EXECUTIVE SUMMARY

INTRODUCTION

In pursuing its goal to provide cost-effective, reliable power to its customers, Sabah Electricity Sdn Bhd (SESB), the Project Initiator is planning to implement a 300MW Power Plant to help meet Sabah's long term energy needs. The proposed project is a development of coal-fired Power Plant in Silam, Lahad Datu, Sabah. The Project Proponent for the development of this power plant is Lahad Datu Energy Sdn. Bhd (LDE), a consortium of TNB Remaco Sdn. Bhd., Eden-Nova, Maser, and Yayasan Sabah, which was awarded by Government of Malaysia and Sabah Electricity Sdn. Bhd (SESB) to develop this project. The project will be developed based on the Independent Power Producer (IPP) concept where the Power Purchase Agreement will be signed between LDE and SESB ("the Off-Taker") for a concession period of 25 years.

STATEMENT OF NEED

The increase in economic activities in the state of Sabah has led to an increase in demand for infrastructure facilities such as electricity. Frequent power disruptions especially in the East Coast of Sabah have affected the business community and have caused inconvenience to the customers. Meanwhile, the high operation costs of diesel generators as a result of spiralling oil prices have convinced SESB to retire its old and uneconomical diesel generators in stages. It is crucial for Sabah to have sufficient power supply due to the rapid development throughout the state, particularly the development of the Palm Oil Industrial Cluster (POIC) in Lahad Datu, education hub in Sandakan, the recently launched Sabah Development Corridor and numerous commercial centres, industrial estates, tourist areas and housing estates. A power plant with a bigger capacity is critically needed. The proposed 300MW power plant in the East Coast will further reinforce and stabilise the Sabah Grid on the East Coast.

PROJECT OPTIONS

In this section various project options considered at the planning stages of the project development. Various alternative options were studied at the initial stages of the project development and comparisons were made, including incorporating suggestions and recommendations by the Federal and State Government Agencies. In the absence of hydroelectric scheme of such scale and commercial natural gas being unavailable in the East

Coast, it was decided that the power plant will use coal as its primary fuel. This includes No Project Options, Project Site Options, Fuel Options, Coal Options, Coal Technological Options and Emission Control Options that are available and chosen for the project. The final options chosen for the project were based on the assessments of socio-economic benefits, environmental cost benefit, and minimum environmental impacts due to the development of the project.

PROJECT DESCRIPTION

The proposed project is a coal-fired IPP will be developed at the abandoned Integrated Timber Complex (ITC) site that had been operated by Pacific Hardwood Sdn. Bhd. in Silam, Lahad Datu District, Sabah. The project will be developed comprising of 4 x 75MW nett units. The power plant complex will comprise of five primary components namely (i) Coal Terminal including coal unloading jetty (for coal barges), offshore conveyor, inland conveyor, coal storage yard and other coal handling facilities; (ii) the main power plant including boilers, steam turbines, generators, and their associated auxiliaries such as circulating cooling seawater chlorination system, water treatment plant and feed water system, environmental control equipment i.e. flue gas desulphurisation plant (FGD) and electrostatic precipitator plant (ESP), and wastewater treatment plant; (iii) ash handling facility including ash silos and pond, (iv) transmission line and switchyard for transmitting power to the Sabah grid; and (v) amenities including administrative building and support facilities.

The proposed project will be situated on 58.93 hectares (145.62 acres) of land partly owned by Yayasan Sabah (YS) and partly State Land to be alienated to YS in Silam, District of Lahad Datu, Sabah. This land is later to be leased to Sabah Electricity Sdn Bhd (SESB) and subsequently sub-leased to Lahad Datu Energy Sdn Bhd (LDE) for the development of the project. The coordinates of the project site are 4^{o} 59' N, 118^{o}-14'E. The site is located about 17 km to the southwest of Lahad Datu town. The access to the site is currently via the logging gravel road about 2.4 km from the junction of Tawau – Lahad Datu Highway.

The project site is fronting fairly deep sea at Darvel Bay conducive for cooling water supply for the power plant and also the operation of jetty for transportation of fuel. The site was formerly housed by the power plant servicing the Integrated Timber Complex (ITC) operated by Pacific Hardwood Sdn Bhd. It was also recently being used as a transit station for export of timber logs from surrounding areas by sea. At present, this complex has ceased as ITC operation and is under going demolition to make way for this project. The power plant will be operated as a base-load plant and the electricity produced will be purchased by Sabah Electricity Sdn. Bhd under the Power Purchasing Agreement (PPA) for a period of 25 years

TOPOGRAPHY

The project site is situated on the south east foothills of the Silam Range in Lahad Datu District. It is surrounded on both north and western side by Sepagaya Forest Reserve. In general the terrain is hilly and undulating to flat lying along the major river valleys. The topography pattern gradually increases in relief from south to northwest and from south to north. Generally, the entire project site is flat areas with a height from 0 m to 100 m. The terrain is characterized by NE-SW trending rolling hills with gentle slopes. Several streams drained the undulating terrain of the site and the main river is Sg. Silam. These streams formed a dendritic and parallel drainage pattern. The dendritic drainage pattern may be controlled by the bedrock fracture pattern such as fault and joints. The hilly to undulating region to the northwest is underlain by cristalline basement rock and ultramafic rock. The undulating to low lying areas to the southwest is underlain by Chert Spilite Formation. The project site is dominated by recent alluvium mainly on the valleys and coastal area.

