
- Ministry of Energy and Mineral Resources Regulation No. 4 year 2020 amendment from Regulation No. 50 year 2017 concerning renewable energy utilization for electricity supply.
- Ministry of Energy and Mineral Resources Regulation No. 12 year 2020 amendment from Regulation No. 20 year 2019 concerning the update on regulation for Gross-Split Production Sharing Contracts (PSCs).
- Ministry of Energy and Mineral Resources Decree No. 13 year 2020 concerning the implementation of LNG supply, infrastructure development and conversion for electricity supply.
- Government of Indonesia Regulation No. 44 year 2021 concerning the prohibition against monopolistic practices and unfair business competition.
- Ministry of Energy and Mineral Resources Regulation No. 24 year 2021 concerning the provision and utilization of biodiesel in the palm oil plantation fund management agency's financing framework.
- Ministry of Energy and Mineral Resources Regulation No. 26 year 2021 concerning the roof-top solar PV network utilization for public interest.
- Ministry of Energy and Mineral Resources Regulation No. 69 year 2021 concerning the fuel retail price, supply and distribution.
- Production Sharing Contract (PSC) agreement as oil and gas contractor under Special Task Force to conduct upstream oil and gas business activities, both in the form of cost-recovery and gross-split scheme. However, declining RRR and longer bureaucracy in oil and gas investment can put the overall company profitability at risk since it is contribute for more than 50% of main business portfolio, while the amendment of the law is uncertain.
- Built-own-operate-transfer scheme elimination increasing new and renewable energy investment attractiveness potentially increase the revenue stream particularly for power, new and renewable energy portfolio.
- Flexibility to choose between cost-recovery and gross-split scheme under the Production Sharing Contract (PSC), particularly for mature fields oil and gas investments.
- Potentially increase revenue stream, particularly for gas portfolio. However, the uncertainty of COVID-19 pandemic recovery can prolonged demand cut that contributes to the underachievement of gas utilization.
- Company must ensure to avoid monopolistic practices and unfair competition in conducting business activities.
- Ensure biodiesel raw material feedstock, production and quality align with biodiesel blending mandates from the government. However, comprehensive monitoring and evaluation is required to maintain product quality.
- Increase revenue stream particularly for power, new and renewable energy portfolio, however the implementation currently still below expectation.
- Prolonged volatility of oil price for more than US\$ 100/barrel put the company profitability and cash flow at risk in the short-run, since the unbalance between fuel and other petroleum products e.g. LPG retail price obligation and cost of production, in addition due to dependency on oil imports.

Although the company subject to monopoly practices by pricing power, assessing the current industry dynamic environment is required since the establishment of antitrust policy that potentially increase business competition, which identified by five-forces framework [18] below:

Main Competing Sellers	Degree of Rivalry (S/M/W)	Types of Competitive Weapon
- Other upstream oil and gas contractors	S	- Higher RRR, lower cost/barrel to boost sales volume and increase revenue and profit.
- Other refinery & petrochemical businesses	W	- Broadens access to buyers by building better dealer network.
- Other fuels, other petroleum products and services	M	- Perceived value to increase revenue and market share, likely to increase cost.

- Other gas distribution services	W	- Broadens access to buyers by building better dealer network.
- Other new and renewable energy producers	S	- Broadens access to buyers by building better dealer network.

*) S : Strong; M: Moderate; W: Weak

B. Competitive Pressure of Potential Entrance

Potential Entrance	Entry Barriers (H/L)*	Expected Defending Action against New Entry
- Energy businesses' disruption strategy towards low-carbon energy technology portfolio	L	- Main business portfolios optimization, build strong-integrated energy network from upstream to downstream, strategic partnership with high-qualified suppliers/competitors, accelerating R&D, acquiring new ideas from start-ups that align with company strategy.
- Low-carbon energy technology's start-ups	H	

*) H: High; L: Low

C. Firms in Other Industries Offering Substitute Product

Firms Offering Substitute Products	Competitive Pressure (S/W)*	Explanation
- EV charging station development by state-owned enterprise	S	- Increase competitive pressure since the competitor investing in added capacity.
- EV charging station development by EV manufacturers.	S	- Manufacturers' EV ecosystem increase competitive pressure.
- Oil companies' EV charging station development	W	- Market power currently dominated by state-owned enterprise and manufacturers.
- Coal-fired power generation	S	- Coal-fired power generation offering stable electricity supply as an alternative substitute for gas.

