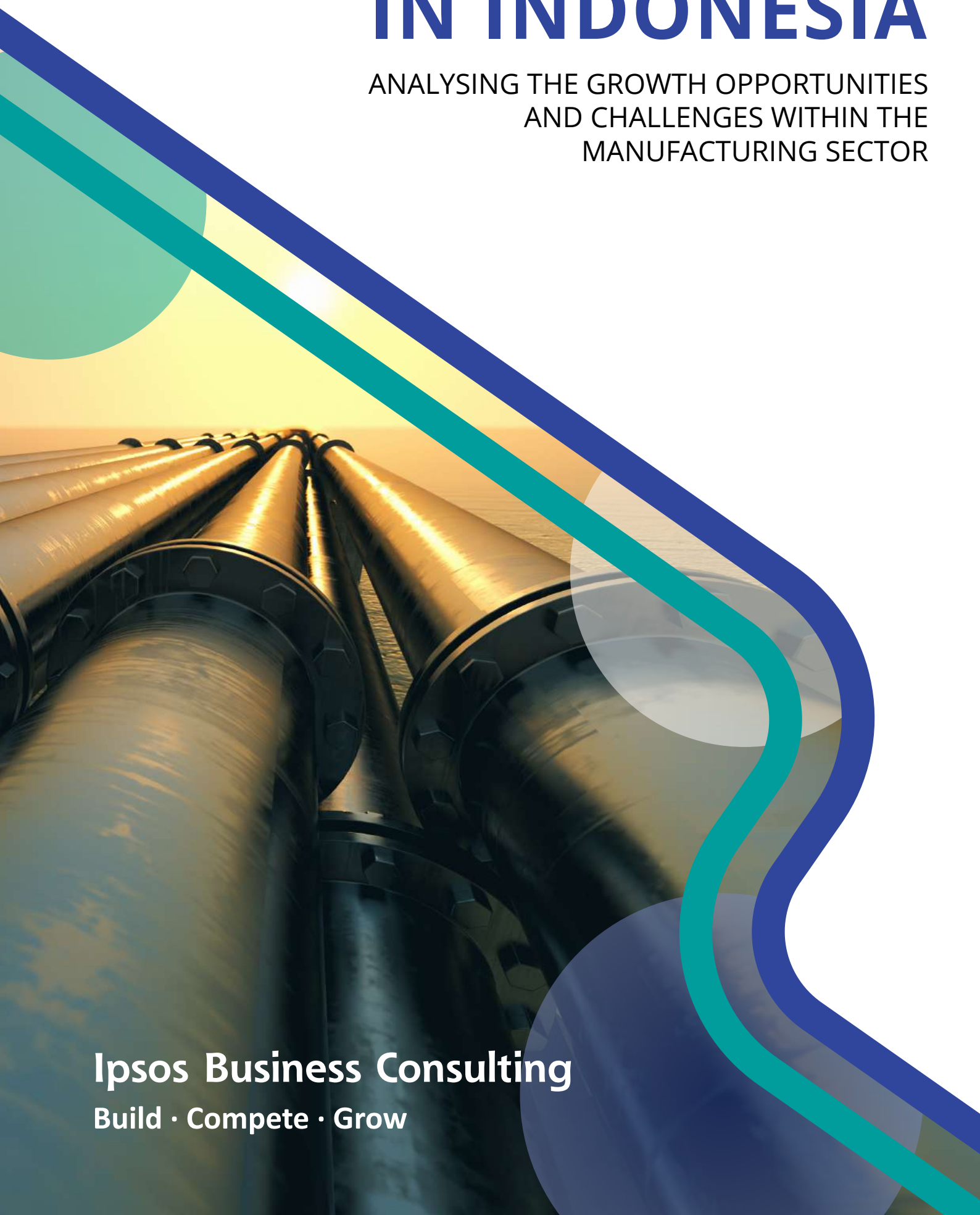
NATURAL GAS IN INDONESIA

ANALYSING THE GROWTH OPPORTUNITIES AND CHALLENGES WITHIN THE MANUFACTURING SECTOR



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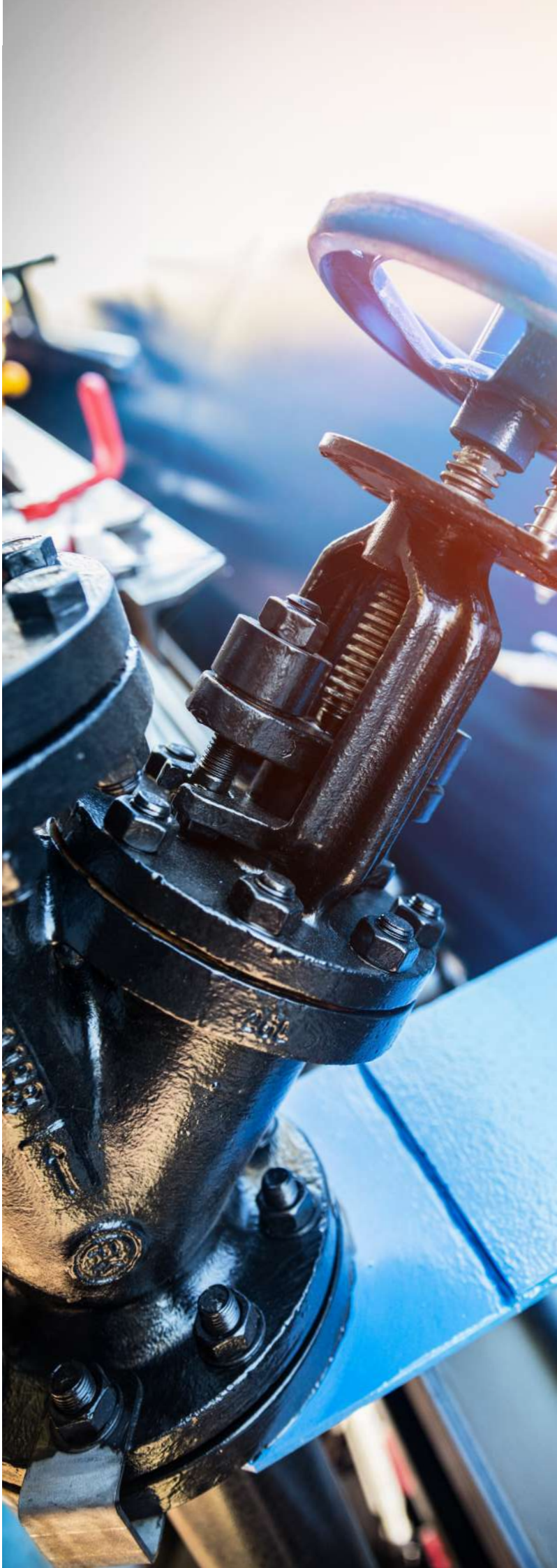

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Introduction

Natural Gas in Indonesia

analysing the growth opportunities and challenges within the manufacturing sector

Manufacturing is a key driver of the Indonesian economy, contributing more than 20% of the country's GDP each year. Yet this industry depends on resources like raw materials, R&D capability, and energy – each of which has the potential to be subjected to disruption in the near future. Indonesia's current levels of energy availability and use are of particular interest to the country's industrial prospects, and are therefore a main focus of this paper.

Energy price fluctuations have a great impact on overall cost structure within manufacturing. Companies often face the choice of balancing energy cost with supply certainty. Other concerns, such as safety and environmental effects, often carry a "hidden" cost, which may or may not be borne by the organisation responsible.

