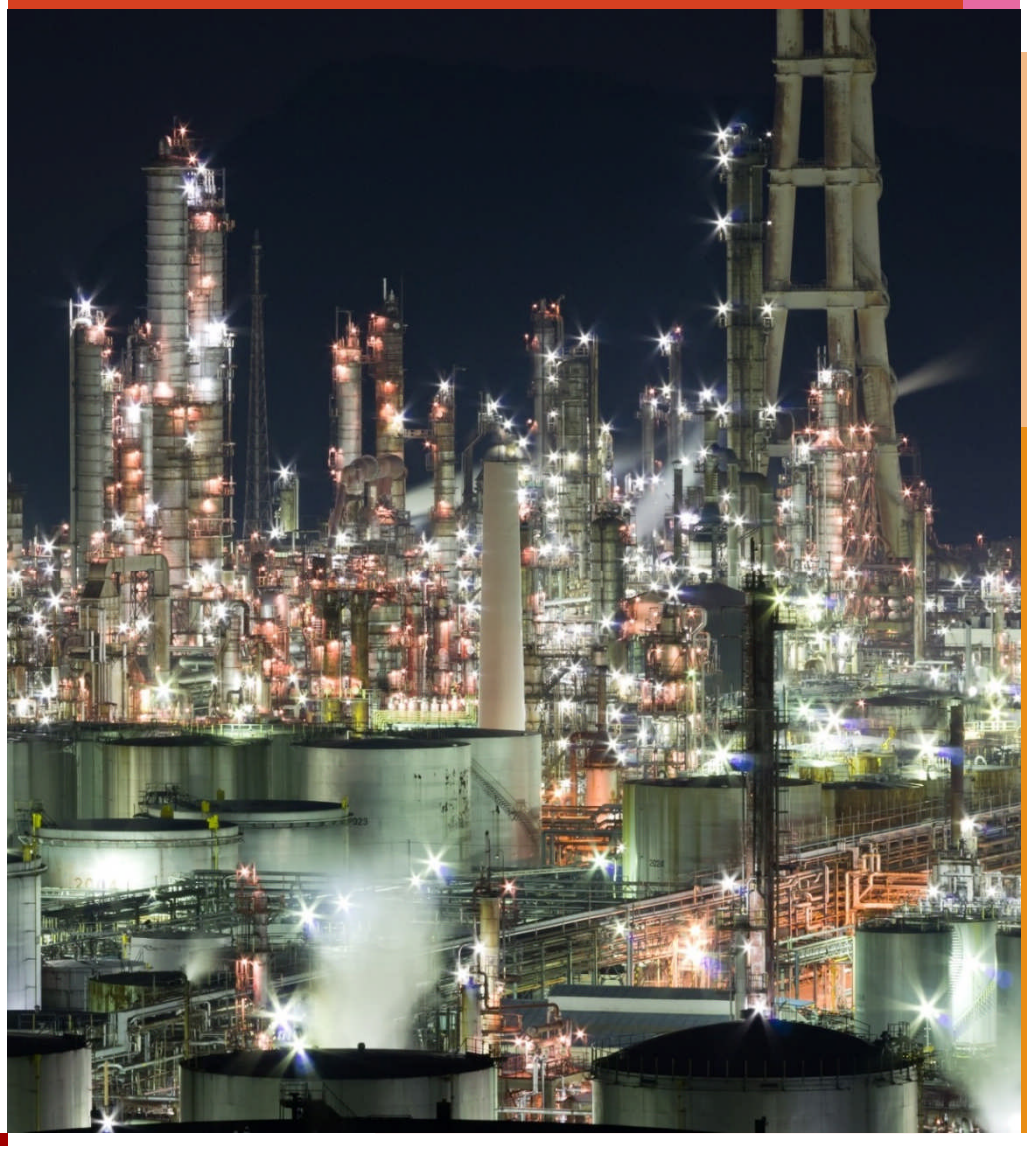
www.pwc.com/id

Private Power Utilities: The Economic Benefits of Captive Power in Industrial Estates in Indonesia

March 2016



pwc

Important Notice: By reading this report, any person who is not an addressee of this report accepts and agrees to the terms set out on page 56.

Foreword

Saleh Husin
Minister of Industry

"Indonesia as a strong industrial country" is the objective of the Master Plan of National Industry Development (RIPIN) 2015 – 2035. A key policy direction supporting this objective is the development of Industrial Estates and Special Economic Zones, as well as the overall development of the industrial sector. RIPIN targets to add 9,000 new large and medium industrial firms with half outside Java as well as 20,000 small industrial firms. To achieve this growth, abundant and reliable electrical power is necessary.

In past decades, Indonesia has reduced its shortfall in electricity supply through large investments in power. To meet future power demand, an additional 70.4 GW of additional generating capacity is going to be needed between 2015 and 2024.

As a large investment is required to meet this need, the Indonesian Government has already invited private sector to participate in terms of Independent Power Producers selling to PLN. There is also another form of which the private sector could participate to meet the Nation, especially industry growing needs for power in terms of Captive Power Producers selling power to industrial players.

This report highlights how the private sector, PLN, and the Government can benefit by working together to identify and develop key opportunities for electrical power investment in Industrial Estates and Special Economic Zones, with the ultimate objective to drive economic activity across Indonesia.

It is my hope that Captive Power will prove to be a catalyst for Indonesia's industry. Industrial growth will remain a major thrust of the Government's economic development strategy, and we view industrial estates and special economic zones as the crucial drivers. The long-term development of these estates and zones must not be constrained by weak infrastructure.

I believe that the use of Captive Power will help to make this policy a success and because of that I am glad to have been associated with this report and welcome what it has say.

Foreword

Sanny Iskandar
Chairman of Industrial Estates Association (HKI)

As Chairman of Industrial Estates Association (HKI) and Vice President of the Indonesian Chamber of Commerce and Industry (KADIN) in the Economic Zones Development division, I was delighted to be asked to contribute to this report.

Industrial Estates are crucial for Indonesia's prosperity. The Industrial Estate has a strategic role for Indonesia's development. Industrial Estates can improved the efficiency of infrastructure provision, increase environmental pollutant control, increase employment opportunities and attract investment. Besides, Industrial Estates also encourage the growth of supporting industries both in the private and public sector. Moreover, Industrial Companies located in Industrial Estate broadly contribute 21% to GDP.

Industrial Estates provide a focal point for manufacturing investment, integrate supply-chains across industries, and allow the concentration of infrastructure needed for production and access to markets. Investors, suppliers, and consumers all benefit from this agglomeration of economic activity.

Recognising this, the Government of Indonesia has mandated (in PP 142/2015 and UU 3/2014) that manufacturing industry companies are located inside Industrial Estates and that tenants' basic needs must be met, for example, water and electricity. Expanding manufacturing activities in Industrial Estates will be critical to Indonesia's competitiveness, industrial development and the creation of well-paying jobs. But, the lack of reliable and universally available power represents an obstacle to achieving this expansion.

This study by GE and PwC confirms that blackouts and brownouts damage manufacturing businesses in Indonesia, and may account for at USD 415 million of business costs annually in key manufacturing sectors (see page 27). For this reason, potential tenants are increasingly evaluating Industrial Estates based on their power supply, and a reliable power supply helps attract tenants. Tenants whose activities are particularly power-sensitive require a higher level of service quality than is standard today. GE and PwC have researched different ways to develop power projects to meet these needs, and we are open to any development structures and parties who can fulfil these needs.

Industrial Estate developers will also benefit from an increase in captive power arrangements. Not only will these premium tenants increase overall revenue, but infrastructure investments provide an attractive return and stable cash flow even when the wider real estate market is down.

The government has an important role to play in supporting the private sector to realise this opportunity. There are many possible investment destinations for global private sector tenants, so we need to make Indonesia the most attractive.

I sincerely hope that the Government of Indonesia can work together with business to provide a clear set of opportunities for power generation under the *Kawasan Industri* and *Kawasan Ekonomi Khusus* programmes, and will underwrite private sector risks where needed. Lastly, I hope that permits and licenses will be forthcoming for reputable players who wish to develop these opportunities.

About This Report

PT PricewaterhouseCoopers Indonesia Advisory (PwC) was commissioned by PT GE Operations Indonesia (GE) to develop this report. The project started in September 2015 and was completed in March 2016.

The key objective of the project is to increase understanding of the benefits of captive power to the private sector, the Government of Indonesia as well as PLN. Throughout this report, we refer to captive power, defined as power supply that is generated by a firm for its own use. This can refer to an individual firm, or to an industrial estate that generates power to be ultimately sold to its tenants.

Private Power Utilities: The Economic Benefits of Captive Power in Industrial Estates in Indonesia explores the potential benefits that captive power can bring to Indonesia – not only to the private sector, but also to the Government of Indonesia and PLN.

The report focuses on three key questions:

- What are the cost savings from reducing incidences of blackouts and brownouts?
- How can captive power benefit both tenants and developers in an industrial estate?
- How can captive power support Government and PLN in achieving their capacity expansion and electrification targets?

To answer these questions we draw on insights obtained from interviews with private sector firms and industrial estate developers, as well as government officials.

To gauge potential costs from blackouts, PwC engaged with stakeholders via questionnaires and face-to-face interviews, then used this insight to build an economic model for seven sectors for which data was available.

PwC developed the approach and drafted the report. GE provided valuable comments and feedback over the course of the project. Stakeholder consultation was conducted jointly. During the project PwC and GE also received valuable comments and feedback from:

- Indonesia Investment Coordinating Board (BKPM)
- Industrial Estates Association (HKI)

PwC retained overall editorial independence, and this report ultimately reflects the data collected, independent analysis, and third party opinions received during the project.

Contents

Key value of Captive Power in Industrial Estates

For Government ...

Captive Power (Private Power Utilities (PPU)) can support economic activity

- Power supply was identified by BKPM as a key bottleneck for Industrial Estate development.
- Captive Power could increase the power supply to key industries in Indonesia, without public sector funding, and improve Indonesia's ranking in the global Doing Business Index.
- Industrial Estates are key GDP and job generators, and can move Indonesia up the value chain.
- Recent regulation (PP 142/2015) on the development of power for use in industrial estates is welcome, but there is still a need to clarify the precise conditions under which *Wilayah Usaha* licenses will be granted, and to streamline the regulatory environment so the private sector can contribute more.

For PLN ...

Captive Power represents a significant revenue opportunity, where PLN has a commercial role to play

- Captive Power reduces the pace of PLN's demand growth in core areas, allowing it more time to build generation capacity and improve reserve margins under the 35 GW Plan.
- Captive Power does not normally require PLN to take on new liabilities, such as entering into long term, USD-denominated contracts. This allows PLN to focus its debt capacity on priority projects.
- Captive Power reduces the need for PLN to make extensive Transmission and Distribution (T&D) investments to extend the grid to remote locations, while also meeting its Public Service Obligations.
- Captive Power is strategically aligned with PLN's intention to develop 35 GW of capacity before 2019, and, through cooperation and deals with the private sector, presents an opportunity to generate significant revenue with limited costs.

For Industrial Estate developers ...

Captive Power attracts high quality tenants, in turn attracting other tenants and increasing overall occupancy.

- For developers, a full industrial ecosystem, including power supply, is essential to attract high quality tenants, and financial returns on Captive Power can make it an attractive investment.
- It could provide significant new sources of long-term, recurring income in the real estate portfolio.

For tenants ...

Captive Power could avoid costs associated with blackouts and brownouts

- By improving the stability of the power supply, costs such as lost output, spoiled inventory and delayed production can be avoided.
- This could save firms in seven manufacturing sectors around USD 415 million a year if they avoid an average of around 60 hours of blackouts per year.
- Tenants in the food and beverages, chemicals and textile sectors may see the highest benefits from Captive Power.

01

Executive summary

"Energy is the lifeblood of the global economy."

World Economic Forum

Introduction

PwC and GE have jointly developed this publication on *Private Power Utilities: The Economic Benefits of Captive Power in Industrial Estates in Indonesia* in order to explore the potential benefits that Captive Power (Private Power Utilities) can bring to Indonesia – not only to the private sector, but also to the government of Indonesia and PLN.

The focus of this report is to identify not only *who* benefits from captive power, but also *how* and *why* they would benefit from captive power. Interviews with Industrial Estate management and tenants were used to identify benefits and design a methodology for modelling sector-wide blackout costs (or benefits from PPUs) at the national level.

Indonesia's growth potential is being constrained by the available power supply.

The Indonesian government, and in particular BKPM, has recognised the role of Industrial Estates as a key driver of economic growth. The realisation of the potential of Industrial Estates as growth centres may be delayed by bottlenecks.

Major barriers to developing Industrial Estates include land acquisition/preparation and power supply. In particular, the rapid growth in demand for power has outpaced capacity increases, and some areas are not yet electrified.

Captive power is one solution that could help overcome this constraint

Captive Power, or Private Power Utilities (PPUs), or power generated by a private owner for its own/other companies' use, reduces load on the grid. It can increase reliability, reduces business costs, and can rapidly deploy power to regions that currently lack power.

In doing this, captive power generates productivity benefits to tenants in Industrial Estates, particularly in areas with poor grid connectivity.

Executive summary (cont'd)

Both the private and the public sector stand to gain from captive power

The use of captive power not only benefits firms and industrial estate developers, but also Indonesia as a whole

Captive power would significantly reduce the risk of blackouts to firms, lowering overtime and genset costs, avoiding loss of revenue. High level calculations estimate blackout costs of around USD 415 million/year for the seven sectors modelled in this study (which account for 20% of GDP and 85 % of manufacturing GDP), assuming annual blackouts of around 60 hours.

The costs for each sector are as follows:

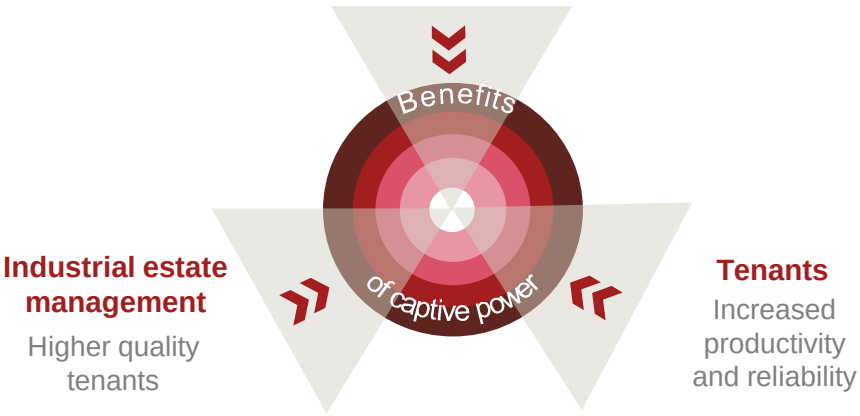
- USD 12 million in Printing
- USD 17 million in Machinery
- USD 28 million in Petroleum/Coal
- USD 42 million in Paper
- USD 44 million in Textiles
- USD 106 million in Chemicals
- USD 167 million in Food and Beverages.

These estimates exclude damage to machinery and inventory costs. Accounting for these, based on international studies, could increase these cost estimates by a further 70%.[1]

A more reliable power supply in turn could help real estate developers attract higher quality tenants. Developers can also capture some of the value premium through power bills.

At a national level, industrial captive power reduces the additional capacity burden on PLN. PLN has a Public Service Obligation to serve households in Indonesia. By allowing the private sector to drive captive power for key industries without any need for additional funding, PLN can maintain its focus and funding on the mission of powering residential and commercial customers across the nation.

Figure 1: Captive power as a mutually beneficial strategy



[1] Source: Source: http://www.onpower.com/pdf/epricostofpowerproblems.pdf

Executive summary (cont'd)

Converting a "vicious cycle" into a "virtuous circle"

Captive Power can play an important and complementary role to PLN in Indonesia's growth

Electrical power is essential to the government's plan of industrial development and poverty alleviation in Indonesia. Electricity not only supports industries, but improves outcomes such as quality of life, access to health and education.

