



SWOT and Impact Analysis for Indonesia Upstream Oil and Gas Industry to Survive from COVID-19 Pandemic and New Normal Forecast

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Abstract.

Numerous oil and gas companies globally have experienced low oil prices and difficulty of operation, due to the destruction of demand associated with COVID-19. They are also facing a high oversupply of oil than the demand. Indonesia's oil and gas industry plays a pivotal role in driving the nation's economy. The upstream sector is generally considered essential by government and has been most familiar with safety and health management issues. However, continued upstream operations will likely become increasingly difficult due to economic and operation shortages. Employees being exposed to the COVID-19 and the practical difficulties in many cases of social distancing have disrupted the normal workflow. The objectives of the paper are to perform a SWOT analysis model, conduct impact analysis for the Indonesia's upstream oil and gas industry in dealing COVID-19, and forecast new normal post-COVID-19.

Keyword: SWOT modeling, impact analysis, upstream, COVID-19, new normal

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1. Introduction

Even though Indonesia has managed to rank 11th in the global gas production and 23rd in the global oil production, the country did not get to survive the declining oil and gas production due to the COVID-19 pandemic. In February 2020, Indonesia produced 729.83 thousands of barrels per day until the number slowly decreases. Notably in April 2020, when the production reached a mere 720.69 thousands of barrels per day. This leads to an increase in consumption rate and has resulted in Indonesia being a net oil importer.

Indonesia's upstream oil and gas industry is currently facing an unprecedented crisis. The crude oil price has been fluctuating for more than ten years, yet this year's global Brent crude oil price has taken the biggest plunge as the price fell to 31.13 USD per barrel.



The matter also affects Indonesia's oil and gas industry since the falling oil price urges Indonesia to revise down its annual oil production outlook from IDR 192.04 trillion to IDR 100.16 trillion. Aside from crude oil price fall, workforce productivity has also been going down due to the preventive protocols taken to dampen the spread of coronavirus. The number of workers in the fields has been reduced to maintain safe distances. Several national strategic upstream gas projects are also held back due to the pandemic, namely the Abadi field in Masela Block, near Maluku; Indonesia Deepwater Development (IDD) in the Makassar strait; Tangguh Train 3 in West Papua; and Jambaran Tiung Biru (JBT) in East Java. The four projects boast a combined value of 37.21 million USD. Although the projects offer high economical and material gain to the industry, the lack of manpower and currently low-priced crude oil are major factors that hamper the projects' development.

The pandemic also cuts down petroleum consumption and demand due to the economic repercussions. A decrease in oil and gas consumption is a product of lower industrial productivity and restrictions on using transportations. Furthermore, the exchange rate of the Indonesian Rupiah has fluctuated in the past few months. In March 2020, Indonesian Rupiah dropped to IDR 16.575 per USD. However, in April, the currency rose to IDR 15.880 per USD. The uncertainty that has been created by the shift of the exchange rate affects the oil and gas industry, since lower exchange rates lessens the demand for foreign products including crude oil.

As the economy and the industry are slowly going up in the new normal era, oil and gas production is facing new challenges. According to World Data Atlas analytics, Indonesia's oil consumption rate exceeds the production, with 1,514.37 thousand barrels for consumption, yet only 709.5 thousand barrels per day for production. Moreover, the imports have exceeded exports since 2012. If the trends of the past years persist, with the current oil and gas production rate during the pandemic, we could exacerbate the gap between supply and demand.

2. Methodology

To strengthen and support our analysis, a step by step study is proposed as per below chart to get the actual data and predict the ongoing and future situation. As the main problem of this paper is not tangible, a qualitative approach is used. When trying to reflect the adverse effect of COVID-19 on the upstream oil and gas industry, one should not disregard the industry's performance throughout the years: how it operates, past and current projects, average production and consumption reports, and how they correlate to the economy. These variables are usually not susceptible to quantitative methods of counting and measuring. Major companies' perspective and field reports directly derived from experts in the field are all crucial in conceiving a whole impact analysis.

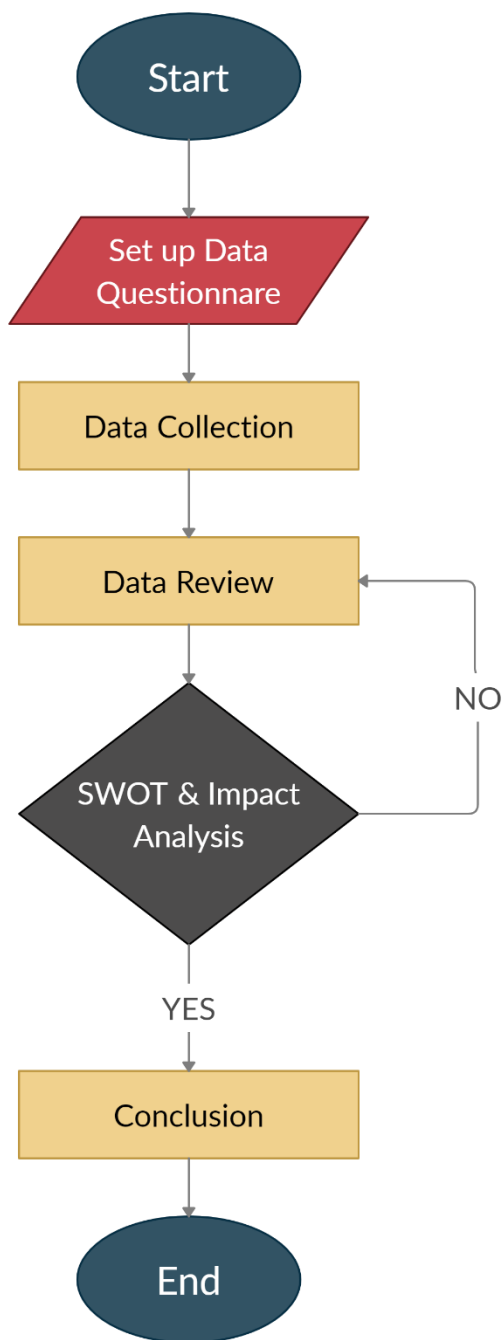


Figure 1. Methodology of this Paper



The basis for this study is an in-depth interview conducted with an expert on the oil and gas industry. As a methodology, the current condition of Indonesia's upstream oil and gas is gathered via questionnaire. The questionnaire was directed towards the oil and gas companies across Indonesia, upstream service companies, and SKK Migas. The subject of the questionnaire revolves around CAPEX/OPEX, exploration and production activities, new field development projects, and existing mature fields.

Following the data gathering, a SWOT analysis based on the collected data was developed using skeleton approach. SWOT analysis consists of strength, weakness, opportunity, and threats. This approach is taken to see different points of view of the oil and gas industry. From a SWOT analysis, strategic suggestions will emerge. As strengths can minimize threats and take advantage of opportunities, this analysis will help the industry identify the strategic plan needed for the upcoming years. Discovering weaknesses in a SWOT analysis could also drive the industry to develop more and be better post-COVID-19 pandemic. Recognizing the shortcomings will lead the industry to figure out the threats and risks that exist. Complete comprehension of the industry's SWOT will support the oil and gas industry's pathway to make a better future.

