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Trends in
Southeast Asia

DEVELOPING EASTERN JOHOR:
THE PENGERANG INTEGRATED
PETROLEUM COMPLEX

SERINA RAHMAN

ISEAS YUSOF ISHAK
INSTITUTE

Trends in Southeast Asia



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FOREWORD

The economic, political, strategic and cultural dynamism in Southeast Asia has gained added relevance in recent years with the spectacular rise of giant economies in East and South Asia. This has drawn greater attention to the region and to the enhanced role it now plays in international relations and global economics.

The sustained effort made by Southeast Asian nations since 1967 towards a peaceful and gradual integration of their economies has had indubitable success, and perhaps as a consequence of this, most of these countries are undergoing deep political and social changes domestically and are constructing innovative solutions to meet new international challenges. Big Power tensions continue to be played out in the neighbourhood despite the tradition of neutrality exercised by the Association of Southeast Asian Nations (ASEAN).

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Developing Eastern Johor: The Pengerang Integrated Petroleum Complex

By Serina Rahman

EXECUTIVE SUMMARY

- The Pengerang Integrated Petroleum Complex (PIPC) is a huge development that has emerged on the east coast of Johor. Comprising Petronas' largest refinery facility and numerous ancillary and supporting industrial areas, it is pegged to diversify Malaysia's petrochemical industry and reap the benefits of the area's fortunate position on international maritime trade routes.
- While initial responses to the PIPC development were of concern for Singapore's oil and gas business, the island-nation's long reputation and position in the industry means that the PIPC has some steep learning curves to traverse before coming on par with its southerly neighbour. However, the PIPC is likely to provide a solution to Singapore's limitations in terms of costly services and limited land space. It may also rejuvenate an industry now seen by some SMEs to be somewhat stagnant.
- While there are myriad global trends that may inhibit the complete success of the PIPC, it seems to be well placed to provide economic spillover benefits for Johor and Malaysia. Even if it does not become a top regional player, it will be able to meet local demands for Euro 5 quality products.
- The PIPC received a boost with Saudi Aramco's commitment to invest in the Refinery and Petrochemical Integrated Development (RAPID) project. More investments may come on board when the refinery begins operations in 2019.
- A full assessment of PIPC's success or failure can be conducted once other announced developments are completed and full operations begin.

Developing Eastern Johor: The Pengerang Integrated Petroleum Complex

By Serina Rahman¹

INTRODUCTION

Johor has had the fastest growing state economy in all of Malaysia since 2011. With lofty goals of becoming the next Shenzhen,² the peninsula's southernmost state now seems poised to become the country's second largest state economy within the next few years.³ Johor is already the country's busiest transshipment hub, benefiting from its position along some of the world's most important maritime routes.⁴ Its diversified economy has manufacturing and services as its main strengths.⁵

While Johor has vast land banks, development has mostly been on its western and southern coasts. Much of its industrial areas remain within

¹ Serina Rahman is Visiting Fellow under the Malaysia Studies Programme at the ISEAS – Yusof Ishak Institute, Singapore. She is truly grateful to Javier Revilla Diez and Francis E. Hutchinson for their guidance and advice on this paper, and to Pearlyn Y. Pang for her invaluable contribution of maps for this publication.

² *Straits Times* "Iskandar's success still up in the air", 21 June 2017 <<http://www.straitstimes.com/opinion/iskandars-success-still-up-in-the-air>>.

³ *Nikkei Asian Review*, "Singapore commuters fueling growth in Malaysia's Johor", 18 October 2017 <<https://asia.nikkei.com/Politics-Economy/Policy-Politics/Singapore-commuters-fueling-growth-in-Malaysia-s-Johor?page=1>>.

⁴ Oxford Business Group, "The Report: Malaysia", 2016.

⁵ Prospect Group, "Ports acting as a catalyst in Malaysia's southern state", 24 April 2017 <<http://www.theprospectgroup.com/ports-development-malaysia-southern-johor-state-82354/>>.

the Greater Johor Bahru area.⁶ Areas to the east of the Johor River are not part of the Iskandar Development Region, and while Mersing in the upper reaches of eastern Johor is meant to benefit from the Eastern Economic Corridor,⁷ “progress” there has been minimal.

The arrival of the Pengerang Integrated Petroleum Complex (PIPC) on the east coast is said to have been the game changer for the eastern shores of Johor. The transformation of the wider Pengerang region from five fishing villages and adjacent smallholder farmlands to the bristling metallic towers of the petrochemical refinery, innumerable white domed storage chambers and barren red landscapes waiting to be built upon is both startling and extraordinary.

This paper looks into the details of the PIPC and examines the components that make up the complex and adjacent auxiliary projects. The sections will discuss the significance of the PIPC in light of regional oil and gas facilities and the value that it brings to Malaysia. The paper will then consider both the need and the success of the project as a catalyst for development in east Johor, as well as its impact on the local community and the environment.

BACKGROUND TO THE PIPC

The PIPC began in 2011 as the Refinery and Petrochemical Integrated Development (RAPID) project in response to the realization that gas resources in Peninsular Malaysia were finite, limiting the growth of the gas-based petrochemical industry.⁸ It was thus decided that it would be financially sustainable to enhance Petronas’ petrochemical portfolio through an integrated refinery and petrochemical complex enabling

⁶ *Malay Mail Online*, “Johor banks on tourists, rails, ports and parks to drive the economy forward”, 14 June 2017 <<http://www.themalaymailonline.com/malaysia/article/johor-banks-on-tourists-rails-ports-and-parks-to-drive-economy-forward#haL3pydGYhDdRzAq.97>>.

⁷ East Coast Economic Region (ECER) website <<http://www.ecerd.com.my>>.

⁸ Juniwati Rahmat Hussin, Vice President and Venture Director of the Pengerang Integrated Complex in the Petronas Sustainability Report 2014.

Malaysia to move into downstream production of premium differentiated petrochemicals. In 2012, then Prime Minister Najib Abdul Razak declared the Pengerang Integrated Complex, comprising RAPID and its associated facilities, to be a “National Project of Strategic Importance”.⁹ The Johor Petroleum Development Corporation (JPDC) was thereafter formed, in April 2012; a federal agency under the Malaysia Petroleum Resources Corporation, in collaboration with the Johor state government. As an indication of the importance of JPDC and this new petrochemical endeavour, the Board of Directors for JPDC is co-chaired by a Federal Minister and the Chief Minister of Johor.

JPDC’s role is to implement the vision that began with the Petronas RAPID project and coordinate the development of the wider Pengerang region under the auspices of the PIPC, a state government initiative in support of the national Economic Transformation Programme where oil, gas and energy are listed as a National Key Economic Area.¹⁰ This task includes managing finances and funding, marketing and information dissemination, post-development operations and overseeing infrastructure and utilities development in the wider region.¹¹ The overarching goal of the entire endeavour was to transform Johor into a sustainable world class downstream oil and gas hub so as to derive greater value and investment from the oil and gas industry.¹² The PIPC began with an overall start-up target of 2019 and 10 million cubic metres of oil and gas storage facilities by 2020.¹³

In January 2017, the Pengerang Local Authority, administered by Johor Corporation (JCorp) was launched to oversee the PIPC industrial zone and its surrounding areas. Its jurisdiction covers 128,830 hectares that were previously under Lembaga Bandaran Johor Tenggara and Kota

⁹ Johor Petroleum Development Corporation (JPDC) website <www.jpdc.gov.my>.

¹⁰ Petronas Sustainability Report, 2014.

¹¹ JPDC website.

¹² Petronas Sustainability Report, 2014.

¹³ JPDC website.

Tinggi District.¹⁴ Pengerang lies within the Penawar and Tanjung Surat state constituencies.¹⁵

DECONSTRUCTING THE PIPC

The Pengerang Integrated Petroleum Complex covers about 20,000 acres in a single piece of land allocated by the Johor state government; about 80 km² and equivalent to about 10 per cent of Singapore's size.¹⁶ The PIPC is made up of several parts; the Pengerang Integrated Complex (PIC) by Petronas which comprises RAPID and other ancillary facilities; the Pengerang Deepwater Terminal (PDT), a joint-venture between Petroliaam Nasional Bhd (Petronas), Dialog Group Bhd, the Johor state government and Royal Vopak; and the Pengerang Maritime Industrial Park (PMIP) by Benelac Holdings Bhd. Also within the PIPC is the Pengerang Integrated Development Project (PIDP) by Serba Dinamik Holdings Bhd, comprising the Pengerang Eco-Industrial Park (PEIP) and Pengerang International Commercial Centre (PICC). Flanking the development are numerous townships and other infrastructural developments that surround the area and extend towards Bandar Penawar, Kota Tinggi and Desaru. Sungai Rengit is the main town closest to the PIPC development and the main node for existing amenities and facilities. Residents of the original five villages within the PIPC boundaries were moved to Taman Bayu Damai¹⁷ and the wider Punggai area¹⁸ about 20 km away. Total

¹⁴ *New Straits Times*, "New local authority launched to oversee Johor's PIPC", 16 January 2017 <www.nst.com.my/news/2017/01/204574/new-local-authority-launched-oversee-johors-pipc>.

¹⁵ *The Star Online*, "Development in Pengerang will be fed by its oil and gas industry which will create jobs and opportunities", 18 February 2013 <www.thestar.com.my/news/community/2013/02/18/development-in-pengerang-will-be-fed-by-its-oil-and-gas-industry-which-will-create-jobs-and-opportun/>.

¹⁶ Johor Petroleum Development Corporation (JPDC) website <www.jpdc.gov.my>.

¹⁷ Malaysian Insider, "Once tranquil, Pengerang now dusty, overrun with migrants and crime", 29 February 2016 <<https://sg.news.yahoo.com/once-tranquil-pengerang-now-dusty-230013347.html>>.

¹⁸ Personal communication, Pengerang local informant — name withheld by request.

investment in the PIPC is said to amount to RM97 billion (about US\$25 billion).¹⁹ Figure 1 illustrates the overall make-up of the area.

The PIPC also has non-refinery sectors that support the main industrial areas. Details of these sectors and the acreage allocated to them are listed in Table 1.

The following sections provide details of the larger sectors within the PIPC. While projected start dates for the PIC component of PIPC is 2019, adjacent developments will continue construction for at least another decade. Petronas is said to still be on the lookout for other partners,²⁰ and there is still substantial space available for other complementary facilities. Table 2 is a summary of the progress of development within the PIPC and gross development values where available.

The Pengerang Integrated Complex (PIC)

The PIC takes up 6,242 acres comprising mainly of the Refinery & Petrochemical Integrated Development (RAPID), a RM53 billion (about US\$13.611 billion) investment by Petronas, the pioneering and biggest investor in the PIPC.²¹ It has a 2019 commissioning target and intends to attain a 300,000 bbl²² per day refining capacity. This is Petronas' single largest downstream undertaking in Malaysia and will cater to mid-sour crude from the Middle East, with final products of gasoline and diesel that meet Euro 4 and Euro 5 specifications.²³ The RAPID refinery will

¹⁹ Hydrocarbons Technology www.hydrocarbons-technology.com/projects/petronas-rapid-project-malaysia/>.