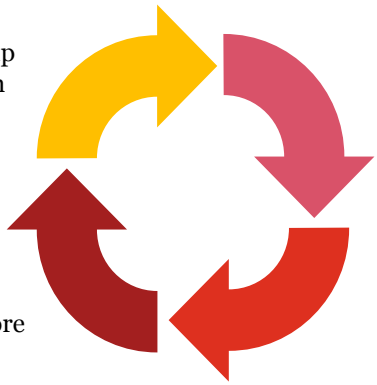
Captive power can free up limited resources and help to develop industrial areas, especially in areas where it is both challenging and costly to connect to the grid.

The Government and PLN have made great strides in progressing the 35 GW programme. However, investment still lags demand growth. The World Bank argues that such under-investment in infrastructure risks creating a vicious cycle which could depress growth, revenue and taxes[2].

The use of industrial captive power can change this 'vicious cycle' to a 'virtuous circle', and provide benefits for each stakeholder:

- Tenants benefit from a more reliable power supply.
- Industrial Estate and Power Plant developers (and co-developers) benefit from diversified, stable and sustainable sources of income.
- PLN benefits from avoiding grid overload at key locations, and could also participate in deals to generate incremental revenue (e.g. bulk buy-back contracts with a margin).
- The Government of Indonesia benefits from attracting investment to Industrial Estates and Strategic Economic Zones and having flexibility and options in the case of delays to the 35 GW Plan.

Figure 2: A virtuous circle of improved power quality



Increased power reliability and availability
- Captive power can help avert blackout costs in industrial areas
- Greater investor confidence

Higher value-adding industries
- Greater investor confidence leads to increased investment
- More technology-intensive and skilled industries

Improvement in infrastructure
- Increased profits and revenue allows for more private investment in infrastructure
- More economic activity leads to higher infrastructure utilisation and better business cases

Increased economic activity
- Investment and improved productivity leads to growth
- This increases corporate revenue and profits

[2] Source: World Bank, Connecting East Asia: A New Framework for Infrastructure

02

Electrical Power and Indonesian Development

A cornerstone of Indonesia's ambitious development plans is Industrial Estate development

Indonesia aims to increase income levels significantly by 2019

Indonesia aims to almost double its Gross Domestic Product (GDP) per capita to USD 5,500 by 2019 under the National Medium Term Development Plan (RPJMN) 2015 – 2019. This requires GDP to grow by between 6.0% and 8.0% per annum during 2015 – 2019. To achieve this, Indonesia requires accelerated industrialisation, with a target growth for the industrial sector of 7% per annum in the years 2015 – 2019.

The manufacturing sector is a key contributor to the Indonesian economy, forming 21% of 2014 GDP. However, manufacturing has under-performed compared to the economy as a whole, and to regional competitors, since 1997. The share of manufacturing in GDP has declined from 29% in 2000 to 21% in 2014.[3]

Industrial Estates will be the engines to drive investment and economic activity

The development of Industrial Estates is likely to be essential to the achievement of these challenging growth targets, given the need to encourage manufacturing competitiveness. Industrial Estates are created in order to focus industrial activities on a concentrated area, encouraging economies of scale and enabling the easier management of supply chains. They are also a significant employer; the manufacturing sector employed 15.3 million people in 2014, based on *Badan Pusat Statistik* (BPS) data.

Based on *UU no. 3/2014*, the Ministry of Industry announced that it will create at least 15 new industrial estates to spread growth to the country's less-developed provinces.

About Industrial Estate Regulations in Indonesia

These zones are regulated under PP 41/1996, PP 24/2009, UU 3/2014

These regulations state that:

- All manufacturing activities must take place within Industrial Estates.
- The domestic or foreign private sector is allowed to own and develop designated Industrial Land. Up to 70% of land may be sold/leased to tenants, with the rest being used for green spaces and infrastructure.
- Estates must meet certain infrastructure requirements, including electrical technical specifications in line with *Standar Nasional Indonesia*, with criminal and financial penalties applicable for violations.

[3] Source: World Bank

Key industrial trends point to significant opportunities in Industrial Estates and infrastructure development, particularly outside Java

The outlook for Industrial Estates is positive, though with realisation risks

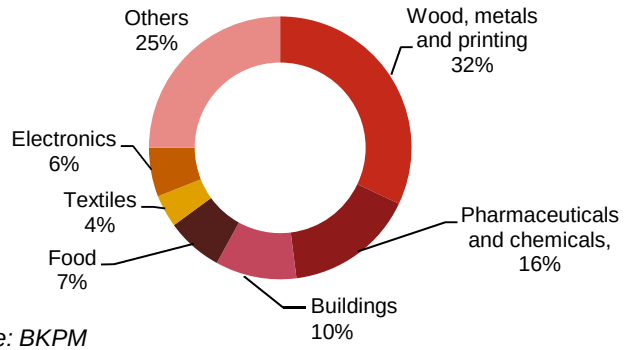
The Widodo Administration is planning to create 11 new Special Economic Zones (SEZs) and 15 new Industrial Estates across Indonesia before 2019. This amounts to at least 24,000 ha of new Industrial land, which we estimate will require 8-10 GW of new power capacity.

In November 2015, BKPM announced a relaxation of foreign ownership restrictions for some SEZs. Under the new Negative Investment List, foreign investors will be able to own a majority of shares and lease land for up to 80 years.[4]

However, these should probably be interpreted as 'stretch targets', given that the historical realisation of planned Industrial Estates has been patchy. Only 31%[5] of the planned Industrial Estate hectarage was occupied by tenants in 2013. Realisation rates were highest in Java, Northern Sumatera (excluding Aceh), East Kalimantan and South Sulawesi.

In the short term, Food and Beverages and Automotive appear to be strongly expanding sectors. Industrial land purchases in 2014 were concentrated on Logistics/Warehousing (28%), Automotive (23%), and Food and Beverages (29%).[6] The relationship between these industries and Captive Power is described in Section 3 of this document.

Figure 3: A significant proportion of current tenants are in wood and metal products, with chemicals, food, textiles, and electronics also prominent



Source: BKPM

Key trends

1. **Industries are moving towards more value-added and manufacturing activities.** Food and Beverages, Electronics, and Apparel stand out as sectors expected to be both large and fast-growing.

2. **Industrial shift to provinces outside Java likely to continue,** driven by government support as well as increasing costs in West Java.

3. **A planned infrastructure programme is likely to support the development of Industrial Estates** in traditionally undeveloped areas, especially if power, deep-water ports, natural gas and better road/rail infrastructure can be provided.

[4] 8-10 GW estimate based on individual zone presentations and assumption of 4 ha/MW where data is not available. Source: bisniskeuangan.kompas.com/read/015/11/05/140000526/ Pengelolaan.Kawasan.Ekonomi.Khusus.oleh.Asing.Terbatas Strictly speaking, Special Economic Zones (*Kawasan Ekonomi Khusus*), including Free Trade Zones, differ from Industrial Estates (*Kawasan Industri*) and are regulated under UU 39/2009. SEZs are eligible for a broader range of tax and regulatory incentives. For the purposes of this report we refer to all *Kawasan* as "Industrial Estates"

[5] Source: GIZ: An overview of Industrial Estates in Indonesia

[6] Source: Colliers International

Industrial growth may be encouraged by a shift towards more value-added and manufacturing activities

Slowing GDP growth is linked to a slowdown in primary sectors

Overall GDP growth in Indonesia has slowed since 2013, and is expected to be 4.7% in 2015. This has been largely due to poor performance in primary sectors, for example mining slowed overall GDP growth by 0.5% in Q2 2015[7]. Some of these sectors (Energy, Metals and Mining, and Plantations) could slow further without government intervention or a global rebound in commodity prices. Vertically-integrated supply chains such those in the minerals sector are exposed to cash flow squeezes upstream, although non-vertically integrated companies may see a boost from reduced input costs.

However, manufacturing's contribution to growth has remained broadly steady, with only a few exceptions. The medium-term trend of strong growth in smaller, higher value-added sectors such as Machinery and Equipment, Automotive and Textiles is forecast to continue[8]. Key growth factors include interest rate cuts by Bank Indonesia, infrastructure investments, and the increasing wealth of Indonesians.

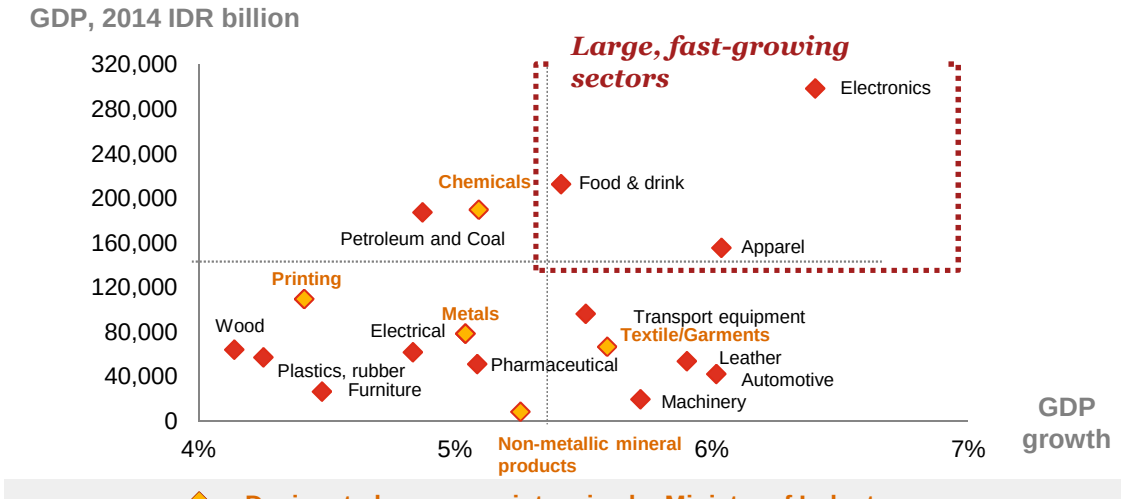
Key sectors to consider for Industrial Estates developments are the large, fast growing sectors. Oxford Economics expect Electronics, Food and Beverages and Apparel to maintain growth rates of at least 5.4% up to 2024, despite already accounting for sales of over IDR 150 trillion (USD 11.1 billion). These sectors are not all "energy-intensive" but are significant power users with operations often sensitive to the availability and quality of power supply.

So, for Indonesia to continue its industrial development, reliability of the power supply is likely to be important.

With uncertain commodity prices, and China rebalancing away from commodity-hungry industrial-led growth, Indonesia needs to prioritise development of the manufacturing industry to ensure long-term growth.

[7] Source: World Bank, Indonesia Economic Quarterly (October 2015)
[8] Source: Oxford Economics (GDP Forecast 2015)

Figure 4: Size and growth rates of major industries in Indonesia



Source: Oxford Economics, Ministry of Industry

Government policies and rising costs in West Java are likely to drive a shift in industrial activity to other provinces

The government has a concurrent aim to encourage growth outside of Java

Most Industrial Estates in Indonesia are currently in DKI Jakarta, West and Central Java, in line with Indonesia's overall historical economic development. Exceptions include Batam and Bintan, which have developed in order to complement Singapore's economy. Factors such as population density, per capita income, infrastructure access and agglomeration effects (when businesses benefit from being located near each other) give these areas a significant advantage in future industrial development.

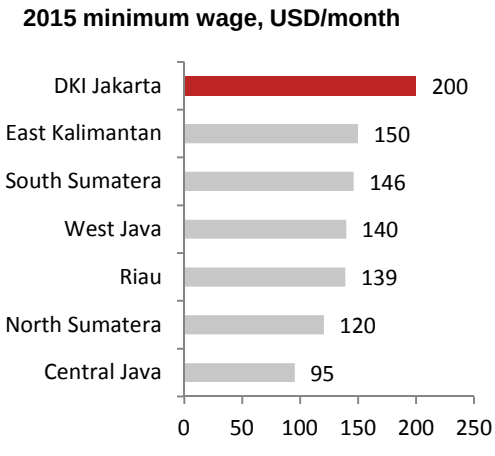
The Government is expected to pay special attention to less developed regions like East Indonesia. For example, it aims to raise the proportion of manufacturers outside Java from the current 27% of the total to 40% by 2025.[9]

The cost of doing business in 'traditional' industrial areas such as West Java is increasing.

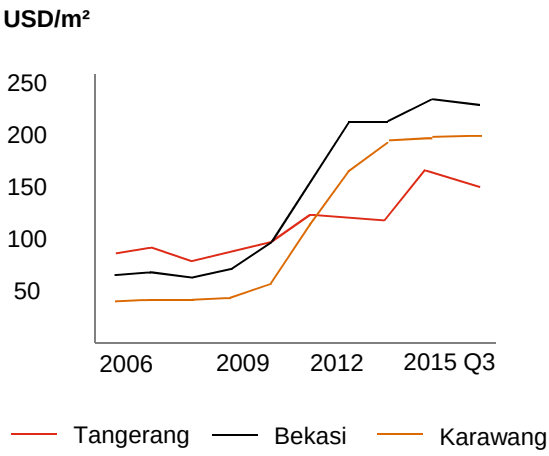
Depleting land banks around Jakarta, as well as significant competition with residential and commercial developments, have led to rising land costs. Labour costs are also increasing, as the government has mandated a rapid rise (relative to GDP growth) in the minimum wage in recent years.

All else being equal, this trend may well spur industries to relocate to new areas in Central and Eastern Java, Southern Sumatera, and Kalimantan. New factories are especially likely to consider locating themselves in these areas.

Figure 5: Land prices and wages have risen sharply in Jakarta in recent years



The minimum wage in Jakarta is at least 20% higher than in other areas



Land prices in and around Jakarta have increased by 50% – 100% over the last 10 years

Source: BPS, Colliers International

[9] Source: 'http://www.kemenperin.go.id/artikel/6974/Investasi-Manufaktur:-PMDN-Diarahkan-ke-Luar-Jawa

The planned infrastructure programme should help support Industrial Estate development

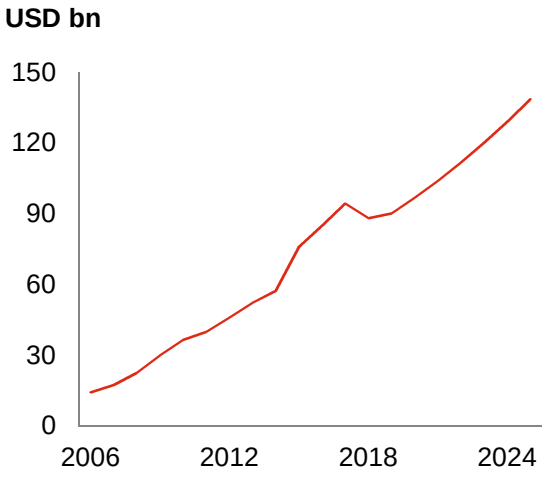
The infrastructure programme was outlined in the National Medium Term Development Plan (RPJMN) 2015 - 2019. The government expects infrastructure spending to increase to USD 81.5 billion per annum from 2015 - 2019.

On a like-for-like basis, our projections are around a fifth lower. However, total infrastructure investment is still projected to increase by 87% in real terms, compared to the 2010 - 2014 spending.[10]

There is significant uncertainty regarding the timing of the realisation of government infrastructure targets. The public sector, including State Owned Enterprises, can fund around 69% of the target, but private funding is needed for the remaining 31%[10].

In the power sector specifically, as discussed on page 21, it is possible that some delays in reaching the 35 GW Commercial Operations Date target of December 2019 will occur.

Figure 6: Indonesia infrastructure spending 2006-2024



Note: 2014 exchange rates
Source: Oxford Economics, PwC

Infrastructure and institutional improvements, particularly to the power sector, will be key to enabling the growth of Industrial Estates.