Variables from the SWOT analysis are then divided into sections and quantified. The total amount of strengths is subtracted by the total amount of weaknesses. Similarly, the overall number of threats is subtracted from the overall number of opportunities. Both calculation yields are then summed together, divided by the total amount of variables, and multiplied by 100%. The result is a percentage which depicts the overall impact of the industry. Both the SWOT analysis and impact modelling are used to project a new normal forecast to help the industry survive its current predicament, particularly the COVID-19 pandemic.



3. Result and Discussion

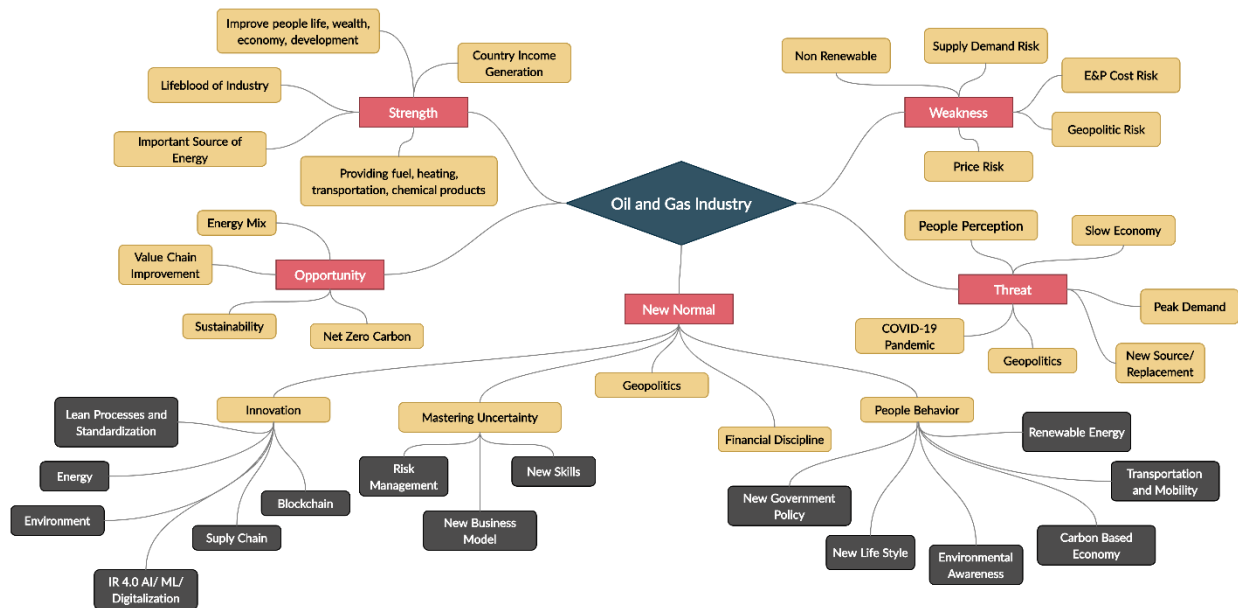


Figure 2. SWOT Analysis and New Normal Forecast of The Oil and Gas Industry

In Figure 2, the results of the analysis towards Indonesia’s upstream petroleum sector are shown with a skeleton figure. The skeleton represents each and every positive and negative impact from the oil and gas industry. Furthermore, it shows the opportunity that could have been taken and the threats that could hinder the development of the industry. The figure also lays out the new normal forecast surrounding the industry and what the future may bring.

The skeleton approach is used to map out the SWOT of Indonesia’s upstream oil and gas industry. From the SWOT, the strengths and weaknesses are analyzed and thoroughly explained. Likewise, the opportunities and threats encircling the industry are explored and analyzed to further determine the new normal forecast.

Strength

Energy and mineral resources are the biggest contributor to the country’s non-tax revenue, with oil and gas being the primary driver. The sector has been thriving, with its non-tax revenue increasing steadily since 2015. In 2016, non-tax revenue of the energy and mineral sector reached IDR 79.1 trillion which amplified to IDR 217.8 trillion in 2018. During 2019, the amount dropped to IDR 172.9 trillion from the projected target of IDR 214.3 trillion. However, the petroleum industry still played a major role in holding the sector together, holding a share of IDR 115.1 trillion in revenue. Investment on the petroleum industry reached 12.5 billion USD in 2019 which also has the biggest share in the entire energy and mineral sector’s investments. Meanwhile, the petrochemical industry’s contribution to the nation’s



non-tax revenue has been quite stable, ranging between 0.64% to 0.75% of the total revenue from 2015 to 2019. In 2019, the industry contributed to 0.66% of the revenue. According to BCG, before the fall in oil prices in 2013, the sector generated 28 billion USD a year in foreign income, provided 20% of the government's revenues, and supported 280,000 jobs.

Regardless of fluctuations in price, expenses on E&P projects, and its identity as an untenable energy, oil and gas industry is fundamental in every aspect of human's life. As a developing country, Indonesia depends on oil and gas exploitation for energy supply and petroleum has long been a major pillar of the country's economy. Indonesia's primary energy consumption data from BP Statistical Review of World Energy 2020 showed that oil took account for 37.93% energy consumption, while natural gas accounted for 17.73% of consumption. Crude oil is also necessary for creating petrochemical products, for instance synthetic fibers, plastics, rubbers, etc.

Geographically, Indonesia has highly potent petroleum basins. Indonesia's oil reserves are proven to hold 3.2 billion barrels at the end of 2018, as stated by the BP Statistical Review of World Energy 2019. As of now, the government has also declared several new upstream oil and gas strategic projects, namely the Jangkrik field development, Tangguh Train-3, the Indonesia Deepwater Development (IDD) Project, and Inpex's Abadi field development, though only the Jangkrik Floating Production Unit (FPU) has started production activities, starting from May 2017.

Indonesia's Special Task Force for Upstream Oil and Gas Business Activities, known as SKK Migas, noted the availability of Indonesia's 42 oil and gas main projects until 2027 which is expected to require the investment of 43.3 billion USD. Following the finding of 2 trillion cubic feet (TCF) of potential gas reserves in the Sakakemang working area in South Sumatera, SKK Migas also noted ten potential areas for giant discovery and it plans on obtaining additional investors for potential working areas.

Weakness

As the national economic growth thrives (projected at 5.2% per year through 2025) whilst oil and gas production from maturing fields decline, Indonesia consumes more energy than it produces. In 2015, domestic production of oil and gas covered less than half of the total consumption, and the gap between supply and demand is expected to increase. The increase in gap follows the trend from 2010 through 2015 with production declining by approximately 3.5% a year while domestic consumption increased by 1.1%.