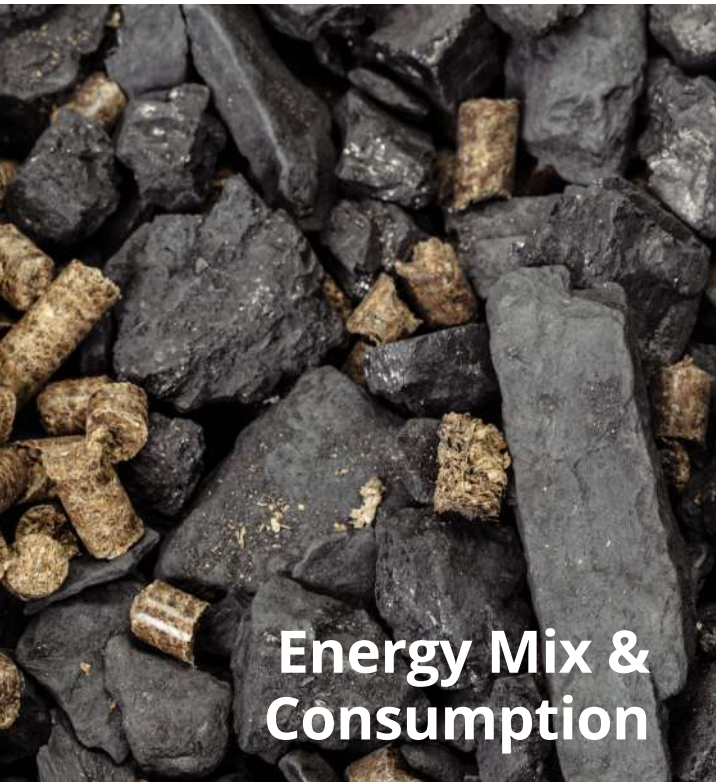
In general, manufacturing in Indonesia still largely relies on coal and oil-based fuels. While natural gas(NG) has gained significant market share over the past 5 years, its potential has not yet been reached. Natural gas remains held back by the challenges of price and availability, which in turn stem from distribution challenges. Covering the entire Indonesian archipelago with natural gas pipelines, to deliver gas from the supply points to the demand points, while also leaving shipping lanes undisturbed, would be a major engineering challenge at significant cost.

The prospects for NG among manufacturing companies could be vastly improved, however, with an alternative NG logistic / delivery system in lieu of pipelines. Such a solution would provide a cheaper and more reliable energy source for manufacturers moving forward – leading to better outcomes for NG producers, greater savings for manufacturers, and fewer externalities requiring additional attention.

Aside from the cost, manufacturing companies also consider other factors such as availability of supply, time efficiency, environmental effect, space management, waste management, and risk. Each of these concerns can be addressed by utilising natural gas over the long term, as long as a reliable NG supply infrastructure is put into place.

Where pipelines are not currently feasible, Compressed Natural Gas(CNG) and Liquified Natural Gas(LNG) solutions are already seen as alternative solutions to meet the demand for cheaper and cleaner energy. This distribution model also allows demand to be measured continuously, enabling estimates of increased demand in the future if a pipeline or other delivery method were to be constructed. Global trends in manufacturing show a clear move towards NG, particularly through LNG distribution, as the world prepares for a future of cleaner energy use.

Our Study Encompasses



Manufacturing Industry Background

Indonesia's GDP has recorded steady growth at 5.1% CAGR (Compound Annual Growth Rate) over the last 5 years. As one of the economic backbones of the country, non-oil & gas manufacturing contributes around 21% of Indonesia's total GDP referring to Exhibit 1.

At 4.4% growth, the sector consistently performs slightly below national growth rates, and is outperformed by the growth of service and resource related industries. The Central Bank of Indonesia estimated that the country's overall economic growth would be at a 5.1 - 5.2% level in 2019. Based on the government's classification, the manufacturing industry consists of 24 industry sectors, ranging from food, textile, and even manufacturing and assembly of vehicle.

Exhibit 1

Indonesia Manufacturing Industry Growth and Contribution to GDP (in IDR Tn)

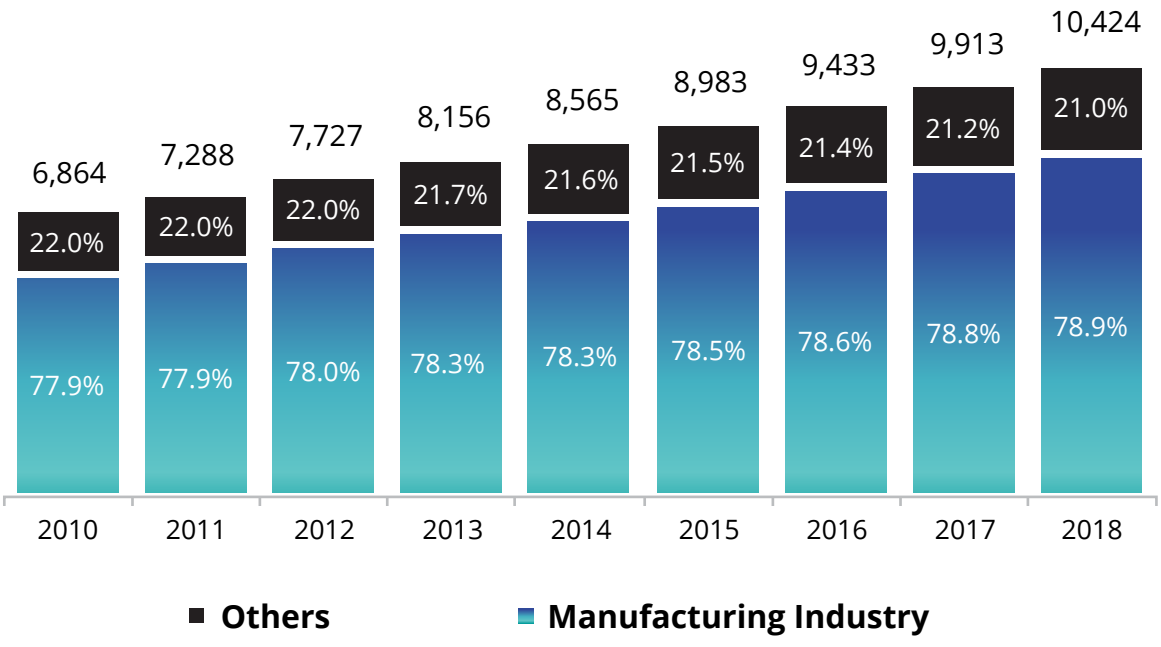
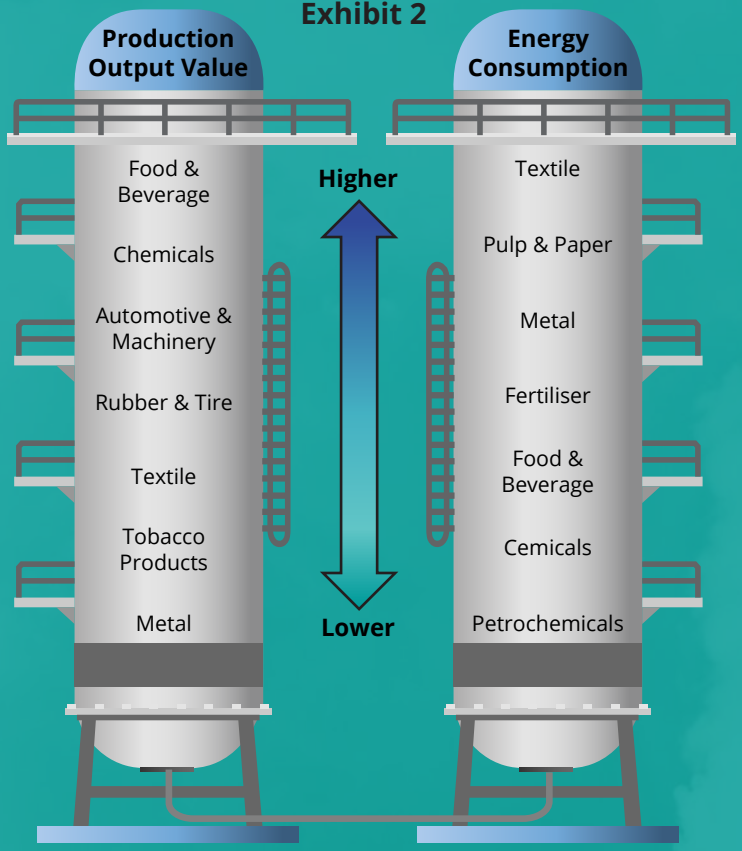