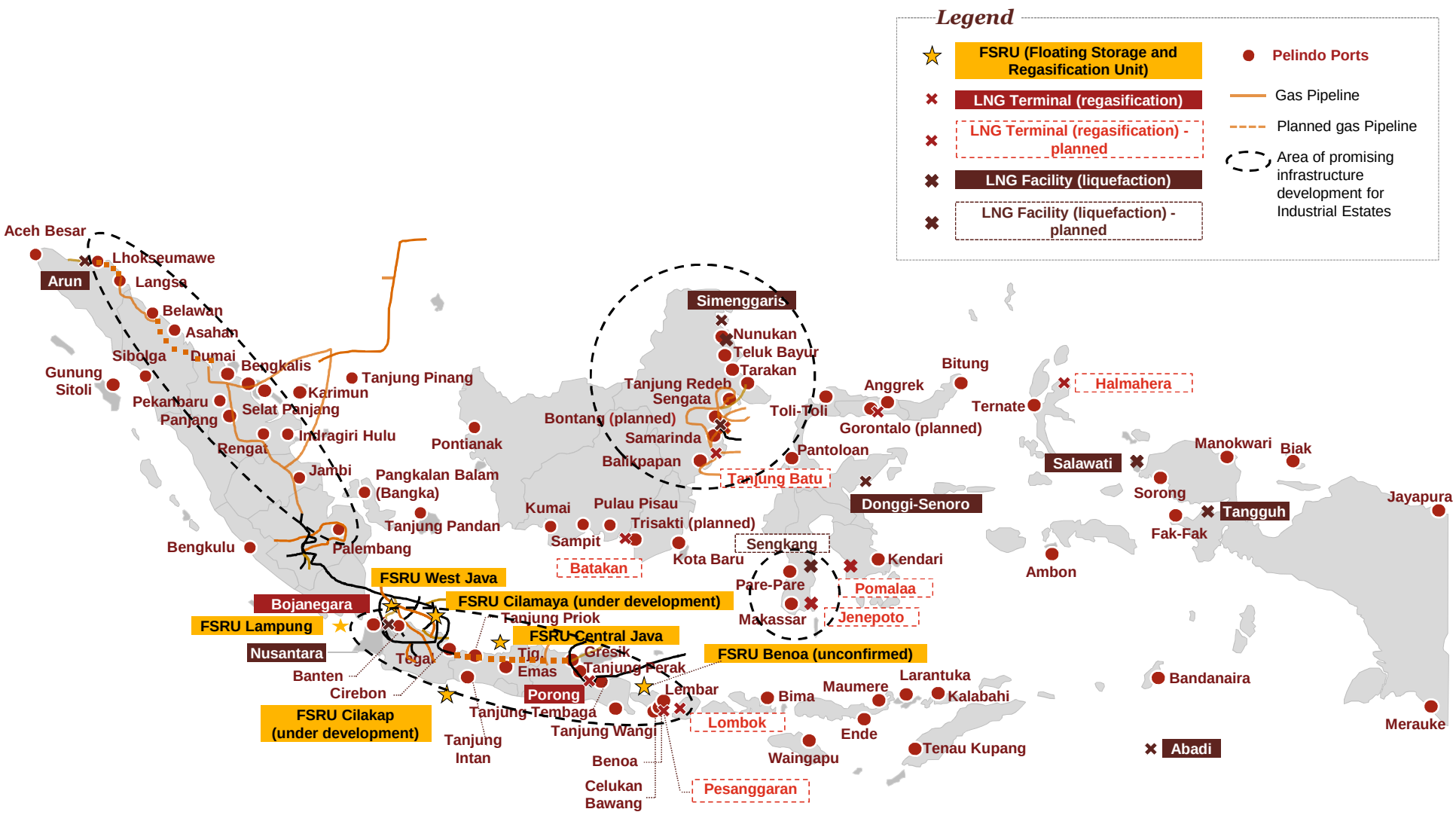
The realisation of the potential of Industrial Estates as growth centres may be delayed by bottlenecks, which impact economic growth more broadly. PwC has previously highlighted concerns over land acquisition procurement, the stability of the investment climate, and the lack of coordination between government agencies.[10]

Industrial Estates require infrastructure, especially ports and roads, power, water, and often natural gas access. This requirement is likely to add momentum to those Industrial Estate developments which are near to planned infrastructure developments, such as East and Central Kalimantan, East Java, Eastern Sumatera as well as many areas in Sulawesi and West Papua (see map on next page).

BKPM has identified that the main barriers to doing business in Indonesia for Industrial Estates are land acquisition/preparation and power supply[11]. If the required infrastructure, especially the 8-10 GW of required power capacity, is not available, it could seriously hinder the development of Industrial Estates.

[10] Source: 'Building Indonesia's Future – Unblocking the Pipeline of Infrastructure Projects', PwC Indonesia
[11] Source: Discussion with BKPM

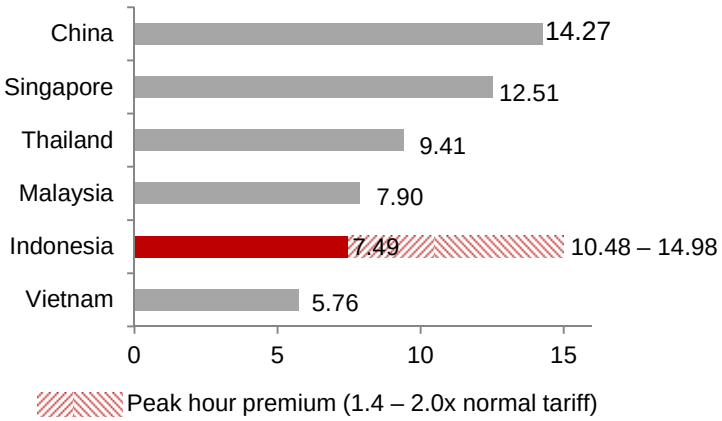
Industrial zones located near key infrastructure such as natural gas plants and ports would have a competitive advantage



The lack of reliable power is a key infrastructure constraint

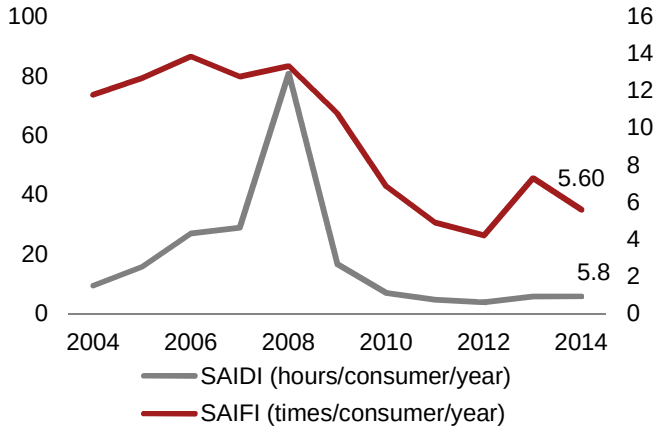
Figure 7: The base cost of electricity is relatively low in Indonesia, but reliability is also low.

Industrial power prices in Asia 2015 (USD cents per kWh)

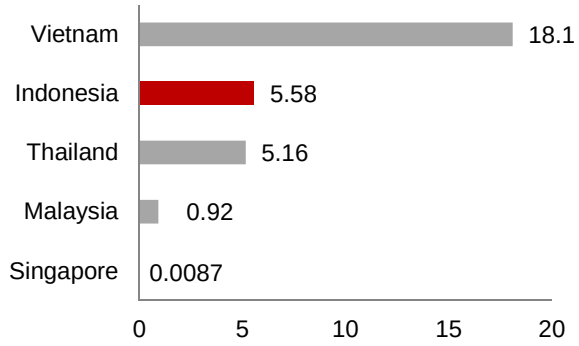


Indonesia SAIDI (hours/consumer/year)

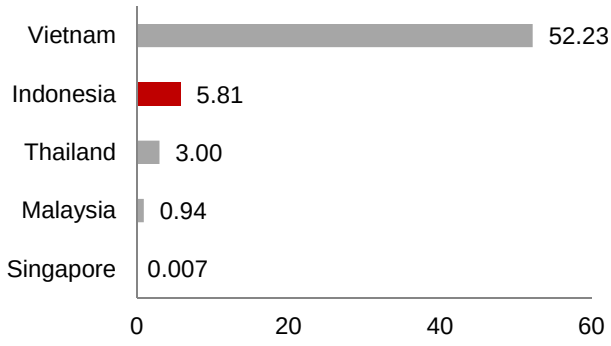
Indonesia SAIFI (times/consumer/year)



2014 SAIFI (times/consumer/year)



2014 SAIDI (hours/consumer/year)



Source: Ministry of Energy and Natural Resources, PT PLN, Energy Commission of Malaysia, Singapore Power, Vietnam Electricity, Thailand State Enterprise Review (Provincial Energy Authority). Tariffs calculated by PLN using utility and FX rates at the year end 2014

Rapid growth in demand for power has outpaced capacity increases

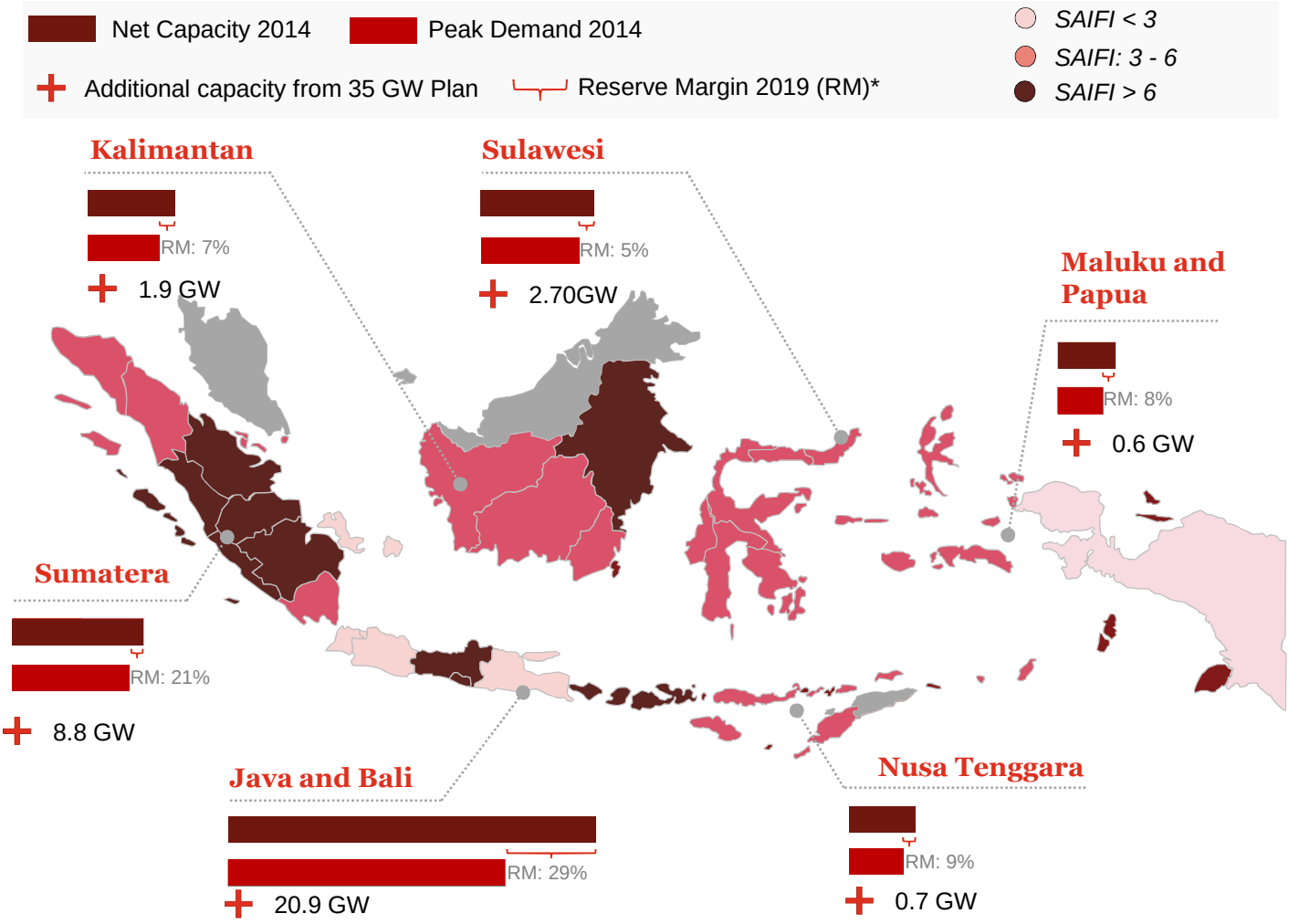
Strong economic growth (5.9% average from 2009 - 2013) and a rapidly expanding middle class have caused a surge in demand for electricity. Capacity growth has not kept up, and PLN has been forced to implement blackouts in some provinces. As a result, many users own their own backup diesel generators.

For example, according to *PLN Statistik,* consumers in Riau province were disrupted for on average 14.1 hours per disruption in 2014. In Central Java and Yogyakarta a typical electricity consumer would experience on average 13.1 power disruptions per year.

Both the System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) in Indonesia (5.8 and 5.6 respectively) lag behind regional neighbours such as Malaysia and Singapore.

The 35 GW plan is intended to increase capacity and reduce the frequency of power interruptions

Figure 8: Reserve margins are low in many provinces, and system interruptions are common



Source: MEMR, Masterplan on Indonesia Power Plant Development, PLN RUPTL
Note: SAIFI refers to the average number of interruptions experienced per year

The 35 GW plan is planned to be completed by 2019

This stress on the power grid is evident across the country, with Reserve Margins (*the difference between capacity and peak demand) in every island group, except Java – Bali, below the International Energy Agency's recommended level of 20-35%.

Further, the Java - Bali average reserve margin is deceptively high. In fact, the distribution of load (heavy in DKI Jakarta and West Java) versus capacity (concentrated in Banten, Central and East Java) still creates localised issues for the grid on Java.

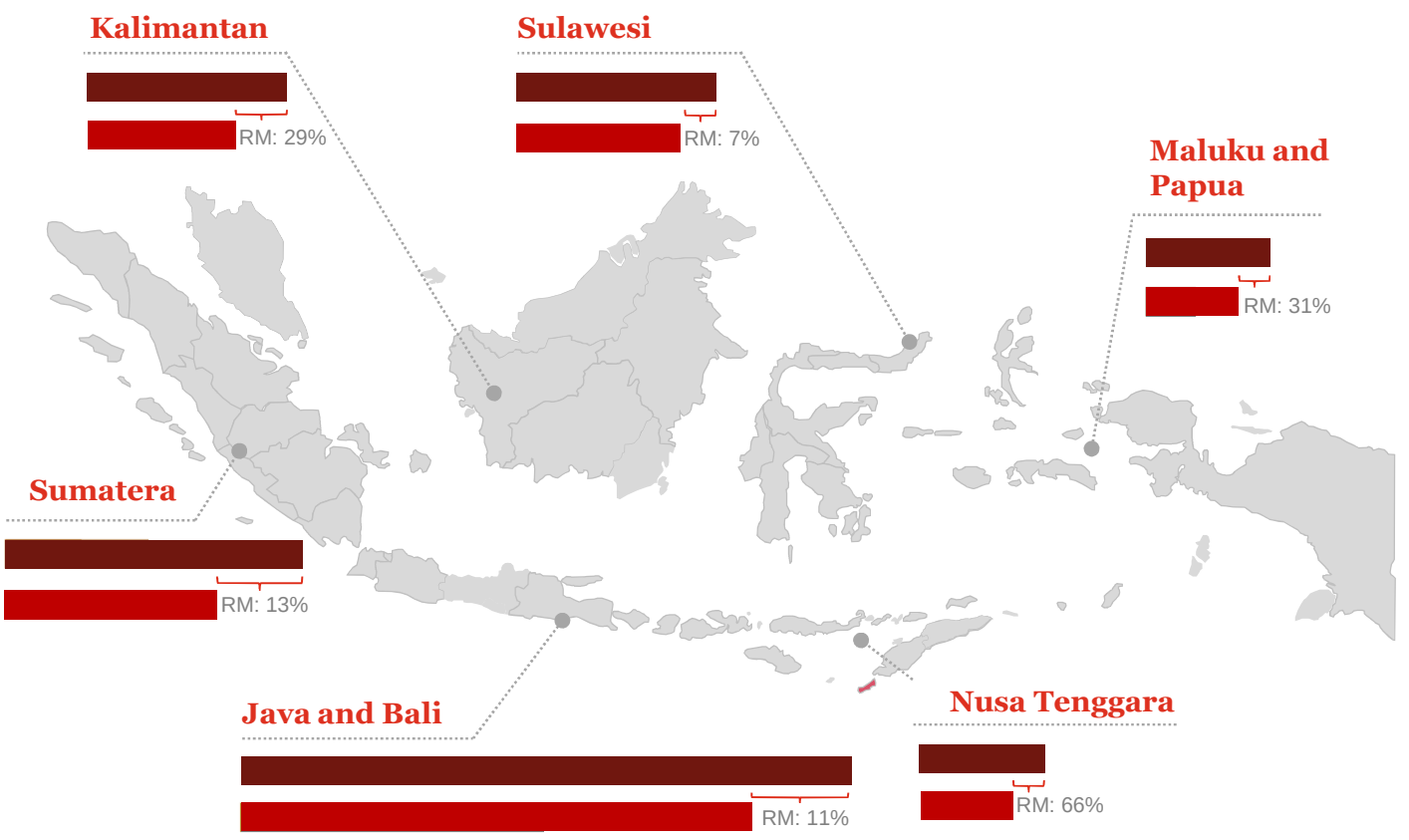
In recent years, when the reserve margin has fallen to 15%, PLN was forced to implement load shedding, leading to 2-3 hour daily blackouts[12].