According to BCG, the perseverance of current trends in Indonesia's oil and gas production will exacerbate the gap between the energy supply and its demand up to 2.3 million barrels of oil equivalent per day by 2026. Importing oil will likely increase up to 2.5 times its production which puts Indonesia in an unfavorable position in the country's currency and energy security. Not to mention how there is a huge difference between the rate of new reserve discoveries compared to reserve depletion; SKK Migas noted the investment in exploration areas was a mere 122 thousand USD in 2018, compared to the 10.92 billion USD invested in exploitation areas. Upstream oil and gas investments from 2008 to 2018 can be seen in the table below.



Table 1. Upstream Oil and Gas Investments (in million USD)

Type of Operation	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Exploration	532	633	670	719	1,439	1,877	1,735	1,345	1,078	565	546
Administration	981	730	833	958	1,016	1,199	1,157	1,286	702	944	873
Development	2,523	2,671	2,495	3,149	3,288	4,306	4,048	2,116	1,322	705	1,310
Production	6,579	6,391	7,033	9,196	10,370	11,960	12,336	10,883	8,156	8,053	8,189
Total Expenditure	10,615	10,425	11,031	14,022	16,113	19,342	19,275	15,630	11,258	10,267	10,918

Source: PwC, 2019

The natural maturation of older oil fields and the slow reserve replacement rate combined with decreased exploration and investment made up the reason for Indonesia's crude oil production decline over the last decade. Derived from PwC's 2019 report, Indonesia's crude oil production in 2018 was slightly reduced from 2017's 804 thousand barrels of oil per day (MBOPD) to about 772 MBOPD. The daily oil lifting target in 2019 was also reduced slightly from 2018's target, being only 775 MBOPD from the previous year's 800 MBOPD. Since there are only a few significant oil discoveries in Western Indonesia in the last decade, Indonesia still relies on the declining mature fields.

Indonesia's oil and gas reserves are still ripe, yet the uncovered potential seems to be in vain since oil and gas contractors have lost their interest in investing in oil explorations. The lost of interest is due to the high risk and high cost of available regions' explorations despite valuable prospects; declining revenue and reduction in assets for investments, cutting exploration expenditures; uncertain regulations; and long timelines for developing projects.

Volatility is an inherent characteristic of oil and gas prices. Fluctuating price is not a new thing in the industry, since a great deal of aspects play a part in deciding the end price. For instance, crude oil price is affected by the supply (from OPEC and non-OPEC countries, with OPEC countries contributing more to the chart), physical inventories (which amount helps predict the near term prices relative to prices in the near future), market participants (oil producers, airlines, banks, etc) and demand (each countries' difference in economic structure and conditions influence the relationships among oil prices, economic growth, and oil consumptions).

Geopolitical issues play a huge role in the industry, causing fluctuating oil prices since the last quarter of 2018. Gas prices on the other hand showed a steady decline during the first half of 2019 due to mild weather and how Japan decided to restart its nuclear power reactors, causing their natural gas imports to decline. Oil price plays a huge role in exploration activities as well. The number of exploratory wells once plunged from 64 in 2014 to 35 in 2015 due to a price shock, though it recovered to 43 in 2016. Revenues from oil and gas export also decreased along the oil price, with its lowest being below 30 USD



per barrel in 2016. On the topic of exports, Indonesia's National

Statistics Agency (Badan Pusat Statistik) noted that Indonesia's oil and gas exports has long been exceeded by imports since 2012 and that this energy trade deficit may exceed other sectors' surplus in trades.

Opportunity

The energy mix of a country is the use of different energy sources to meet the country's energy consumption needs. It comes from various sources that are classified into renewable and nonrenewable sources. Renewable energy in Indonesia consists of geothermal, biomass, hydropower, and solar while nonrenewable are fossil fuels such as coal and petroleum.

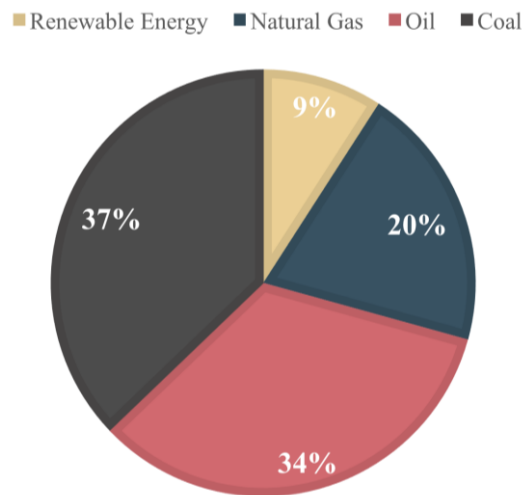


Figure 3. Primary Energy Mix in Indonesia 2019
(source: Dunia Energi, 2020)

Figure 3 shows that in 2019 renewable energy in Indonesia has only accounted for 9.15% of the primary energy fields while the other 90.85% is fulfilled by fossil fuels. Indonesia also has been struggling to meet their 2025 target to reach 23% renewable share in the primary mix. The same trend can be seen in Indonesia's power sector that has stagnated since 2011. The power ranged around 11 – 13% from 2011 – 2019 and 12.2% in 2019 with hydropower and geothermal as the main contributors to the mix. However, the stagnation and insubstantial amount of contributions of renewable energy only accounted for a small part in Indonesia's growing demand.

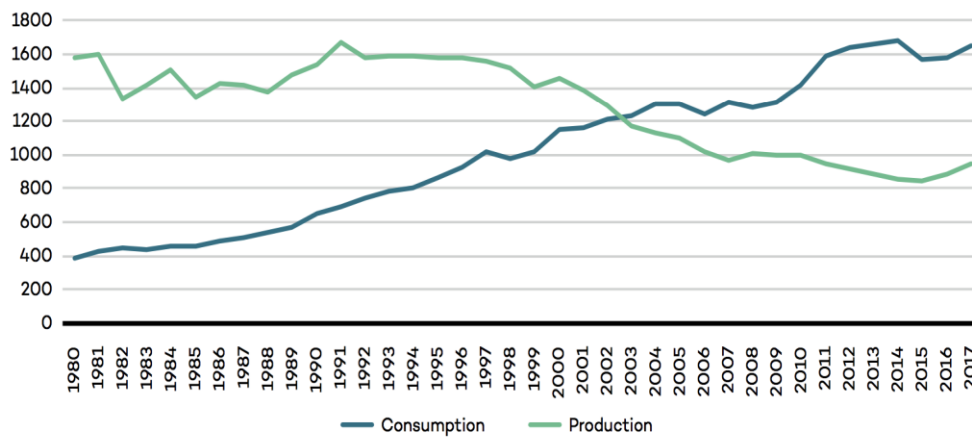


Figure 4. Production vs consumption of petroleum oil fuels in Indonesia, 1980 – 2017 (000 barrels/day)
(source: The International Institute for Sustainable Development, 2019)

As shown in figure 4, Indonesia's annual petroleum oil consumption is increasing due to the growing population, but the production of petroleum oil fuels is decreasing year by year. The growing energy demand makes it impossible to completely eliminate the use of fossil fuels to power the country. Yet, Indonesia needs to make a conscious effort to minimize the percentage of fossil fuels use while at the same time trying to optimize the use of renewable energy to keep powering the country despite the decreasing production of the petroleum industry. To keep the oil and gas industry running, they need to implement energy mix in their activities. For instance, Pertamina, Indonesia's state-owned oil and natural gas corporation is committed to expand their business into renewable energy to support Indonesia's target to reach 23% renewable share in the primary energy mix. Despite the COVID-19 pandemic, there is still a significant amount of capital available for investment in renewable energy projects in Indonesia. The oil and gas industry could keep running while diversifying their business into renewable energy.