D. Suppliers Bargaining Power

Suppliers	Bargaining Power (S/W)*	Explanation
- Goods and services suppliers across main business portfolios	S	- Dominated by a few large suppliers, where state-owned enterprises required to conduct synergy, goods and services fabricated or produced domestically by developing local labors unless the technologies are unavailable or lack of capabilities in domestic market in terms of procurement of goods and services, and registered in Indonesia Special Task Force for Upstream Oil and Gas Activities for upstream oil and gas procurement.

*) S: Strong; W: Weak

E. Buyers Bargaining Power

Buyers	Bargaining Power (S/D)*	Explanation
- Government	S	- Well informed about the quality, prices and costs of sellers. Ability to postpone PSO compensation.
- Fuel and petroleum products retail consumers	S	- Buyers are price-sensitive where the majority earn low income.
- Household sector gas consumers	S	- Buyers are price-sensitive where the majority earn low income.
- Industry sector gas buyers	S	- Buyers have the ability to cancel purchasing agreement.
- New and renewable energy power off-taker	S	- Buyers are currently the only and large relative to number of industry sellers.

*) S: Strong; D: Decrease

Assessing current internal environment condition to determine company strengths and weaknesses to build its strength in seizing new business opportunities and how to mitigate external threats as follows:

Table 9 - SWOT ANALYSIS [18]

Strength & Competitive Assets (S)	Weakness and Competitive Deficiencies (W)
✓ Strong presence, brand image and reputation in domestic market.	- Highly sensitive to external threats, e.g. oil price volatility, regulations.
✓ Wide geographical distribution capabilities.	- Difficulties in business operational monitoring since wide-geographical coverage and distribution.
✓ Market domination by pricing power.	- Declining RRR, internal operating problems, obsolete, under-utilized.
✓ Diversified business portfolio from upstream to downstream.	- Minimum R&D, lack of digitalization and data management culture.
✓ Stable [11] credit risk rating and Medium-Risk [12] sustainability rating.	- Uneven human capital competencies, talent and career development.
	- Highly exposure of conflict of interest.

Company has strong presence, brand-image and reputation in domestic market with wide-geographical coverage and distribution capability, broad low-cost and strategic-fit between its diversified main business portfolios from upstream to downstream. However, declining RRR, aging facilities, difficulties in operational monitoring since wide-geographical coverage, uneven human capital competencies to adapt with the current business situation, lack of digitalization and data-driven culture and highly exposure to conflict of interest contributes to the underperformance.

Market Opportunities (O)	Current External Threats (T)
✓ Low-carbon fuels production by strongly-integrating upstream to downstream business portfolio. ✓ Investing or acquiring new clean energy technologies or ideas from start-ups, small-medium enterprises that align with company strategy. ✓ Strengthen and expand current domestic commercial business by improving product quality and services. ✓ Battery storage business development to stabilize the utilization of new and renewable energy power generation by strategic partnership with high-experience and qualified parties, with environmental aspect consideration.	- Prolonged COVID-19 pandemics and global energy supply disruption increase the oil price volatility. - Prolonged PSO compensation can put company cash flow, profitability and credit worthiness at risk. - Rapid technological advancement in cleaner energy technologies can increase black-swan [25] risk that potentially disrupt the current company business strategy & model. - Carbon tax implementation for business that emit CO₂ can put company profitability at risk. - Increasing air temperature and rainfall intensity that caused drought, flood, landslide, lightning and sedimentation that can put the overall company performance at risk.

Implication to Improve Current Company Strategy (O-T)

Company already has diversify integrated business from upstream to downstream that creates opportunities to develop cleaner energy in the future. However, company overall performance is highly sensitive to external environment, e.g. volatility of oil price, regulations, rapid technological advancement of cleaner energy that potentially disrupt the whole company business model and strategy, increasing competition which can reduce company profitability in the long run. Therefore, it is require to conduct strategic energy portfolio optimization to enhance company resilience during uncertainty condition while reducing GHG emission.