Exhibit 2

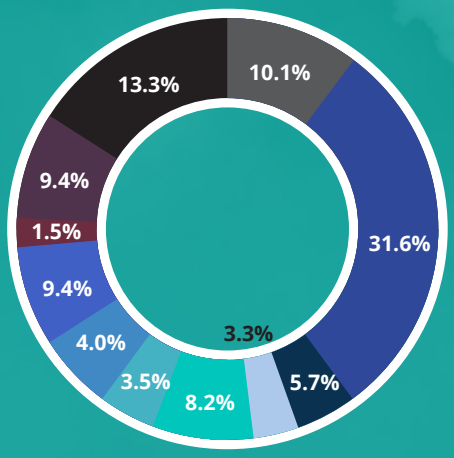


This study focuses on industry sectors with more intensive energy requirements.

The figure on the left shows the top industries in terms of output value and energy consumption, in which 4 out of 7 top industry sectors appear in both the output value as well as the energy consumption chart. Those 4 sectors are *Food & Beverage, Chemicals, Textile, and Metal.*

Exhibit 3

Breakdown of Manufacturing Sector Contribution to GDP (2018)



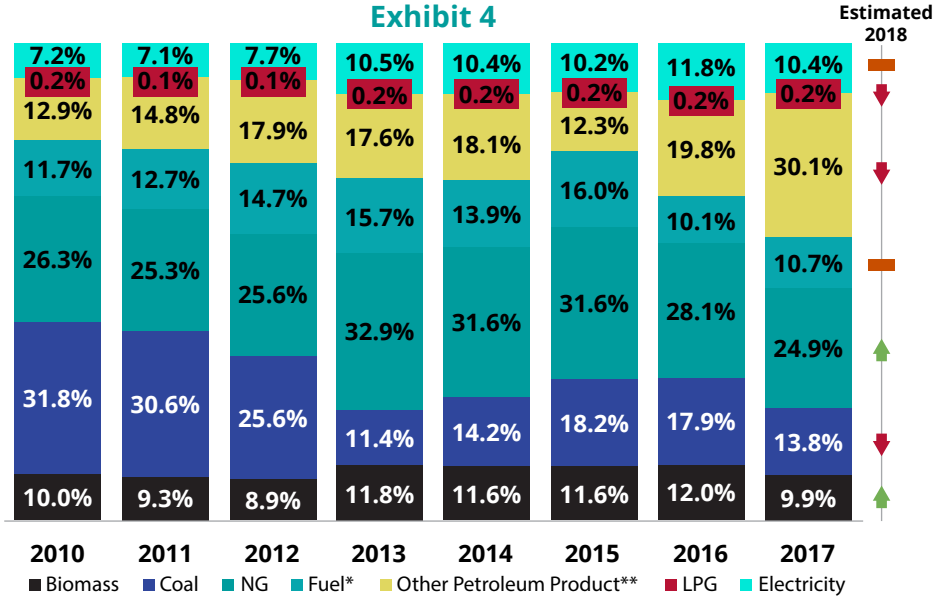
Energy Mix of Indonesia's Manufacturing Industry

On the whole, Indonesia's manufacturing industry currently still relies heavily on fossil fuels, with Oil and Coal as the main sources of energy. The recent fluctuation in oil price have driven companies to use more oil-based fuel. Although there has been a reduction in coal usage, NG usage is also seen to have a smaller share in recent years.

Considering that around 30% of NG usage is used as feedstock by industry sectors such as Fertiliser and Petrochemical, Natural Gas is an even smaller source of energy for other manufacturing sectors.

Aside from electricity, Majority of the energy-heavy manufacturing sector still relies largely on Coal and Oil based fuel, only a Ceramic and Clay sector utilize natural gas as their major source of energy. Fertilizer and Petrochemical sector on the other had mainly use Natural Gas for their feedstock instead. Based on the data showcased, there should be still a lot of opportunity for Natural Gas to replace coal and oil based usage within energy-heavy manufacturing sector.

Exhibit 4

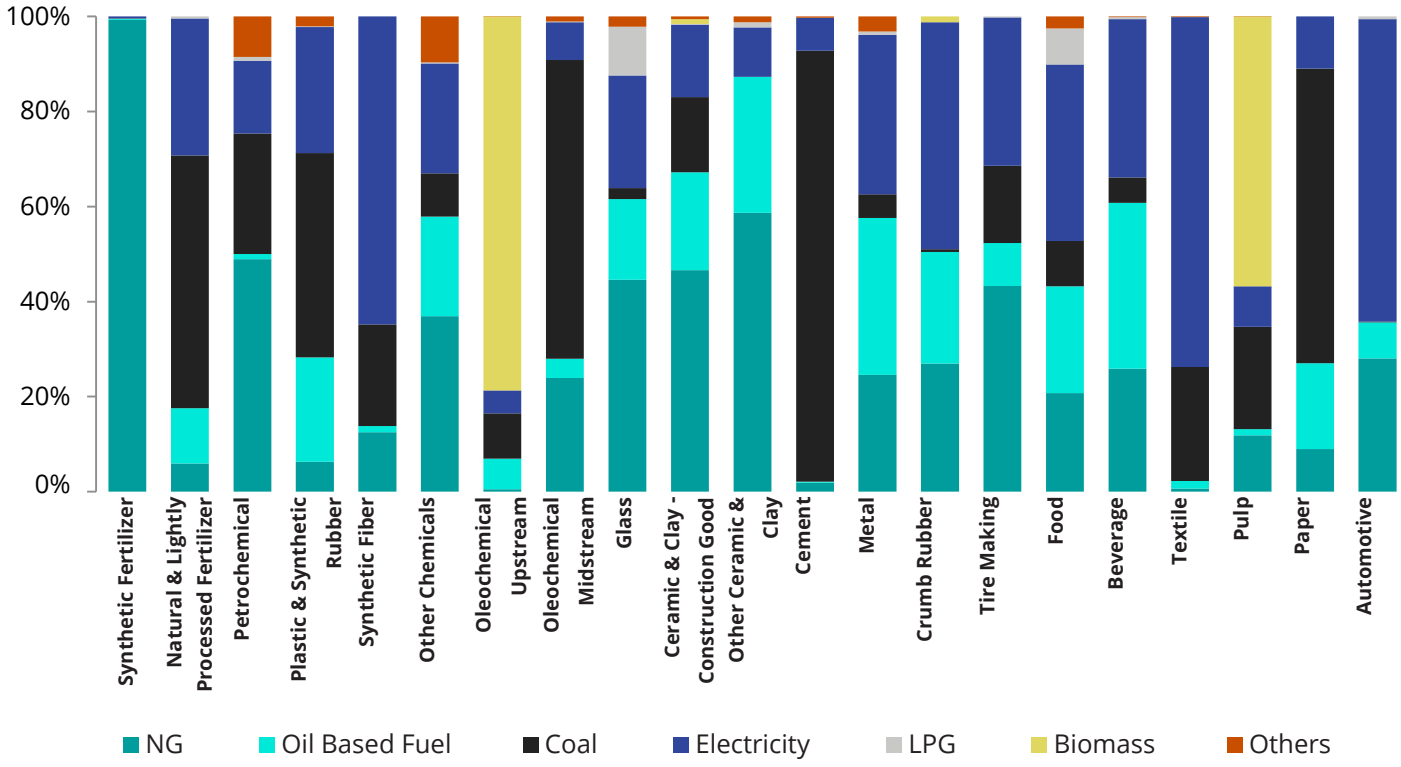


Indonesia's manufacturing industry usage of NG is still relatively low, which is mainly caused by the lack of access and cost competitiveness of the NG itself from the perspective of industry players. The recent drop in oil prices has driven a sharp increase in the usage of oil-based fuel.