²⁰ *New Straits Times Online*, "Petronas US\$27b Pengerang complex to refine crude oil from Oct 2018", 25 January 2018 <www.nst.com.my/business/2018/01/328734/petronas-us27b-pengerang-complex-refine-crude-oil-oct-2018>.

²¹ JPDC website.

²² "bbl" is the abbreviation for "blue barrel" or oil barrel, a standard measurement used for crude oil and petroleum products that is equivalent to 42 gallons or 159 litres (source: www.petropedia.com).

²³ Hydrocarbons Technology <www.hydrocarbons-technology.com/projects/petronas-rapid-project-malaysia/>.

Figure 1: Illustration of the Wider Pengerang Area and the Extent of Associated Development projects

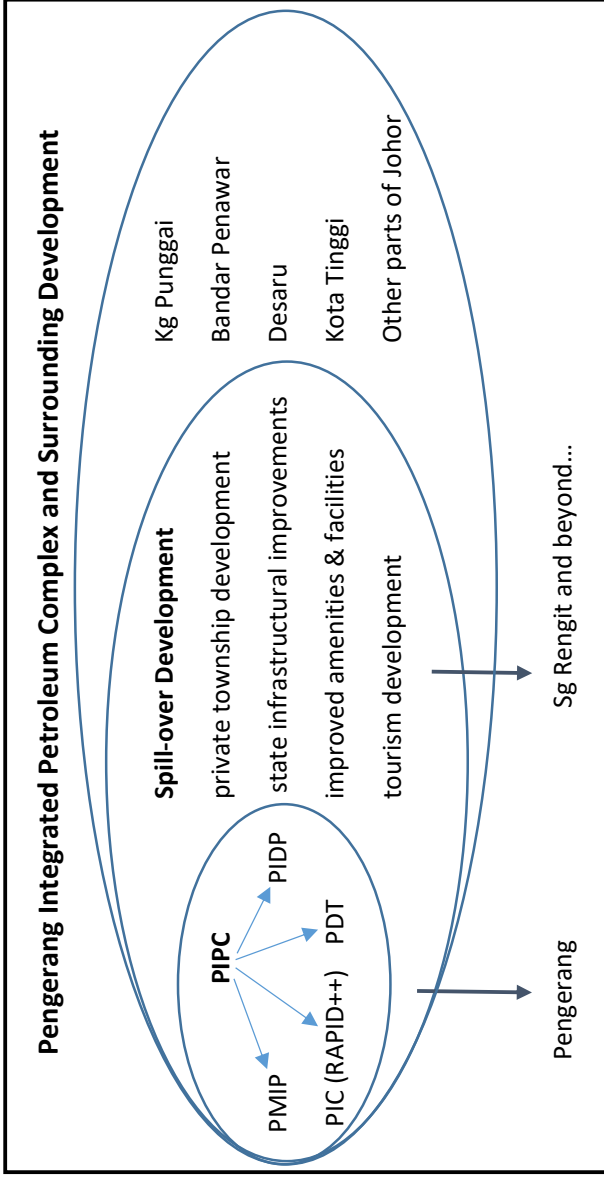


Table 1: Non-refinery segments within the PIPC

Non-refinery Sector	Details	Acreage
Emergency Coordination Centre	Emergency coordination, hospital and clinic, PIPC security coordination	
Waste Management Centre	Waste water treatment, solid waste conversion	60 acres
Emergency Response Centre	Fire response team, ambulance base	10 acres
Centralized Tank Farm	Crude & product handling, sulphur & coke handling	1,400 acres
Commercial Services Hub	Professional services, banking & finance	180 acres
Downstream Finished Product Zone	Plastics & fine chemicals, SMEs	1,081 acres
Medium & Light Industry Hub	Support industries, testing & metering	700 acres
Solid Logistics Hub	Container facilities, sulphur & coke	125 acres

Source: Johor Petroleum Development Corporation Berhad.

Table 2: Progress of development and investment value within PIPC (as of January 2018) and investment figures, where available

Aspect	Gross Development Value	Progress: % completion
Refinery complex (RAPID)	RM53 billion (about US\$13.611 billion)	94%
Steam cracker plant (RAPID)		91%
Petrochemical complex (RAPID)		74.3% completion as of August 2017
Raw water supply facility (PAMER)	RM36 billion	Began operations in July 2016
Cogeneration plant (PCP)	about US\$9.245 billion)	Began operations in October 2017
Regasification Terminal 2 (RG2)		Began operations in October 2017
Air separation unit (ASU)		74%
Pengerang Deepwater Terminal 2 (PDT2)	RM5 billion (about \$1.284 billion)	83%
Pengerang Maritime Industrial Park (PMIP)	RM14 billion (about US\$3.572 billion)	Target: 100 acres of land ready for topside development in mid-2018
Pengerang Integrated Development Project (PIDP)	RM1.4 billion (about US\$357.2 million)	Target: Construction begins in 2018

Note: The overall investment in PIPC is said to be RM97 billion (about US\$27 billion).

Sources: Johor Petroleum Development Corporation; Hydrocarbons Technology; The Star Online; The Edge Weekly; Benelac Holdings Berhad; The Edge Property Malaysia.

also supply feedstock for the petrochemical complex, resulting in highly specialized chemicals such as C4 and C5 derivatives.²⁴

The RAPID facility includes a naphtha cracker²⁵ facility that contains a propylene fractionator process column that is one of the tallest and heaviest in Malaysia. This facility will have a combined annual production of more than 3 million tonnes per annum (mtpa) of ethylene, propylene and C4-C6 olefin products; all of which are feedstock for premium differentiated specialty petrochemical products.²⁶ Also installed in RAPID are two ethylene oxide reactors, said to be among the biggest in the world. With the installation of these reactors, RAPID is said to be on track for its first refinery start-up within the first quarter of 2019.²⁷

Aside from RAPID, a RM36 billion (about US\$9.245 million) investment was made for associated facilities including a co-generation plant, an LNG re-gasification terminal, an air separation unit, a raw water supply project, a liquid bulk terminal, and central and shared utilities and facilities.²⁸

Project Air Mentah RAPID (PAMER) or the raw water facility is another component within the PIC that comprises an intake station, dam, booster pumping station and 88 km of raw water pipelines.²⁹ PAMER

²⁴ C4 and C5 derivatives are chemicals necessary for the production of synthetic rubber, etc.

²⁵ Steam cracking is a thermal process that produces ethylene by breaking down hydrocarbons into smaller molecules, which are then manufactured into more valuable chemicals. Naphtha, primarily derived from crude oil, is one of the main feedstocks for the steam cracking process (source: www.hosemaster.com).

²⁶ This process column made it into the Malaysian Book of Record. Source: Petronas Sustainability Report 2016.

²⁷ *The Star Online*, “Petronas installs among world’s largest ethylene oxide reactors at Pengerang”, 2 October 2017 <www.thestar.com.my/business/business-news/2017/10/02/petronas-installs-among-world-largest-ethylene-oxide-reactors-at-pengerang/>.

²⁸ Johor Petroleum Development Corporation (JPDC) website <www.jpdc.gov.my>.

²⁹ The Edge Markets, “What’s completed and not in Petronas’ US\$27b Pengerang project”, 25 January 2018 <<http://www.theedgemarkets.com/article/whats-completed-and-whats-not-petronas-us27b-pic-project>>.

began operations in July 2016 and contributes 30 million litres per day (MLD) of raw water to the Sungai Lebam reservoir to supplement Johor's water supply. Another 230 MLD produced is used by the PIC.³⁰ The facility is projected to be able to produce 520 MLD of water supply when it is running at full capacity.³¹

The Pengerang Co-generation Plant (PCP) is fully owned by Petronas and comprises four co-generation units that use Siemens H-class gas turbine technology and a dual stream configuration to produce 1.22GW of electricity and a continuous supply of steam (at 1480 tonnes per hour) when running at full capacity.³² The PCP began operations in October 2017 and currently produces 900 MW of electricity, of which 400 MW is sold to the national grid while the rest is used for the PIPC. Steam production is used by plants within the PIC.³³

Other facilities within the PIC include liquid natural gas (LNG) and oil storage tanks, a regasification plant and an air separation unit.³⁴ The Regasification Terminal 2 (RGT2) began operations in October 2017 and is a joint venture between Petronas, Dialog Group Berhad and the Johor state government. This facility supports the national gas industry liberalization initiative and helps to ensure the continuity of future gas supplies to the country.³⁵ The air separation unit (ASU), a joint venture

³⁰ Petronas Sustainability Report 2016.

³¹ Johor Petroleum Development Corporation Berhad presentation on PIPC, 25 August 2016.

³² Hydrocarbons Technology <www.hydrocarbons-technology.com/projects/petronas-rapid-project-malaysia/>.

³³ Sales to the national grid will increase to 600 MW when the plant is running at full capacity. Source: Petronas Sustainability Report 2016.

³⁴ Johor Petroleum Development Corporation Berhad presentation at the 30th Annual General Meeting of the Malaysian Gas Association on 12 May 2016.

³⁵ *Malay Mail Online*, "Pengerang Integrated Complex to be fully operational by Q1 2019, says Najib", 24 October 2017 <www.themalaymailonline.com/money/article/pengerang-integrated-complex-to-be-fully-operational-by-q1-2019-says-najib>.

between Petronas Gas Berhad and Linde AG will produce 2954 tonnes of industrial gases a day to the PIC.³⁶

The PIC is expected to reach 98 per cent completion by the end of 2018.³⁷ The RGT2 and the PCP began the accreditation process to meet industry requirements in October 2017.³⁸ As of January 2018, the project involves 70,000 personnel from 65 nationalities and is expected to take another 350 million man hours to reach total completion.³⁹

The Pengerang Deepwater Terminal 2 (PDT2)

The Pengerang Deepwater Terminal 2 (PDT2) is a RM5 billion investment (about US\$1.284 billion) by a joint venture between Petronas PRPC Utilities & Facilities Sdn Bhd, Dialog Equity (Two) Sdn Bhd, Vopak Terminal Pengerang BV and Johor State Secretary Incorporated.⁴⁰ PDT2 is scheduled for commissioning in phases from the first half of 2019, and will serve RAPID as its main customer. It will have an initial storage capacity of 1.65 million m³ for crude, refined products, petrochemical products and liquefied petroleum gas (LPG). The terminal will have twelve berths with a draft of 24 m, thus being able to accommodate Very Large Crude Carriers (VLCCs).⁴¹ PDT2's primary purpose is to facilitate

³⁶ Hydrocarbons Technology <www.hydrocarbons-technology.com/projects/petronas-rapid-project-malaysia/>.

³⁷ *New Straits Times Online*, "Petronas US\$27b Pengerang complex to refine crude oil from Oct 2018".

³⁸ *Malay Mail Online*, "Pengerang Integrated Complex to be fully operational by Q1 2019, says Najib".

