4 PROJECT OPTIONS

4.1 Site Selection Options

PEC considered the following as critical success factors for its facility:

- Central location;
- Comprehensive logistics support;
- Low cost of production;
- Readily available feedstock;
- Strong product demand; and
- Latest technology.

In brief, PEC had chosen Pengerang, Johor to set up the PEC facility for the following reasons:

- Located near the Petronas's USD 27 billion RAPID in the PIPC which can provide feedstock and can share the excellent infrastructure, common utilities and supporting services; and
- Direct access to international shipping channels via Pengerang Deepwater Terminal (PDT)'s deep water (24m) port facilities with third party bulk storage facilities;
- Being located strategically close to the markets and outlets for its products.

Three (3) optional sites were considered for the development of the PEC facility, shown in Figure 4.1; the sites are located about 2.5 km apart. Given all three sites are within the PIPC area, there are little differences amongst them in terms of environmental, socio and economic aspects. Of the 3 options, PEC ultimately chose the proposed site in JCorp's designated PIP.

Based on an appraisal conducted for the ESI exercise in the TOR of applicable national, Johor State and Kota Tinggi District plans together with the PIPC and PIP masterplans, and in accordance with DoE/ PLAN Malaysia guidance, the proposed site is preliminary assessed as suitable for the PEC project; as it is in a designated industrial zone, the PIP/ PIPC, and is compatible with government planning for the area.

In addition, the PEC is situated a minimum of 500 m from the PIPC border as shown in Figure 4.2, and hence satisfies the minimum buffer requirement for heavy industry to public settlements.