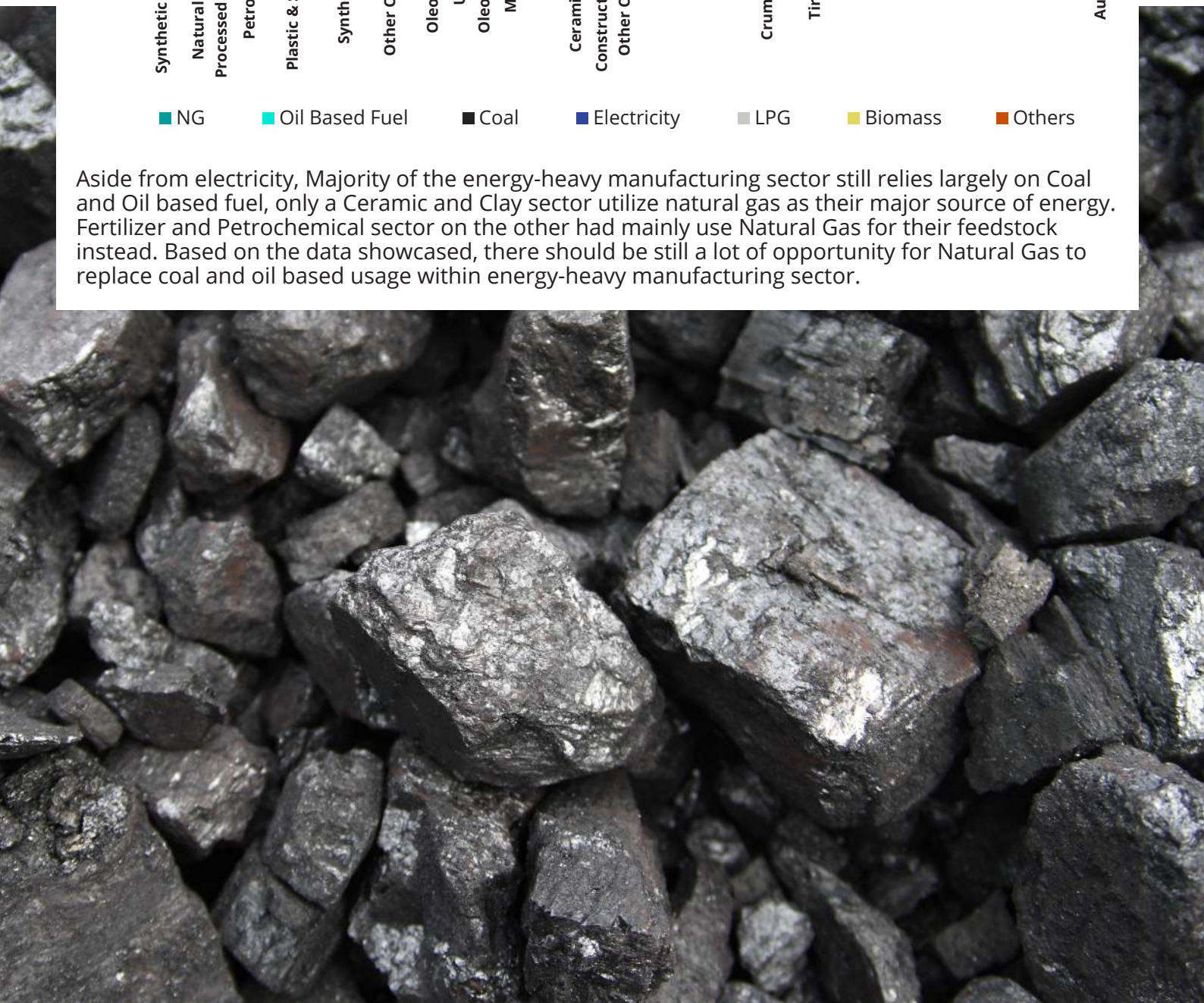
Source: Indonesia Statistic Bureau and Ministry of Energy

Exhibit 5

Energy Mix in "Energy Heavy" Industry Sectors



Aside from electricity, Majority of the energy-heavy manufacturing sector still relies largely on Coal and Oil based fuel, only a Ceramic and Clay sector utilize natural gas as their major source of energy. Fertilizer and Petrochemical sector on the other had mainly use Natural Gas for their feedstock instead. Based on the data showcased, there should be still a lot of opportunity for Natural Gas to replace coal and oil based usage within energy-heavy manufacturing sector.



Natural Gas in Indonesia's Manufacturing Industry

Energy used by the manufacturing industry can be generally divided into three categories: Feedstock, process, and power generation. Most energy used in manufacturing industry is categorised as "process" fuel, which in general is used to generate heat either directly, or indirectly in the form of steam or hot water.

Utilisation of energy for "process" fuel is normally achieved through a simple mechanism. Replacing the fuel does not involve large changes, and thus most other fossil fuels currently being used are considered replaceable by NG, given the appropriate cost - benefit hyphenated - trade-off in switching, as well as adequate availability.

Simple equipment used widely within the manufacturing industry, such as furnaces and boilers, can be refitted to use NG with minimal cost and effort. There will be initial investment required however, and with current oil price, there are not many companies that want to adopt NG as it becomes more costly.