GEOLOGY AND SOIL

The geology around the project site shows, two major rock associations namely the amphibolite gneisses rock, and ultramafic rock. Amphibolite gneiss rock is well exposed at the main office of Yayasan Sabah and Bt. Silam. Ultramafic rocks occupy a major part of the hilly area mostly and also the lowland area which is overlain by alluvium. The alluvium Quaternary occupies the major part of the project site. The alluvium is believed overlain the Chert Spilite Formation on the Eastern part of the Project site. Most of the outcrop show well-exposed serpentinite, having the slickenside structures. The major positive lineament and negative lineament pattern could be a reflection of the major fracture zone of the area with a NE-SW orientation indicated the direction of tectonic force. Overall, the soils behave in between extremely low to high plasticity. The sample classified as extremely low plasticity having very low clay. From the analysis of the particle-size distribution, it shows that generally percentage of the soil in the study area is varied from silt to coarse sand.

The erosion and slope instability are considered as major impacts on geology and soil during the construction phase. Therefore, the soil erosion potential in the project area was calculated using Universal Soil Loss Equation (USLE) to estimate soil loss rate at existing, with control and without control (worst) measures. Based on the modelling results, the existing maximum soil loss rate of 27.51 tons/acre/year will increases drastically to a maximum rate of 182.59 tons/acre/year. However, with necessary control measures including implementing approved construction practices the soil erosion rate can be minimised to 2.54 tons/acre/year.

LAND USE

The most part of the project site was formerly a timber complex belonged to Pacific Hardwood Sdn. Bhd (PHSB), a subsidiary of Sabah Foundation. The land is still gazetted as an Integrated Timber Complex. Within the project site, there are several abandoned and demolished buildings previously used by PHSB for their timber processing activities, power generation and associated activities. The land use categories within the 5 kilometre radius of the project site consists of the timber transfer station, Sepagaya Virgin Jungle Reserve (VJR), state lands, palm oil plantation / smallholders, five major settlement areas, and aquaculture farms. There are four major islands in the area namely, Pulau Saga, Pulau Saddle, Pulau Laila, and Pulau Baik. Most of the aquaculture farms are located in the islands and a few near the coast. In the master plan for Lahad Datu, the Silam area is targeted as an aquaculture zone and in the future the National Aquaculture Centre (PAN) is planned for the area. Other economic activities are not very prominent in the study area but Silam as a whole has been identified as tourism spots for highland (Mount Silam) and rattan industry. The Federal Road A5 will be upgraded to cover a 12.5 kilometres stretch of dual carriage-way which will be supporting the development of the POIC in Lahad Datu.

LANDSCAPE, VISUAL AND AESTHETIC

The common feature of the area is made up of steep hills with occasional low undulating hills form within the whole five kilometre radius. The highest peak of the area is Silam Hill which is geologically made up of serpentinite and amphibolite rocks. Overall setting of the site can be concluded as a secondary forest area classified as Sepagaya Forest Reserve with adjacent to commercial plantations common to most part of the east coast of Sabah. The geomorphologic nature of the proposed project site is not a popular site for scenic viewing due to long history of timber industry, less cultural feature of outstanding visual and landscape value and no outstanding land mark or landscape feature exist on the or near the proposed project site.

The protection of quality landscape, scenic view, and aesthetic value of an area from adverse impact has been recognized as a legitimate action as well as sustainable policy issue worldwide. Impact to landscape, visual and aesthetic resources resulting from the presence of Power Plant within the area is in the interest of the public. The exposed activities associated with any development inevitably pose landscape and visual impacts to the general public and to the image and identity of the area. Most common issue is to what extent the project might affect the visual receptors or viewers. In this particular project, the potential significant impact to the landscape, visual and aesthetic resources is dependent on the level of public visual and physical access to the project area and the phasing of the project operations and implementations.