Indonesia's LNG sector should not be overlooked as it can be one of the largest natural gas resources or exporters in the world. There are two prolonged gas project developments, the offshore Masela Block and the discovery of a gas reserve in Sakakemang Block in South Sumatra. Shell and Japan's Inpex Corp are the entities that are slated to develop the LNG facilities in the Abadi field in the Masela Block. The Masela project is expected to produce 9.5 million tons while Sakakemang block discovery is estimated to contain about 2 trillion cubic feet (tcf) of LNG.

SKK Migas and has released a statement on March 4 about the resumption of these projects may actualize Indonesia to be a leading global gas exporting country by 2030 with total production for about 12.300 million cubic feet per day (mmscfd). Nevertheless, in June 2020, this project faced a challenge with Shell reporting their 35% participating interest withdrawal in the Masela Block project due to the financial problem that was affected by the pandemic.



There is still a room for value chain improvement in the upstream industry of oil and gas. Value chain, a sequence of actions that occurs in the exploration and production site could be developed in a more general way, as digitalization could be the future of oil and gas. As we move into Society 5.0 where

innovation is driven by technologies to improve the life of humans all over the world, digitalization is approaching every sector in the industry including oil and gas. Furthermore, the COVID-19 pandemic is causing the industry to think about the competence of their value chains to compete with other industries. Integrating a smart analytics system could be the solution to optimize the industry of oil and gas.

To be able to compete with other industries, the oil and gas sector needs to integrate sustainable value into their production. Oil and gas are sustainable because they exist in great amounts and it will be around for a long time. The means of sustainability in oil and gas revolves around making improvements for a safer living environment. Moreover, sustainability is also defined as managing resources and technology to maintain and optimize its operations for a substantial economic, social and environment. There are many ways to reach sustainability in oil and gas companies, one of which is cleaner production by implementing flare gas recovery under Clean Development Mechanism (CDM). The main objective of CDM is to reduce the industry's carbon footprint. Another approach is applying water recycling for drilling fluid or frac fluid. In the upstream industry, water is needed in large quantities about 4 million gallons during the drilling and operation of unconventional gas wells. Thus, the usage of water can be optimized and reduced. Sustainable strategies implementation is needed to survive the growing population and increased energy needs, making CDM a big opportunity for the oil and gas industry.

Threats

Besides not being the first affliction for the oil and gas industry, COVID-19 pandemic impacts are very serious and have brought the industry to the most transformative and inevitable changes. Pandemic has diminished global oil demand, created excessive supply, imposed severe travel restrictions, and reduced the assets and workforce of the industry, which contributed to the collapsing oil prices, reaching the lowest level since 1999. These can't be recovered without the containment of the coronavirus. With these major impacts, the oil and gas industry will never go back to where they were before, instead facing an indelible change.

The COVID-19 pandemic also limits the supply and logistics chain in the oil and gas sector. Limitation in material transportation, facilities, and inspection equipment is happening because of safety regulations that everyone must comply with. This causes obstacles to arise at the working upstream industry of oil and gas where the industry itself is involved in domestic and international transportation, ordering and inventory, and facilitation. Some difficulties appear in supplying manufactured equipment and transporting services across borders.

When comparing the current pandemic to the falling oil prices crisis in 2014 – 2016, now the service providers are in much worse financial state resulting in reduction of equipment and associated services. This eventually hinders oil and gas project engineering and construction activities and leads to



delays in the schedule for facilities to come onstream. The restraint in daily activities of producers, service providers and equipment has created a gap along the supply and logistic chain in the industry.

In addition, the pandemic has caused delays in several activities such as operations planned shutdowns, well drilling, and also well maintenance. Since July 31th 2020, due to the current pandemic and falling oil prices, two exploration projects in SKK Migas Indonesia have been delayed and four projects are cancelled. Furthermore, in the seismic survey activities three projects have been suspended,

three more have been delayed and two have been cancelled. In the drilling development, a total of 14 standby ops (ready to operate), 17 delayed projects and 100 cancelled projects. Overall, the upstream industry in Indonesia is very much affected by the pandemic. On the account of COVID-19, oil and gas prices have fallen, and new rules regarding HSE restricts flexibility of workforce. To avoid exposure and fast spreading of the virus when working in the fields, social distancing policies are limiting the number of workers present.

Petroleum industry has been struggling with their image for quite a long time. People are seriously concerned about climate change and the environmental crisis. Global humanitarian and government sectors have escalated their concern of the importance to accelerate in changing the government policy to support transition on a lower-carbon economy. Due to this, some of the oil majors, such as Shell, BP, Chevron, Total, Eni, and Exxon, are shifting towards cleaner energy sources. They have spent billions of dollars in renewables, especially in solar and wind energy. People are trying to find new replacements for a more sustainable and clean energy.

The world may have started to transition into renewable energy, new technologies are emerging, plenty of new investments are coming for renewables. Nevertheless, crude oil and natural gas are hard to be replaced. Oil and gas industry contribute to 85% of the world energy demand and the remaining 15% are hydropower and renewables.

With the pressure from many sectors, uncertainty in oil price, and awareness of global emissions, the world is trying to find another new source like geothermal, solar, wind, and bioenergy. As a country that's located at the ring of fires and around three oceans, Indonesia has the potential to generate 14 times the country's current electricity consumption which is 788,000 MW of power from the country's renewable energy sources. The huge potential for renewable energy to be used in Indonesia is shifting the oil consumption into a precarious position. However, natural gas, which emits the least GHGs among other fossil fuels, is projected to rise up in the future and Indonesia also has large reserves of natural gas.

Indonesia's oil and gas sector contribution to the state revenue or APBN has shrunk a lot, from 70% in the 1970s to less than 5% today. Indonesia's economy is also recorded at 2.97% in the first quarter of 2020 and has shrunk up to 5.32% in the second quarter quoted from The Jakarta Post. This is because the new policies pandemic has made travel restrictions, physical distancing, and several lockdown policies. This resulted in low demand in every sector of the industry, including the oil and gas industry. This is because most of crude oil is used for transportation and industrial sectors which is shut down due to health issues. The closure or underperform of many industries combined with travel restrictions, which interfere with trade activities, causing excessive oil supply and plunged the demand.