Exhibit 6

Utilisation of NG in Manufacturing Industry

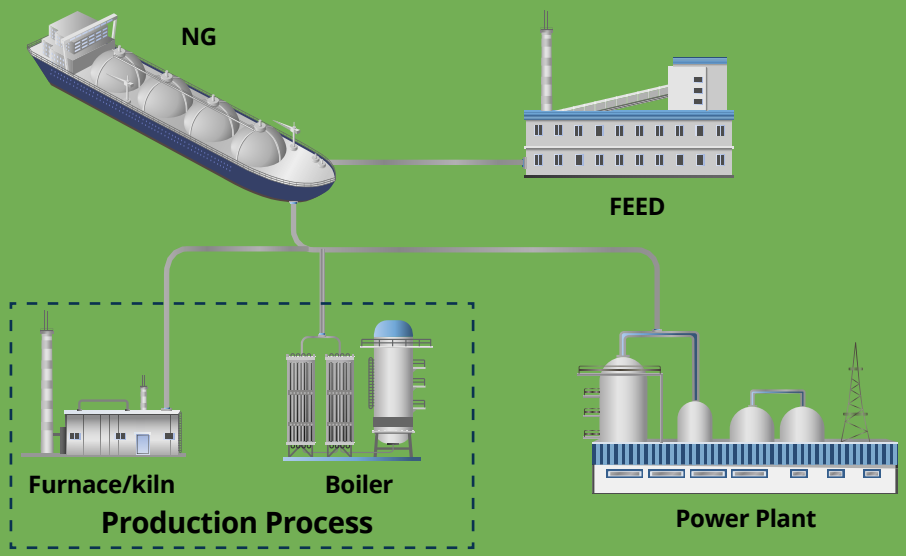
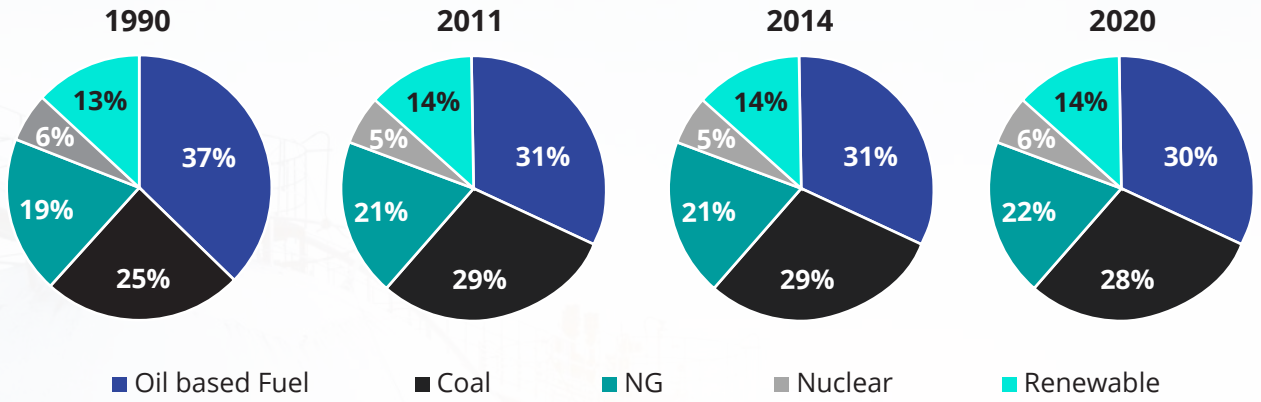


Exhibit 7

Global Energy Mix



Source: International Energy Agency

Oil based fuel and coal are still the main sources of world energy, a trend that will possibly continue for the next 10 years. However, among all the fossil fuels, NG has shown the fastest growth.

Global NG consumption has increased by 1.4% per year (IEO, 2017). Although the world is aiming to increase the use of renewable energy, most countries are not ready yet and will need an intermediary step after oil and coal. This role is often filled by Natural Gas.

Exhibit 8

Manufacturing Industry Energy Mix Comparison Between Countries

	Indonesia		South Korea		US		Canada		Brazil		China		Malaysia		Thailand	
Year	2010	2017	2010	2017	2010	2017	2010	2017	2010	2017	2010	2017	2010	2017	2010	2017
Oil Based Fuel	25%	41%	13%	8%	11%	8%	12%	14%	15%	14%	7%	6%	29%	17%	11%	18%
Coal	32%	14%	18%	18%	9%	7%	7%	6%	9%	8%	62%	59%	12%	11%	35%	19%
NG	26%	25%	16%	17%	41%	48%	30%	33%	11%	12%	2%	5%	29%	37%	8%	11%
Electricity	7%	10%	44%	51%	26%	26%	36%	35%	22%	21%	24%	30%	30%	36%	21%	24%
Renewable Energy	10%	10%	9%	6%	13%	11%	15%	12%	43%	45%	5%	0.04%	0%	0%	26%	28%

Source: International Energy Agency

Exhibit 8 shows that the manufacturing industries in many industrial countries are increasing their NG consumption. By contrast, Indonesia has slightly decreased its use of NG for its manufacturing industry, in relative terms. Considering Indonesia as a Natural Gas producing country, Indonesia supposedly utilise more of their NG instead of oil-based fuel which is mostly imported.

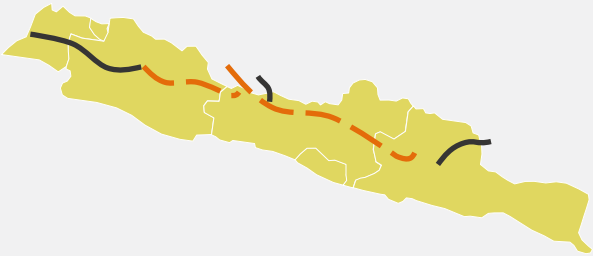
Indonesia's Natural Gas Infrastructure

As part of its future energy plan, the Indonesian government continues to push the development of pipeline infrastructure in the hope that NG becomes Indonesia's main energy source in the next 20 - 30 years. Other means of transporting NG, such as CNG and LNG, have also been flourishing recently.

Exhibit 9

Pipelines Map of Sumatra Island

Pipelines Map of Java Island



LEGENDS

Pipeline Existing (Tender)

Pipeline Plan (Tender)

NG infrastructure has already reached most industrial centres in Java, but not in Sumatra and Eastern Indonesia.

Long distances between industrial centres are coupled with the condition where the nearby NG source starts to be less productive, which means that the NG must be brought from other lifting locations, which are usually located in less developed areas such as Kalimantan and Maluku.

Moreover, the Indonesian manufacturing industry's small and micro enterprises, with an estimated count of more than 3 million companies, can take advantage of cheaper, non-subsidised fuel for their business needs when supplied with CNG.

Development of better infrastructure and logistic networks for NG is vital in working towards higher penetration of NG among manufacturing industry companies.

NG logistic solutions in the form of Compressed Natural Gas (CNG) and Liquified Natural Gas (LNG) represent the most suitable method of delivery, given the archipelagic and mountainous terrain of Indonesia, and the associated challenges in building an extensive NG pipeline network.