HYDROLOGY AND DRAINAGE

The topographic feature of the area consists of rugged and steep slopes terrain carved by ephemeral streams. The largest drainage system of the area is Sg. Silam , an intermittent stream and its tributaries initially flow into a reservoir which is the source of raw water for about 40% of the population in the Timber Camp and the whole of the Logging Depot . The river then flows downstream through the project area, serving as the drainage system and finally discharging into the sea. Thus, the drainage system of the area do es not play any significant role in the socio-economic development of the study area. The existing erosion rate for the site is very low. This is be cause the site is made up of massive ultrabasic rocks with gentle slopes and vegetated by undergrowths, shrubs and others trees.

WATER QUALITY

The baseline water quality analysis was carried 29 locations; four located at river / reservoir (freshwater) and 25 located at sea. Eight stations (W3 – W10) were monitored for high and low tides and eight stations (M1 to M7), the marine water was tested at three layers namely surface, middle and bottom. At all stations, samples were analyzed for all 23 parameters specified in Standard B under the Environmental Quality (Sewage and Industrial Effluent) Regulations, 1979 plus *E. coli*, dissolved oxygen and salinity. In addition several in situ parameters and TSS were measures at eight marine sampling stations (S1 – S8) at two different depths by research team from Universiti Malaysia S abah (UMS). Both of the river water and marine water data analysis were compared against Interim National Inland Water Quality Standards (NIWQS) and Interim National M arine Water Quality Standards (NMWQS) respectively. Water Quality Index (WQI) was cal culated for Sg. Silam at the four points of sampling locations using selected parameters . The Water Quality Index (WQI) recorded for station W1A falls under Class II, W1 falls under Class II and Class III, while W2 falls under Class II of INWQS.

There is some variation in marine water quality between but most of the data are well within NMWQS except for pH at Station s W2, W6, W8, and W9. All the heavy metals are well within the IMWQS limit except for mercury at Station W4, W5, and W8. Overall, there are some differences between high and low tides some water quality parameters . Generally, the parameters showed slightly highly values during the high tide as compared to low tides, especially temperature, pH and COD. The dissolved oxygen is slightly low during low tide at stations W3 to W6. The surface temperature of the seawater is well within the range of any tropical water. However, differences in depths do interfere with the level of temperat ure recorded. Higher temperature was found in the surface and decreased with increasing water depth.

The impacts during the construction phase is mainly related to soil erosion and nutrient runoff affecting coastal water quality and marine ecosystems. However, this could be controlled effectively with appropriate mitigation measures proposed. Meanwhile, the impacts during the operation phase of the project are the spillage of coal during transportation, slurry and waste water runoff or leakage from coal yard and ash pond, blown out dust from coal yard and ash pond, cooling water discharge containing increased temperature and residual chlorine, process wastewater and effluents, sewage and sanitary wastes and finally solid wastes from the power plant. Several control measures will be implemented as part of the project development to limit any discharge to water bodies within the acceptable level.

CLIMATE AND METEOROLOGY

The nearest meteorological station to the project site is in the Tawau Airport. Meteorological data from 2002 – 2006 was collected from the Tawau Airport meteorological station. The annual mean temperature varied from 26.4°C to 26.8°C. Total annual rainfall recorded at the Tawau Airport varied between 122.8 mm (2002) to 219.3 mm (2006). The total number of rainy days ranged from 141 days (2002) to 182 days (2006). Annual mean daily evaporation rate for the period was in the range of 3.8 – 4.4 mm. The annual mean values for daily sunshine hours ranged from 6.8 hours (2006) to 7.4 hours (2002). The annual mean wind speed is 21.1 m/s, which is generally calm. Meanwhile, long term climatic data from Tawau Airport, selected climatic data from Lahad Datu Airport are given in appendix for future reference.

AIR QUALITY

Baseline air quality measurement was carried around the project site at three locations and to test Total Suspended Particulate (TSP), Respirable Particulates (PM_{10}), Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2), Carbon Monoxide (CO), Lead (Pb), Arsenic (Ar), and Cadmium (Cd). The total suspended particulate (TSP), and respirable particulate (PM_{10}) concentrations monitored were found to be within the recommended DOE limit of 260 $\mu g/m^3$ and 150 $\mu g/m^3$ respectively with baseline TSP and PM_{10} values are 53 $\mu g/m^3$ and 47 $\mu g/m^3$ respectively. The NO_2 and SO_2 were not detected at all the stations and far below the recommended limit of 320 $\mu g/m^3$ and 105 $\mu g/m^3$ respectively. The CO was also not detected based on 1-hour monitoring, so well within the recommended DOE limit of 30 ppm. The air quality monitored at meteorological station in Danum Valley for the year 2007 was also analysed and given in the report as baseline data for future reference.

The dominant air pollutant emitted during the construction phase would be fugitive dust and exhaust emission. These could be controlled effectively employing good housekeeping and

construction practices, apart from other mitigations measures proposed. However, during the operation phase, the project produces air pollutants including fly ash and coal particles from coal yards and TSS, PM10, SOx, NOx, CO, CO_2 and trace elements from stack emission.