³⁹ *New Straits Times Online*, "Petronas US\$27b Pengerang complex to refine crude oil from Oct 2018".

⁴⁰ Hydrocarbons Technology <www.hydrocarbons-technology.com/projects/petronas-rapid-project-malaysia/>.

⁴¹ *The Star Online*, "Petronas JV secures RM5.1b to finance Pengerang terminal", 12 December 2017 <[www.thestar.com.my/business/business-news/2017/12/12/petronas-jv-secures-us\\$1pt25b-to-finance-pengerang-terminal/](http://www.thestar.com.my/business/business-news/2017/12/12/petronas-jv-secures-us$1pt25b-to-finance-pengerang-terminal/)>.

the import of crude oil to PIC to be refined into feedstock that will be further processed within PIPC into high demand and high value products such as polymers, pharmaceutical products and plastics.⁴²

The Pengerang Maritime Industrial Park (PMIP)

The PMIP is a ten-year 1672.8-acre reclamation project handled by Benalec Holdings Berhad on the only remaining 3.7 km stretch of seafront land within the PIPC, near Tanjung Ramunia. Phase 1 entails the reclamation of 1,180.1 acres over a span of six years. The gross development value of the project is about RM14 billion (about US\$3.58 billion).⁴³ Site preparatory works began in August 2016 and 100 acres of land is targeted to be ready for topside development by mid-2018.⁴⁴ Reclamation will surround and engulf Pulau Cik Kamat, a small island not far from the coast.⁴⁵

The Pengerang Integrated Development Project (PIDP)

This large development by Serba Dinamik Holdings Berhad on 132 acres within the PIPC represents a RM1.4 billion investment⁴⁶ (about US\$358

⁴² JPDC website.

⁴³ The Edge Weekly, “Benalec poised to enter the big league”, 21 November 2011.

⁴⁴ Phase 2 comprises the reclamation of the remaining 492.7 acres, all of which will be available on a 99-year lease. PMIP will complement RAPID, which is only 6 km away and will include downstream support activities such as an oil storage terminal, industrial warehousing, light to heavy industry factories, fabrication yard and ship repair, integrated logistics park, shipyards and a free commercial zone. The park will have two jetties with up to twenty berths for VLCCs. Source: Presentation by Benalec Holdings Berhad on TPMIP and PMIP, August 2017.

⁴⁵ Personal communication, JPDC staff — name withheld by request.

⁴⁶ The Edge Property Malaysia, “Serba Dinamik take part in RM1.4 billion Johor development”, 18 August 2017 <<http://www.theedgemarkets.com/article/serba-dinamik-take-part-rm14b-johor-development>>.

million) that includes the Pengerang Eco-Industrial Park (PeIP), the Pengerang International Commercial Centre (PICC) and the Pengerang Northshore Residences.⁴⁷ Perisind Samudra Sdn Bhd, a Johor-based engineering consultant manages this project.⁴⁸ The 9-acre PICC, which begins construction in 2018, will encompass corporate office towers, service apartments, retail, conference and banquet facilities.

Figure 2 illustrates the various sectors within the PIPC and nearby township and resort developments that have come about in tandem with the project.

WHY PENGERANG?

Before the advent of the PIPC, the wider Pengerang area comprised seven fishing villages and adjacent smallholdings in a relatively rural part of Johor with limited access and infrastructure. The selection of the site is attributed to a number of natural and fortunate circumstances. The Pengerang coastline enjoys a safe and sheltered harbour where no breakwater is required for coastal development.⁴⁹ Coastal waters are deep (between 20 to 24 metres) resulting in cost savings from ample available anchorage area with minimal need for maintenance dredging and minimal capital outlay for shorter jetty trestles for VLCC berthing.⁵⁰ Pengerang is accessible via a number of highways and airports (both in

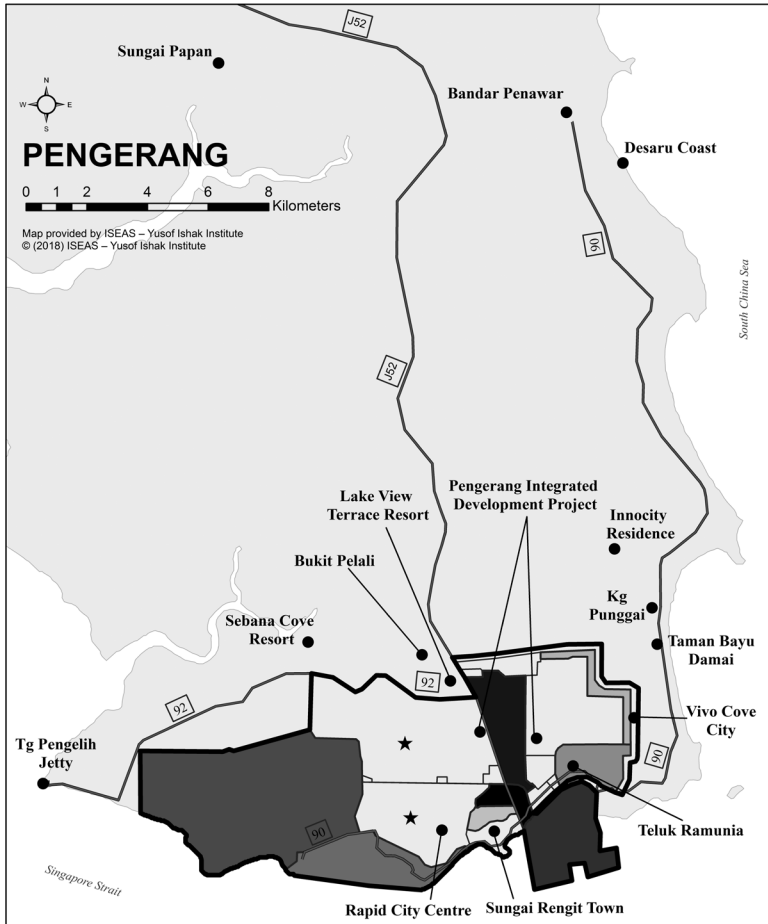
⁴⁷ The Edge Property Malaysia, “Serba Dinamik buys 30% stake in housing developer for RM18.3 million”, 21 August 2017 <<http://www.theedgemarkets.com/article/serba-dinamik-buys-30-stake-housing-developer-rm183m>>.

⁴⁸ The PeIP by itself is a RM300 million service centre for oil and gas inspection, repair and maintenance of plants, machineries and equipment in the PIPC. This will include an 18-acre Plant-Turnaround Village that provides services during scheduled cleaning, maintenance, inspection and repair shutdowns of PIC plants. Source: The Edge Property Malaysia, “Serba Dinamik inks MOA to kickstart RM1.4 billion Pengerang Project”, 18 August 2017 <<http://www.theedgemarkets.com/article/serba-dinamik-inks-moa-kickstart-rm14b-pengerang-project>>.

⁴⁹ JPDC website.

⁵⁰ Personal communication with representative of Benalec Holdings Berhad who declined to be named, 3 October 2017.

Figure 2: Map of Pengerang



- 92 New highways
- Pengerang Integrated Petroleum Complex (PIPC) ★ Areas still available for investment
- Commercial Services Hub
- Downstream finished product zone
- Medium & Light industry
- Pengerang Deepwater Terminal (PDT)
- Pengerang Integrated Complex (PIC)
- Pengerang Maritime Industrial Park (PMIP)
- Plastics & Fine Chemicals Park
- Solid Logistics Hub

Johor and in Singapore)⁵¹ and is in close proximity to other deepwater port facilities and regional demand centres, enabling easy transport of finished products to the market.⁵² The 633 million strong ASEAN population and the overall Asian population of 3 billion people are highly accessible via international shipping lanes for which Pengerang is already en route.⁵³ Existing facilities in Malaysia are scattered, further away from international ports and non-integrated. Many do not have deepwater ports, are unable to produce according to Euro 4 and Euro 5 specifications, and have no space for expansion.⁵⁴ The matrix in Table 3 illustrates the existing oil and gas activity centres in Malaysia.

PIPC BENEFITS TO PETRONAS AND MALAYSIA

The oil and gas industry contributes between 20 to 30 per cent of Malaysia's GDP, even with existing low prices for global crude oil. There are more than 3,500 local and international oil and gas companies functioning in Malaysia;⁵⁵ the multiplier effect of this industry is high and it is a strategic priority sector identified as a National Key Economic Area.⁵⁶ Since 2015, Malaysia has suffered marginal growth in oil production and reserves, while gas production has been in decline.⁵⁷ There are currently thirty-six gas (LNG) producing fields across Malaysia with more deepwater

⁵¹ PIPC is only 100 km away from Senai International Airport in Johor (by land) and 26 km away from Changi International Airport in Singapore.

⁵² Hydrocarbons Technology <www.hydrocarbons-technology.com/projects/petronas-rapid-project-malaysia/>.

⁵³ Johor Petroleum Development Corporation Berhad presentation at the 30th Annual General Meeting of the Malaysian Gas Association on 12 May 2016.

⁵⁴ Johor Petroleum Development Corporation Berhad presentation on PIPC, 25 August 2016.

⁵⁵ Export.gov by International Trade Administration, USA <www.export.gov/article?id=Malaysia-Oil-and-Gas-Equipment>.

⁵⁶ Petronas Sustainability Report, 2014.

⁵⁷ Export.gov by International Trade Administration, USA.

Table 3: Existing oil, gas and petrochemical (or related) activity in Malaysia. These facilities support either the petrochemical process or the transport of feedstock or finished products

	OFSE manufacturing	Container port	Offshore struct fabrication & supply	Offshore services base	MHE	Oil storage	Marine services	Chemical	Oil Refinery	Petrochemical facility	LNG RGT
Senai, Johor											
Port of Tg Pelepas, Johor											
Teluk Ramunia, Johor											
Tg Langsat, Johor											
Pasir Gudang (Johor Port)											
Tg Bin, Johor											
Pengerang (before PIPC)											
Kertih, Terengganu											
Kemaman, Terengganu											
Sg Udang, Melaka											
Port Dickson, Negri Sembilan											
Nilai, Negri Sembilan											
Gurun, Kedah											
Prai, Penang											
Gebeng, Pahang											
Tg Agas, Pahang											
Lumut, Perak											
Labuan											
Bintulu, Sarawak											
Sipitang, Sabah											

Notes: OFSE = Offshore field service & equipment; MHE = Materials handling & equipment; LNG RGT = Liquid natural gas regasification terminal.