For this reason, the 35 GW Plan was launched, and is planned to be completed by 2019. The target set for the power sector is to increase Indonesia's capacity by 43 GW by 2019, including 8 GW of leftover projects from an earlier Fast Track Programme (FTP). This additional capacity, illustrated in the graphic above, is designed to alleviate the power deficit in Indonesia.

[12] Source: http://www.adb.org/sites/default/files/linked-documents/41074-013-ino-ssa.pdf

If the 35 GW Plan is delayed by two years, power grids will be under extreme stress

Figure 9: If capacity increases are delayed, reserve margins could fall to <13% in Sumatera, Java/Bali and Sulawesi



Source: MEMR, Masterplan on Indonesia Power Plant Development, PLN RUPTL

However, given the expected rapid growth in demand, delays to the 35 GW Plan would mean continued stress on the grid.

We have performed a 'what if' scenario, looking at a two year delay in the Commercial Operations Date (COD) of the planned power plants to 2019, compared to the expected peak load growth over the same period. The results, illustrated above, show that only a two year delay in the 35 GW Plan would lead to deteriorating reserve margins in Sumatera and Java - Bali.

This would be likely to lead to a deterioration in grid performance measures such as SAIFI and SAIDI.

The Government has made great strides in accelerating the 35 GW Plan. But, as outlined in the following section, it is quite plausible given historical experience, that the Plan will still be delayed by two years due to land acquisition, procurement and other bottlenecks. In this context, Captive Power provides flexibility and backup options for the Government in the event of delays to the national Plan.

Procurement constraints may delay the implementation of the 35 GW plan

Figure 10: Typical timeline of Independent Power Producer plant development

Technology	Average Construction Time (months)
Coal	36-54
Gas	18-32
Hydro	24-48

Source: PLN, PwC Analysis in consultation with IPPs, IEA, IRENA.
Note: Stages are also broadly appropriate for PLN EPC contracts as well as IPP tendering.

Typical Independent Power Producer plant development timelines mean it is unlikely that projects not yet at the tender stage will come online before 2019

Given historical procurement and construction times, there is a risk that the 35GW Plan may not be completed in time. This is despite significant progress by Government and PLN in seeking to address bottlenecks (e.g. the 8 acceleration step programme, Presidential Regulation No.4/2016).

Independent Power Producer (IPP) projects account for 29 GW out of the total 43 GW target capacity. However, as of January 2016, only 14 GW of Power Purchase Agreements (PPA) had been signed[13].

Given the typical timeline for power plant development (see graphic opposite), this means that at least 15 GW of projects are unlikely to come online even by 2020. Those projects which form part of the 14 GW and which have signed PPAs but are not near Financial Closing are also unlikely to come online by 2019. Our estimate is conservative, as it assumes construction timelines which are aggressive for Indonesia.

Leading IPP investors have also highlighted the risk of delays in the 35 GW Plan due to the lengthy procurement process[14], and there are also concerns among investors regarding:

- Land acquisition (for generation sites and transmission corridors)
- Transmission capacity
- Permit-granting procedures at the sub-national level
- The financial sustainability of some consumer/Feed-in Tariffs (fixed per-kWh prices for some technology types)

In February 2016, the Minister of Energy and Mineral Resources, Sudirman Said, also stated his uncertainty that the full 35 GW Plan would come online by 2019[15].

Depending on the offtake options and procurement process, a Captive Power Plant could be developed to Financial Close within two years, plus a construction time of one to two years for gas-fired power plants.

[13] Source: Ministry of Energy and Mineral Resources website (esdm.go.id)
[14] As quoted by President Director of PT Cirebon Energi Prasarana, in Coal Asia, December 2015
[15] http://bisniskeuangan.kompas.com/read/2016/02/03/204640226/menteri.esdm.tak.yakin.mampu.selesaikan.proyek.35.000.mw.pada.2019

Full implementation still might not be enough

Even if currently planned power generation programmes are implemented on schedule, there may not be sufficient capacity to service some Industrial Estates

To illustrate this underlying supply issue, one of the plans to develop industrial activity in Morowali, Central Sulawesi proposes a nickel smelter company and stainless steel companies as tenants of the planned Industrial Estates. These companies would require an estimated total of 1,030 MW of power.

However, the nearest transmission line is approximately 200 km away. The three existing IPP power plants near the area would be insufficient once the smelters came online, as their total capacity is 435 MW. There are no plans under the current RUPTL (2015-2024) to meet this demand.

A local source of power will clearly be needed regardless of the progress of the 35 GW plan. There are other examples of Industrial Estate demand exceeding the planned generation or transmission capacity under the RUPTL, for example, Maloy (palm oil and coal based Special Economic Zone) and Buli (planned Special Economic Zone for metals extraction and refining).

Captive power can address these risks

What is captive power?

A captive power unit is a generator or power plant set up by a company to generate electricity primarily for its own use or for the use of its customers.

There are two types of units:

The first type is a **Captive Power Plant** (CPP), designed to service primary power needs. This is typically bigger than 1 MW and can run on fossil fuels (gas, coal, oil) or renewable sources of energy.

CPPs can be divided into two sub-categories :

(a) CPPs that are built to supply power to many companies. The main examples of this type of setup are the CPPs used in Industrial Estates, which are analyzed in this study. In Indonesia, these are referred to as Private Power Utilities (PPUs).

(b) CPPs that are built to supply power solely for the owner's own use (e.g. one CPP for one factory).

The second type is a **backup generator set** (genset), which is built for use in the event that other power sources fail, and runs only when needed. These range from smaller household units (10 kW) to larger industrial backup gensets (up to 10 MW). These need to run on a fuel type which can provide electrical energy on demand, and thus are usually diesel-fired.

Reliable statistics are hard to find, but a 2009 estimate placed the total Captive Power capacity in Indonesia at 16.8 GW, of which 8.5 GW was for primary use, and 7.8 GW for backup power. 49% of Captive Power capacity was in Java.[16]

There is strong potential for captive power to help drive growth in industrial areas

As noted in the previous section, the timeframe of the 35 GW Plan is ambitious, and there are still many areas where CPPs present a good opportunity, as the 35 GW Plan does not include meeting the power needs of those areas.

[16] Source: 'Overview of Diesel Consumption for Captive Power in Indonesia' GIZ

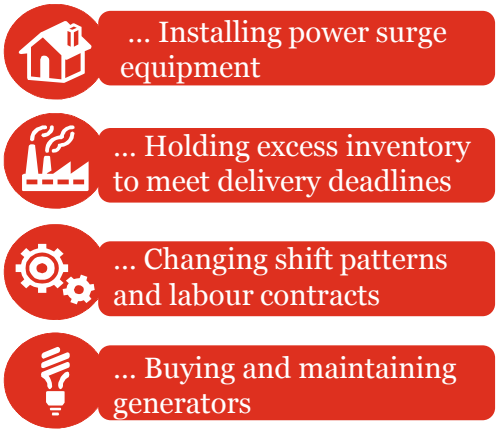
03

Economic benefits of captive power

Economic benefits from avoided blackouts/brownouts are wide-ranging

When a blackout or brownout occurs, there may be ...

In anticipation of blackouts and brownouts, firms may take long-term but costly mitigation measures such as ...



Our interviews suggested blackout (cash and opportunity) costs are in the range USD 10,000 – 100,000 per blackout

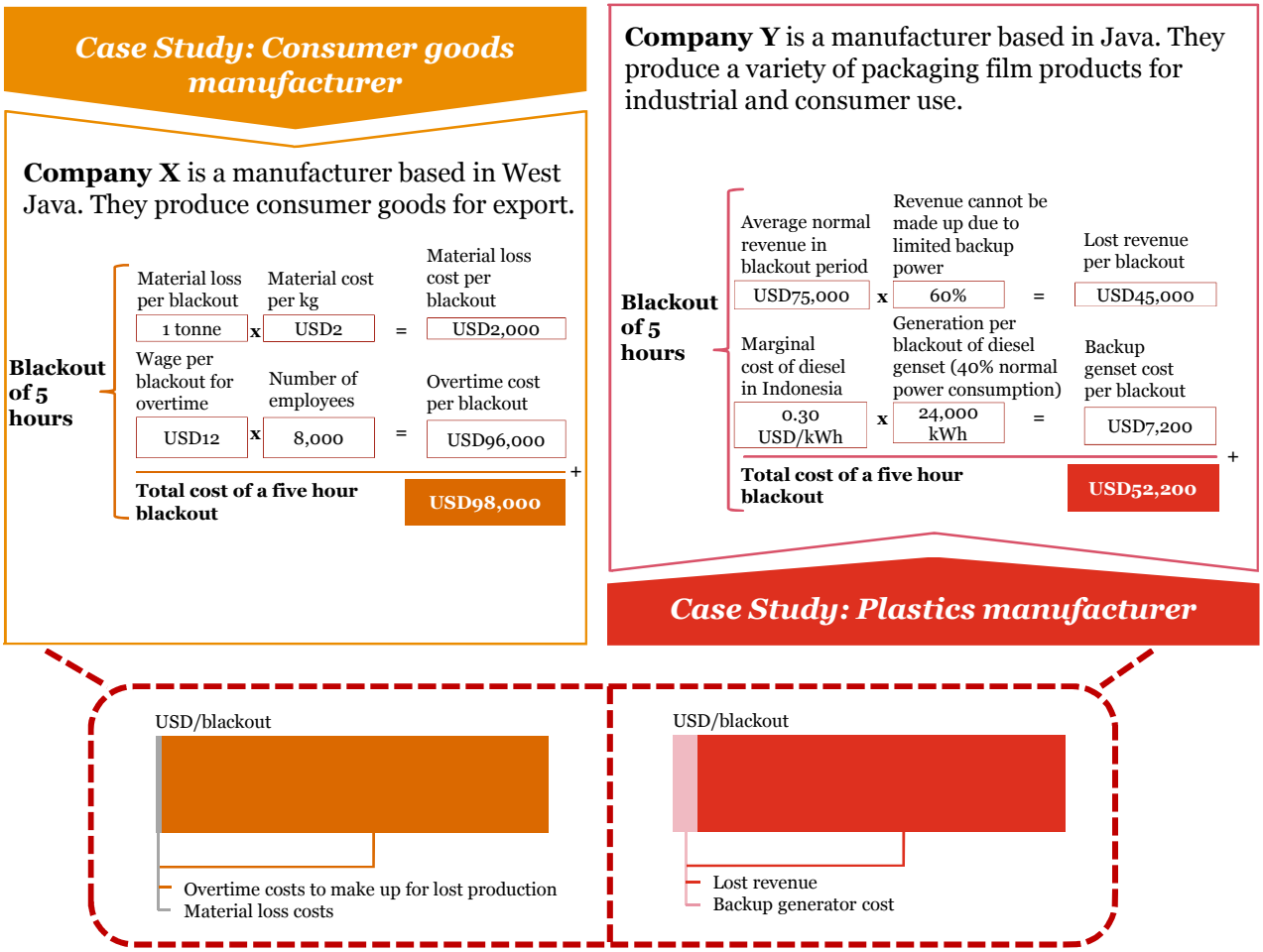
Five tenants and three industrial estate managers/operators were interviewed to understand the benefits of Private Power Utilities with Uninterruptible Power Supplies (UPS). All five tenants agreed that blackouts could be expensive for their businesses, although two of these were averse to any increase in power bills, despite potential overall savings.

A brief blackout can damage equipment, or require machinery to be restarted. Inventory which is in the process of machining, cutting or heating may need to be written off as a result. Workers are legally entitled to overtime pay at 1.5 – 3 times the normal wage for the hours needed to make up lost production. In the meantime, overheads are still being incurred. Downtime hours may not be able to be made up later. Alternatively, significant fuel costs may be incurred running in-factory diesel generators.

Based on the interviews conducted, these blackout costs can range widely, from around USD 10,000 to USD 100,000 per blackout. Detailed illustrations of the potential total annual costs to two of these five firms are included overleaf.

In the longer term, firms may take mitigation measures to reduce these costs. This may include equipment to protect machinery from surges, holding excess inventory to avoid missing delivery deadlines, changes to workers' shifts, or expenses to buy and maintain diesel generators.

Illustration: how a typical blackout affects firms' operations



Calculating blackout costs

Based on interviews, an economic model was built focusing on four cost items for which data was available:

- Lost Production during blackout
- Lost Production during restart period
- Overtime wage costs
- Diesel fuel costs

Two items of costs for which data were not available – damage to equipment and material losses – have been demonstrated to account for around 40% of total blackout costs globally (see page 59). This could mean the estimates are around 70% under-stated.

Brownouts (varying voltages which can cause equipment damage and productivity losses) were also not included in the calculations.

These statistics cover the seven sectors listed below, accounting for 49 TWh of power consumption in 2015. This represents 66% of industrial power consumption in Indonesia, compared to 45% of industrial GDP (20% of total GDP).

The scenarios that follow assume that the:

- **Low Case**: annual number of blackouts will be 5.6 (2014 SAIFI), and the average duration 5.8 hours (2014 SAIDI).
- **Medium Case:** annual number of blackouts will be 10.0, and the average duration 5.8 hours.
- **High Case:** annual number of blackouts will be 15, and the average duration 8 hours.

Full details on model assumptions and process are included in the Appendix (Methodology).

1. Machinery
2. Petroleum and coal
3. Paper
4. Chemicals
5. Food and beverages
6. Textile and garments
7. Printing

The annual costs of blackouts to manufacturing businesses in Indonesia could be USD 415 million …

"In early 2015, we lost a month's revenue due to power failures. Even with backup power and overtime, we will never make that up."

Leading Indonesian Food and Beverages Manufacturer

Across these seven manufacturing sectors, it was estimated that blackouts could cost businesses around USD 415 million/year:

- USD 74 million in diesel fuel costs from running gensets during blackouts
- USD 9 million in employee overtime costs after blackouts
- USD 332 million in lost production during blackouts that cannot be made up due to lack of time. This includes the time spent restarting operations.

Spread across these industries' annual power consumption, this is around 0.9c/kWh. Or, 0.3% of annual revenue.

The results depend heavily on assumed blackout hours. In the Low Case (32 blackouts hours) the cost would be USD 233 million and in the High Case (120 blackout hours) the cost would be USD 871 million.

The Medium Case (58 hours) corresponds to reported duration and frequency of blackouts for some provinces already (see page 18). The number and duration of blackouts is also non-linear with respect to the reserve margin. As discussed on page 20, the reserve margin is likely to fall dramatically in the event of a delay in the 35 GW Plan, potentially leading to the magnitude of results in the High Case.

Results may also vary by province. For example, wages in West Java are typically higher (e.g. minimum wage is 15% higher than national average minimum), boosting overtime costs by around 15%.

Tenants in the food and beverages, chemicals and textile sectors may bear the highest costs

These sectors have the highest revenue levels among the seven sectors modelled. As such, the potential revenue that cannot be recovered can be significant for such tenants – food and beverages revenue, for example, was about USD 55.2 billion, leading to potential losses of USD 166 million/year.

While not modelled (as damage and material costs depend heavily on company-specific information), it is worth noting that blackouts may be even more costly for firms in the food and beverages sector and the chemicals sector. Their raw materials could easily be spoilt without appropriate temperature controls.