Impact Modelling

SWOT analysis has given a gist of both the merits and shortcomings of the petroleum industry. The overall impact of the industry can be further illustrated via an impact modelling. Though there are various definitions on the matter, impact modelling ultimately serves as a method to quantify the impact of a subject on a wider range of systems; in this case, how the petroleum industry impacts the entire country.

Table 2. Strengths and Weaknesses Analysis

	Section	Sub-section	Quantification
Strength	Important Energy Source	Industries	+9
		Households	
		Transportations	
	Major Contributor to the State Revenue	Energy (non-tax)	
		Petrochemical (non-tax)	
		Foreign Income	
		Workforce	
Potent Reserves	Geological Potential		
	New Projects		
Weakness	Supply and Demand Imbalance	Production and Consumption Gap	-7
	Rate of E&P Progress	Maturing Fields	
		Lack of Investments	
	Fluctuation of Price	Supply and Demand (Market)	
		Geopolitics	
	Non-renewable	Decline in Reserves	
Unsustainable			
TOTAL			+2



Table 3. Opportunities and Threats Analysis

	Section	Sub-section	Quantification
Opportunity	Energy Mix	Renewables	+10
		Development of New Projects	
	Value Chain Improvement	Digitization	
		Smart Analytics System	
	Sustainability	Clean Development Mechanism	
		Water Recycling	
	Net Zero Carbon	Cutting Emissions	
		Reducing Gas Flare	
		Carbon Capture	
		Generating LNG from Gas Byproduct	
Threats	COVID-19	Supply and Logistics Limit	-8
		Delays in Projects	
		Decline in Price and Cutting in Expenditures	
	Geopolitics	Tension Between China and the US	
	People Perception on Petroleum Industry	Climate Change due to GHG	
		New Source/Replacement	
	Peak Demand and Slow Economy	Peak Demand	
Slow Economy			
TOTAL			+2



The tables above are a depiction of the quantification of SWOT variables. The numbers derived from the quantification is calculated using impact modelling formula. Further calculation yields the final percentage of 11.76 %. A positive percentage implies a good influence of the petroleum industry towards the nation in general. In order to keep the industry up and running, a new normal forecast is needed since it is currently facing an unprecedented crisis.

After SWOT analysis of current pandemic conditions with low oil prices, social-environmental pressure, and major uncertainties, we can say that there's no other way than to change. The "new normal" approach is not only about health and sustainability but also with massive changes in business models and developing new technologies and strategies. With fundamental changes, this industry will develop new opportunities for providing affordable energy and making extra time to shift into renewable energy.

First of all, what Indonesia's oil and gas industry must do is to attract investors. Upstream activities are the most complex and high-risk sector which needed a massive capital to operate it. Investors are a fundamental stakeholder for this. For it to be attainable, companies are urged to make innovations regarding financial and supplier market uncertainty, commodity constraints and pricing, and exchange rate fluctuations. The obvious innovation for these problems is the utilization of technology for data collecting and analysis.

4. Conclusion

The unprecedented crisis of COVID-19 pandemic has driven the oil and gas industry into a corner. A thorough analysis on the industry's impact towards the country has proven the merits of the industry and that Indonesia is not yet ready to transition from fossil towards renewable energy completely. Thus, a new normal forecast is constructed in order to guide the industry to smoothly traverse through not only the pandemic but also the shifting lifestyle and progression of clean energy. Possible new normal forecasts are as follows: low cost CAPEX and OPEX management, radical strategy in managing portfolio, E&P, JV investment and spending (financial discipline), logistic, storage, and inventory management. Furthermore, automation and digitalization will be on demand as well as innovation based on knowledge management, including HSE and organization efficiency and slim work force (new skill set). By abiding this forecast, Indonesia is expected to withstand and persevere through the pandemic, hoping to come out as one of the leading nations in the world of oil and gas.

References

- [1] 2019. *Beyond Fossil Fuels: Indonesia's Fiscal Transition*. [ebook] Geneva, Switzerland: International Institute for Sustainable Development. Available at: <<https://www.iisd.org/sites/default/files/publications/beyond-fossil-fuels-indonesia-fiscal-transition.pdf>>
- [2] 2020. *Oil And Gas In Indonesia: Investment And Taxation Guide*. 10th ed. [ebook] PwC, pp.1-19. Available at: <<https://www.pwc.com/id/en/energy-utilities-mining/assets/oil-and-gas/oil-gas-guide-2019.pdf>>
- [3] 2B1st Consulting. 2020. *Covid-19 Impacts On Oil & Gas : Operators And Long Term PART 2 - 2B1stconsulting*. [online] Available at: <<https://2b1stconsulting.com/covid-19-impacts-on-oil-gas-operators-and-long-term-part-2/>>
- [4] 2B1st Consulting. 2020. *Covid-19 Impacts On Oil & Gas : Short And Mid Term PART 1 - 2B1stconsulting*. [online] Available at: <<https://2b1stconsulting.com/covid-19-impacts-on-oil-gas-market-short-mid-and-long-term/>>