Sources: Johor Petroleum Development Corporation Berhad; Pengerang Maritime Industrial Park website: International Trade Administration <www.export.gov>; J. Calabrese, *Positioning Malaysia within the global energy landscape* (Middle East Institute, 2014); Presentation by Frost & Sullivan on Malaysia LNG Outlook, 25 October 2011; Hydrocarbons Technology; PEMANDU; MIDA.

fields to be developed.⁵⁸ Malaysia's main LNG consumers are currently mainly power stations (53.7 per cent) and industries (33.3 per cent). The projection for LNG in 2010 is for more production (88.5 per cent) than consumption (53.7 per cent). The presence of RGT2 in the PIPC will allow other suppliers to enter the market and any party will be able to supply LNG to local power companies and other customers.⁵⁹

Newly available oil reserves off North Borneo are between 200 to 1,200 metres in depth and are therefore costlier to extract.⁶⁰ However increased pressure on oil prices means that the downstream segment continues to do well as low oil prices translates into low feedstock prices and thus lower production costs for downstream markets.⁶¹

Adjusting Malaysia's energy security strategy to increase refining capacity so as to become a net oil product exporter will help Petronas meet increasing demand for high value products in the Asia-Pacific for the next twenty years and attract domestic and foreign direct investments into the country.⁶² Upon completion of the PIPC in Johor, coupled with the development of the Sipiting Oil & Gas Industrial Park (SOGIP) in Sabah, Malaysia's national refining capacity will double from 588,000 bbl per day to 1,158,000 bbl per day.⁶³ The PIPC alone is expected to generate RM8.3 billion (about US\$2,131.5 million) to Malaysia's Gross National Income by 2010.⁶⁴

⁵⁸ The deepwater LNG producing fields can be found in Peninsular Malaysia (40.7%), Sabah (9.6%) and Sarawak (49.5%). Source: Presentation by Frost & Sullivan on Malaysia LNG Outlook, 25 October 2011.

⁵⁹ Ibid.

⁶⁰ Export.gov by International Trade Administration, USA.

⁶¹ *New Straits Times Online*, "Is oil and gas industry healing?", 7 August 2017 <<https://www.nst.com.my/business/2017/08/265001/oil-and-gas-industry-healing>>.

⁶² Ibid.

⁶³ Export.gov by International Trade Administration, USA.

⁶⁴ *New Straits Times Online*, "PIPC garner RM83 billion income", 24 October 2017 <<https://www.nst.com.my/business/2017/10/294502/update-pipc-garner-rm83-billion-income-2020>>.

Petronas stands to benefit greatly from the PIPC and an increase in LNG exports as MISC Berhad, a Petronas-linked LNG shipping and engineering company owns and operates 8 per cent of the global LNG Carriers fleet.⁶⁵ Petronas Gas Berhad (PGB) is also involved in the gas infrastructure and utilities (I&U) business, and owns and operates Gas Processing Plants and Peninsular Gas Utilisation (PGU) systems for both Malaysia and Singapore. In PIPC, PGB is involved in the PCP, RGT2 and ASU.⁶⁶

Unlike other recent large infrastructure projects in Malaysia over the last few years,⁶⁷ the PIPC is clearly positioned as a locally driven development. As of January 2018, more than 40 major engineering, procurement, construction, commissioning (EPCC) packages and 13 licensors comprising more than 200 suppliers and contractors of various nationalities have been awarded.⁶⁸ In its 2016 Sustainability Report, Petronas declared that it has awarded 649 Malaysian subcontractors with contracts for fabrication, equipment supply, solution services, telephone communications, F&B, laundry and sundry shops; with a total value of about US\$7.35 million. In a review of 71 documents and websites that mentioned the PIPC over the past year, 39 organizations said to be involved in or collaborating in the PIPC originated from 13 countries; 17 (55 per cent) were Malaysian, 11 were from other Asian countries, 8 were European and 3 were from the United States. The list of companies examined from the documents and websites sampled, as well as some

⁶⁵ Information is accurate as of 2010. Source: Presentation by Frost & Sullivan on Malaysia LNG Outlook, 25 October 2011.

⁶⁶ PGB is already involved in the extraction of feedstock and the production of essential utilities for Petronas petrochemical plants in Kertih and Gebeng and runs Malaysia's first regasification terminal in Sungai Udang. The Sungai Udang regasification terminal already secures domestic gas supply and future needs. Source: Petronas Sustainability Report 2014.

⁶⁷ ASEAN Today <<https://www.aseantoday.com/2016/03/high-speed-rail-project-goes-to/>>.

⁶⁸ *New Straits Times Online*, "Petronas US\$27b Pengerang complex to refine crude oil from Oct 2018".

details of their involvement in the PIPC are listed in the Appendix. This snapshot of companies involved in the PIPC demonstrate that there are indeed a substantial number of local players and a broad mix of international collaborators, as claimed by Petronas.

PIPC AS A REGIONAL PETROCHEMICAL HUB

The Pengerang Integrated Petroleum Complex was inspired by the Amsterdam-Rotterdam-Antwerp (ARA) model⁶⁹ of maritime activity, port network and oil supply chain connectivity. The ARA is vital to Northern European oil and gas bunkering and transport.⁷⁰ The tripartite of Singapore, Johor and the Riau Islands would be the local parallel of ARA, with Pengerang projected to surpass Rotterdam in its success.⁷¹ Figure 3 illustrates PIPC's fortunate position on maritime routes, as well as its proximity to various sites for oil and gas activity.

In addition to the area's geographical assets, Pengerang has easy access to major shipping lanes between the Middle East, Singapore and China. Given its proximity to Singapore's deepwater terminals, there is a good pool of VLCC and ULCC⁷² traffic to tap on.⁷³ Not only do 15.2 million barrels of oil pass through the Melaka Straits every day, the Malaysian government also offers myriad tax incentives for oil and gas

⁶⁹ JPDC website.

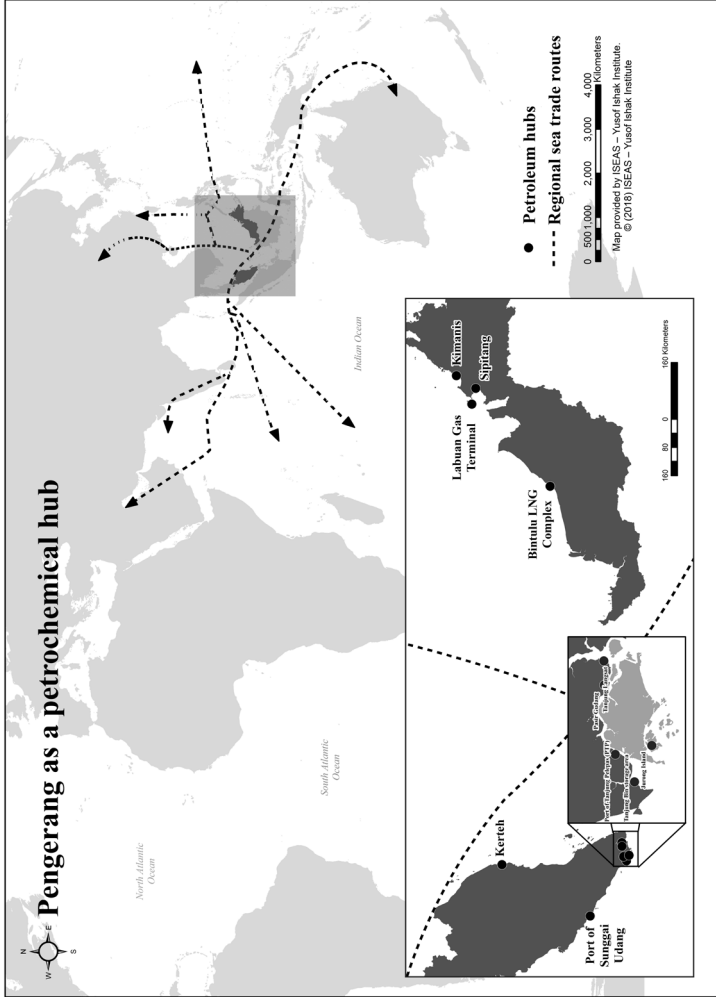
⁷⁰ GENSCAPE, "ARA Bunkering — the Ports of Amsterdam, Rotterdam & Antwerp", 2 November 2016 <www.genscape.com/blog/ara-bunkering-ports-amsterdam-rotterdam-antwerp>.

⁷¹ Ngau Boon Keat, Dialog Group Berhad executive chairman projected that "in 20 years Pengerang could surpass Rotterdam". Source: The Malaysia Project. Pengerang's Property Play <<http://malaysiaproject.blogspot.sg/search/label/sg%20rengit>>.

⁷² ULCC = ultra large crude carriers; these can carry up to 5 million tons of crude per shipment.

⁷³ JPDC website.

Figure 3: Pengerang as a petrochemical hub



companies that choose to use Malaysian ports of call and invest in the local oil and gas industry.⁷⁴

Domestically, the PIPC can benefit from increased opportunities for Malaysian oil and gas producing states such as Kelantan, Terengganu, Sabah and Sarawak. Ongoing reviews of oil royalties are expected to further encourage greater participation in the oil sector, which can mean benefits to PIPC in terms of transshipment or LNG storage.⁷⁵ New developments in East Malaysia including an integrated LNG hub in Bintulu targeting underserved markets such as Brunei may also benefit the PIPC.⁷⁶

One of the most common questions asked with regard to the PIPC is whether it will complement or compete with Singapore. Historically used as an oil storage facility for the British, the island-state has been actively involved in the oil and gas industry since the 1960s. Today it is one of the largest petrochemical hubs in the world, one of Asia's leading oil trading hubs and one of the world's top three export refining centres as well as a world-class research hub for oil and gas.⁷⁷ Singapore is recognized for its product quality, efficiency and ease of business, but it suffers

⁷⁴ Malaysian government tax incentives include 100% income tax exemption for five to ten years, financial assistance for land acquisition, investment tax allowances of up to 100 per cent of qualifying capital expenditure for five to ten years, Global Incentive for Trading (GIFT) programme for petroleum and petroleum-related trading companies that includes a flat corporate tax rate of 13 per cent on chargeable income and 100 per cent income tax exemption on statutory income for the first three years of operations for LNG trading companies. Source: Benelac Holdings Berhad.

⁷⁵ *New Straits Times Online*, "Brighter prospects ahead in oil and gas sector", 28 October 2017 <<https://www.nst.com.my/news/nation/2017/10/296197/brighter-prospects-ahead-oil-and-gas-sector>>.

⁷⁶ *New Straits Times Online*, "Asia bioenergy set one stop hub", 14 March 2017 <<https://www.nst.com.my/news/2017/03/220587/asia-bioenergy-set-one-stop-hub>>.