Analyzing internal important resources and capabilities to measure company's competitive assets to measure whether it can support a sustainable competitive advantages over market rivals and business strategy as follows:

Table 10 - VRIO ANALYSIS [14]

Resources	Type (T/I)*	Valuable (V)	Rare (R)	Costly to Imitate (I)	Organized to Capture Value (O)	Competitive Advantages (S/D/P/T)*
A. Physical Resources						
Land Building	T	✓	✓	✓	✓	S
Plants	T	✓	✓	✓	X	T
Distribution	T	✓	✓	✓	X	T
Integrated Network	T	✓	✓	✓	X	T
Natural Resources	T	✓	✓	✓	X	T
Access Right	T	✓	✓	✓	X	T
B. Financial Resources						
Cash Equivalent	T	✓	✓	✓	X	T
Marketable Securities	T	✓	✓	✓	✓	S
Credit Ratings	T	✓	✓	✓	X	T
Borrowing Capacity	T	✓	✓	✓	X	T
C. Technological Assets						
Patents	T	✓	✓	✓	✓	T
Copyrights	T	✓	✓	✓	✓	T
Production Technology	T	✓	✓	✓	✓	T
Innovation Technology	T	✓	✓	✓	✓	T
Technological Process	T	✓	✓	✓	✓	T
D. Organizational Resources						
IT, Servers, Workstation, Communication System, etc.	T	✓	✓	✓	X	T
Planning, Coordination and Control System	T	✓	✓	✓	X	T
Organizational Design	T	✓	✓	✓	X	T
Reporting	T	✓	✓	✓	X	T
E. Human Assets and Intellectual Capital						
Education, Experience, Knowledge, Talent	I	✓	✓	✓	X	T
Learning, Tacit Knowledge	I	✓	✓	✓	X	T
Intellectual Capital and Work Group	I	✓	✓	✓	X	T
Managerial & Leadership Skill	I	✓	✓	✓	X	T
F. Brands, Company Image, Reputational Assets						
Brand Names, Trademarks	I	✓	✓	✓	✓	S
Products, Company Images	I	✓	✓	✓	✓	S
Loyalty and Goodwill	I	✓	✓	✓	✓	✓
Quality, Service, Reliability	I	✓	✓	✓	X	T
Reputation with Suppliers and Partners	I	✓	✓	✓	✓	S
G. Relationships						
Alliances, Joint Ventures, Partnerships	I	✓	✓	✓	✓	S
Network, Dealers, Distributor	I	✓	✓	✓	✓	S

H. Company Culture and Incentive System						
Business Behavior Principles	I	√	√	√	X	T
Ingrained Beliefs within Company Personnel	I	√	√	√	X	T
Attachment to Company Ideals	I	√	√	√	X	T
Compensation System	I	√	√	√	X	T
Motivation Level of Company Personnel	I	√	√	√	X	T

*) T: Tangible; I: Intangible; **) S: Sustainable; D: Disadvantages; P: Parity; T: Temporary

Table X shows that company has sustainable competitive tangible both physical and technological assets as well as intangible brand images, reputation and relationship with partners. However, access right of natural resources e.g. oil is considered as temporary competitive, product and quality considered as temporary since it is require to improve as the competition increase, postponed compensation from the government that put company cash flow at risk since it can reduce credit ratings and borrowing capacity. Building excellent company culture and human capital are essential for the company to align between human capital capabilities with business strategy to increase productivity and giving sustainable added-value to stakeholders, where productivity and added-value overtime will create sustainable competitive advantage.

Analyzing stakeholders' impact to recognize, prioritize and address the needs of different stakeholders to manage effectively in order to gain sustainable competitive advantage as a strategic stakeholder management, where the stakeholders involved identified below:

Table 11 - STAKEHOLDER IMPACT ANALYSIS [14]