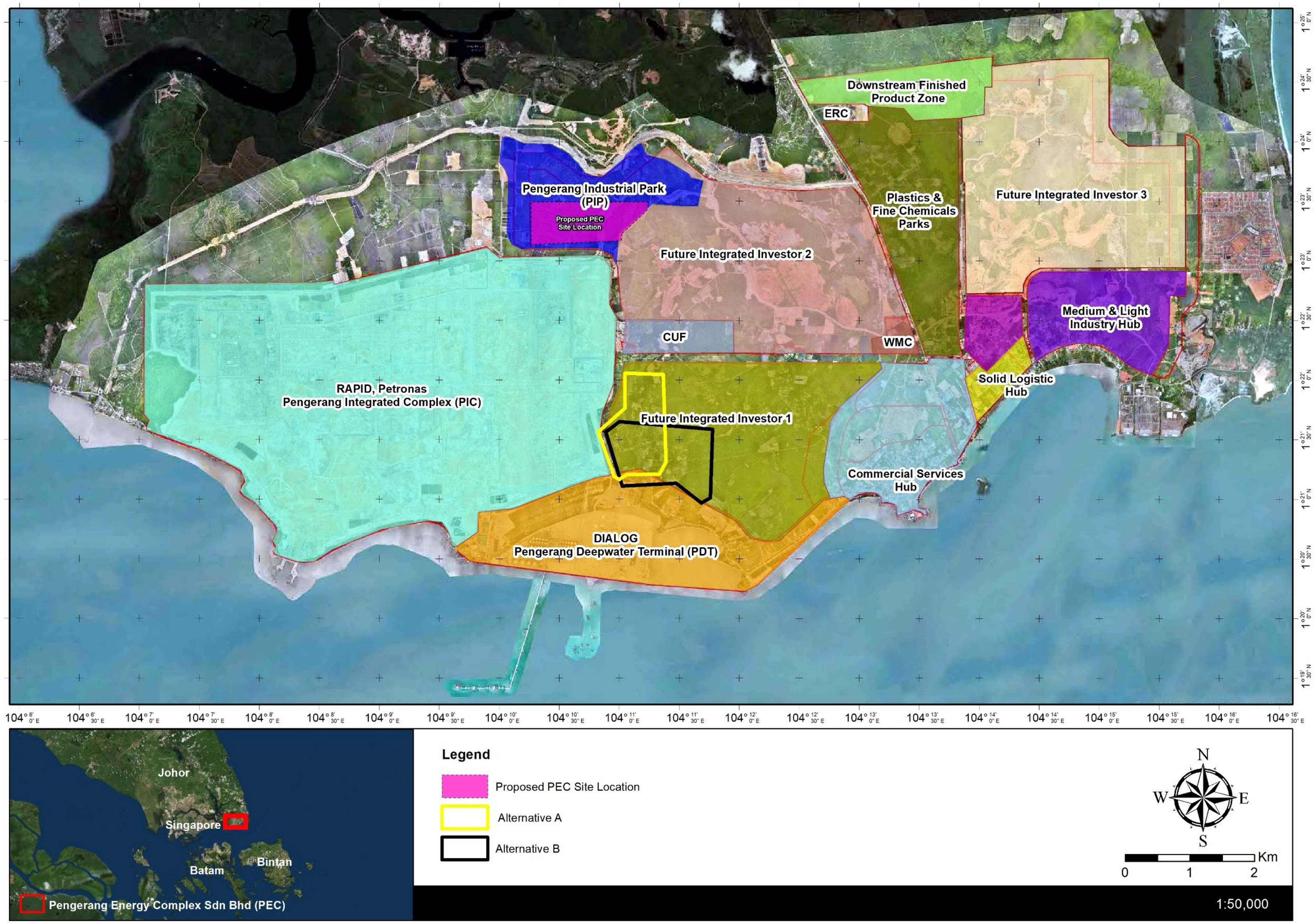

Figure 4.1 – Site Options

Source: JPDC and Google Earth Image, 2016

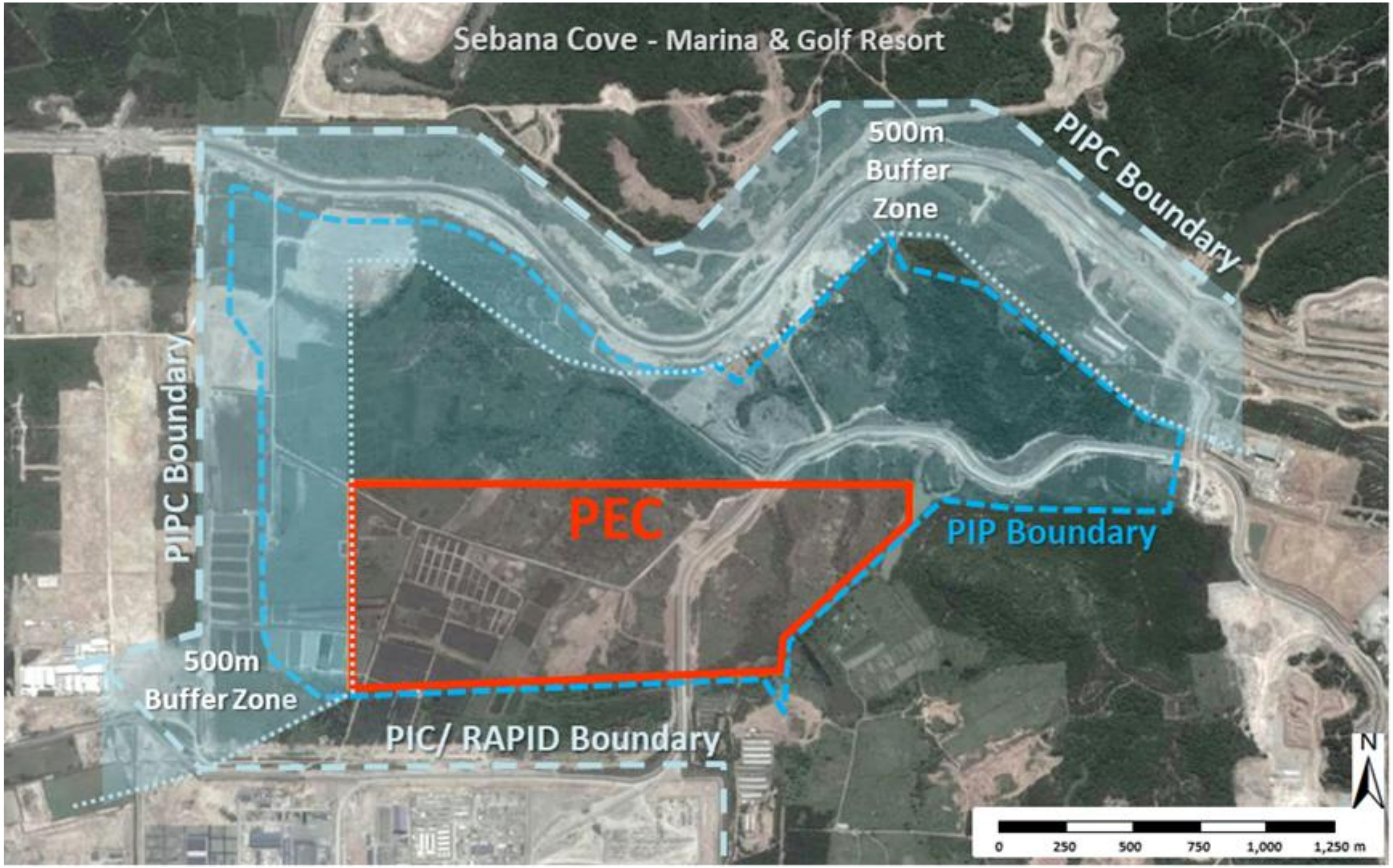

Figure 4.2 – Site Location
Source: JCorp and Google Earth Image, 2016

4.2 Project Options

4.2.1 Technology Options

The PEC products, Benzene and Xylene, can be manufactured via a number of different processes, namely catalytic reforming, toluene hydrodealkylation, toluene disproportionation, transalkylation and steam cracking. Catalytic reforming and steam cracking are the two processes which use more abundant naturally occurring commodities (such as condensate), which are a cheaper feedstock than the toluene feedstock that is required for the alternative manufacturing processes listed above. Considering there are 3rd party technology suppliers who specialise in the development and advancement of all available technologies, PEC desired to obtain such technology to make them more efficient and position themselves on the same platform as any other major player in the industry. PEC research has indicated that the 3rd party technology for catalytic reforming is more cost competitive than 3rd party technology for steam cracking, hence a manufacturing process via catalytic reforming was selected as the preferred option.

In catalytic reforming, a mixture of hydrocarbons (heavy naphtha from refining condensate) are reacted with hydrogen gas in the presence of a catalyst at elevated temperature and pressure. Under these conditions, aliphatic/straight chain hydrocarbons form rings and lose hydrogen to become aromatic/ring chain hydrocarbons (BTX; Benzene-Toluene-Xylenes). The aromatic products of the reaction are then separated from the reaction mixture (or reformate) by extraction and distillation.

PEC proposes to convert the lower value by-product of toluene to xylene and benzene. To realise this aim, PEC has the option to use a toluene hydrodealkylation process, toluene transalkylation process, and/or toluene disproportionation process. Toluene hydrodealkylation was discounted because the process converts toluene to benzene by releasing methane gas, which is a greenhouse gas. Furthermore, the hydrodealkylation process was not considered economically feasible under conditions where the price differential between benzene and toluene is small.

The toluene disproportionation (TDP) process provides an attractive alternative to the toluene hydrodealkylation process as in the TDP process, two toluene molecules are reacted, and the methyl groups rearranged from one toluene molecule to the other, yielding one benzene molecule and one xylene molecule without the production or emission of methane gas. Transalkylation is a reaction between toluene and C9 aromatics to convert into xylenes.

4.2.2 Optional Technology Provider