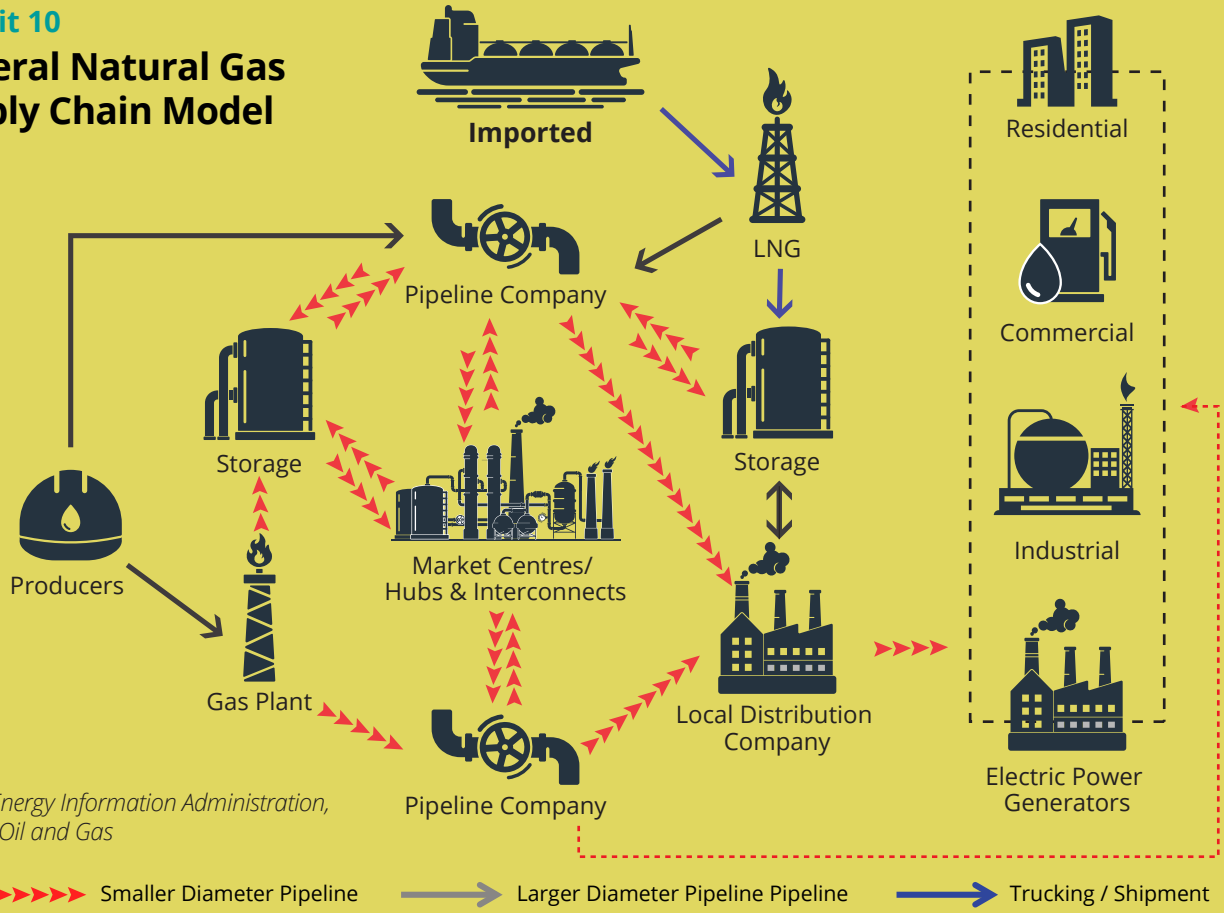
NG Supply Chain Model

NG distribution methods depend on the location of the NG source as well as the available pipeline. In Indonesia, however, many potential NG users are not reachable by gas pipeline, for reasons of geography or economics. As an archipelago, Indonesia faces unique challenges for any effort to develop integrated pipelines connecting its islands.

Furthermore, the high variability in elevation, and mountainous geography of most islands in Indonesia, make the difficulty of building pipeline infrastructure even greater.

Exhibit 10

General Natural Gas Supply Chain Model



Source: Energy Information Administration, Office of Oil and Gas

CNG and LNG allow for an alternative or substitute entry point in the absence of a completed pipeline network, while construction of such a pipeline is underway. Despite the higher price caused by the logistics cost, in general CNG and LNG would nevertheless cost less than oil-based fuel in general. The challenge for both models is:

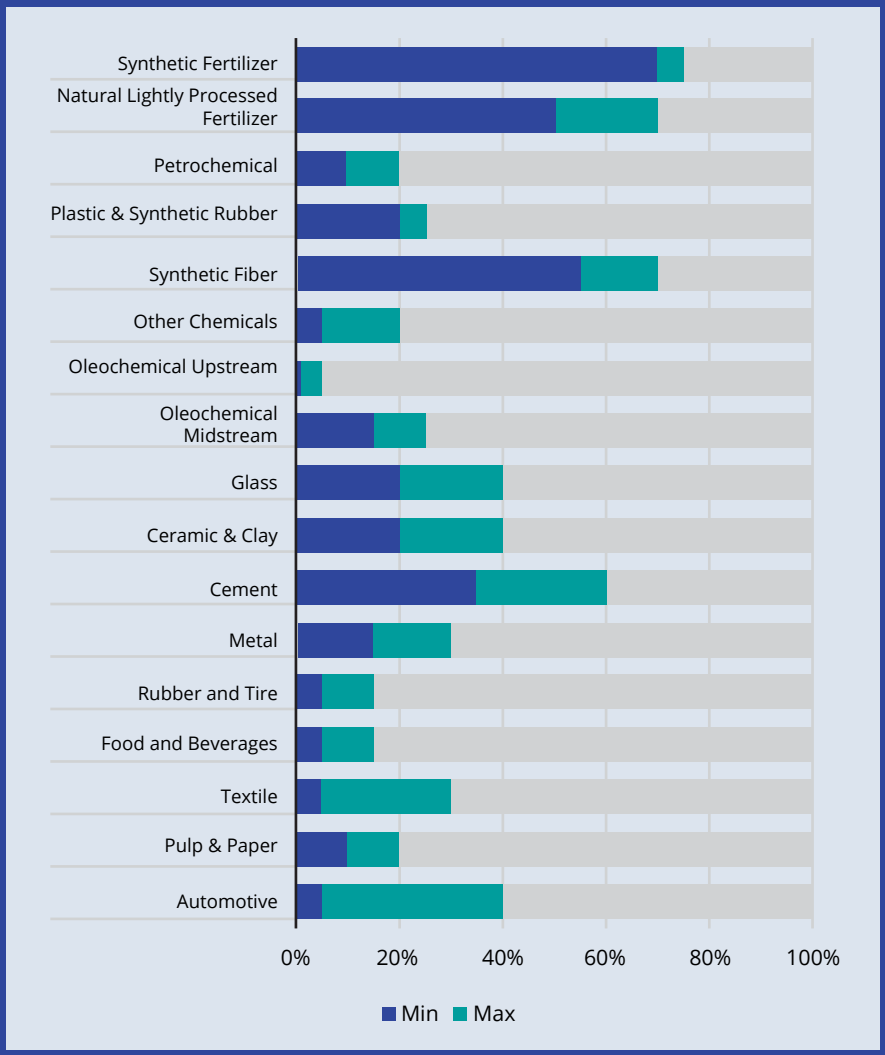
- CNG is not reliable for large scale demand, as the logistic requirements (in terms of space, and the amount of CNG tanks) would be overwhelming at a large scale;
- LNG prices are still linked to oil, removing the benefit of price stability that piped NG could offer.

Oil & gas experts throughout the world, however, foresee that the future distribution of NG will be similar to that of oil, which does not rely on pipe but instead uses a shipment model. In addition, the price of LNG would be independent of the oil price once LNG hubs are established around the world. With such a development in place, LNG prices would be solely determined by direct supply and demand, instead of being tied back to oil prices (as is presently the case) in most parts of the world.

Energy Cost to Production Cost in Indonesia's Manufacturing Industry

Exhibit 11

Comparison of Energy Cost to Production Cost for Each Industry Sector



Within the top sector of Indonesia's manufacturing industry, Ipsos Business Consulting found that on average, at least 25% of the production cost can be traced back to the cost of energy, although there is variance across sectors.

The majority of sectors within the manufacturing industry are found to have 15% - 40% of their production cost traced back to the cost of energy. Outliers include sectors which are energy intensive such as the cement industry, and sectors that use energy sources as raw material such as synthetic fertiliser. These sectors have more than 50% of their production cost traced back to energy / fuel.