⁷⁷ J.R. Diez, "Territorial complementarities or competition for FDI? Johor, Singapore and the oil and gas sector", *ISEAS Perspective* no. 54/2017, ISEAS – Yusof Ishak Institute, Singapore, 2017.

from land scarcity and could reach maximum capacity with no space to expand its facilities. Industry analysts feel that there is more than enough business for Singapore and Pengerang to share, although PIPC will probably pick up on spillover business or attract traders who need less expensive alternatives.⁷⁸ A comparison of facilities between Malaysia, Singapore and PIPC is shown in Table 4. While PIPC will greatly expand Malaysia's capacity, some aspects will continue to lag behind Singapore. With Singapore's long-standing reputation, its substantial long-term investment in the oil and gas industry and its complete and seasoned ecosystem for oil and gas, Johor may have a steep climb to overcome before it can be on par with its southerly neighbour.⁷⁹

Within ASEAN, oil production is said to be steady, but increased demand has resulted in an increasing need for oil imports. While there is rising demand for natural gas, this remains below production levels; ASEAN countries are net exporters of natural gas. Even as Southeast Asian countries try to diversify their energy sources, there is a rapid growth in coal consumption. Indonesia and Malaysia are strong producers of oil, while Thailand joins them in having large reserves of natural gas.⁸⁰ This is an indication that there is still great potential in Southeast Asia when it comes to oil and gas production, processing, trade and transit; all of which bodes well for the PIPC.⁸¹

The development of PIPC benefits Petronas in particular due to its existing transregional businesses. Its joint ventures with Trans Thai Malaysia for the transportation and processing of gas from the

⁷⁸ *Straits Times*, "Malaysia's oil hub — will it be a threat to Singapore?", 17 July 2014 <<http://www.straitstimes.com/opinion/malaysias-oil-hub-will-it-be-a-threat-to-singapore>>.

⁷⁹ Diez, "Territorial complementarities or competition for FDI?"

⁸⁰ ASEAN UP, "Overview of oil and gas in Southeast Asia", 16 September 2017 <<https://aseanup.com/overview-of-oil-and-gas-in-southeast-asia/>>.

⁸¹ Industry experts also agree that while regional energy usage is half the global average on a per capita basis, it will expand sharply as ASEAN economies grow which will result in more energy shipments in the region and a need for more storage space. Source: *Straits Times*, "Malaysia's oil hub — will it be a threat to Singapore?".

Table 4: Comparison of Singapore's and Malaysia's existing capacity (as of 2016) and PIPC's potential capacity

	Malaysia's capacity (as of 2016)	Singapore's capacity (as of 2016)	PIPC potential capacity (when complete)
Oil storage capacity (for trading)	2.93 million m ³	10 million m ³	5 million m ³
Oil refinery capacity	0.58 million bbl/day	1.45 million bbl/day	1 million bbl/day
Petrochemical production capacity	3.85 MTA	9.8 MTA	11.8 MTA
RGT (LNG) capacity	3.8 MTA	6 MTA	3.5 MTA

Notes: bbl/day = blue barrel (42 gallons/159 litres); MTA = million tonnes per annum.

Source: Johor Petroleum Development Corporation Berhad presentation on PIPC, 25 August 2016.

Malaysia-Thailand Joint Development Area (MTJA) and its stake in the Transasia Pipeline Pvt Ltd, Indonesia could ensure that oil and gas from neighbouring countries are channelled through Pengerang, enhancing its usefulness as a regional hub.⁸² Royal Vopak, the joint venture partner in RAPID, as the world's largest independent tank storage company (in terms of capacity), may also be able to influence the transit of oil and gas between its global facilities.⁸³ These far-reaching networks will be a boon to the PIPC as an entity, as well as to its investing companies as they drive business towards these new downstream facilities.

PIPC AS A CATALYST FOR DEVELOPMENT

Johor's former Chief Minister, Mohamed Khaled Nordin, cited the PIPC as the starting point of development on Johor's east coast.⁸⁴ Even as the technical aspects of the PIPC are still being finalized and built, steps have been taken to improve connectivity between Pengerang and the surrounds. Existing roads have been widened and new roads have been built to either improve access or cater specifically to heavy vehicles.⁸⁵ Federal government investment in supporting infrastructure for the PIPC has amounted to RM2.49 billion (about US\$640 million).⁸⁶ The RAPID

⁸² Petronas Sustainability Report 2014.

⁸³ *The Star Online*, "Dialog propelled by RAPID development", 2 September 2017.

⁸⁴ Astro Awani, "Pengerang poised to be catalyst for east Johor corridor development", 16 January 2017 <english.astroawani.com/business-news/pengerang-poised-be-catalyst-east-johor-corridor-development-129167>.

⁸⁵ The Edge Property, "The elements needed for Iskandar Malaysia's success", 7 May 2017 <<https://www.edgeprop.my/content/1128646/elements-needed-iskandar-malaysia%E2%80%99s-success>>.

⁸⁶ These projects include: new roads, improved drainage, new fire and police stations, the Sg Rengit clinic, a new secondary school (SMK Pengerang Utama), new public low-cost houses, and a new fishery complex. Sources: Pengerang Maritime Industrial Park website <<http://pengerangmaritime.com.my/johor-pipc/>> and Johor Petroleum Development Corporation Berhad presentation on PIPC, 25 August 2016.

City Centre is a 196-acre development launched in 2015 in Sungai Rengit comprising shop houses and office lots.⁸⁷ Other new amenities are located around the relocation site of displaced villagers and are meant to specifically benefit the original local community of the area.

Given the scale of the PIPC, it is projected that by 2020, the population of the area will more than doubled from 30,008 people in 2010 to 70,043 people. Housing demand will thus increase from accommodation needed for 7,280 families in 2010 to about 14,000 families in 2020.⁸⁸ Petronas direct staff numbers alone are expected to increase from 59 in 2016 to 4,483 people in 2010.⁸⁹ Local rental opportunities are very scarce and rental costs are high given the scarcity;⁹⁰ there is a great need to develop housing and other associated facilities for this new migrant PIPC working population.⁹¹ In response, a number of new townships catering to various strata of society have sprung up. The locations of these townships are shown in Figure 2. Table 5 provides a summary of most of the new housing and other developments that have come up around the PIPC.

Also not too far from the PIPC, other recently announced residential developments include the Innocity Residence and Vivo Cove City. Bandar Penawar is now the nearest satellite town and is currently the main township beyond Sungai Rengit to support PIPC housing needs. In Kota Tinggi, Sungai Papan is a 3,160-hectare growth area slated to be yet another satellite town that will serve the needs of the PIPC. Johor Corporation will build 60,000 units of housing of various types

⁸⁷ Malton Berhad Group, 2017 <<http://www.malton.com.my/portfolio-items/rapid-city-centre/>>.

⁸⁸ Johor Petroleum Development Corporation Berhad presentation on PIPC, 25 August 2016.

⁸⁹ Petronas presentation on “Accommodation and amenities readiness for Pengerang Integrated Complex”, 24 March 2016.

⁹⁰ Personal communication, Pengerang local informant — name withheld by request.

⁹¹ These new migrants comprise Malaysians from other parts of Johor and other states who move to Pengerang to work, some foreign professionals where relevant and a large number of foreign contractors and construction workers.

Table 5: Summary of townships around PIPC

Name of township	Location	Developer	Details (if any)
Bukit Pelali	Bordering PIPC	Astaka Padu	363 acres – first strata township: 3,884 residential units (including 1,598 affordable homes units), 2018 completion of first phase, 8–10 year development
Sebana Cove Resort Township	Bordering PIPC	IJM Corp	1,188 acres – resort township: residential & commercial components along existing resort, private marina and golf course
Pengerang Northshore Residence	Within PIDP	Almurisi Development Sdn Bhd (Serba Dinamik Grp Bhd)	70 acres – mixed residential & commercial property including landed residential properties, affordable apartments, shop offices and community complex
(NA)	Bordering PIPC	Capital World	207.5 acres – right to develop township on land owned by Yayasan Pelajaran Johor

Source: The Edge Property Malaysia.

as well as facilities for trade, marine industries, education and research and development.⁹² In order to provide for second-generation families of those displaced from the original seven villages that existed in the area before the PIPC was built and to meet future relocation needs, a new settlement is being built in Kampung Punggai, not far from Taman Bayu Damai.

Before the arrival of the PIPC, Pengerang was designated an ecotourism destination anchored around its quiet seaside villages, popular lobster restaurants and the rare dugong sighting. However, tourism did not take off.⁹³ With PIPC completely transforming the economic targets of this area, tourism in nearby Desaru and Pantai Timur are being reinvigorated. While existing resorts and attractions are being spruced up, Khazanah Nasional Bhd is focusing on Desaru as an integrated tourism hub. An area of about 4,114 acres along a 17 km coastline along the South China Sea⁹⁴ is being transformed into five-star resorts, golf courses and theme parks.⁹⁵ Marketed under the brand name Desaru Coast, golf courses headlined by Ernie Els and Vijay Singh are already open for business.

PIPC IMPACT ON THE LOCAL COMMUNITY

When the RAPID project was first announced in 2011, there was substantial pushback from the Pengerang local communities as there had

⁹² *New Straits Times Online*, “JCorp set to roll out 11 major development projects in Johor”, 20 November 2016 <<https://www.nst.com.my/news/2016/11/190295/jcorp-set-roll-out-11-major-development-projects-johor>>.

⁹³ The Edge Markets, “Petronas in the spotlight”, 10 August 2017 <<http://www.theedgemarkets.com/article/cover-story-petronas-spotlight>>.

⁹⁴ The Malaysia Project, “Pengerang’s Property Play” <<http://malaysiaproject.blogspot.sg/search/label/sg%20rengit>>.

⁹⁵ *The Sun Daily*, “Desaru Coast unveiled: Malaysia’s first premium integrated destination”, 31 October 2017 <<http://www.thesundaily.my/news/2017/10/31/desaru-coast-unveiled-malaysia%E2%80%99s-first-premium-integrated-destination-itb-asia-2017>>.

been no earlier warning that their land would be taken for the project.⁹⁶ As they were also unaware of the state plan to allocate 20,000 acres to the larger PIPC, they also questioned the need to take more than the 6,424 acres reported to make up just RAPID. News of the planned relocation of the seven villages was released during the run up to Malaysia's 13th General Elections, and the project then became a political tool, with opposition politicians, nationwide NGOs and the newly formed Kekalkan Pengerang Lestari (Maintain Pengerang's Sustainability) coming together to protest against the development.

Three thousand one hundred Malay and Chinese fishermen and smallholders were relocated to Taman Bayu Damai, a newly constructed settlement area built on land reclaimed from coastal mangroves between Teluk Ramunia and Ponggai. A thousand Muslim graves and 1,500 Chinese graves had to be relocated as part of the process. According to a representative of JPDC,⁹⁷ the law actually states that relocated villagers are to be given only cash compensation but, in this case, they were also given subsidized housing and replacement agricultural lots for lost smallholdings.

At the time, however, the community was not appeased. Many claimed that the allocation of compensation was not transparent, and that promises were not guaranteed in writing (and therefore unfulfilled). Fishermen were given RM4,000 or less if they were unlicensed and smallholders of between 1 and 2 acres were paid between RM65,000 to RM105,000. While they were offered subsidized housing, many complained that the quality of the houses was poor (as the newly reclaimed land was still settling) and that the new houses were very small compared to the homes that they were used to, and never had to pay for. Some families who had lived in Pengerang for generations did not have land titles, while others shared land with many siblings. This meant that

⁹⁶ Free Malaysia Today, "10 Questions on the Pengerang project", 26 September 2012 <www.freemalaysiatoday.com/category/opinion/2012/09/26/10-questions-on-pengerang-project>.