Stakeholders	Power Interest	Opportunities to Company	Threats to Company	Company Responsibility (Economic/Legal/Ethical)	Company Action
A. External Stakeholders					
Suppliers	High Power/ High Interest	Collaboration, exchange knowledge	Increase bargaining power, reduce ability to determine reasonable price	Economic, Legal and Ethical	Engage closely with GCG (18)
Alliance Partners	High Power/ High Interest	Expand market-share, exchange knowledge, collaboration	Underperformance, different goals & potentially creates conflict	Economic, Legal and Ethical	Engage closely with GCG (18)
Buyers	High Power/ Low Interest	Pricing-power	Reduce company profitability since consumers tend to economize	Economic	Diversify portfolio, demand-side efficiency
Government	High Power/ Low Interest	Legal certainty	Legal uncertainties, unsupportive regulation	Economic, Legal and Ethical	Monitoring, evaluation, reporting
Union	High Power/ Low Interest	Increase productivity	Conflict of interest	Economic, Legal and Ethical	Engage closely with GCG (18)
Creditors	Low Power/ High Interest	Increase capital for business expansion	Financial under-performance	Economic, Legal and Ethical	Maintain relationship
Communities	Low Power/ High Interest	Increase image & reputation	Conflict of interest	Economic, Legal and Ethical	Monitoring, evaluation
Media	Low Power/ High Interest	Increase image & reputation	Conflict of interest	Economic, Legal and Ethical	Monitoring, evaluation
Competitors	Low Power/ Low Interest	Increase performance, innovation, R&D	Unhealthy competition	Ethical	
B. Internal Stakeholders					
Employee	High Power/ High Interest	Increase productivity, organizational capabilities	Difficulties in talent development monitoring & evaluation	Economic, Legal and Ethical	Build excellent company culture
Commissionaire	High Power/ Low Interest	Aligning company aspiration & strategies with government agendas	Potential conflict of interest	Economic, Legal and Ethical	Credible & transparent performance reporting
C. Decision Makers					
Chief Executive Officer (CEO)	High Power/ High Interest	Providing strategic direction	Potential conflict of interest	Economic, Legal and Ethical	Credible & transparent performance reporting
Board of Directors (BOD)	High Power/ High Interest	Aligning CEO strategic direction to the organization	Potential Conflict of interest	Economic, Legal and Ethical	Credible & transparent performance reporting
Senior Executives	High Power/ High Interest	Providing business unit's strategic direction align with BOD & CEO	Potential Conflict of interest	Economic, Legal and Ethical	Credible & transparent performance reporting

4) Strategic Formulation: Strategic formulation [14] to optimize energy portfolio as well as to unlock new values as an adaptive strategy towards climate change mitigation in corporate level, conduct as follows:

Driving forces [3] identified from both external and internal business environment analysis in the industry and the impacts against the current corporate energy portfolio strategy represent below:

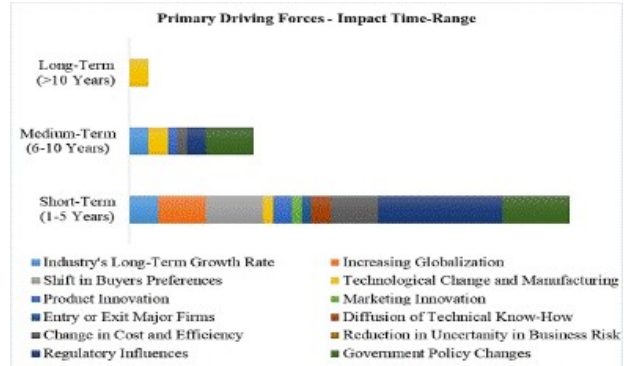


Fig. 4. Driving Forces Impact Time Range

Fig. 4 shows that regulatory influence, government policy changes shift in buyer preferences, increasing globalization, change in cost and efficiency projected to give short-term impact to the current corporate strategy. However, technological advancement in cleaner energy technologies potentially increase black-swan [25] effect that cause disruption to the current corporate's energy portfolio strategy in short, medium, or even long term, since the increase in regulatory, legal and bureaucratic risk, where the former issues usually reflects on administrative barriers and catastrophic risk since widespread events create several impacts in the occurrence area, e.g. socio-political instability, epidemics and natural hazards.

Analyzing critical uncertainties [3] that influence the driving forces since it is difficult to assign any probabilities of future random events, represent as follows:

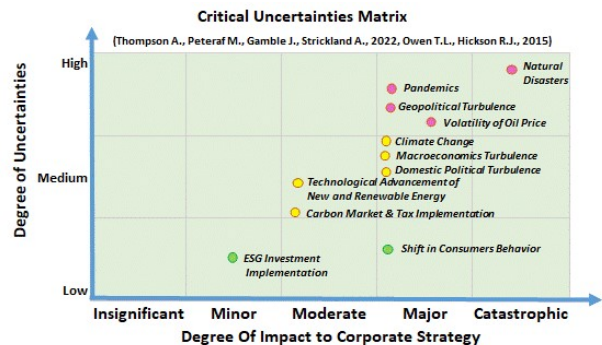


Fig. 5. Critical Uncertainties Matrix

Fig. 5 shows that oil price volatility, both fall and surging can reduce the ability of the current corporate's energy portfolio strategy to achieve profitability. Therefore, the company required to build shock-absorber in mitigating the consequences or disturbances of the critical uncertainties to enhance its resiliency in ensuring national energy security to be equally accessible and affordable throughout society while reducing GHG emission.