Figure 11: Potential business benefits of captive power (assuming 58 blackout hours per year)

	Food and beverage	Chemicals	Textile/ Garments	Paper	Machinery
Revenue (USD billion), 2014	55.2	23.1	11.1	8.6	2.5
Labour cost /revenue (%), 2014	4.1	4.6	8.3	5.4	8.8
Capacity utilisation (%), 2010	73.1	80.1	80.7	85.0	86.0
Material loss and equipment damage during blackout	← Various by industries, not included in estimation →				
Assumed restart times (hours)	0.5	2.0	0.5	2.0	0.5
Estimated annual blackout costs (USD million)	166.0	105.8	44.3	42.4	16.5
Blackout costs/ revenue (%)	0.3	0.5	0.4	0.5	0.7

... implying the full cost of grid power to businesses is at least 9.5c/kWh

By providing reliable captive power, developers can capture the avoidable costs of blackouts

This economic cost could be expressed as a price premium (i.e. the extra that a user would be willing to pay) for reliable power of, on average, 0.9 cents per kWh on total power bills.

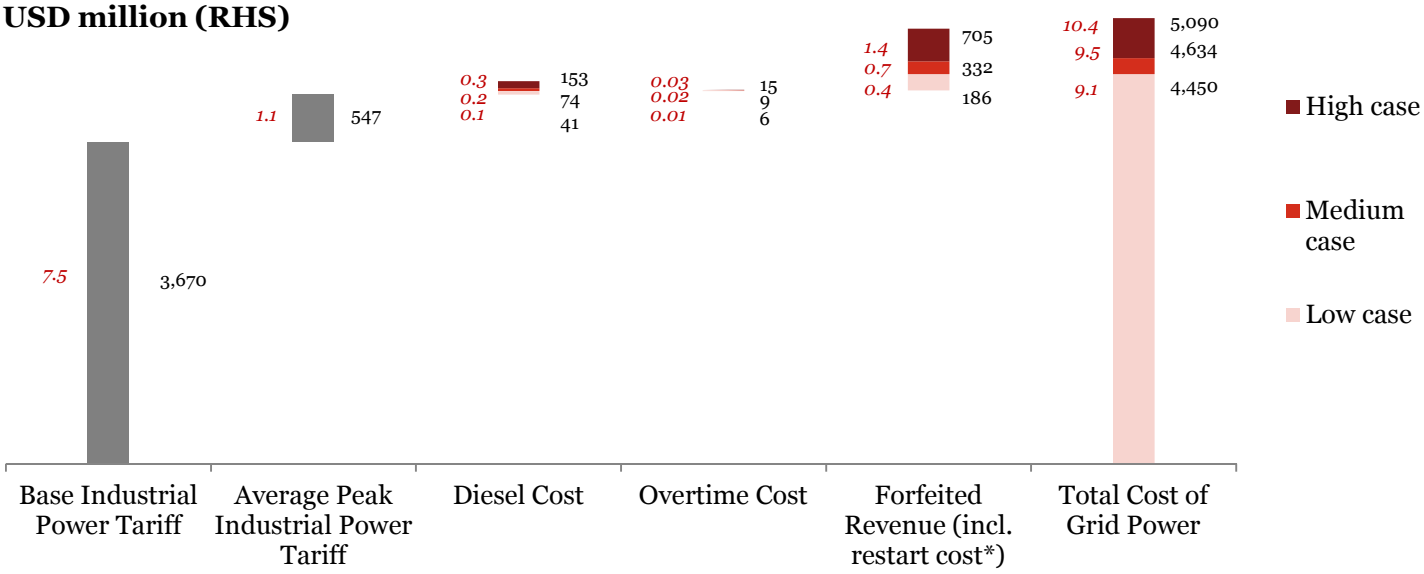
This suggests that the full cost of grid power to businesses is at least 9.5c/kWh (1,280 IDR/kWh):

- 7.5 c/kWh base industrial tariff
- 1.1 c/kWh peak hours surcharge (estimated average)
- 0.9 c/kWh economic costs (see previous page)

And, this excludes equipment damage and material losses, which are around 40% of total blackout costs based on internal experience.

Industrial estate developers looking at new ways to improve their margins and attract quality tenants may be in a position to capture these gains by providing an Uninterruptible Power Supply (UPS) under a PPU arrangement.

USD cents/kWh (LHS)
USD million (RHS)



Source: PwC Analysis, Base Industrial Power Tariff based on PLN tariff for large industry in Indonesia 2015, Average Peak Industrial Power Tariff based on PLN Peak Hour multiplier of 1.7 for peak hours 6pm to 10pm with Baseload-Peak ratio of 0.7 . Total consumption for 7 sectors: 49 TWh. Note: Restart cost is the time taken after a blackout for manufacturing to restart, during which time revenue is not earned. Key assumptions: Diesel price IDR 9,000/litre, 68% of firms have diesel generators, firms are not able to run higher than 90% capacity utilisation, USD:IDR 13,500

Captive Power supports industry as well as the government's development goals

> ***"Captive power is not just a differentiator for Industrial Estates; it's a necessity."***
>
> **Director, Industrial Estate development company and power plant development company in Java**

Captive Power may also open up new economic opportunities

Through access to UPS, firms can avoid these blackout costs and may reap wider benefits including:

- Greater capacity to negotiate long-term contracts, as well as higher-value contracts
- Less risk of penalties for missing contractual targets
- The confidence to enter into contracts supporting just-in-time value chains

Just-in-time supply chains do not have a cushion of raw materials as a fallback and so confidence that operations can be maintained during power outages is needed to supply to these value chains. Such supply chains are common in the automotive sector, as well as high-tech sectors.

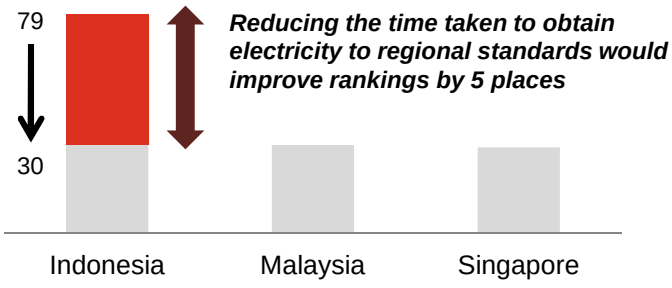
High quality power supply would also attract investors and encourage economic activity

Increased/improved electricity capacity would benefit Indonesia in global competitiveness rankings and encourage investors. Currently, obtaining electricity in Indonesia takes around 79 days, compared to 32 days and 31 days in Malaysia and Singapore respectively.

The 79 days required to obtain electricity includes applications and contracts with electricity utilities, all necessary inspections and clearances from the distribution utility and other agencies, and the external and final connection works. However, in at least one leading Industrial Estate, Captive Power only takes 14-30 days to obtain.

If Captive Power can contribute to significantly reducing the time taken to obtain electricity from 79 days to 30 days across Indonesia (close to Malaysia's current time), Indonesia's ranking in the Doing Business Index would improve by 5 places.

Figure 12: Number of days to obtain electricity



In addition to this, it is estimated that a 10% increase in service penetration of electricity and telecommunications would increase long-term economic growth rates by approximately 0.25 %[17].

[17] Source: Schwartz, Jordan, Luis Andres, and Georgeta Dragoiu. 2009. "Crisis in Latin America: infrastructure investment, employment and the expectation of stimulus." World Bank. Policy Research Working Paper 5009

Note: MEMR is reportedly considering new regulations to reduce the time to connect to the grid to 40 days (Source: http://www.cnnindonesia.com/ekonomi/20160121131311-85-105786/kementerian-esdm-pemasangan-listrik-baru-maksimal-40-hari/), but the date for enactment and the speed of practical implementation is unclear.

04

The Way Forward

How is private sector participation in power regulated in Indonesia?

Introduction: private sector participation in power

The core legal framework for electricity supply is set out in the Electricity Law of 2009 (UU 30/2009), which allows the private sector to hold generation licenses (IUPTL).

This is now supplemented by PP no. 142/2015 (see page 34), which grants each Industrial Estate developer in Indonesia a facility to ease the development and management of its electricity supply for its own use and for the use of its tenants.

Private sector generation and sale, primarily to the grid, is allowed through IPP arrangements.

Private Power Utilities (PPUs), often referred to in broad terms as Captive Power, the generation of power primarily for own use or to a customer base (tenants) rather than for sale to PLN, is also permitted.

PPUs must acquire an *Izin Operasi* as well as an IUPTL.

The 2009 electricity law also provides a right of first refusal for PLN to provide electricity supply to an area before the government can offer the opportunity to regionally-owned entities, private entities or cooperatives.

MEMR 28/2012 clarifies the requirement that there must only be one supplier of power in any one area (*Wilayah Usaha*), and states that a *Wilayah Usaha* can be granted if:

1. The area is not yet covered by an existing *Wilayah Usaha* holder; or,

2. The existing *Wilayah Usaha* holder is not able to supply power, or not able to supply power with good quality/reliability; or,

3. The existing holder has returned its *Wilayah Usaha*.

There have been 21 *Wilayah Usaha*[18] granted by MEMR since 2009, to various power generation entities.

As far as we are aware, there is no legal definition of 'good quality/reliability' or of the criteria needed for the existing holder (usually PLN) to have to return its *Wilayah Usaha* to the Ministry of Energy.

With the introduction of the BKPM "One Stop Shop" under MEMR 35/2014, investors can now obtain all their national permits, including *IUPTL, Izin Operasi* and *Wilayah Usaha* through BKPM upon the submission of the correct paperwork.

[18] Source: Draft RUKN, June 2015: http://www.djk.esdm.go.id/index.php/rencana-ketenagalistrikan/rukn-djk

The private sector can sell excess power to PLN, but the regulations may not fully support this.

Regulations regarding sale of excess power

In recent years, several cooperation deals have been struck between PLN and Captive Power Providers, involving offtake, backup, synchronisation and buy-back arrangements under long-term contracts. These deals were usually *ad hoc*, depending on local circumstances.

Private sector participation is allowed through Independent Power Producer (IPP) arrangements. IPP appointments are most often made through tenders, although IPPs can be directly selected or appointed in certain circumstances.

In line with Government Regulation No.14/2012 as amended by No.23/2014 and MEMR Regulation No.1/2006 and No.4/2007, MEMR Regulation No.3/2015 states that PLN may purchase power using the direct selection method when changing the feedstock of an existing power plant from diesel to non-diesel, and that PLN may use the direct appointment method for mine-mouth, marginal gas or hydro projects (including purchases of excess power from PPUs), for critical and emergency power supply, and for expansion projects. The maximum timeframe for the execution of the PPA is 45 days for direct selection and 30 days for direct appointment from due diligence document evaluation to PPA signing.

Further details on the procurement process are available in PwC's 2015 *Power in Indonesia: Investment and Taxation Guide*[19].

[19] URL: https://www.pwc.com/id/en/energy-utilities-mining/assets/Power%20Guide%202015%20(final-octL).pdf

Maximum tariffs for sale are defined but function more as benchmark prices

The "maximum tariff" for the sale of power to PLN, based on assumed fuel prices and other factors, is defined in MEMR 03/2015. These are set out in Figure 13 below. Other technologies, such as hydropower, are also included in the regulations.

Note that these are "maximum benchmark" prices. Actual prices may be both higher (with Ministerial Approval) and also lower.

In practice, the price offered is likely to need to match the relevant PLN *Wilayah's* (Regional PLN) generation costs to be accepted. If these generation costs are low (perhaps due to a high coal or hydro share of generation), the Excess Power tariffs may not be relevant, and the business case for Captive Power may be undermined. More transparent costs of generation of each *Wilayah* should be made available to allow CPPs to set competitive and relevant prices.

Power Wheeling

In addition to offtaking of excess power by PLN, since MEMR 01/2015, Captive Power Plants have been able to "wheel" (i.e. transmit) power over the PLN Transmission and/or Distribution (T&D) Network to other customers (who may be hundreds of kilometres away from the generation site).

However, access to PLN's T&D network is not guaranteed, or may not be available, and tariffs per kVA or kWh have not yet been specified in implementing regulations.

Figure 13: Maximum tariff for sale of power to PLN

	Coal (Non Mine Mouth) Power Plants				Gas/Gas Engine Power Plants	
Capacity Unit (MW)	**15**	**50**	**100**	**300**	**40 - 60**	**100**
Price (USD cents/kWh)	10.61	9.11	8.43	7.25	8.64	7.31
Assumptions						
Availability Factor	80%				85%	
Contract Period	25 years				20 years	
Heat Rate	3,500	3,200	3,000	2,600	9,083	8,000
Calorific Value (GAR) kcal/kg	5,000				-	
Fuel price	USD 60/Metric tonne (CIF)				USD 6/MMBtu	

Source: Ministry of Energy and Mineral Resources Regulation 03/2015

What can Government do? Promote projects for development and streamline the regulatory process.

Recognising that power supply is crucial to the success of Industrial Estates, the Government recently issued PP No. 142/2015 (Government Regulation No. 142/2015), which contains a key provision on Captive Power, under which each Industrial Estate developer in Indonesia is granted a facility to ease the development and management of its electricity supply for its own use and for the use of its tenants. Further details regarding the facility will be regulated in a Ministry of Energy and Mineral Resources decree.

This provision is welcome. However, additional steps can be taken to encourage investment in projects. Those identified in the course of this study are listed below:

Extent of barrier	Key Barriers	Potential Solution
Critical/ Urgent	• *Wilayah Usaha* (Key permit) is difficult to obtain, and the process is not transparent or well understood	• Clarify 'good quality and reliability' criterion in MEMR 28/2012, Article 6 (see page 31). • Automatically grant *Wilayah Usaha* where a developer meets the criteria in MEMR 28/2012, Article 4. • Consider granting the developers of SEZs and Industrial Estates an automatic *Wilayah Usaha* where they pass appropriate screening/due diligence mechanisms. • Automatically include potential Captive Power projects in Industrial Estates/Special Economic Zones in the RUPTL (PLN's business plan).
	• Uncertain demand (unbankable offtake contracts)	• To address unpredictable tenant ramp-up rates, PLN could provide short/medium term excess power agreements (<10 years) at guaranteed prices to reduce offtake risk. • BUMN (state-owned enterprises) to make clear commitment to purchase power from strategically important industrial Estates.
	• Investment opportunities with good project economics are hard to find • Lack of clarity as to whether PLN will supply a site's power needs means project economics are not clear	• Identify areas not included under the 35 GW Plan and/or at risk of delays in receiving new capacity, and provide a master list of opportunities to the private sector. • Publish PLN *Wilayah* local generation costs to help developers understand the likely maximum tariffs they will receive.
	• New rules for CPPs in Industrial Estates are unclear (Government Regulation No.142/2015)	• Accelerate implementing regulations for PP 142/2015, ensuring that clear guidance is provided on: ➢ Process and conditions for acquiring *Wilayah Usaha* ➢ Likely tariff for excess power in each Industrial Estate. ➢ Potential/permitted commercial arrangements with PLN including eligibility for backup power arrangements. • Discuss regulations with industry before finalising.
Important	• Some projects socio-economically beneficial but not financially viable, especially in remote regions	• Provide public Viability Gap Funding (Government-provided capital costs subsidy for projects with socio-economic benefits but not financially viable) • Provide tax incentives
	• Unclear commercial process/cost for power wheeling	• Accelerate implementing regulations for MEMR 01/2015
	• Other permits and licenses sometimes difficult to obtain	• Streamline overall permit application process and absorb local government permits under BKPM's One Stop Shop as far as is constitutionally permissible.

Other countries have made similar moves to promote Captive Power development.

Case study: Captive Power in India

- The Electricity Act 2003 facilitated the setting up and operation of captive power generators
- The National Electricity Policy noted that liberal policies for captive power were implemented to:
    - Build cost effective power
    - Generate Employment opportunities
    - Support industrial growth
- The 2003 act removed licensing needs for generation, and removed controls for captive power.
- The result of the above regulation was that the total installed Captive Power capacity reached almost one quarter of the country's total installed capacity in 2012-2013.

The Indian Electricity Act 2003

This regulation encourages captive power capacity additions through the de-licensing of captive generation in India. As stated in the Act "any generating company may establish, operate and maintain a generating station without obtaining a licence under this Act if it complies with the technical standards relating to connectivity with the grid referred to".

Benefits for industry

The avoidance of production loss outweighs the cost of captive diesel power generation. Industries which have a high level of value added through reliable electricity input will naturally insulate themselves through standby power.