⁹⁷ Personal communication, JPDC staff — name withheld by request.

they were either not eligible for compensation or received very little and few had money set aside to pay for the new homes, which cost between RM35,000 and RM105,000.⁹⁸ Taman Bayu Damai is also about 20 km away from where many park their fishing boats, which can mean an hour's travel by motorbike and additional petrol costs; in the past it only took the fishermen 5 minutes to get to sea.⁹⁹

After the initial furore died down however, there was little news of the plight of the local community in terms of displacement and livelihoods lost. Instead, efforts by Petronas and various state agencies to assist the community and provide amenities, infrastructure and job training dominated the public discourse.

Petronas' Sustainability Reports¹⁰⁰ consistently list their contributions to the communities of Pengerang. Publicity material for PIPC from various agencies list its potential to create 4,000 high-skilled jobs¹⁰¹ and 8,600 other jobs.¹⁰² While at the time of writing, 60,000 jobs had already been created in the development, many of these are construction related and thus taken up by foreign workers. The local community had already questioned the possibility of their residents getting jobs in the development as few had the required skill sets.¹⁰³ By sheer numbers, the local population of about 10,000 people in the wider Pengerang area is insufficient to meet the needs of the PIPC.

JPDC has a unit specifically devoted to human capital development, but because plans for the PIPC took off so quickly, they currently focus

⁹⁸ Free Malaysia Today, "10 Questions on the Pengerang project".

⁹⁹ Malaysian Insider, "Once tranquil, Pengerang now dusty, overrun with migrants and crime", 1 March 2016 <<http://www.theedgemarkets.com/article/once-tranquil-pengerang-now-dusty-overrun-migrants-and-crime>>.

¹⁰⁰ Petronas Sustainability Reports 2014 and 2016.

¹⁰¹ These include: job matching for main contractors, entrepreneurship training, school programmes and sponsorship for vocational training. Source: Petronas Sustainability Report 2014.

¹⁰² Johor Petroleum Development Corporation Berhad presentation on PIPC, 25 August 2016.

¹⁰³ Free Malaysia Today, "10 Questions on the Pengerang project".

on providing upgrading skills to available candidates to fill knowledge gaps. Petronas is moving qualified staff from other centres to PIPC to provide start-up guidance while newly-hired staff are sent to long-running facilities for training.¹⁰⁴ JPDC runs several programmes with a variety of entities to train and certify vocational and supervisory staff as well as provide entrepreneurial training, assistance and financing.¹⁰⁵ While nearby Universiti Teknologi Malaysia (UTM) has a petroleum engineering programme, there seems to be a gap between jobs available, skills required and the quality of graduates entering the market. New groups such as NrgEdge, a network of oil and gas professionals help to bridge the gap between study and work by providing internships, boot camps and networking opportunities for fresh graduates to the industry.¹⁰⁶ Private initiatives such as this will help to meet the needs of the PIPC and provide job-matching facilities for the wider Malaysian population.

Beyond jobs and compensation, Petronas has also set up KOPEJA (Koperasi Pengarang Jaya Johor Berhad), a cooperative with membership comprising mostly displaced residents from Taman Bayu Damai. The cooperative operates a retail station within the PIPC and members are also provided with entrepreneurship and job training. In response to grievances that came about because of the relocation exercise, a Social Impact Management Plan (SIMP) was devised and a Community Leadership Committee (CLC) comprising village heads, women and youth groups' representatives are involved in project disclosure sessions and participate in arranged visits to Petronas' Kerteh Integrated Petroleum Complex (KIPC). Petronas has also set up a grievance mechanism

¹⁰⁴ Personal communication, Abd Rahim Ahad, Manager, Investor Management, JPDC, 8 March 2018.

¹⁰⁵ These include: such as Yayasan Peneraju Pendidikan Bumiputera (Bumiputera Education Foundation), TERAJU, SME Bank, and the Bandar Penawar Community College, among others. Source: Johor Petroleum Development Corporation Berhad presentation on PIPC, 25 August 2016.

¹⁰⁶ *New Straits Times Online*, "A head start for oil and gas industry", 16 August 2017 <<https://www.nst.com.my/education/2017/08/268382/head-start-oil-and-gas-industry>>.

through which residents can channel complaints directly to an assigned Community Liaison Officer.¹⁰⁷

In spite of all these efforts, however, news broke in 2016 of continued dissatisfaction in Pengerang. With the influx of foreign workers, Sungai Rengit town is now derogatively referred to as “*Pekan Bangla*” (Bangladeshi Town); residents complain that local mosques are overrun with foreigners who have also set up shops and homes there.¹⁰⁸ This is in spite of Temporary Workers’ Villages built and already being used within the PIPC.¹⁰⁹ A drive through the edges of Sungai Rengit town reveals a number of workers’ quarters fashioned out of refurbished containers and other improvised facilities.¹¹⁰

Fishermen report that their earnings have plunged from RM200–RM1,000 per day to RM25 after three days of fishing and increased petrol costs of RM50 per day for motorbike travel to their boats and having to go further to put down their nets. Others say that their fishing nets, which cost them between RM1,500 to RM2,500 each, have not been used in years and supplementary incomes are no longer available with the loss of their home gardens and smallholdings.¹¹¹ There have also been reports of increased crime and fatal accidents as a result of speeding contractor vehicles and lorries.¹¹²

ENVIRONMENTAL IMPACT OF THE PIPC

In marketing collateral for the PIPC, a brief reference to the surrounding natural environment is made in these terms: “limited environmentally

¹⁰⁷ Petronas Sustainability Report 2015.

¹⁰⁸ Malaysian Insider, “Once tranquil, Pengerang now dusty, overrun with migrants and crime”.

¹⁰⁹ Petronas Sustainability Report 2015.

¹¹⁰ Personal observation.

¹¹¹ Malaysian Insider, “Once tranquil, Pengerang now dusty, overrun with migrants and crime”.

¹¹² *New Straits Times Online*, “(Actionline) It causes watery, itching eyes”, 25 January 2017 <www1.nst.com.my/news/2017/03/207081/actionline-it-causes-watery-itchy-eyes>.

sensitive areas that are easily protected”.¹¹³ No matter how it is positioned, the oil and gas industry is always perceived as an environmentally unfriendly endeavour. The sight of raw red earth from hills, forests and other natural habitats being cleared and piles of sand dumped at sea for coastal reclamation do not help to alleviate these negative perceptions. Yet, apart from the initial protests by Kekalkan Pengerang Lestari, rumours of a purported nuclear plant in the area and complaints about bias in the Detailed Environmental Impact Report,¹¹⁴ there has been very little in the news about the environmental impact of the PIPC.

Environmentalists will be quick to point out that hill and forest clearing on land translates into major run-off and erosion into rivers and seas. An examination of Google satellite maps and drone photos of the area clearly indicate that the coasts around Pengerang suffer severe siltation. Coastal reclamation by nature results in sedimentation, damage and sometimes, total loss of marine environments.

Local fishermen say they not only have to travel further to get to their boats, but they also have to risk choppier waters and pirate encounters when they head out to sea as inshore and coastal waters are now severely polluted and there is less fish to catch. On top of that, fishing areas have shrunk as previously popular fishing holes are now out of bounds for safety or blocked by new structures at sea.¹¹⁵ While less fish catch translates into economic difficulties for the local community, increased boat traffic from sand barges and other vessels leads to increased dangers for fishermen in their small fishing boats. Increased vessel traffic can also result in oil dumping or oil spills in the event of accidents.¹¹⁶

¹¹³ JPDC website.

¹¹⁴ Free Malaysia Today, “10 Questions on the Pengerang project”.

¹¹⁵ Malaysian Insider, “Once tranquil, Pengerang now dusty, overrun with migrants and crime”.

¹¹⁶ Accidents already frequently take place around Pengerang due to heavy vessel traffic. One recent example can be found at *Straits Times Online*, “Two vessels collide near Johor, causing oil spill”, 28 August 2017 <<http://www.straitstimes.com/asia/se-asia/two-vessels-collide-near-johor-causing-oil-spill>>.

On land there are also environmental issues. Development-related flooding during heavy rains have been reported,¹¹⁷ and dust from cleared land, lorries transporting earth and sand and general construction material have resulted in severe air pollution. Residents have complained that their shops and houses are constantly covered in red dust, stinging their eyes and causing many to have respiratory problems and asthma attacks.¹¹⁸

These sentiments were corroborated in a survey of Johoreans' opinions conducted in 2017;¹¹⁹ of 300 residents in East Johor, comprising Johoreans living between Pengerang and Mersing, 76 per cent expressed concern about the environmental impacts of the PIPC.¹²⁰ With construction in this area set to continue for at least the next ten years, these impacts will be prolonged, and will add to prevailing environmental issues that come with the sudden materialization of a petrochemical complex in an area that was once deemed an ecotourism destination.

WILL PIPC SUCCEED?

Official media consistently lauds the PIPC and its potential. It is projected that the development could generate RM1.6 billion (about US\$409 million) to Malaysia's GNP by 2020.¹²¹ Recent announcements of Saudi Aramco's commitment of US\$7 billion for a 50 per cent equity share of RAPID's cracker and refinery is said to be an early indication of its future success,¹²² but since then there has been scant news of other foreign investment in the project.

¹¹⁷ Personal communication — local informant, name withheld by request.

¹¹⁸ *New Straits Times Online*, "(Actionline) It causes watery, itching eyes".

¹¹⁹ Commissioned by ISEAS – Yusof Ishak Institute and implemented by the Merdeka Institute.

¹²⁰ Serina Rahman, "Johor Survey 2017: Johorean views on Iskandar Malaysia and Investments in Johor", *ISEAS Perspective*, no. 82/2017, ISEAS – Yusof Ishak Institute, Singapore, 2017.

¹²¹ The Edge Markets, "Petronas in the spotlight.

¹²² The agreement ensures that Saudi Aramco meets 70 per cent of RAPID's refinery feedstock needs, while the refinery's output becomes feed for the polymer

Some analysts and industry experts are more hesitant to predict success too soon. According to MIDF Research,¹²³ upstream segments of the oil and gas industry will face some difficulties. Interviews with a number of major international oil and gas players revealed caution in financial commitment and expectations as a result of perceived political instability in Malaysia, as well as a lack of transparency and consistency in business dealings.¹²⁴ It has also been mentioned that Johor is well established in terms of manufacturing and relatively low-skilled industries, while high-end and more technical fields are not one of its strengths. Malaysia lacks the R&D facilities for oil and gas that Singapore has. Thus while Johor is well placed to supply land for the project, it seems to be geared towards the “brute” end of the oil and gas process whereas Singapore will remain the “brain” of the region’s industry.¹²⁵ An informant from JPDC conceded that the PIPC is at the “infancy stage”, and that there is no prior expertise or human capital development in Johor for the skills that are needed.¹²⁶ In order to attract higher level talent, however, a more complete residential and leisure ecosystem needs to be in place so as to meet the lifestyle needs of the relevant specialists.¹²⁷ It remains to be seen whether this deficiency will inhibit the progress and success of PIPC.

plant. Saudi Aramco has also taken a 50 per cent equity stake in PRPC Polymers Sdn Bhd, giving it exposure to the full cycle of PIPC’s petrochemical activities, helping Saudi Arabia to diversify its dependence on oil for its government budget. To some quarters the investment will benefit Saudi Aramco more than Petronas or Malaysia. However, the commitment is portrayed as evidence of international confidence in the project’s future success. Source: *Star Online*, “Dialog propelled by rapid development”, 2 September 2017 <<https://www.thestar.com.my/business/business-news/2017/09/02/dialog-propelled-by-rapid-development/>>.