- [5] Abdulrahman, A., Huisingsh, D. and Hafkamp, W., 2015. Sustainability improvements in Egypt's oil & gas industry by implementation of flare gas recovery. *Journal of Cleaner Production*, [online] 98, pp.116-122. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0959652614013894?casa_token=QxnxXNMc2aEAAA:AA:bEOu8en1Gn-0t5AoyiMA_7raTCtaTiVji5JfV6g9P584j-C2u50cT_EzI0GS_CztjnoKUGuk9g>
- [6] Anis, M. and Siddiqui, T., 2015. Issues Impacting Sustainability in the Oil and Gas Industry. *Journal of Management and Sustainability*, [online] 5(4), p.115. Available at: <https://www.researchgate.net/publication/285629212_Issues_Impacting_Sustainability_in_the_Oil_and_Gas_Industry>.
- [7] Aravind, D., 2020. *Oil And Gas Value Chain*. [online] Hindustan Oil Exploration Company Ltd. Available at: <<https://www.hoec.com/oil-and-gas-value-chain/>>
- [8] Arif, A., 2020. Covid-19 Menurunkan Emisi Karbon Global. *Kompas*, [online] Available at: <<https://kompas.id/baca/humaniora/ilmu-pengetahuan-teknologi/2020/05/23/covid-19-menurunkan-emisi-karbon-global/>>
- [9] Asmarini, W., 2020. *UPDATE 1-Indonesia Cuts 2020 Oil, Gas Production Outlook - SKK Migas*. [online] U.S. Available at: <<https://www.reuters.com/article/indonesia-oil-production/update-1-indonesia-cuts-2020-oil-gas-production-outlook-skk-migas-idUSL3N2C42P1>>
- [10] Beck, C., etc. 2020. *The Future Is Now: How Oil And Gas Companies Can Decarbonize*. [online] McKinsey. Available at: <<https://www.mckinsey.com/industries/oil-and-gas/our-insights/the-future-is-now-how-oil-and-gas-companies-can-decarbonize?cid=other-eml-alt-mip-mck&hlkid=b73ef65d8c944969b551b7801507beb0&hctky=10170764&hdpid=b276a271-7c42-451f-be47-874d07255c98>>
- [11] Bergman, L., 2019. *Ways The Oil & Gas Industry Is Trying To Become More Sustainable And Green*. [online] Biofriendly Planet Magazine. Available at: <<https://biofriendlyplanet.com/eco-awareness/air-quality/emissions/ways-the-oil-gas-industry-is-trying-to-become-more-sustainable-and-green/>>
- [12] Bloomenthal, A., 2020. *Gross Profit Margin*. [online] Investopedia. Available at: <https://www.investopedia.com/terms/g/gross_profit_margin.asp>
- [13] Bourne, A. and Antony, M., 2017. *Expert Advice On How Oil And Gas Companies Can Increase Efficiency*. [online] IFS Blog. Available at: <<https://blog.ifs.com/2017/10/expert-advice-on-how-oil-and-gas-companies-can-increase-efficiency/>>
- [14] BP, 2020. *Statistical Review Of World Energy 2020*. Statistical Review of World Energy. [online] London: BP, p.8. Available at: <<https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2020-full-report.pdf>>
- [15] Budiartie, G., 2020. *Harga Minyak Dunia Minus, Bagaimana Nasib Harga Minyak RI?*. [online] market. Available at: <<https://www.cnbcindonesia.com/market/20200421114822-17-153345/harga-minyak-dunia-minus-bagaimana-nasib-harga-minyak-ri>>
- [16] Cindy, M., 2020. *How Hard COVID-19 Outbreak Could Hit Indonesia'S Energy Sector? - The Purnomo Yusgiantoro Center*. [online] The Purnomo Yusgiantoro Center. Available at: <<https://www.purnomoyusgiantorocenter.org/how-hard-covid-19-outbreak-could-hit-indonesias-energy-sector/>>
- [17] Climate Transparency, 2019. *Brown To Green: The G20 Transition Towards A Net-Zero Emissions Economy*. [online] Available at: <https://www.climate-transparency.org/wp-content/uploads/2019/11/B2G_2019_Indonesia.pdf>
- [18] Corporate Finance Institute. 2020. *Cash Conversion Cycle - Overview, Example, Cash Conversion Cycle Formula*. [online] Available at: <<https://corporatefinanceinstitute.com/resources/knowledge/accounting/cash-conversion-cycle/>>
- [19] Deloitte, 2020. *Is Blockchain'S Future In Oil And Gas Transformative Or Transient?*. [online] pp.1 - 9. Available at: <<https://www2.deloitte.com/content/dam/Deloitte/de/Documents/energy-resources/gx-blockchain-report-future-in-oil-and-gas.pdf>>
- [20] Dickson, D., 2020. *2020 Oil And Gas Industry Outlook*. [online] Deloitte United States. Available at: <<https://www2.deloitte.com/us/en/pages/energy-and-resources/articles/oil-and-gas-industry-outlook.html>>



- [21] Dolya, A., Martono, E. and Sastry, A., 2020. Analysis: Unlocking Indonesia's \$500b oil and gas revenue opportunity. *The Jakarta Post*, [online] Available at: <<https://www.thejakartapost.com/news/2020/03/02/analysis-unlocking-indonesia-s-500b-oil-and-gas-revenue-opportunity.html>>
- [22] Dolya, A., Sastry, A., Tamboto, E. and Rahman, F., 2017. *Indonesia'S \$120 Billion Oil And Gas Opportunity*. [online] BCG Global. Available at: <<https://www.bcg.com/publications/2017/upstream-oil-gas-energy-environment-indonesia-billion>>
- [23] Dunne, D., 2019. *The Carbon Brief Profile: Indonesia*. [online] Carbon Brief. Available at: <<https://www.carbonbrief.org/the-carbon-brief-profile-indonesia>>
- [24] EIA. 2020. *Nuclear Reactor Restarts In Japan Displacing LNG Imports In 2019 - U.S. Energy Information Administration (EIA)*. [online] Available at: <<https://www.eia.gov/todayinenergy/detail.php?id=38533>>
- [25] EIA. 2020. *Prices And Factors Affecting Prices - U.S. Energy Information Administration (EIA)*. [online] Available at: <<https://www.eia.gov/energyexplained/electricity/prices-and-factors-affecting-prices.php>>
- [26] Energy Training: Oil, Natural Gas, Power, Trading & Risk Management. Online & Classroom. n.d. *The Oil And Gas Value Chain*. [online] Available at: <<https://www.mennta.com/component/redevent/details/162-The%20Oil%20and%20Gas%20Value%20Chain.html>>
- [27] Energy Voice. 2020. *Green Hydrogen To Be Competitive With Fossil Fuels By 2040 - News For The Oil And Gas Sector*. [online] Available at: <<https://www.energyvoice.com/otherenergy/260842/green-hydrogen-competitive-fossil-fuels/>>
- [28] Euro Petroleum Consultants. 2020. *4 Ways Oil & Gas Companies Can Improve Energy Efficiency Within Their Operations*. [online] Available at: <<https://europetro.com/media/2018/4-ways-oil-gas-companies-can-improve-energy-efficiency>>
- [29] Global Business Guide. 2012. *Overview Of The Oil & Gas Sector In Indonesia*. [online] Available at: <http://www.gbgingonesia.com/en/energy/article/2011/overview_of_the_oil_gas_sector_in_indonesia.php>
- [30] Grupp, T., 2018. *Indonesia'S Nationally Determined Contribution - Climate Scorecard*. [online] Climate Scorecard. Available at: <<https://www.climatescorecard.org/2018/06/indonesias-nationally-determined-contribution/>>
- [31] Hajilary, N., Rezakazemi, M. and Shahi, A., 2020. CO2 emission reduction by zero flaring startup in gas refinery. *Materials Science for Energy Technologies*, [online] 3, pp.218-224. Available at: <<https://www.sciencedirect.com/science/article/pii/S2589299119301375>>
- [32] Harsono, N., 2020. Explainer: Delay, exiting operator, what is happening to Indonesia's strategic gas projects?. *The Jakarta Post*, [online] Available at: <<https://www.thejakartapost.com/news/2020/08/25/explainer-delay-exiting-operator-what-is-happening-to-indonesias-strategic-gas-projects.html>>
- [33] Harsono, N., 2020. Indonesia grants oil and gas companies flexibility over production sharing contracts. *The Jakarta Post*, [online] Available at: <<https://www.thejakartapost.com/news/2020/08/03/govt-grants-oil-and-gas-companies-flexibility-over-production-sharing-contracts.html>>
- [34] Harsono, N., 2020. Indonesia's oil sector in decline, but options remain. *The Jakarta Post*, [online] Available at: <<https://www.thejakartapost.com/paper/2020/08/13/indonesias-oil-sector-in-decline-but-options-remain.html>>
- [35] Harsono, N., 2020. Shell plans to exit gas-rich Masela Block project. *The Jakarta Post*, [online] Available at: <<https://www.thejakartapost.com/news/2020/07/07/shell-plans-to-exit-gas-rich-masela-block-project.html>>
- [36] Harsono, N., 2020. SKK Migas lowers oil and gas targets, seeks fiscal stimulus. *The Jakarta Post*, [online] Available at: <<https://www.thejakartapost.com/news/2020/04/20/skk-migas-lowers-oil-and-gas-targets-seeks-fiscal-stimulus.html>>
- [37] Hasiyany, S., Noor, E. and Yani, M., 2015. The Implementation of Cleaner Production to Manage Produced Water in the Petroleum Industry. *Journal of Natural Resources and Environmental Management*, [online] 5(1), pp.25-32. Available at: <https://www.researchgate.net/publication/295101136_The_Implementation_of_Cleaner_Production_to_Manage_ProducedWater_in_the_Petroleum_Industry>
- [38] Hawkins, E., 2016. *The Importance Of ROI | Call Tracking And Analytics*. [online] CallRail. Available at: <<https://www.callrail.com/blog/importance-of-roi-why-it-matters-for-all-businesses/>>
- [39] Hydrocarbonprocessing.com. 2019. *Defining Sustainability In The Oil And Gas Industry*. [online] Available at: <<https://www.hydrocarbonprocessing.com/conference-news/2019/10/defining-sustainability-in-the-oil-and-gas-industry>> [Accessed 3 September 2020].