Benefits for the country

Captive Power lowers transmission and distribution losses and the need for cross subsidisation of electricity for rural areas. It has also led to the improvement of the financial condition of State Electricity Boards, as well as promoting economic growth.

So why invest in Captive Power for Industrial Estates?

Rewards of captive power projects

The potential benefits for Industrial Estates and CPP Developers are threefold:

1. A chance for **new and ongoing profit streams**, while the potential to expand the core business (land development) is finite.

2. A chance to **diversify revenue and profit**, with a more stable stream of long-term cash flow less correlated with the wider economy and property market than the core business.

3. A chance to '**brand' zones** to attract premium tenants, who may in turn attract other premium tenants, increasing overall occupancy.

Captive power investments can help to drive new and recurring profit streams for developers

Historically, land development has been lucrative for many developers.

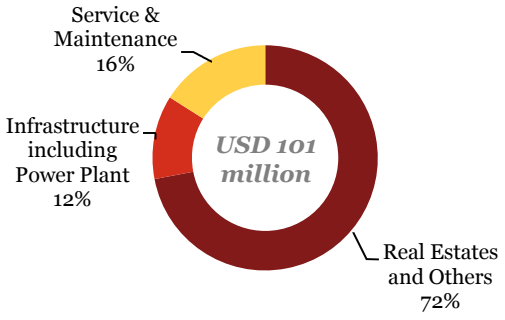
Industrial land prices for sale and lease around Jakarta doubled between 2010 and 2015. Land development generally accounts for the majority of profits even on diversified estates (shown in Figure 14).

However, land is fundamentally finite, and based on a sample of Industrial Estates in West Java[20]:

- Total saleable land is around 9,000 ha. Given existing tenancies, only 1,500 ha remains immediately available for sale.
- With further investment, only another 4,000 ha could be brought online.

Industrial land absorption in and around Jakarta has been 400-1,200 ha a year between 2010 and 2014. The existing land bank (1,500 ha) is equal to a little over one year of industrial land demand at the 2012 peak levels, or four-and-a-half-years if other available land (4,000 ha) were invested in.

Figure 14: Gross profit breakdown for a leading developer (2014)



Source: Company accounts

Limited land and capacity issues mean that developers need additional profit generators

Many zones have already reached full capacity[20], and there are limited alternative options for Industrial Estates to generate cash. Service fees generally only cover operational costs, and despite rising wage and fuel costs, have not risen for several years now in most Industrial Estates.

In the case of one Industrial Estate, the share of profit derived from infrastructure projects has risen from 12% (see Figure 14) to 17% over the past nine months, as power revenue remained stable while overall Industrial Estate revenue fell.

Utilities development, in the form of on-site water and power provision, may represent an attractive additional source of profits

Tenants might be willing to pay a premium for an Uninterruptible Power Supply (see page 27), suggesting a total Captive Power tariff of at least 9.5 USD cents/kWh (IDR 1,280/kWh) may be able to be charged. And, they may be willing to pay more if equipment damage and material losses are important to them.

The "levelised" cost, which is a per-kWh lifetime cost, discounted at the cost of capital, for a 100 MW Gas-fired power using the latest technology, and sourcing gas at USD9/MMBtu would be about the same as the current PLN premium tariff[21]. Because the levelised cost as a lifetime cost already assumes an attractive return on capital, this implies that significant profits are attainable, if best practice cost profiles can be achieved. The return could even be higher if Combined Heat and Power (CHP) is applied, as explained on the next page.

[20] Source: Colliers International, Research Report, Industrial Land, Jakarta (Q4 2014)

[21] Assumptions were made on $/kW capex, capacity factor and years of operation/concession. Source for cost data: GE, market consultation and internal data.

Double Value: Co-generation/CHP

Case study: CHP in Thailand[22]

IRPC Public Company Limited (IRPC) is a Public SET (Stock Exchange of Thailand)-listed Petroleum and Petrochemical company in Thailand.

IRPC began producing petroleum and petrochemical products in 1982 and has since expanded its line of production to many products.

IRPC's refinery and petrochemicals complex is located in its own industrial estate in Rayong province. The estate is fully equipped with infrastructure and utilities supporting production, including a deep-sea port, oil tank farm and a power plant.

The decision was taken by IRPC to install a co-generation plant to generate heat and power (CHP), given tenants' needs for both, with the following characteristics:

- 220 MW capacity
- 53% thermal efficiency
- Pipeline natural gas input
- Steam pipeline to tenants
- Distribution via IRPC-owned system

Introduction

Co-generation or Combined Heat and Power (CHP) is the production of electricity simultaneously with the recovery and utilisation of heat.

Business model

An IRPC subsidiary owns the asset and sells power and heat from the co-generation plant directly to the tenants in the Industrial Estate, under a mix of long-term and short-term contracts for offtake, depending on the tenant's needs. Excess power is sold back to the grid at a non-fixed rate based on short-term avoided generation costs with no obligation to supply power during the system peak months. Carbon credits based on emissions reductions formed an additional revenue stream.

The gas sales agreement is a long-term agreement with Thailand state-owned SET-listed oil and gas company (PTT) under a combined industrial and non-firm power rate. Operation and Maintenance activities are handled by the owner, but other parties are contracted for the long-term servicing of the gas turbines.

Financing/commercial case

- IRPC provided [all] of the equity required for the investment. IRPC usually raises equity from the SET (Stock Exchange of Thailand).
- The project is financed on-balance sheet (i.e. IRPC raised debt using its own collateral to invest in the project vehicle).
- The Board of Investment of Thailand provided additional commercial incentives including import/corporate tax reductions/subsidies.

Benefits for stakeholders

- Tenants in Industrial Estates experience "significant cost savings" in their power/heat bills.[23]
- Reduced emissions compared to crude oil boilers: by 400,000 tonnes/year of Co_2.
- Reduced fuel consumption of 1.46 million MMBtu/year and avoided grid imports of 100MW, compared to the oil boilers previously used for the same electrical and heat output.
- High reliability of supply - crucial for continuous process industries such as petrochemicals and refineries.

[22] Source for all information on this page: IRPC and GE
[23] Source: Customer quote

Captive power can also help to diversify profit streams and build premium branding

Diversified profit streams help to reduce overall risk

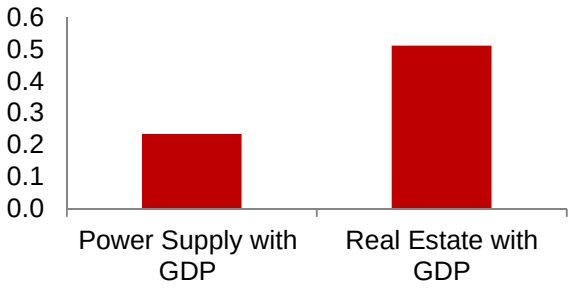
These new profit streams are complementary to existing profits as they diversify risk. Land development and real estate margins are typically reasonably pro-cyclical; their 'beta' in terms of industry output growth with respect to GDP growth was 0.51 over the last economic cycle (see Figure 15).

While infrastructure projects entail their own risks (see next page), their cash flow is generally stable and often only loosely correlated with GDP once they are operational. Taking power supply as the closest proxy for operating power assets, the beta against GDP is only 0.24. The beta is likely to be near zero in the case of cash flow secured against a long-term offtake contract, such as excess power offtake to PLN. This stable, 'defensive' cash flow enables diversification against the pro-cyclical cash flow of the real estate sector.

The point is illustrated with GDP data, but the same argument could be made with equity indexes, and would suggest a lower cost of equity for diversified firms.

It is not necessary to take on responsibility for infrastructure development, or to bear the full commercial risk. International partners can provide the majority of equity capital and bring project development expertise. Defensive (counter-cyclical) plays can be made through lease, royalty, or profit-sharing agreements with developers, while still delivering the benefits of diversified, stable profits.

Figure 15: Economic beta (2009 – 2014)



Source: BPS, PwC Analysis

Note: Beta is defined as covariance of sector output growth with overall GDP growth, divided by variance of overall GDP growth. It measures how much industry revenue changes for each 1% change in GDP.

Building a 'premium' brand helps to attract high quality tenants

The prevailing view in the real estate industry is that securing one or two 'premium tenants' (i.e. large, well-known corporate brands) has a significant impact on the ease of securing other tenants (both premium and non-premium). This was confirmed during the interviews conducted for this study. Attracting such tenants therefore remains a priority for most Industrial Estate management teams.

Engagement with industry developers indicated that a key benefit of providing captive power was the ability to attract higher quality tenants.

Captive power carries risks typical for an infrastructure project

Infrastructure projects are exposed to a unique set of investment risks due to their long payback periods, physical immovability, and high financial and operational leverage.

Payback periods are likely to exceed those of the core investment of an industrial estate (i.e. land development). Risk factors for a power project development typically include:

Risk	Description	Key risk for IPP	Key risk for Captive Power*	Comment
1. Capacity/revenue risk	For the plant to be profitable, it must sell generated units of power more than 60-80% of the time. If the customer base declines or consumption falls, returns will fall significantly due to the high proportion of fixed costs.	✓	✓	a) More likely to be high risk issues for CPPs than IPPs because of the large numbers of small contracts, short contract tenors, and changes to tenant composition b) Adding PLN as an offtaker of 'excess power' partly mitigates this risk.
2. Macroeconomic risk	Depending on tariff denomination and indexation in the power sales contracts, the project may be exposed to inflation or exchange rate movements, eroding real returns. These risks can sometimes be hedged or otherwise insured against.	✓	✓	
3. Fuel price risk	Fuel costs make up about 50% (coal) to 70% (gas) of the power price. Given volatile fuel prices, power is generally structured on a fuel cost pass-through basis. While the project is protected from fuel price risk under such an arrangement, the offtake quantity may be take-or-pay (especially gas), leaving fuel costs too high if power cannot be dispatched. Fuel availability may also be an issue in some areas due to logistical considerations or restrictive practices.	✓	✓	a) It is easier to negotiate fuel cost pass-through to large, diversified utilities (i.e. PLN) than to small, unhedged Industrial Estate operators/tenants.

Note: Above-and-beyond the risk profile for typical IPP projects*

Captive power carries risks typical for an infrastructure project (cont'd)

Risk	Description	Key risk for IPP	Key risk Captive Power*	Comment
4. Construction risk	Large construction projects are prone to cost inflation and/or delays unless well managed[24]. This could be due to difficulties getting equipment to site, wage demands, unforeseen technical/engineering issues, weather and other issues.	✓	✓	a) Cost overruns can be mitigated via Lump Sum Turnkey contracts, and liquidated damages built-in for delays in the plant coming online for both IPP and CPP projects
5. Operational risk	Turbine breakdowns may stop the production of electricity, overloading of machines may cause malfunctions or permanent damage, and other events may disrupt the operational activities such as *force majeure*, employee demonstrations, natural disasters, etc. These would result in cash flow interruptions.	✓	✓	a) Depending on the cause, this risk is shared between the equity sponsor and the O&M contractor. b) CPP may carry a slightly higher equity risk if the sponsors operate the plant themselves.
6. Political/ regulatory	General changes in laws and regulation including tax law, environmental and social regulations, employment regulations, power sector technical requirements and others could entail additional compliance costs. More specific changes in regulations relevant to CPPs could change the economics or legality of a project. Changes-in-law compensation clauses can be negotiated under PPP/IPP frameworks, but are simply an inherent risk of doing business for purely private arrangements.	✓	✓	a) If not selling to the government or government-related entities, it is likely to be difficult to get equivalent compensation clauses in the contract. Private insurance may or may not cover these risks, but they will have a cost if so. b) Precedent for legal/commercial structure for CPPs is harder to identify.

Note: Above-and-beyond the risk profile for typical IPP projects*

[24] Source: PwC Capital Projects and Infrastructure publication: Correcting the Course of Capital Projects

Captive power: a model for the future?

How could an investment in captive power be structured?

Developing captive power is a complex task requiring experience, expertise and a degree of patience.

Any infrastructure project development is complex, and captive power is no exception. Project development timelines are likely to span 2-3 years. For those with sufficient patience and risk equity to cover development costs, the rewards could be significant, as highlighted in this report.

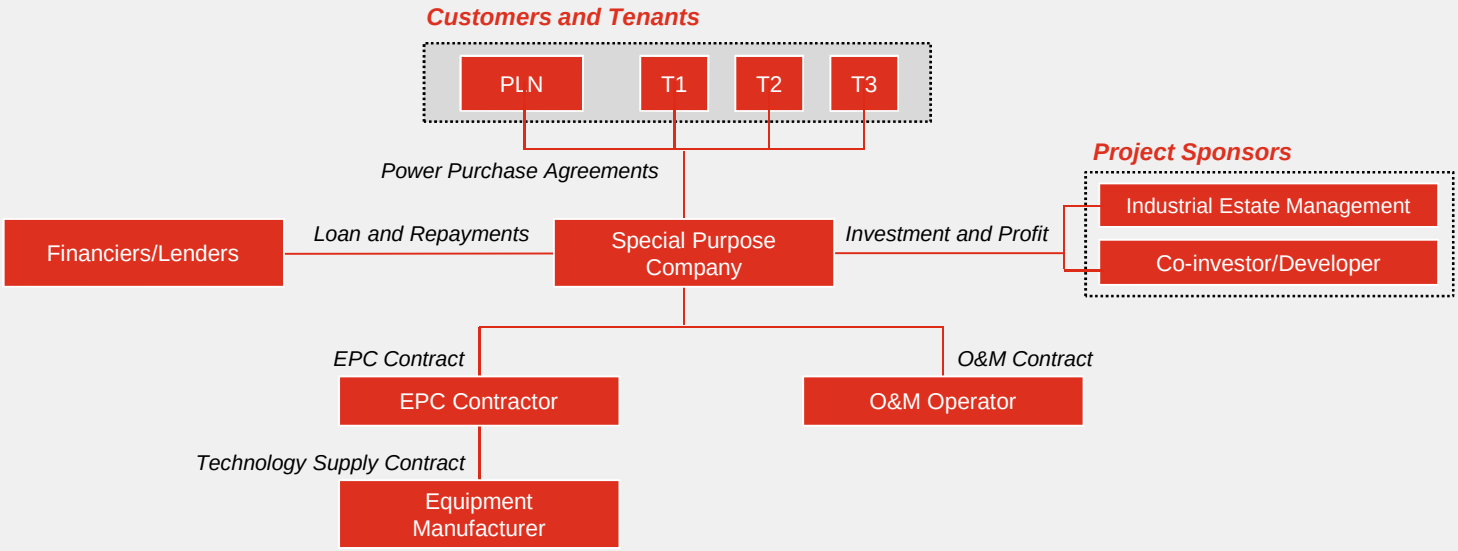
Developing captive power is a complex task requiring experience, expertise and a degree of patience

Outlined below are some of the major steps in captive power project development in Indonesia (until financial closing) along with possible challenges at each stage. It is assumed that the investors already own the land, and that public sector financial support is not required.

The following is roughly in chronological order, but many stages are more efficiently processed in parallel (especially given likely delays to permit acquisition).

Stage	Comments
1. Site Selection	• Developers will need to target sites consistent with their development expertise, risk appetite, and ability to negotiate the regulatory system. • Key decisions include whether to focus on greenfield or brownfield, electrified or remote regions, tenant type and power requirements, and what technologies are consistent with local fuel infrastructure.
2. Pre-Feasibility Study	• The developer will need to analyse the potential investment to help determine whether it is even worth moving to the feasibility phase.
3. Investor and Developer Agreement	• Having identified an industrial site, the initial developer will need to decide if they are going to develop it independently; in partnership with another power company, manufacturer, or fuel supplier; or, in conjunction with the land/real estate developer.
4. Support from Local Government	• The developer will need to obtain a supporting letter from the local government head (*Bupati* or Governor); this is a regulatory requirement and also could help with negotiating a deal later.
5. Licensing and Permitting	• The developer will need to obtain National permits including IUPTL, *Izin Operasi* and *Wilayah Usaha*.
6. Consent from PLN (depending on structure)	• If excess power is being offtaken, power "wheeled" via PLN's T&D networks, or other arrangements being made with PLN (e.g. backup connection), the developer may need to negotiate with PLN. • PLN will also likely have a role in granting a *Wilayah Usaha,* if the area is currently served by PLN.
7. Feasibility Study	• The developer will need to confirm the practical and logistical feasibility of the project, and evaluate technological and financing options.
8. Drafting Project Contracts	• The developer will need to choose its key partners (operator, fuel supplier, etc.) and agree key contracts including EPC, O&M, FSA, PLN or private offtaker PPAs with its business partners. • Typically, Heads of Agreement are drafted early in the project to begin the financing process, with full contracts drafted as other development tasks are completed.
9. Financing	• The developer will need to structure its credit agreements, focusing on the currency of debt repayment, level of recourse to the sponsor(s), and credit enhancements in cases of limited offtake security.