¹²³ *New Straits Times Online*, “Is oil and gas industry healing?”.

¹²⁴ Diez, “Territorial complementaries or competition for FDI?”.

¹²⁵ Discussion during Johor Economic Update seminar, ISEAS – Yusof Ishak Institute, 23 February 2018.

¹²⁶ Personal communication with JPDC staff — name withheld by request.

¹²⁷ Discussion during Johor Economic Update seminar.

Plans for the PIPC were made in 2010 when crude prices were on their way down and policymakers realized that there was a need to offset reduced incomes from falling crude prices with diversification into the downstream sector. While the prediction was for better economic returns from refined products,¹²⁸ the approach seemed to be more of the old-school economic style of creating the infrastructure and product first, then the demand second. These plans did not foresee new global trends such as the move towards electric cars, increasing bans on plastic and disposable products and the trend towards alternative energy sources. It is possible that by the time PIPC is fully online, the plans would have been a decade too late to tap onto these rising trends.¹²⁹ The expectation that lower crude prices will lead to lower processing costs only lasts as long as prices remain low. As the price of crude oil increases, it is unclear how much of a negative impact this will have on refining costs.¹³⁰

An understanding of investor tentativeness is clear at all levels of JPDC. Its chief operating officer Izhar Hifnei Ismail revealed that many investors were “still taking a wait-and-see approach”.¹³¹ Other staff commented that there were a number of reasons for the unfulfilled search for investors. One of the main reasons behind the unwillingness to invest is the time needed to relocate existing residents. While the overall 20,000 acres have been allocated to the PIPC by the state, land ownership remains in the hands of the local community. Although JPDC takes care of the relocation procedure, compensation and the costs of relocation are paid for by the investor. Not only is upfront payment required for the process to begin, groundworks cannot take place until about two years later, when relocation is complete. Staff also hint at difficulties in consolidating announcements made at the federal level and action taken

¹²⁸ Export.gov by International Trade Administration, USA.

¹²⁹ Personal communication, Javier R. Diez, Visiting Fellow, ISEAS – Yusof Ishak Institute, 27 February 2018.

¹³⁰ Personal communication, oil and gas industry player — name withheld by request.

¹³¹ The Edge Markets, “Petronas in the spotlight”.

on the ground. For example, while the Saudi Aramco deal is a boon for the PIPC, the substantial refinery output commitment tied into the contract hampers negotiations with other potential investors who might also expect a pledged feedstock supply.¹³² JPDC is currently engaging with parties from Korea, Taiwan, Japan and China as prospective investors in the remaining available areas (as shown in Figure 2). Industrial and maritime parks such as those developed by Benelac, JCorp and Serba Dinamik will accommodate smaller investors who need only 10–50 acres of ready land.¹³³

While there are many naysayers, there are also those who seem excited about the PIPC. Conversations with SME businessmen from Singapore revealed their surprise that analysts were doubtful about the PIPC. Their view was that Jurong Island was getting smaller and that there are no new investments. The PIPC will rejuvenate the market in the region and provide fresh opportunities; they are keen to get involved. These businessmen provide maintenance, manpower and support services to the oil and gas industry.¹³⁴

Others see huge potential in the storage business; a sector that provides quick returns on investments. With Jurong Island limited in space, there will be a need for more storage facilities, especially with the United States coming into the LNG market and attempting to sell its products to China.¹³⁵ The presence of the new RGT2 will greatly enhance PIPC's ability to tap into these opportunities.¹³⁶ With regional energy

¹³² Personal communication, JPDC staff – name withheld by request.

¹³³ Personal communication, Abd Rahim Ahad, Manager, Investor Management, JPDC, 8 March 2018.

¹³⁴ Personal communication, oil and gas SME representatives — names withheld by request

¹³⁵ J.O. Moeller, “Oil, LNG, and fracking defines a new power game: US main exporter, China and India main importers; new alliances in the Middle East”, presented at a seminar by the Regional Strategic and Political Studies (RSPS) Programme, ISEAS – Yusof Ishak Institute, 6 February 2018.

¹³⁶ Personal communication, oil and gas industry player — name withheld by request.

demand set to grow and LNG seen as a cleaner source of fuel, experts foresee that its demand will increase by 150 per cent in the Asia-Pacific region.¹³⁷ Malaysia's own LNG reserves may make it more competitive in the long run, even though Singapore has already established itself as an LNG hub. Malaysia has also taken other steps to expand its LNG business. New laws that allow third-party access will open the market to foreign suppliers, making LNG prices more competitive.¹³⁸ Several collaborations by Petronas in LNG have created movement in the market. Its agreement with Pavilion Gas Singapore diversifies its LNG portfolio, integrates the LNG value chain and provides a link to Singapore's LNG market.¹³⁹ The Secretary-General of the Malaysian Gas Association, Rosman Hamzah¹⁴⁰ sees good growth prospects in expanding local use of LNG, as well as in the business of pipeline infrastructure to new areas such as Kelantan.

Analysts from the carrier business also see growth potential. With increased shipments of LNG in the region, and Saudi Aramco's commitment of feedstock, there will be increased need for VLCCs and ULCCs, both of which will be able to dock at PIPC when construction is complete. Finished products will also have to be shipped to receiving parties.¹⁴¹ As it is, Johor Port is reported to have increased traffic, partly due to increased activity related to the PIPC.¹⁴²

¹³⁷ *Straits Times*, "Malaysia's oil hub: Will it be a threat to Singapore?"

¹³⁸ *New Straits Times*, "Local LNG price expected to be more competitive by 2019", 2 January 2018 <<https://www.nst.com.my/business/2018/01/320540/local-lng-price-expected-be-more-competitive-2019>>.

¹³⁹ *New Straits Times*, "Petronas LNG inks MOU with Pavilion Gas", 31 March 2017 <<https://www.nst.com.my/news/2017/03/225989/petronas-lng-inks-mou-pavilion-gas>>.

¹⁴⁰ *New Straits Times*, "Local LNG price expected to be more competitive by 2019".

¹⁴¹ Personal communication, Sameer C. Mohindru, Senior Editor, S&P Global Platts.

¹⁴² *Star Online*, "Rakuten calls a buy on Straits Inter Logistics", 2 January 2018 <<https://www.thestar.com.my/business/business-news/2018/01/02/rakuten-calls-a-buy-on-straits-inter-logistics/>>.

Some JPDC insiders feel that even if wider plans are unfulfilled, the presence of RAPID and DIALOG alone will provide enough economic benefits and spillover for Malaysia. While Malaysia's sweet crude reaps better economic benefits by being exported, the import and processing of cheaper sour crude will also help to meet local demands for Euro 5 quality products. Support and maintenance services alone could take up another 2,000 acres of the PIPC land allocation. There is also general optimism that once RAPID is fully online in 2019, investments will begin to come in.¹⁴³ As at August 2017, Petronas spending has mostly been on RAPID. With positive projections on its potential returns, RAPID is seen as a high source of growth and profit in the medium term.¹⁴⁴

IS PIPC A NECESSARY CATALYST FOR DEVELOPMENT?

Johor's former chief minister Mohamed Khaled Nordin cited the PIPC as the beginning of development for east Johor, suggesting that the state's contribution to the project is driving benefits for its people.¹⁴⁵ However JPDC insiders affirm that the state has only allotted land to the project. Thus far all financial support for infrastructural and other development has come from the federal government.¹⁴⁶ They also note that projects such as Bio-Desaru by JBiotech and Desaru Coast by Khazanah were planned before PIPC became a reality. While there is little news about Bio-Desaru, Desaru Coast is now showing progress with the golf course open to players. Mersing's advancement as part of the Eastern Economic Corridor has also seemed somewhat negligible.

¹⁴³ Personal communication, JPDC staff — name withheld by request.

¹⁴⁴ *The Star Online*, "Leaner, meaner Petronas targets key markets growth", 17 August 2017 <<https://www.thestar.com.my/business/business-news/2017/08/17/leaner-meaner-petronas-targets-key-markets-for-growth/>>.

¹⁴⁵ Astro Awani, "Pengerang poised to be catalyst for east Johor corridor development".

¹⁴⁶ Personal communication, JPDC staff — name withheld by request.

But these definitions come with the tacit caveat that development is only tangible when physical change is visible. While the colossal construction happening in Pengerang may indicate “development” on these terms, the realization of financial goals will only determine the success of industrialization. Development in terms of human capital, public amenities, leisure facilities and other social infrastructure also needs to be examined, not to mention the socioeconomic and environmental impact of this change.

The official stand on Pengerang is that it was once designated an ecotourism destination, but beyond being a sleepy seafood town and a popular route for Malaysian and Singaporean cyclists, tourism did not bring great economic benefits to the region. Golfing facilities in nearby Desaru were often patronized by domestic tourists; Singaporean golfers often commented that these were “jungle courses” overgrown and frequented by wild animals. The recent opening of Desaru Coast’s newest golf courses, headlined by international golf legends are seen as signs of positive progress.¹⁴⁷ There is no official correlation between the development of PIPC and the completion of the first phase of Desaru Coast, but the happy coincidence is a bonus for both.

The local community of Pengerang was forced to relocate and had no choice but to embrace change. Some noted, however, that even before the PIPC, there were problems with coastal water quality, reduced fish catch and piracy.¹⁴⁸ While old livelihoods such as fishing and the shrimp paste (*belacan*) industry are effectively extinct, new incomes are available. Some locals were able to use their cash compensation to buy property in Bandar Penawar and now benefit from rental incomes.¹⁴⁹ These opportunities are undoubtedly not available to all relocated residents, but

¹⁴⁷ Personal communication, Singaporean golfers — names withheld by request.

¹⁴⁸ The Edge Markets, “Two sides to Pengerang’s coming boom”, 14 March 2013 <<http://www.theedgemarkets.com/article/highlight-two-sides-pengerangs-coming-boom>>.