Optimizing current company energy portfolio strategy to improve long-term company performance using scenario planning approach to anticipate plausible future and influence future decision [14] conducts as follows:

Analyzing system dynamic [1] of interdependency and interactions between company's current energy portfolio strategy, external-internal business environment, critical uncertainties, and the interventions:

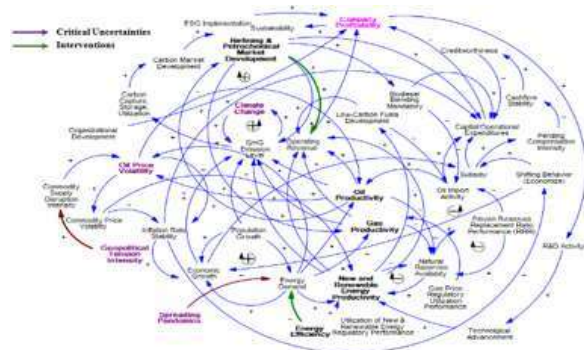


Fig. 6. Company's Strategic Energy Portfolio Optimization System Dynamics Model

Fig. 6 shows that energy efficiency intervention in the demand-side expected to increase energy saving in oil consumption to reduce oil import to enhance cleaner energy technologies development in short-term. Integrated refining and petrochemical market development aims to optimize the existing portfolio to generate new revenue stream to enhance profitability in short-medium term, to give additional fund for the company to increase its R&D in cleaner energy technologies to prevent major disruption in the long-run, by creating strong-integrated energy network from upstream to downstream align with GHG emission monetization from CO₂ capturing activity, e.g. utilization for industrial purpose to minimize stranded

assets. There are several scenarios of energy portfolio composition to optimize the outcomes, conduct using stock and flow diagram simulation [1] in accordance to Fig.4:

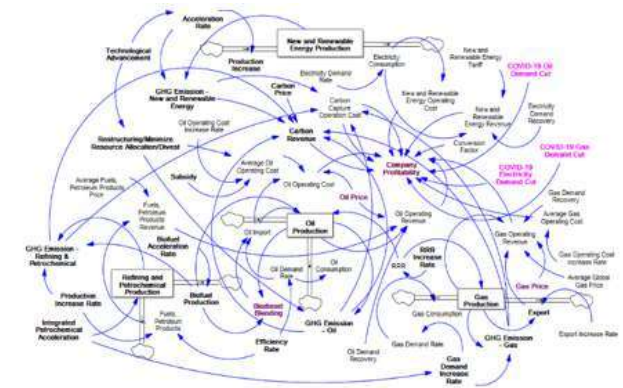


Fig. 7. Stock and Flow Diagram

Stock and flow diagram scenario simulation's primary equations described in the table below:

Stock and flow diagram scenario simulation's primary equations described in the table below:

Table 2 - STOCK AND FLOW DIAGRAM EQUATIONS

Primary Stock			
Variables	Unit	Initial Value	Equations
Oil Production	Barrels Oil/Day	870,000 [10]	(Oil Import-Oil Consumption-Biofuel Production)/RRR
Refining and Petrochemical Production	Thousand Barrels	300,000 [10]	(-Biofuel Production-Fuels, Petroleum Products)/Integrated Petrochemical Acceleration
Gas Production	Million Standard Cubic Feet/Day	2,634 [10]	-Gas Consumption+(Gas Production*RRR)-Export
New and Renewable Energy Production	Gigawatt hour	4,637 [10]	(Oil Import-Oil Consumption-Biofuel Production)/RRR
Oil Import	Barrels Oil/Day	110,000 [8]	(-Biofuel Production-Fuels, Petroleum Products)/Integrated Petrochemical Acceleration
Oil Consumption	Barrel Oil/Day	14e+06 [8]	-Gas Consumption+(Gas Production*RRR)-Export
Oil Demand Rate	1/Year	0.021 [12]	Assumption
Oil Price	US\$/Barrel	30, 60,120	Proven Reserves Replacement Ratio (RRR)*RRR Increase Rate ((Oil Production/365)* (GHG Emission - Oil)*(-(Restructuring/Minimize Resource Allocation/Divest)* (GHG Emission - Oil))
RRR	Dmnl	1.02 [11]	Biofuel Production *Biofuel Acceleration Rate
GHG Emission-Oil	Million TonCO2eq/Day	0.0217 [12]	Electricity Consumption *Electricity Demand Rate
Biofuel Production	Barrels Oil/Day	0.5438 [10]	Fuels, Petroleum Products -(Fuels, Petroleum Products*Production Increase Rate))
Electricity	Gigawatt hour/Day	12.70 [10]	(GHG Emission - Refining & Petrochemical Production/365)* (GHG Emission - Refining & Petrochemical Production/365)* Production Increase Rate)
Fuels, Petroleum Products	Barrels Oil/Day	82.19 [10]	Production Increase New and Renewable Energy*Acceleration Rate (New and Renewable Energy Production)*Acceleration Rate
GHG Emission - Refining & Petrochemical	Million TonCO2eq/Day	0.02 [10]	Gas Demand Rate*Gas Consumption
Production Increase New and Renewable Energy	Gigawatt hour	3,000 [10]	GHG Emission - Gas *(Gas Production/365)*Gas Demand Increase Rate
GHG Emission - New and Renewable Energy	MillionTon CO2eq/Day	0.00054 [11]	Ministry of Energy and Mineral Resources Regulation No. 8 year 2020 [6]
Gas Consumption	Standard Cubic Feet/Day	68459[10]	Price Floor
GHG Emission - Gas	MillionTon CO2eq/Day	0.0022	Assumption
Gas Price	US\$/ Million British Thermal Unit	6	
Carbon Market Price	US\$/ MillionTon CO2eq	50, 75[5]	

B. Strategic Plans to Address Future Scenario

Table 13 - STRATEGIC ENERGY PORTFOLIO OPTIMIZATION SCENARIOS

Energy Portfolio Optimization Scenario	Primary Stock		
	Low	Base	High
Scenario	US\$30/Barrel	US\$60/Barrel	US\$ 120/Barrel
Scenario 1	60% Oil 20% Gas 10% Refining and Petrochemical (Biofuel) 10% New and Renewables RRR Increase Rate +/- 5% Energy Efficiency Increase Rate +/- 2%/year		
Scenario 2	45% Oil 25% Gas 15% Refining and Petrochemical (Biofuel, Petrochemical Integration) 15% New and Renewables (Technological Advancement of New and Renewable Energy) RRR Increase Rate +/- 10%/year Energy Efficiency Increase Rate +/- 3%/year		
Scenario 3	35% Oil 25% Gas 20% Refining and Petrochemical (Biofuel, Petrochemical Integration) 20% New and Renewables (Technological Advancement of New and Renewable Energy) RRR Increase Rate +/- 5%/year Energy Efficiency Increase Rate +/- 4%/year		
Scenario 4	25% Oil 25% Gas 25% Refining and Petrochemical (Biofuel, Petrochemical Integration) 25% New and Renewables (Technological Advancement of New and Renewable Energy e.g. Low Carbon-Fuels, Battery Storage Manufacturing) RRR Increase Rate +/- 20%/year Energy Efficiency Increase Rate +/- 5%/year Carbon Market Price Implementation +/- US\$50-75/tonCO2eq		

III. RESULTS

A. Strategic Energy Portfolio Optimization Scenario Simulation Results

Table 13 - STRATEGIC ENERGY PORTFOLIO OPTIMIZATION SCENARIOS

A. Energy Portfolio Optimization Scenario

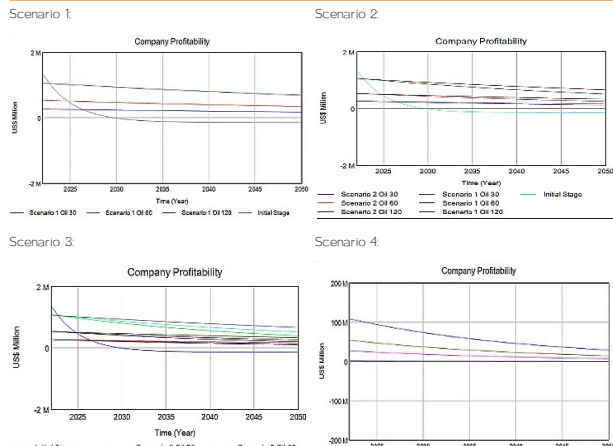


Fig. 8. Strategic Plans to Address Future Scenario

B. Strategic Plans to Address Future Scenario

Strategic plans to address future scenario according to the simulations' analysis as follows:

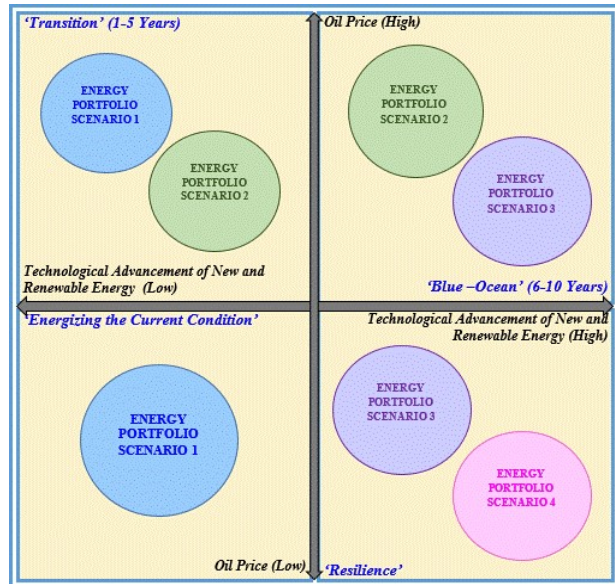
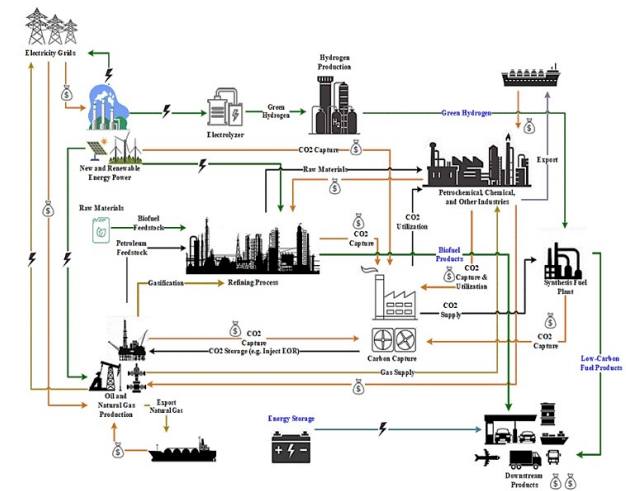


Fig. 9. Proposed Future Business Model

C. Proposed Future Business Model

Future business model to address the strategic energy portfolio optimization scenarios:



D. Early Warnings

Early warning signals, which are the leading indicators that highlight the likely emergence of one scenario to another to determine the adaptive strategy that the company should consider in the future, show that the company requires to evaluate the current corporate strategy as well as to accelerate the transition stage within 1-5 years from now.

IV. DISCUSSION

Since the scenario approach is not a one-time event, integration with the current business strategy is required to determine prioritization as well as the implication in terms of gaps, vulnerability, options or mitigation by embedding external risk factors in the current company's risk register, which expected to help the company identify the events beyond the company's control, particularly in facing the increasing uncertainties and to determine the climate change mitigation strategy in the implementation plan.

V. CONCLUSION

According to the scenario simulations and analysis, the conclusions found and recommendations as follows:

Strategic plans show that by gradually optimizing 10-25% of the company's new and renewable energy portfolio and integrating refining and petrochemical portfolio as a new revenue stream by building strong-integrated energy network from upstream to downstream to produce low-carbon fuels align with the implementation of circular carbon economy, e.g. carbon market price that expected to reach US\$50-75/tonCO₂eq will enhance the company profitability, in facing the uncertainty of oil price volatility, technological advancement and the declined cost of renewable energy, countries increasing commitment towards net-zero emission target, of Environmental, Social and Governance (ESG) global investment trend, and oil reserves structural declined projection in the long-run.

Common purpose as well as making smooth-transition both in the internal organization and government support are strongly required to achieve the company's strategic objectives.

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