A typical business model for captive power investments is built around a special purpose company



In general, power generation projects are structured around a Special Purpose Company (SPC). The SPC acts as a ring-fenced entity for the project and enters into contracts with other companies to implement the project. This could also be a dedicated corporate subsidiary.

Firstly, an Engineering, Procurement, and Construction (EPC) contractor will design the installation, procure the necessary materials and build the project, either directly or by managing other subcontractors. They purchase key components, e.g. turbines from technology providers such as GE.

An Operation and Maintenance (O&M) contractor will then operate, maintain, and often manage the performance of the project.

Thirdly, investors and lenders will finance the project through equity and/or debt. The SPC will receive equity investment from the sponsors to fund construction in exchange for dividend payments. The SPC will fund the remaining construction costs using debt, and make repayments over time.

Lending is usually from banks; sponsors could be either the Industrial Estate Developers, or dedicated Power Plant developers. Pure financial investors (such as private Equity firms) are unlikely to feature in the deal at this stage, with trade or strategic investors (such as power companies) typically more interested.

Fourthly, customers would purchase the power. In an Industrial Estate, the main customers would be tenants, who normally purchase under short term contracts (usually a year). Under the new regulation, excess power can also be sold to PLN under a Power Purchase Agreement.

The roles and contractual relationships described are typical of a Captive Power project. However, several different options exist in practice for projects in Indonesia. The key project options revolve around:

- Offtake structure
- Ownership and development structure

Some typical options are mapped out on pages 46 and 49.

Financing a power project depends mainly on the desired exposure of sponsors to the project

Financing: Project vs. Balance Sheet

Broadly speaking, there are two ways of financing a power project: project financing and balance sheet financing. The key difference is the exposure of the sponsors to the project. Balance sheet finance relies on the cash flow available to the sponsor.

Project finance relies on the cash flow generated by the project, and routed through the SPC to fund the servicing of the debt. For a Project Finance project to be "bankable", more robust contractual structures and project economics are therefore required.

Based on interviews for this project, most Industrial Estate tenants use short-term contracts to purchase power. This may be inadequate for the banks to lend money on a pure project finance basis (without recourse to sponsors). The exception to this may be where there are larger offtakers (say, greater than 30 MW) such as petrochemical facilities, who may enter into 10-20 year offtake contracts.

Funding directly from the parent, or Project Finance with recourse to the parent, is often a more straightforward option. Thus, sponsors with a strong balance sheet (i.e. low debt to equity ratios) may need to directly raise or guarantee project debt in order for a subsidiary to obtain project funding.

Offtake options

On page 44, a generic project structure was set out, whereby the SPC sells power to a combination of tenants and utilities (such as PLN). In practice, there are a number of available options for power offtake contracts based on the existing regulations and market precedents to date. The table below highlights some of these. Option 4 is most conducive to Project Financing.

The key features characterising these offtake arrangements are:

- To whom the project is selling power (selling largely to local tenants, other power users via power wheeling, or largely to utilities).
- How long the buyers are committed for (short-term or long-term agreements).
- What the role of utility is in providing operational support (backup and/or synchronisation).
- What the contracted price of power is, and its currency denomination (USD or IDR).

Offtake options	Typical offtake contract length	Additional costs	Comment
1. Standalone operation with tenant offtake (i.e. not connected to utility grid)	Small tenants: 1 year Large tenants: 10 years	Local grid stabilisation	Generally difficult to stabilise an isolated, small grid operation
2. Tenant offtake with backup grid connection in case of excess demand or maintenance	Small tenants: 1 year Large tenants: 10 years	Backup/ synchronisation costs	Not likely to be commercially attractive for utility
3. Tenant offtake with agreed volume of excess power offtake by utility	Small tenants: 1 year Large tenants: 10 years Utility (Excess power): 3 years	Excess power tariff generally lower than tariff charged to tenants	Tariff may be bound by regional utility generation costs as well as national regulations regarding excess power tariffs
4. Collaboration with utility	10-30 years	Margin payable to utility	Probably most attractive option for utility
5. Power wheeling	Unknown	T&D network access charge	Implementing regulations are not yet defined so T&D access costs not yet clear

Note: Sell output to utility under PPA and buy back for tenant consumption*

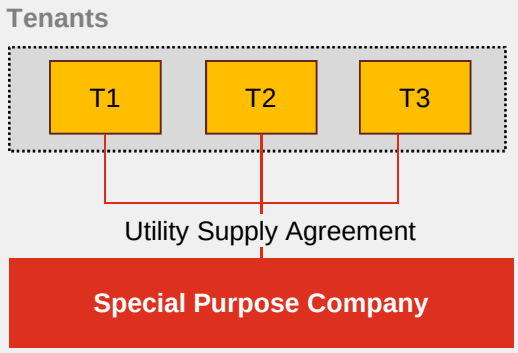
Additional contracts may support the offtake contract in practice (e.g. separate backup power supply agreement) and/or multiple agreements may be bundled into a single contract (e.g. PPA and bulk re-selling agreement).

These options refer to the offtake of power from the project development as a whole. There may be either virtual or actual offtake agreements between the project developer and operator depending on the risk allocation. These are considered on pages 49, 50, and 51.

Offtake options (cont'd)

The offtake options described on the previous page are illustrated below:

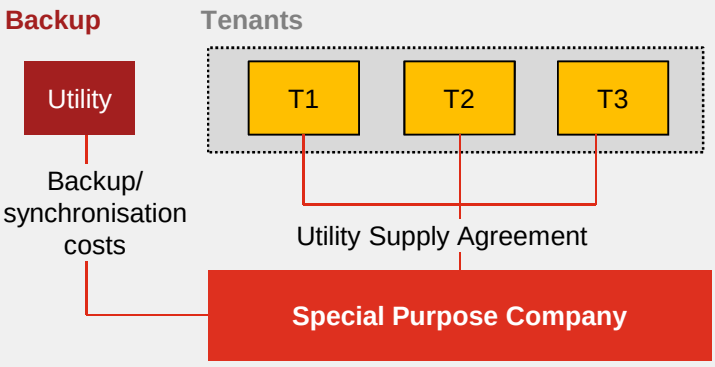
1. Standalone operation with tenant offtake (i.e. not connected to utility grid)



- Good margins on power generation
- Avoid procurement process for utility

- Difficult to balance load and supply during maintenance periods
- No incentives for utility

2. Tenant offtake with backup grid connection

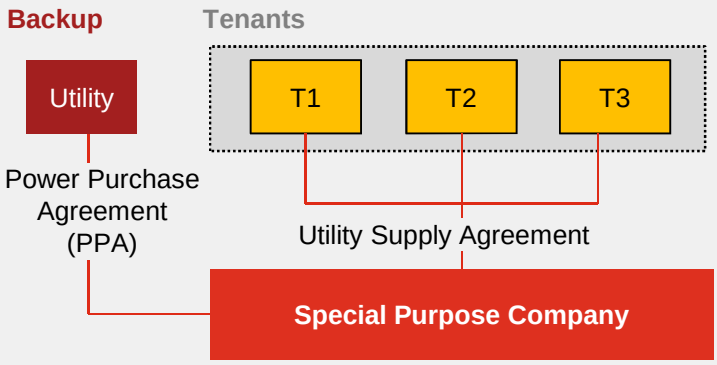


- Good margins on power generation
- Secured connection through back up available from utility

- Limited incentive for utility to support project
- Extra costs for synchronisation

Offtake options (cont'd)

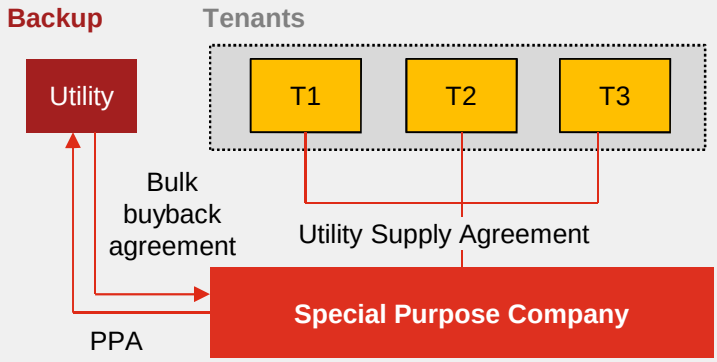
3. Tenant offtake with agreed volume of excess power offtake by utility



- Provides additional revenue security for some years while tenant occupation ramps up
- Security of revenue from excess power

- Offtake contracts likely to be <5 years
- Additional procurement steps required

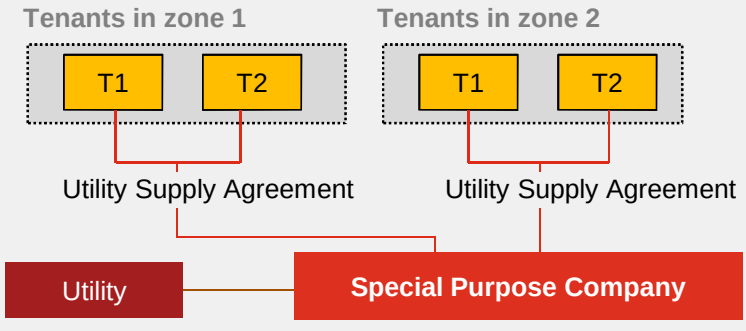
4. Collaboration between two utilities: Sell output to utility under PPA and buy back for tenant consumption



- Gives utility incentive to support project
- Flexible when occupancy changes
- Secured back up connection

- Some level of price increase for tenants or reduced equity return
- Procurement steps unclear

5. Power wheeling



- Gives utility incentive to support project
- Economies of scale on plant size

- T&D tolling fee unknown
- Currently unclear structure for end-user contracts
- Need transmission capacity

Development options for sponsors

There are a number of potential commercial structures for the Real Estate/Industrial Estate developer to develop a power plant. These include:

- **Joint Venture:** The Industrial Estate and Power Developer each hold equity in an SPC and share market risk on the offtaking of power by tenants/PLN.
- **Own Project:** The Industrial Estate Developer sets up an SPC or dedicated subsidiary to develop the project, holding 100% of the equity (or the Power Developer does the same thing). The developer in either case bears market risk on the offtake of power by the tenants/PLN.
- **Build-Operate-Transfer (BOT) (Landlord-style):** The Industrial Estate Developer grants a "concession" for the Power Developer to sell power to the zone's tenants (and PLN) in exchange for a land lease or other fixed or variable payment. The Power Developer is responsible for building, operating and transferring the asset back to the landlord at the end of the concession. The Industrial Estate Developer may or may not bear market risk depending on the payment structure, but in either case is not responsible for debt service.
- **Build-Operate-Transfer (BOT) with PPA:** The Industrial Estate Developer enters into a long-term Power Purchase Agreement (PPA) with the Power Developer, who is responsible for building, operating and transferring the asset back to the landlord at the end of the PPA term. In this case, the market risk lies with the Industrial Estate, which is responsible for on-selling power to tenants/PLN.

The returns under each model would be expected to be proportional to the amount of risk being assumed.

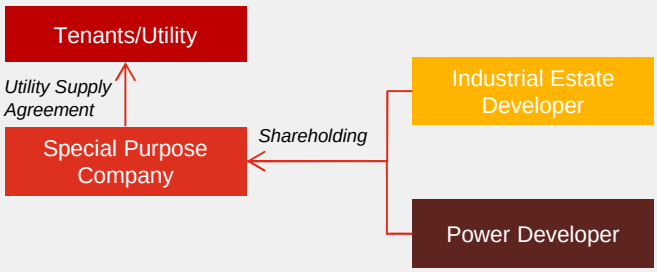
In principle, the sponsorship arrangements are separate from the offtake arrangements. However, note that the sponsorship structures and offtake structures together will largely determine the debt financing structure. In practice, short-term offtake contracts with high market risk exposure are unlikely to be financeable using limited recourse Project Finance.

It is also important to consider exit arrangements. At least one developer is reportedly considering an Initial Public Offering (IPO) to raise equity from its Captive Power projects, which would be the first of its kind in Indonesia. Especially once operational, it is possible that developers could also sell equity stakes to financial investors including Private Equity Funds or Infrastructure Funds, who are currently eyeing up the market.

Development options for Sponsors (cont'd)

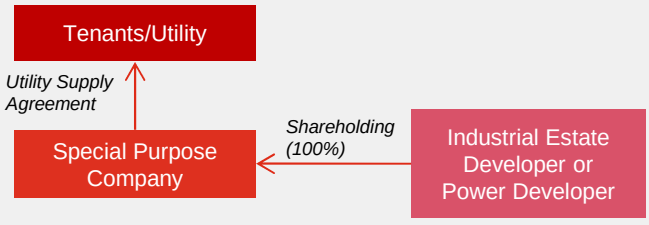
Options for the commercial structures on the previous page are illustrated below:

1. Joint Venture



	Benefits	Risks
Industrial Estate developers	• Share equity upside and market risk • Benefit from specialist external expertise	• Still exposed to some market risk
Power developers	• Share equity upside and market risk • May have role in management of zone	• Still exposed to some market risk

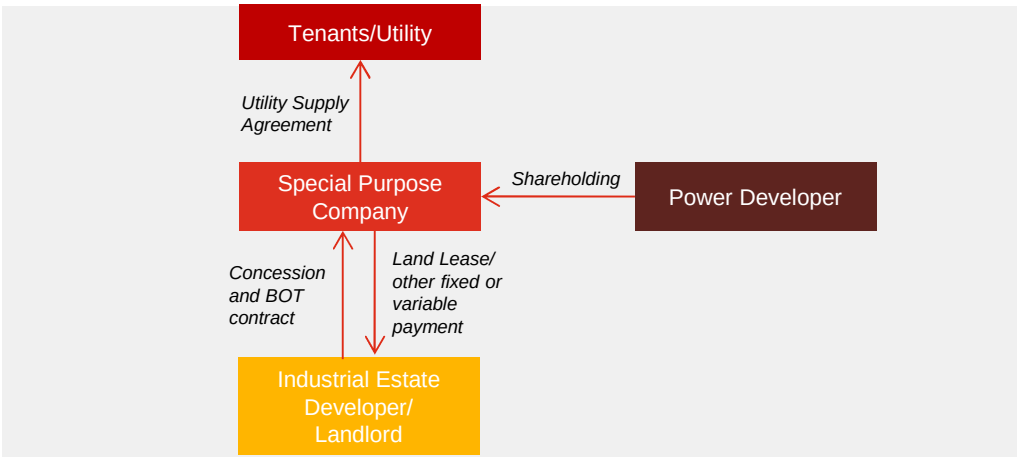
2. Own Project



	Benefits	Risks
Developer	• Earning all equity upside	• Need specialist expertise in-house • Exposed to full market risk

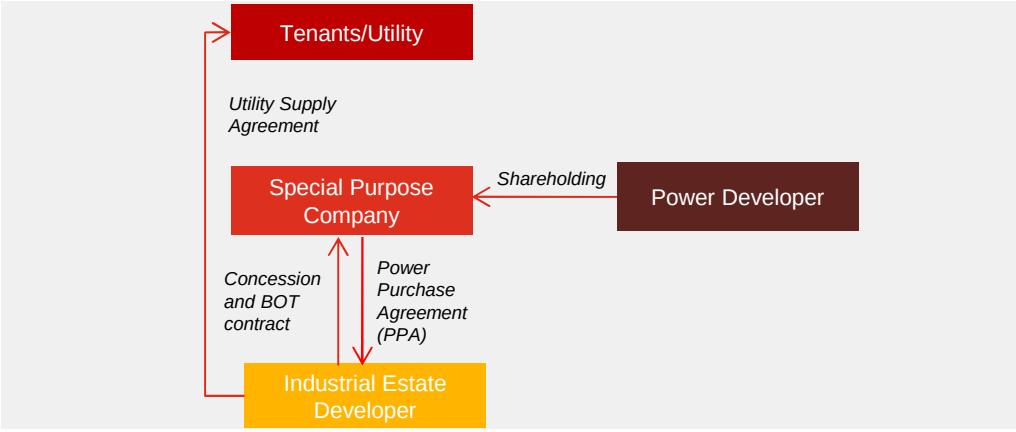
Development options for Sponsors (cont'd)

3. Build-Operate-Transfer (BOT) (Landlord-style)



	Benefits	Risks
Industrial Estate developers	• Payment streams are predictable and low-risk	• No equity upside • Less control over tenant services
Power developers	• Earning 100% of equity upside	• Exposed to full market risk

4. Build-Operate-Transfer (BOT) with PPA



	Benefits	Risks
Industrial Estate developers	• Margin from selling power to tenants	• Bearing market risk
Power developers	• Secure income from PPA • Effectively no market risk	• Landlord's margin reduces demand and capacity factor

Concluding remarks

This report represents the first publicly-available research on Captive Power in Industrial Estates in Indonesia. Based on interviews with Industrial Estate management and tenants, and economic modelling, Captive Power has a key role to play in Indonesia's industrial development. This conclusion is re-iterated in five parts:

1

Industrial Estates will be the engines driving investment and economic activity in Indonesia.