¹⁴⁹ Personal communication, Abd Rahim Ahad, Manager, Investor Management, JPDC, 8 March 2018.

even regular folks note positive benefits such as not having to travel far to get to a supermarket.¹⁵⁰

However increased costs are a significant issue in this area. Costs of food and daily needs are said to be as high as in Johor Bahru town, which is a great increase from before the advent of PIPC. Room rental for potential employees in this area is very high given the scarcity of available accommodation. The problem is so severe that jobseekers are offered substantial food and housing allowance to encourage them to take up the many available but unfulfilled positions.¹⁵¹ SMEs looking for opportunities in Pengerang also grumble about the high costs of land and rental, as well as the need for better road access and transportation services.¹⁵² Requests by JPDC for improvements to the Senai-Desaru Highway have hit constant roadblocks.¹⁵³

In a survey commissioned by ISEAS – Yusof Ishak Institute, of 300 respondents from east Johor, 76 per cent agree that the PIPC will generate economic benefits and 68 per cent of these respondents view the development favourably.¹⁵⁴ There are still areas within the PIPC that have not been cleared of its local residents and repossessed. These relocations will only take place once an investor commits to finance a project. Residents in these areas are already asking when their land will be taken, purportedly because they see the financial benefits of relocation.¹⁵⁵ Future relocation exercises are expected to be far smoother and more systematic than the first round carried out in 2012.

¹⁵⁰ The Edge Markets, “Two sides to Pengerang’s coming boom”.

¹⁵¹ Personal communication, industry informant — name withheld by request.

¹⁵² Personal communication, oil and gas SME representatives — names withheld by request.

¹⁵³ The issue is a debate between the need for evidence of increased traffic before expenses can be made, and the need for better access before more vehicles can use the road. The Senai-Desaru Highway is the most expensive in all of Johor. Personal communication, JPDC staff — name withheld by request.

¹⁵⁴ Serina Rahman, “Johor Survey 2017: Johorean views on Iskandar Malaysia and Investments in Johor”.

¹⁵⁵ Personal communication, Abd Rahim Ahad, Manager, Investor Management, JPDC, 8 March 2018.

While there are some indications of positive economic impacts from the PIPC, at least in terms of infrastructural development, the question is, who reaps the benefits? The PIPC is clearly an asset for Johor; by simply providing land and access, the state is able to earn substantial taxes in myriad forms. Petronas, its joint venture partners and contractors, both local and foreign, will benefit from profits earned and business made. While Petronas profits are channelled back into the Malaysian economy, analysts note that there might be a decrease in immediate short-term contributions to the government due to the expenses incurred on RAPID.¹⁵⁶ A serious concern is about how those in the local community who were not eligible for compensation and who have limited skills will survive these changes and find a way to earn alternative incomes in this new, highly industrialized economy.

CONCLUSION

The true success of the PIPC can only begin to be seen after 2020 when RAPID has begun operations and fresh observations can be made on the progress of investments in the wider complex. The trajectory of federal and state government support for PIPC post-GE14 will also be clear. With new townships and Desaru Coast coming into completion, a complete ecosystem that may attract and support higher quality human capital may be in place. It is only when all the parts of the jigsaw are present that a proper assessment of the success of the PIPC can be made. If even with all this, investments are not forthcoming, and there is no demand for PIPC's finished products, then the project could become a complex catastrophe.

But there is a possibility that the PIPC will find a positive way to collaborate with or complement Singapore, if Malaysia and Johor are able to provide evidence of business transparency and consistency. The PIPC could feasibly meet the need for manufacturing, supplies, space and lower costs that Singapore clearly cannot provide. Notwithstanding the need to adapt to global trends on reduced plastic use and the constant

¹⁵⁶ *The Star Online*, “Leaner, meaner Petronas targets key markets growth”.

search for environmentally friendly energy sources, there is probably enough space in the industry for the PIPC, Singapore and others in ASEAN.

However, development and industrialization will always come at a price. The socioeconomic and environmental costs of the PIPC are not unique to this area alone. While large-scale changes such as these are done with an eye on the larger benefits to state and country, a balance must be found to ensure that benefits reach those on the ground. More needs to be done to ensure that local communities are not forsaken, forgotten or lost in the quest for economic goals, or simply in the huge influx of migrant workers for the project. Priority must be placed on local health and safety issues, whether as a result of heavy vehicle traffic, speeding contractors, increased crime or air and water pollution. Thought must be put into either the integration or separation of local and newly arrived migrants to ensure that the quality of life of locals and the newcomers do not deteriorate even as the project aims to create conducive living conditions and financial gains for the higher echelons of society.

APPENDIX

List of selected organizations or collaborations involved in the PIPC (arranged in alphabetical order) based on a review of seventy-one documents and websites that mentioned the PIPC over the past year. The sample elicited thirty-nine organizations said to be involved in or collaborating in the PIPC, originating from thirteen countries. Seventeen (55 per cent) were Malaysian, eleven were from other Asian countries, eight were European and three were from the United States. Note that this list is not exhaustive.

No	Companies	Country(ies) of origin	Details
1	Asia Bioenergy Technologies Bhd (Asiabio)	Malaysia	Subcontracting work — RM220 million (about US\$56.2 million) contract From Tenisha Construction S/Bhd Designing, erecting, inspecting, maintaining & dismantling of scaffolding & formwork systems in Pengerang
2	Axens IFP Group Technologies	France	Naphtha Hydrotreating (NHT), Octanizing, Prime-K, RFC (etc.) license in RAPID
3	BASF (60%) & PETRONAS (40%) new entity	Germany and Malaysia	Jointly own, develop, construct & operate production facilities for isononanol, highly reactive polyisobutylene, non-ionic surfactants, methanesulfonic acid and plants for pre-materials (under RAPID)

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APPENDIX — cont'd

No	Companies	Country(ies) of origin	Details
4	Benelac Holdings Bhd; Johor State Secretary Incorporated/ Spektrum Budi Sdn Bhd (70% owned by Benelac)	Malaysia	PMIP — oil storage/storage terminal, industrial warehousing, light to heavy industries & factories, fabrication yard & ship repair, integrated logistics park, shipyards, free commercial zone
5	Johor State Secretary Incorporated & Spektrum Budi Sdn Bhd (70% owned by Benelac Holdings Bhd)	Malaysia	Pengerang Maritime Industrial Park (PMIP)
6	Bina Puri Holdings	Malaysia	Civil works for steam cracker complex in RAPID
7	China Petroleum Pipeline Engineering Co Ltd (CPP) & Suria Strategic Energy Resources Sdn Bhd (SSER)	China and Malaysia	370 km gas & petroleum pipeline from Sg Udang, Melaka to RAPID. Transport of petroleum products from refineries in Melaka and Port Dickson to central & northern region of East Peninsular Malaysia
8	CTCI Corp, Chiyoda Corp, synerlitz M'asia S/Bhd & MIE industrial S/Bhd consortium	Taiwan Japan Malaysia	Modularized waste heat boilers for refinery — fabrication & residual fluid catalytic cracking (RFCC) unit in PIC

9	Damansara Realty Bhd (subsidiary TMR Urusharta (M) S/Bhd & ACME Security S/Bhd & AHS Security S/Bhd consortium)	Malaysia	RM26.21 million (about US\$6.7 million) contract: security management services for RAPID
10	Evonik Industries	Germany	Chemical production facilities: hydrogen peroxide (250,000 t/y), C4 co-monomer & oxo-products, 220,000t isononanol (INA), 110,000t 1-butene
11	Fluor Corp	USA	Engineering, procurement, construction management (EPCM) contract for isononanol plant
12	Itochu Corporation & PTT Global Chemical	Japan and Thailand	Downstream units in PIC
13	Jacobs Engineering Group	USA	Basic engineering package for 2 sulfur recovery units (SRUs)
14	Johor Port Bhd	Malaysia	4 yr operatorship contract for material offloading facility (MOLF) at Teluk Ramunia — marine services, manpower, equipment, systems to operate and manage
15	LyondellBasell	Netherlands	Polypropylene process plant to produce wide range of polypropylene products

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APPENDIX — cont'd

No	Companies	Country(ies) of origin	Details
16	Metex Modular Sdn Bhd (wholly-owned subsidiary of Chin Hin Grp Bhd)	Malaysia	Integrated workers complex with comprehensive facilities — RM238.3 million (about US\$60.9 million) investment Hired by Saujana Vision (builder & contractor of construction works)
17	Mudajaya Grp Bhd	Malaysia	EPCC contract to build workers village/temp structures for utilities, interconnecting & offsite (UIO) facilities — US\$113 million investment
18	Petronas, Dialog Grp Berhad, Royal Vopak	Malaysia and Netherlands	Deepwater industrial terminal (PDT)
19	PRPC Utilities & Facilities (PRPC UF-Petronas subsidiary) & SPT Services Sdn Bhd (subsidiary of Johor Port Bhd)	Malaysia	Operate PIC Solid Product Jetty (SPJ) — manage volume produced by PIC; ensure timely export of containerized polymer & sulphur to the market
20	PRPC Utilities & Facilities (PRPC UF), VA Tech Wabag, Muhibbah Engineering (M) Bhd, Wabag-Muhibbah JV	Malaysia India	FEED & EPCC of Effluent Treatment Plant (ETP) for PIPC

21	Punj Lloyd	India	RAPID Tank Farm project — US\$581 million investment
22	Samsung Engineering	Korea	EPCC contracts from Petronas Chemicals — linear low-density polyethylene (LLDPE) & ethylene glycol (EO/EG) plants in RAPID
23	Saudi Aramco	Saudi Arabia	50% equity stake in RAPID refinery & cracker project — will supply 70% of crude feedstock requirements
24	Serba Dinamik Holdings Bhd	Malaysia	PIDP
25	Siemens AG, Siemens Malaysia, MMC Engineering Services Bhd	Germany and Malaysia	Consortium contractors for co-generation plant (PCP)
26	Sinopec Engineering	China	EPCC contract for atmospheric distillation & residual oil hydrotreatment
27	Tanjung Offshore Services Sdn Bhd & Wenmax Sdn Bhd: both wholly-owned subsidiaries of T7 Global Bhd	Malaysia	Insulation work for RAPID from Malaysia Marine & Heavy Engineering Sdn Bhd — RM260 million in contracts Also contract from Petronas Technical Services Sdn Bhd for engineering, procurement, fabrication & commission of Crude Transfer Metering System package for PDT2

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APPENDIX — *cont'd*

No	Companies	Country(ies) of origin	Details
28	Technip	France	FEED and management consultancy contract for 3 hydrogen reformers as part of the hydrogen production facility in RAPID and steam methane reformers license
29	Technip & Flour JV	France & USA	Utilities, interconnecting & offsites (UJO) engineering, construction, construction management services
30	Tecnicas Reunidas	Spain	EPCC for hydrotreating units, catalytic reforming unit, hydrogen production units, saturated gas plant, interconnection and flare
31	Tecnimont S.p.A, China Huanqiu Contracting & Engineering Co Ltd, TECNIMONTHQC S.c.a.r.l and TecnimontHQC S/Bhd	China and Malaysia	EPCC for PIC's flexible high-density Polyethylene (Flexi HDPE) plant

Notes: EPCC = engineering, procurement, construction, commissioning; FEED = Front-end engineering design.

Sources: A Barrel Full, Hydrocarbons Technonlogy, Killajoules, Pengerang Maritime Industrial Park website, Astro Awani Business News, The Edge Markets, and *New Straits Times Online*.

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