- [40] Idnfinancials.com. 2020. *Indonesia's Economic Growth Slows Down In First Quarter* | Idnfinancials. [online] Available at: <<https://www.idnfinancials.com/news/34058/indonesia-economic-growth-slows-quarter>>
- [41] IEA. 2019. *Sources Of Greenhouse Gas Emissions From Oil And Gas Operations In 2017 – Charts – Data & Statistics - IEA*. [online] Available at: <<https://www.iea.org/data-and-statistics/charts/sources-of-greenhouse-gas-emissions-from-oil-and-gas-operations-in-2017>>
- [42] IHS Markit Ltd, 2020. *Autonomy: An Alternative View Of The Energy Future (2020 - 50)*.
- [43] Indrawan, R., 2020. *Butuh Investasi Rp3.500 Triliun Untuk Turunkan 314 Juta Ton Emisi CO2 - Dunia Energi*. [online] Dunia Energi. Available at: <<https://www.dunia-energi.com/butuh-investasi-rp3-500-triliun-untuk-turunkan-314-juta-ton-emisi-co2/>>
- [44] International Energy Agency, 2020. *Flaring Emissions*. [online] Paris: International Energy Agency. Available at: <<https://www.iea.org/reports/flaring-emissions>>
- [45] Jantscher, P., 2019. *AI In Sensors For Iot - News*. [online] Silicon Semiconductor. Available at: <https://siliconsemiconductor.net/article/106227/AI_In_Sensors_For_IoT>
- [46] Katadata. 2020. *Oil And Gas Exploration In Indonesia Has Become Unattractive And Needs To Be Revitalized - Katadata.Co.Id*. [online] Available at: <<https://en.katadata.co.id/news/2015/05/11/oil-and-gas-exploration-in-indonesia-has-become-unattractive-and-needs-be>>
- [47] Kementerian Energi dan Sumber Daya Mineral, 2019. *Laporan Kinerja Kementerian ESDM 2014 - 2019*. Jakarta: Kementerian Energi dan Sumber Daya Mineral, p.30.
- [48] Kementerian Perindustrian, 2020. *Laporan Kinerja Kementerian Perindustrian Tahun 2019*. Jakarta: Kementerian Perindustrian, p.25.
- [49] Knoema. 2020. *Indonesia Production Of Crude Oil, 2018-2020*. [online] Available at: <<https://knoema.com/atlas/Indonesia/topics/Energy/Oil/Production-of-crude-oil>>
- [50] Kontan. 2020. *Perusahaan Gas Negara (PGN) Andalkan Efisiensi Di Tengah Pandemi Covid-19*. [online] Available at: <<https://industri.kontan.co.id/news/perusahaan-gas-negara-pgn-andalkan-efisiensi-di-tengah-pandemi-covid-19>>
- [51] Lammey, M., 2020. *BP Sees Attraction Of Stable Green Energy Returns As Oil And Gas 'Gyrate' - News For The Oil And Gas Sector*. [online] Energy Voice. Available at: <<https://www.energyvoice.com/otherenergy/264697/bp-green-energy-wind/>>
- [52] Lukins, S., 2020. *The 'New Normal': Why Digital Skills Matter More Than Ever*. [online] TopMBA.com. Available at: <<https://www.topmba.com/jobs/career-trends/new-normal-why-digital-skills-matter-more-ever>>
- [53] MAHB. 2020. *When Fossil Fuels Run Out, What Then? | MAHB*. [online] Available at: <<https://mahb.stanford.edu/library-item/fossil-fuels-run/>>
- [54] Mahiddin, F. and Wirabuana, R., 2020. *Impact Of COVID-19 Pandemic On Indonesian Oil And Gas Upstream Activities*. [online] Ssek.com. Available at: <<https://www.ssek.com/blog/impact-of-covid-19-pandemic-on-indonesian-oil-and-gas-upstream-activities>>
- [55] Maris, S., 2019. *Rencana Jangka Panjang Forum EP SKK Migas, Capai 1 Juta Barel*. [online] liputan6.com. Available at: <<https://www.liputan6.com/news/read/4130355/rencana-jangka-panjang-forum-ep-skk-migas-capai-1-juta-barel>>
- [56] Market Watch, 2020. *Oil And Gas Drones Market Global Outlook 2020-2026: The Boeing Company, Draganfly Innovations Inc., BAE Systems Plc*. [online] Available at: <<https://www.marketwatch.com/press-release/oil-and-gas-drones-market-global-outlook-2020-2026-the-boeing-company-draganfly-innovations-inc-bae-systems-plc-2020-08-29>>
- [57] Mohammadpoor, M. and Torabi, F., 2018. *Big Data analytics in oil and gas industry: An emerging trend. Petroleum*, [online] Available at: <<https://www.sciencedirect.com/science/article/pii/S24055656118301421>>
- [58] Murray, J., 2020. *How The 6 Major Oil Companies Have Invested In Renewable Energy Projects*. [online] NS Energy. Available at: <<https://www.nsenergybusiness.com/features/oil-companies-renewable-energy/>>
- [59] Nainggolan, M., 2020. *Industri Hulu Migas Di Tengah Pandemi COVID-19 Dan Rendahnya Harga Minyak Dunia*.
- [60] Olayele, F., 2015. *The Geopolitics Of Oil And Gas*. [ebook] International Association for Energy Economics, pp.29-31. Available at: <<https://www.iaee.org/en/publications/newsletterdl.aspx?id=274>>
- [61] Pandey, P., 2020. *Indonesia'S 2020 Oil And Gas Output Likely To Fall, Despite Official Forecasts For Growth*. [online] Pubs.spe.org. Available at: <<https://pubs.spe.org/en/ogf/article->