The technologies detailed above are offered by a number of companies including UOP (Universal Oil Products), Axens, ExxonMobil, Toray, and SK Corporation. UOP of America has been identified as the only supplier who is able to supply the complete package by providing a single integrated advanced technology, encompassing condensate splitter process, catalytic cracking, product purification and the conversion of toluene to benzene and xylene, whilst still ensuring economic attractiveness and environmental performance.

UOP is the world's leading licensor of process technologies for aromatics production in addition to being a global technology provider for petroleum refining, gas processing and petrochemical production. As of 2006, UOP had licensed over 575 separate process units for aromatics production in complexes ranging in size from 21,000 MTPA to 1,400,000 MTPA.

Besides, PEC has also evaluated Axens, a subsidiary of the French Institute of Petroleum (IFP) as an alternative technology provider. Finally, UOP was selected by PEC as it is the market leader in the Aromatics Technology and it can offer a complete technology package when compared to Axens which encompasses technologies from other parties (Uhde/ Exxon Mobil) in their package.

The services provided by UOP to PEC will incorporate the plant design, inspection, commissioning, performance testing and training of operating personnel. UOP will also supply the proprietary process equipment, chemicals and catalysts for the complex. They will also provide the product and catalyst guarantees for the plant.

Honeywell UOP is the world's leading licensor of process technology for the production of aromatics. As of 2014, UOP has licensed over 100 complexes and more than 700 individual process units for the production of aromatics, including more than 300 CCR Platforming™ process units, 155 Sulfolane™ process units, 80 Isomar™ process units, 65 Tatoray™ process units and 100 Parex™ process units.

In particular, PEC has selected the latest generation of UOP Tatoray™ process technology which provides several advantages such as improved operational flexibility to produce petrochemicals or gasoline as demand changes and increased the production yields of certain petrochemicals by more than 70%.

4.2.3 No Project Option

The 'no-project option' would mean that the PEC facility will not materialise and Malaysia would not have gained a USD 3.38 billion investment, besides the other socio-economic benefits spin-off from this investment, as well as the development of new downstream industry.

Without the PEC project, the PIP developer (JCorp) and JPDC will still move ahead to attract other petrochemicals industry to occupy the plot. As such, Malaysia, and specifically Johor, will not only lose this substantial investment, but it will also miss an opportunity to attract the state of the art technology and develop talents in the petrochemical sector.