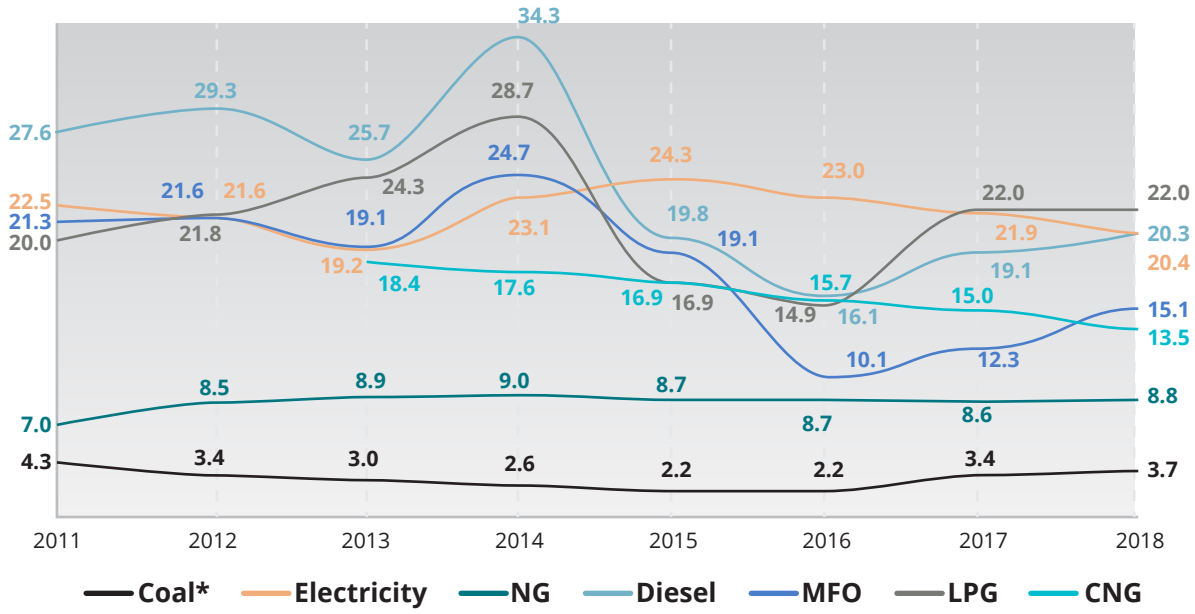
Manufacturers with higher energy cost to production cost percentages are in greater need of a sustainable, price stable, and readily available source of energy. However, some sectors with these characteristics are not gaining access to such energy due to their industry cluster location, which often depends on their industry characteristics, their distance to raw material sources, and the distance to their main customers.

Source: Ipsos BC Indonesia study

Energy Prices Comparison

Indonesia's Historical Average Price of Energy (USD/MMBTU)

Exhibit 12



Energy prices play a significant role in manufacturing industry competitiveness. As one of the primary costs of production, some manufacturing products' prices are highly affected by the price of the primary energy needed to produce them. Exhibit 12 shows that oil based fuel fluctuates the most over time, which may put the manufacturing industry at risk given that it acquires 47% of its energy from this source.

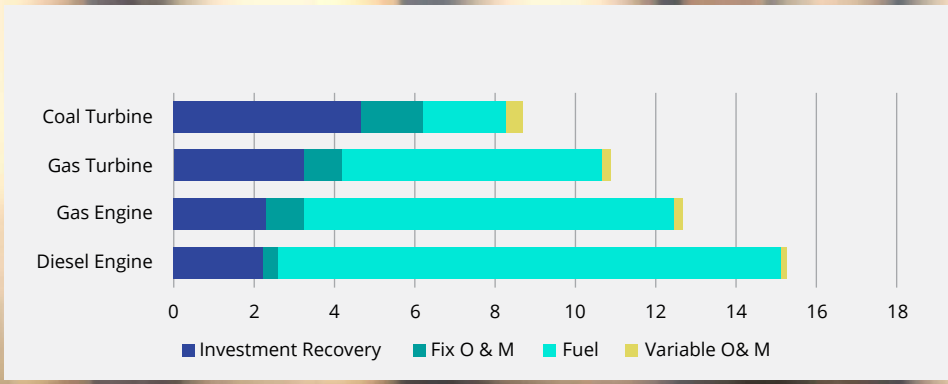
To protect against risk, the manufacturing industry in Indonesia should move towards energy sources with more stable prices, such as NG, Coal, and Electricity. While Coal may not be suitable for some processes, and electricity supply can be erratic at times when relying upon the country's electricity grid, NG can step in as a more sustainable solution for the industry's energy problem.

Although bound to pipeline infrastructure, piped Natural Gas is more stable than all other available energy sources. CNG on the other hand enjoys increased distribution efficiency with a greater number of users, and is thus able to reduce its average price.

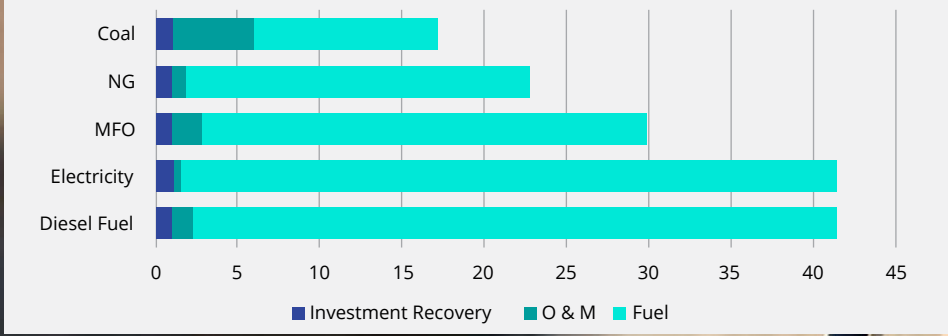
Levelised Energy Cost in Manufacturing Industry

Estimated Levelised Cost for General Industrial Usage

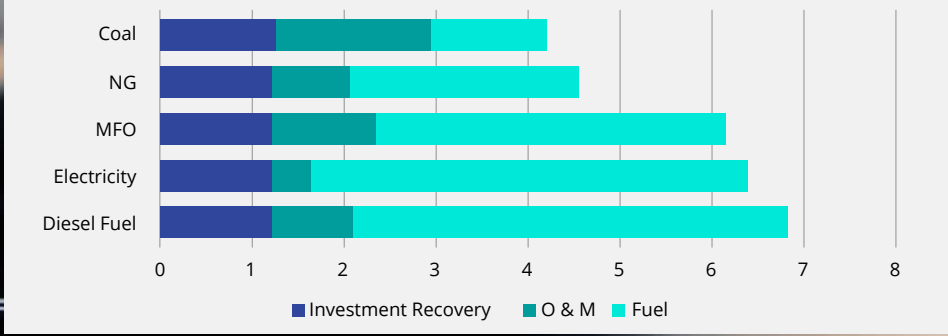
Exhibit 13



Sample: Steam Produced (USD/Ton Steam)



Sample: Furnace in Rolling Mill Industry (USD/Ton)



Without accounting for environmental factors, NG is consistently the 2nd cheapest in fuel price and O&M cost, albeit utilising and acquiring it has proven to be a challenge for the manufacturing industry, which is accustomed to commonly used oil-based fuel

Source: Ipsos BC Indonesia study

Referring to Exhibit 14, NG and Coal are the top choice in terms of cost. However, given the worldwide trend towards more environmentally friendly and sustainable manufacturing, Ipsos Business Consulting believes that the Indonesian government will gradually push out the use of coal in the manufacturing industry due to environmental concerns, although it will continue to be used extensively in power generation for reasons of cost. A review of three common applications using energy within the manufacturing industry shows consistent results, in which NG proves to be second-cheapest in fuel price and O&M cost while also being the most environmentally friendly. The initial investment recovery, however, may vary from application to application.