- [62] Pierce, D., Bertrand, K. and CretiuVasiliu, C., 2010. Water Recycling helps with Sustainability. *SPE Asia Pacific Oil and Gas Conference and Exhibition*, [online] pp.3-5. Available at: <<http://www.onepetro.org/conference-paper/SPE-134137-MS>>
- [63] PricewaterhouseCoopers, 2019. *Oil And Gas In Indonesia - Investment And Taxation Guide*. [online] PricewaterhouseCoopers, pp.12 - 23. Available at: <<https://www.pwc.com/id/en/energy-utilities-mining/assets/oil-and-gas/oil-gas-guide-2019.pdf>>
- [64] Purnomo, A., 2020. *Inpex Committed To The Masala LNG Project*. [online] MEDIA MONITORING OIL AND GAS. Available at: <<https://www.monitoringoil.com/2020/07/inpex-committed-to-masala-lng-project.html>>
- [65] Rafani, I., 2019. *Perspective Of B-100 Biofuel Policy And Programs In Indonesia*. [online] FFTC Agricultural Policy Platform (FFTC-AP). Available at: <<https://ap.ffc.org.tw/article/1611>>
- [66] Ramli, R., 2020. Imbas Corona, Harga Minyak RI Anjlok Hampir 40 Persen pada Maret 2020. *Kompas*, [online] Available at: <<https://money.kompas.com/read/2020/04/05/122020026/imb-30-corona-harga-minyak-ri-anjlok-hampir-40-persen-pada-maret-2020?page=all>>
- [67] Royall, J., 2019. *Understanding Sustainability In Oil And Gas*. [online] Petroleum Economist. Available at: <<https://www.petroleum-economist.com/articles/corporate/sustainability/2019/understanding-sustainability-in-oil-and-gas>> [Accessed 14 September 2020].
- [68] Singh, K., 2019. *Inspecting Pipelines Using Unmanned Aerial Vehicles - Wipro*. [online] Wipro.com. Available at: <<https://www.wipro.com/engineeringNXT/inspecting-pipelines-using-unmanned-aerial-vehicles/>>
- [69] Situs Energy.com. 2020. *Jika Pemerintah Dan KKKS Konsisten, Produksi 1 Juta BOPD Bisa Tercapai*. [online] Available at: <<https://situsenergy.com/jika-pemerintah-dan-kkks-konsisten-produksi-1-juta-bopd-bisa-tercapai/>>
- [70] South African Oil & Gas Alliance, 2018. *Value Chain*.
- [71] Stanton Associates. 2020. *Financial Discipline & Analysis*. [online] Available at: <<https://www.stantonassoc.com/services/top-line-growth/financial-discipline-analysis/>>
- [72] Statista. 2020. *Crude Oil Prices Weekly December 2019 To August 2020 | Statista*. [online] Available at: <<https://www.statista.com/statistics/326017/weekly-crude-oil-prices/>>
- [73] Stevens, P. and House, C., 2019. *How Falling Demand For Oil Is Set To Transform International Relations*. [online] World Economic Forum. Available at: <<https://www.weforum.org/agenda/2019/08/how-falling-demand-for-oil-is-set-to-transform-international-relations/>>
- [74] Tarver, E., 2020. *Financial Forecasting Vs. Financial Modeling: What's The Difference?*. [online] Investopedia. Available at: <<https://www.investopedia.com/ask/answers/difference-between-financial-forecasting-and-financial-modeling>>
- [75] Trade.gov. n.d. *Energy Resource Guide - Indonesia - Oil And Gas | International Trade Administration*. [online] Available at: <<https://www.trade.gov/energy-resource-guide-indonesia-oil-and-gas>>
- [76] Trading Economics. 2020. *Indonesia GDP Growth Rate | 2005-2020 Data | 2021-2022 Forecast | Calendar*. [online] Available at: <<https://tradingeconomics.com/indonesia/gdp-growth>>
- [77] U.S. Energy Information Administration (EIA), 2020. *What Drives Crude Oil Prices? An Analysis Of 7 Factors That Influence Oil Markets, With Chart Data Updated Monthly And Quarterly*. Washington, DC.
- [78] Umah, A., 2020. *Demi Energi Terbarukan Pertamina Rogoh US\$ 17,6 M Hingga 2026*. [online] news. Available at: <<https://www.cnbcindonesia.com/news/20200810201210-4-178805/demi-energi-terbarukan-pertamina-rogo-176-m-hingga-2026>>
- [79] Umah, A., 2020. *Kontraktor Migas RI Ramai-Ramai Potong Capex 25%*. [online] CNBC Indonesia. Available at: <<https://www.cnbcindonesia.com/news/20200611185613-4-164767/kontraktor-migas-ri-ramai-ramai-potong-capex-25>>
- [80] UN Environment Programme, 1987. *Environmental Management In Oil And Gas Exploration And Production*. [online] London, p.3. Available at: <<https://wedocs.unep.org/bitstream/handle/20.500.11822/8275/-Environmental%20Management%20in%20Oil%20&%20Gas%20Exploration%20&%20Production-19972123.pdf>>
- [81] Walton, K., 2019. *Indonesia Should Put More Energy Into Renewable Power*. [online] Lowyinstitute.org. Available at: <<https://www.lowyinstitute.org/the-interpreter/indonesia-s-should-put-more-energy-renewable-power#:~:text=In%20fact%2C%20Indonesia%20has%20the,solar%2C%20tidal%2C%20and%20geothermal.&text=Yet%20in%202018%2C%20of%20the,came%20from%20renewable%20energy%20sources>>



[82] Whalen, T., 2012. The Challenges of Reusing Produced Water. *Journal of Petroleum Technology*, [online] 64(11), pp.18-20. Available at: <https://www.spe.org/en/industry/challenges-in-reusing-produced-water/>

[83] Wiki.aapg.org. 2020. *Production Problems - AAPG Wiki*. [online] Available at: https://wiki.aapg.org/Production_problems

[84] Withers, N., 2020. *Is Digitalisation The Solution For The Future Of Oil & Gas?*. [online] Fircroft. Available at: <https://www.fircroft.com/blogs/is-digitalisation-the-key-to-the-future-of-oil-and-gas-01061516157>

[85] Worldometers. 2020. *Indonesia Oil Reserves, Production And Consumption Statistics - Worldometer*. [online] Available at: <https://www.worldometers.info/oil/indonesia-oil/>