The Indonesian government has envisioned Industrial Estates as the manufacturing hubs of Indonesia in future. A successful Industrial Estate and Strategic Economic Zone programme could boost Foreign Direct Investment, overall Investment, GDP and Employment, as well as opening up Eastern Indonesia for industrial development.

However, a pre-requisite for success is a functioning supporting infrastructure, including in particular transport and power infrastructure.

2

However, power supply is one of the major barriers to developing Industrial Estates in Indonesia.

Captive power, or power generated by a firm/landlord for its own or its customers' use, reduces load on the power grid. It can increase reliability, reduces business costs, and can rapidly make electrical power available to regions that currently lack power.

In so doing, captive power can improve the productivity of tenants in Industrial Estates, particularly in areas with low grid connectivity.

Concluding remarks (cont'd)

3

Captive Power may be one solution to help overcome this obstacle.

High value-added industries are likely to need reliable power to drive growth, with a higher level of reliability than is currently available on-grid.

Captive Power - including privately-financed and -provided power for Industrial Estates - represents an opportunity to meet this need. Especially in remote or grid-stressed areas, it may represent the only practical option.

4

Captive Power would benefit not only tenants and Industrial Estate developers, but also Indonesia as a whole.

Many stakeholders can benefit from targeted Captive Power expansion:

- Tenants benefit from a more reliable power supply, and examples of their willingness to pay for the benefit were revealed in stakeholder interviews.
- Industrial Estate and Power Plant developers (and co-developers) benefit from diversified, stable and recurring sources of income. Returns could be very attractive under certain circumstances.
- PLN benefits from avoided grid load at key locations and could participate in deals to generate incremental revenue.
- The Government of Indonesia benefits by attracting investment in Industrial Estates and Strategic Economic Zones, as well as having flexibility and options in the event of a delay in the 35 GW Plan.

Concluding remarks (cont'd)

5

Captive Power can play an important and complementary role in Indonesia's growth. The Government can catalyse this.

To spur market development, some clear steps are needed, including the following:

- Publicise strategically important projects more effectively to the market.
- Streamline and accelerate the granting of *Wilayah Usaha* (determination of business area) licences to reputable power developers.
- Provide government support for economically beneficial but financially marginal projects (notably encouraging PLN to sign longer-term excess power offtake contracts under MEMR 03/2015).
- Encourage State Owned Enterprises to purchase Captive Power in strategically important locations.
- Accelerate implementing regulations for the new regulations on Industrial Estates (Government Regulation No. 142/2015) and Power Wheeling (MEMR 01/2015).

We estimate that providing a clear regulatory framework could support the potential investment pipeline of 8-10 GW of capacity within the next five years.

Get in touch

George Djohan
Tel: +62 (0) 811 888 5797
george.djohan@ge.com

Kazunari Fukui
Tel: +65 (0) 983-32131
kazunari.fukui@ge.com

Irzan Martakusumah
Tel: +62 818 220 910
irzan.martakusumah@ge.com

Sacha Winzenried
Tel: +62 (0) 21-52890968
sacha.winzenried@id.pwc.com

Triono Soedirdjo
Tel: +62 (0) 816-1324610
triono.soedirdjo@id.pwc.com

Agung Wiryawan
Tel: +62 (0) 812-9444582
agung.wiryawan@id.pwc.com

Patrick SE Tay
Tel: +60 (0) 123-887038
patrick.se.tay@my.pwc.com

Tim Boothman
Tel: +62 (0) 812-88128766
t.boothman@id.pwc.com

Important Notice

The report has been prepared by PT PricewaterhouseCoopers Indonesia Advisory for PT GE Operations Indonesia under the terms of our Work Order under Global Master Framework Agreement dated 23 September 2015.

Any person who is not an addressee of this report, by reading this report accepts and agrees to the following terms:

1. The reader of this report understands that the work performed by PT PricewaterhouseCoopers Indonesia Advisory was performed in accordance with instructions provided by our addressee client and was performed exclusively for our addressee client's sole benefit and use.

2. The reader of this report acknowledges that this report was prepared at the direction of our addressee client, and may not include all procedures deemed necessary for the purpose of the reader.

3. The reader agrees that PT PricewaterhouseCoopers Indonesia Advisory, its partners, principals, employees and agents neither owe nor accept any duty or responsibility to the reader, whether in contract or in tort (including without limitation, negligence and breach of statutory duty), and shall not be liable in respect of any loss, damage or expense of whatsoever nature which is caused by any use the reader may choose to make of this report, or which is otherwise consequent upon the gaining of access to the report by the reader. Further, the reader agrees that this report is not to be referred to or quoted, in whole or in part, in any prospectus, registration statement, offering circular, public filing, loan, other agreement or document and not to distribute the report without PT PricewaterhouseCoopers Indonesia Advisory's prior written consent.

Appendix

Methodology

Stakeholder engagement

The study team also conducted detailed interviews with five firms in order to provide a qualitative analysis of the benefits of captive power. These interviews also included discussions of the key drivers of the cost of blackouts, which guided the modelling approach taken in the study.

Data enabling the estimation of the blackout costs for the seven sectors

The study drew on country and sector-level data; a list of data collected and used is shown opposite. The most recent data available was used.

Data	Source
Sector capacity utilisation (2010)	*Kementerian Perindustrian*
Sales data (2013)	*Badan Pusat Statistik (BPS)*
Electricity demand (2014)[25]	National Energy Council
Annual labour cost (2013)	BPS
Total employment (2013)	BPS
Overtime regulations	UU no. 13 *Tahun 2003 Tentang Ketenagakerjaan*
Cost of running gensets, per kWh	Discussion with industry stakeholders

[25] Due to inconsistent categorisation of industries, assumptions were made for certain sectors: energy consumption for fertilisers were used as a proxy for chemicals, while petroleum and coal products were assumed to have similar demand for energy to the cement sector

Methodology (cont'd)

Approach

The results depend on the length of a blackouts, as well as the number of blackouts a year. PLN report that this is currently around 32 hours/year based SAIDI and SAIFI. The central scenario reported in this report considered a two-fold increase in SAIFI, meaning 58 blackout hours/year. In a blackout, the model estimates one of two mutually exclusive outcomes:

1) Firms with backup power switch to a diesel genset during a blackout and resume production (68% of firms[26]). The total hours worked remain the same. Marginal fuel costs were based on the following assumptions:
    - 11,000 Btu/kWh heat rate
    - 9,000 IDR/litre diesel cost (approx. USD 130/barrel for diesel, and including margin and distribution costs)
2) Firms without backup power (32% of firms) resume production after the blackout, with costs as follow:
    - Incurring wage overtime costs, which were calculated based on the permitted three hours of overtime per worker per day, and the overtime wages mandated by Indonesian law. Overtime costs were only applied to 58% of each sector's employment, as supervisory level employees do not collect overtime. This assumption was made based on educational attainment (42% of manufacturing workers had high school diplomas and above).
    - If the legal overtime maximum was exceeded, or the firm was implicitly running at more than 90% capacity utilisation to recover the earlier downtime, the hours were counted as 'unrecoverable' or 'lost production'. This was calculated based on the annual revenue for each sector divided by 5,280 annual operating hours (330 days/year running 16 hours/day)
    - It was also assumed that for continuous process sectors (Chemicals, Petroleum and Coal, Paper), 2 hours re-start time is needed and that revenue cannot be earned during this time. For other manufacturing sectors (Machinery, Textiles, Food and Beverages, Printing), a re-start time of 30 minutes was assumed.

Equipment damage and material losses were not included in these calculations, as these are highly firm- and sector-specific, making generalisation inappropriate without detailed data. Working capital losses from holding excessive inventory were also not included. This implies that our estimates are conservative for group 1) above in particular. Based on one study in the United States, equipment damage and material losses accounted for around 40% of the total costs of blackouts[27].

The exchange rate used was IDR 13,500 to USD 1.

[26] Estimated based on data from Final Report: Overview of Diesel Consumption for Captive Power in Indonesia, Winarno et al (2013)

[27] Primen (2001) The cost of power disturbances to industrial and digital economy companies

List of relevant regulations

Type	Number/year	Summary
Government Regulation	24/2009	This regulation relates to Industrial Estates in Indonesia including their development, parameters, facilities, activities and obligations. Key points for Captive Power: • All manufacturing activities must be within Industrial Estate areas.
Electricity Law	30/2009	This regulation is about the general business framework for electricity in Indonesia. Key points for Captive Power: • PLN has the "right of first refusal" for electricity supply in an area. • The Private sector can hold IUPTLs. • Regional authorities can provide IUPTLs for power projects which do not involve sale of power to holders of Central Govt. License (i.e. PLN). IUPTL holders can sell directly without connecting to PLN's transmission grids. • PPUs are allowed (holding IUPTL + *Izin Operasi*) to generate, transmit and distribute power for own use or to its customer base (such as an Industrial Zone).
Government Regulation	41/1996	This regulation is about the development of Industrial Estates Key points for Captive Power: • The domestic or foreign private sector is allowed to own and develop designated Industrial Land. Up to 70% of land may be sold/leased to tenants, with the rest reserved for green spaces and infrastructure.
Ministerial Decree	28/2012	This regulation sets out the general framework for obtaining a business area (*Wilayah Usaha*) licence for an electricity supply business. Key points for Captive Power: • For any one area (*Wilayah Usaha*) there can only be one supplier of power, which must be an IUPTL-holder. The *Wilayah Usaha* can be allocated to a company if: 1. The area is not yet covered by an existing *Wilayah Usaha* holder 2. The existing *Wilayah Usaha* holder is not able to supply power, or is not able to supply power with good quality/reliability 3. The existing holder has returned its *Wilayah Usaha*
Ministerial Decree	1/2015	This regulation deals with power wheeling schemes. Key points for Captive Power: • IPPs and PPUs can use PLN's transmission/distribution networks for a toll charge.

List of relevant regulations (cont'd)

Type	Number/year	Summary
Ministerial Decree	3/2015	This regulation sets out the power purchasing procedures to be used by PLN, including the direct appointment and direct selection methods. Key points for Captive Power: • PLN may purchase power using the direct selection method when changing the feedstock of the power plant from diesel to non-diesel, and PLN may use the direct appointment method for mine-mouth, marginal gas or hydro projects (including purchases of excess power from PPUs) • This law also regulates benchmark prices for coal, gas and large hydro power plants.
Indonesia Law	3/2014	This regulation deals with the general framework of Industry in Indonesia. Key points for Captive Power: • Each Industrial Company in Indonesia must meet any technical specification according to the SNI (Indonesia National Standard) in their equipment and products (goods and services including electricity). • Companies that deliberately ignore this SNI requirement will be penalised IDR 3 billion, while in cases of negligence the fine would be IDR 1 billion.
Ministerial Decree	35/2014	This regulation deals with the "one stop shop" for obtaining national permits for electricity supply businesses. Key points for Captive Power: • Investors can now obtain all their national permits, including IUPTL, *Izin Operasi* and *Wilayah Usaha* through BKPM upon submission of the correct paperwork
Government Regulation	142/2015	This regulation sets out the general framework for Industrial Estates including development, maintenance, land permit, the rights and obligations of tenants, and facilities. Key points for Captive Power: • Each Industrial Estate developer in Indonesia is granted a facility to ease the development and management of its electricity supply for its own use and for its tenants. • Further detail regarding the facility will be regulated in a Ministry of Energy and Mineral Resources decree.

List of relevant regulations (cont'd)

Type	Number/year	Summary
Presidential Regulation	4/2016	This regulation provides provision relating to the 35 GW Plan, the development of 46,000 km of transmission lines, and prioritising the use of renewable energy. Key points for Captive Power: • The development of power infrastructure can be carried out in the form of Partnership, when: - The project requires substantial funding - There is a high risk in relation to construction, especially new locations that require land acquisitions - There is a risk relating to the availability of fuel supply - Power is to be generated from renewable energy - Expansion of the existing IPP power plant, and/or there are several IPPs planning to develop a power plant in specific area.

Glossary

AKR	Aneka Kimia Raya
ANTAM	PT Aneka Tambang Tbk.
BKPM	Indonesia Investment Coordinating Board (*Badan Koordinasi Penanaman Modal*)
BPS	Central Bureau of Statistics(*Badan Pusat Statistik*)
CIF	Cost, Insurance and Freight
CHP	Combined Heat and Power
COD	Commercial Operation Date
CPP	Captive Power Plant
EPC	Engineering, Procurement and Construction
ESDM	Energy and Mineral Resources (*Energi dan Sumber Daya Mineral*)
FDI	Foreign Direct Investment
FSRU	Floating Storage and Regasification Unit
FTP	Fast Track Program
GAR	Gross Calorific Value
GDP	Gross Domestic Product
GE	PT General Electric Operations Indonesia
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GW	Gigawatt
ha	Hectare
HKI	Indonesian Industrial Estate Association (*Himpunan Kawasan Industri*)
IDR	Indonesian Rupiah
IDX	Indonesian Stock Exchange
IEA	International Energy Agency
IPP	Independent Power Producer

Glossary (cont'd)

IUPTL	Power Supply Business License (*Izin Usaha Penyediaan Tenaga Listrik*)
JIIPE	Java Integrated Industrial and Port Estate
KADIN	Indonesia Chamber of Commerce and Industry (*Kamar Dagang dan Industri*)
kcal	Kilocalorie
kg	Kilogram
km	Kilometre
kW	Kilowatt
kWh	Kilowatt Hour
kVA	Kilovolt-amps
MEMR	Ministry of Energy and Mineral Resources
Mha	Million Hectares
MKI	Indonesia Electrification Community (*Masyarakat Ketenagalistrikan Indonesia*)
MMBtu	Million British Thermal Units
MRT	Mass Rapid Transit
MW	Megawatt
O&M	Operation and Maintenance
OECD	Organisation for Economic Co-operation and Development
PP	Presidential Regulation (*Peraturan Presiden*)
PF	Project Finance
PLN	State Electricity Company (*Perusahaan Listrik Negara*)
PMN	State Capital Investment (*Penanaman Modal Negara*)
PP	Government Regulation (*Peraturan Pemerintah*)
PPA	Power Purchase Agreement
PPP	Public-Private Partnership
PPU	Private Power Utilities
PwC	PT PricewaterhouseCoopers Indonesia Advisory

Glossary (cont'd)

RAPBN-P	Budget Presented to the Parliament – Amendment (*Rancangan Anggaran Pendapatan dan Belanja Negara – Perubahan*)
RPJMN	National Medium Term Development Plan (*Rencana Pembangunan Jangka Menengah Nasional*)
RUPTL	Power Supply Business Plan (*Rencana Usaha Penyediaan Tenaga Listrik*)
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SEZs	Special Economic Zones
SME	Small Scale and Micro Enterprise
SOE	State-Owned Enterprise
SPC	Special Purpose Company
T&D	Transmission and/or Distribution
UPS	Uninterrupted Power Supply
USD	United States Dollar
UU	Undang-Undang (Constitution/Law)

pwc.com/id