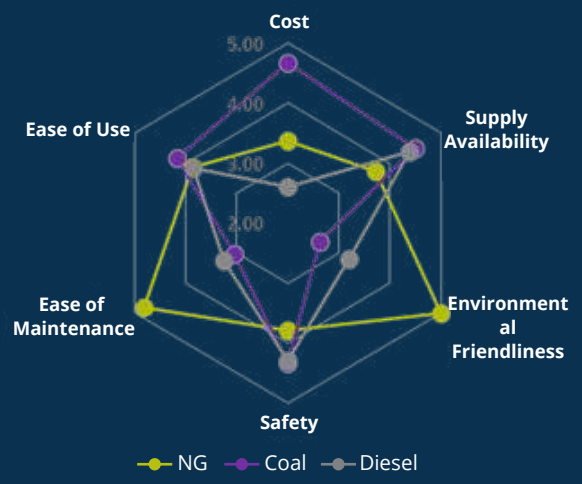
Type of fuel	Estimated Carbon (CO2) Emission (in Pounds) per MMBTU
Coal	95 - 103.4
Diesel Fuel and Heating Oil	73.16
Gasoline (without ethanol)	71.3
Propane (LPG)	63
Natural Gas	53

Source: US Energy Information Administration

Industry Perspective and Requirements on Energy

Exhibit 14

Manufacturing Industry Players' Perspective
(higher score means better performance)



Our analysis shows that NG should be the main source of energy for Indonesia's manufacturing industry, once logistics concerns are settled and NG becomes consistently available at scale to its potential market. Many other countries in the world that have relied upon NG for a long time have already moved on to the next phase, utilising renewable energy for their manufacturing industry.

However, Indonesia's manufacturing industry players feel that there are several critical factors that make NG less desirable than other fuel, especially oil-based fuel. Most importantly, the advantages offered by NG are presently outweighed by the fact that oil-based fuel is highly available – a fundamental requirement within the industry.

Fuel Price, Stability, and Compatibility to their equipment are the top 3 main considerations for manufacturing industry players as they choose an energy source / fuel for production.

Important Aspects for Energy Selection

Conclusion

Manufacturing is one of the most important economic sectors in Indonesia, growing steadily albeit still less rapidly than the country's overall GDP. The current manufacturing industry in Indonesia relies heavily on oil-based fuel, a source of energy which is highly unstable in terms of price.

The manufacturing industry spends an average of 25% of its production cost as energy cost. Current problems in energy involve price stability and availability, although different energy sources vary in these characteristics. Indonesia's manufacturing industry itself is highly reliant on a combination of oil-based fuel and coal, a dependency which has declined only slightly over the past 5 years.

Global energy trends show that successful manufacturing countries are forcing the usage of more environmentally friendly energy sources and means of energy production. Leading industrial countries such as the USA, Korea, and Japan are utilising high levels of Natural Gas (NG) and Electricity (Grid) in their Manufacturing Energy mix. Even the manufacturing industry of Indonesia's closest neighbor, Malaysia, is sourcing 37% of its energy needs from Natural Gas – compared to just 25% in Indonesia. The comparison is more striking on oil-based fuel, where Indonesia's manufacturing Industry source 41% of the energy requirement from oil-based fuel in 2017, compared to just 17% for Malaysia's manufacturing industry.

In the case of Indonesia, the inadequate logistics infrastructure for Natural Gas is one of the root causes. While large companies mostly have access to NG pipelines, medium and smaller companies are often denied access due to their location choice – which instead gives them access to raw materials or logistic hubs – or the fact that they require an insufficient volume of NG to justify the development of expensive NG pipelines. Many manufacturing companies do not bother to source NG, preferring to just use whatever energy is readily available, such as oil or coal, as the development of NG infrastructure seems to be progressing very slowly in the present period.

Manufacturing industry players require sources of energy that offer stable prices and consistent availability, to ensure continuity of manufacturing activity as well as competitiveness within the market. Efficiency and safety are also key factors for manufacturing industry players as they determine their preferred fuel choice. Therefore, innovation in NG logistics (such as CNG and Mini-LNG) to deliver NG quickly and efficiently to the market must become an immediate priority, in order to make NG economically feasible and available to those manufacturing companies – especially those which presently lack access to NG – and support the growth of Indonesia's manufacturing industry.

NG suppliers in Indonesia could significantly increase their sales by focusing on manufacturing industry needs. Our study shows that there are at least 41% more demand from the current usage volume that are easily replacing other fuel within manufacturing industry, if NG were easily available to manufacturing companies and priced below their currently used oil-based fuel, when taking into account the cost of conversion in the long run.

NG suppliers also need to identify what information the prospective customers will need in order to make an informed assessment of the benefits of each of the alternatives, and how to give customers easy and quick access to this data. Another challenge is to offer more advanced solutions such as COGEN and Mini-LNG, which could provide solutions for manufacturing companies that go several steps further than just energy. By effectively putting Indonesia's rich NG resources to good use, the country's manufacturing industry can follow in the footsteps of its peers around the world, and greatly enhance its overall competitiveness on the world stage.

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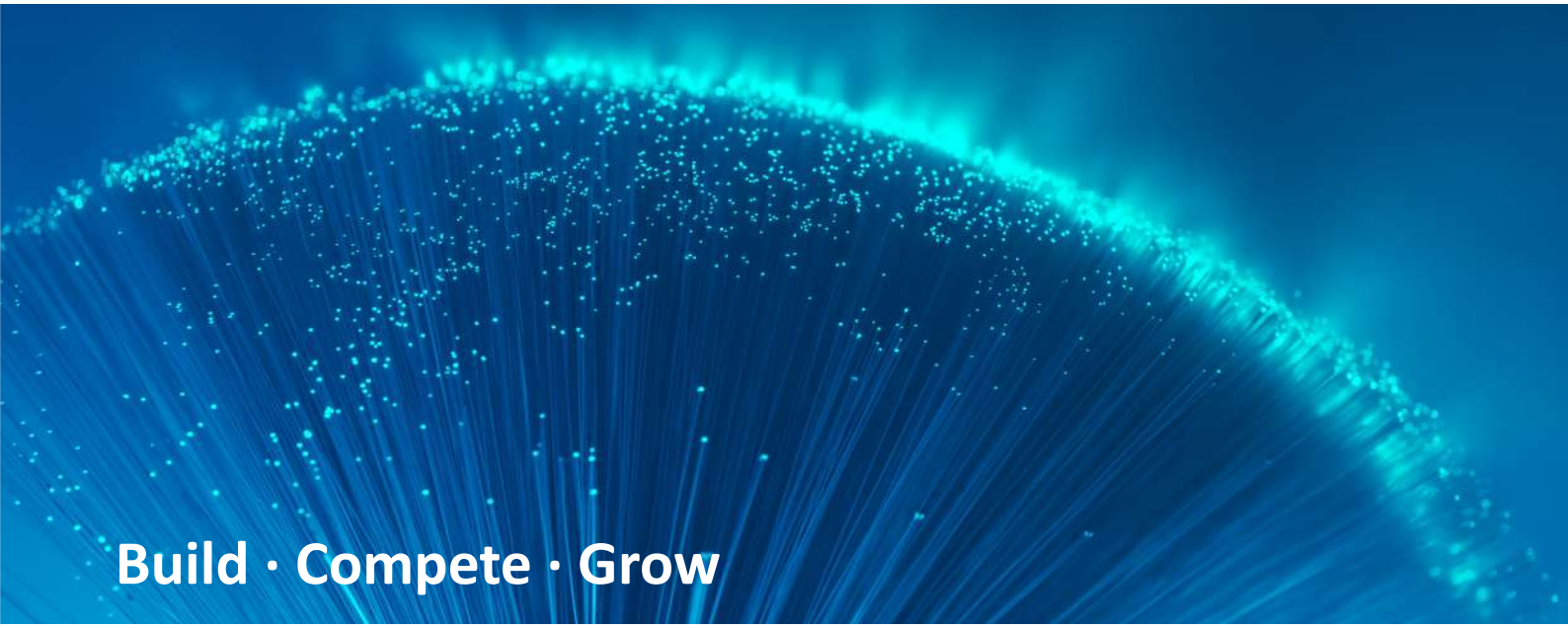

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