An attempt was made to assess air pollutants for the proposed project. The air quality assessment of the project was divided into two parts, impacts during the construction phase and during the operation phase. The air pollution model used in the assessment of air quality was the US EPA Industrial Source Complex Short Term Version 3 (ISCST3) model. This model is the US EPA's current regulatory model for many New Source Review (NSR) and other air permitting applications. To arrive at the best predicted air pollutant concentration, the latest hourly meteorological data from the nearest meteorological station was used in the modelling. A 12km by 10 km receptor grid was chosen to assess the air quality impact. Three sensitive receptors were identified in the receptor grid and pollutant concentration at these receptors was predicted as well. As the project site is surrounded by the sea to the east and undulating terrain with hills to the west, south and north, the effect of terrain on pollution dispersion was accounted for in the modelling assessment.

During the construction phase, the only air pollutant of concern is total suspended particulate (TSP). Two possible scenarios, a case with control measures scenario and a worst-case without control measures were simulated. From the modelling prediction, the most affected areas are at the construction site areas and area south of the project site which is mainly the sea. The predicted TSP concentrations when there are control measures to reduce emissions are below the ambient air standards. However, in the case when there are no control measures to reduce dust emissions, the predicted TSP incremental concentration is above the ambient air standards but only in areas close to the project site.

During the operation phase of the project, a number of air pollutants are emitted by the proposed coal fired power station. The air pollutants of concern are total suspended particulate (TSP), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and trace elements such as arsenic, cadmium and lead. The concentrations of these pollutants were predicted and assessed for the normal operation with control measures scenario and the worst-case without control measures scenario. In the case of SO_2, the predicted concentrations were based on the highest sulphur content in coal.

The simulations found that particulate matter, as TSP concentrations are below the ambient air standards when the particulate control and removal system is in operation. However, when the particulate control and removal system fails, the predicted TSP concentrations in ambient air exceeds the standards in areas close to and within the power station. TSP emissions from the coal yard are not expected to have any impact on air quality based on the TSP modelling for coal yard.

As for the combustion gases, the predicted NO_2 concentration is below the required ambient air standard and for SO_2, the predicted concentrations are also below the ambient air standards when there are control measures and exceeds the standards when there are no control measures based on the highest sulphur content in coal. With the introduction of the FGD the SO_2 level will be well below the ambient air standards.

Long term average trace elements such as arsenic, cadmium and lead concentrations were predicted using emission factors for assessment of health impacts, though these trace elements are not detected in the three brand of coal proposed for the project. Long term average concentration of trace elements such as arsenic, cadmium and lead is negligible and insignificant as these elements are not detectable in the coal samples.

Moreover, although the Danum Valley is more than 20 kilometres away by air and 67 kilometres by road, the impact of emissions from the proposed coal-fired power station was assessed. As distance from the source is the main determinant, the SCREEN3 Model was used in the assessment. The predicted 1-hour average TSP concentration is highest at a distance of 1 km from the source and decreases exponentially with distance to less than 20 ug/m^3 at 20 km from the source. This shows that the 1-hour average TSP concentration in the Danum Valley area is expected to be less than 20 ug/m^3. The predicted 1-hour average SO_2 concentration in the Danum Valley area is less than 10 ug/m^3 when there are control measures (DOE limit 350 ug/m^3). However, when there are no control measures to reduce TSP and SO_2 emission, SCREEN modelling predicted that the TSP concentration in the Danum area can be as high as 222 ug/m^3 and SO_2 can reach 63 ug/m^3. NO_2 concentration is expected to be not more than 11 ug/m^3 (320 ug/m^3).

NOISE

A total of ten noise monitoring stations were selected to establish the existing baseline noise levels near the proposed project area. Minimum duration of fifteen minutes L_{Aeq} noise levels, at those monitoring stations varied from 42.7 dBA to 68.7 dBA during day time, and 38.6 dBA to 53.1 dBA during night time. These levels are representative of the existing baseline noise levels at the proposed project area. Only station N7 which is located near the entrance of the proposed site indicated noise level above the stipulated limit during the day time.

Noise level at the surrounding areas of the proposed project site will increase during construction stage due to the following activities: site clearing, earthworks, reclamation, and construction of structures, piling, and transportation of construction equipment. Noise level at the nearest residential area is expected to reach between 45.6 dBA to 67.4 dBA due to site clearing, earthworks, reclamation and construction work. At 50 meters from the roadside the noise level may increase up to 75.1dBA due to truck movements in the public roads.

The predicted noise level at the nearest affected residents at Kg Soaiun, upon the operation of the proposed power plant project is 60.6dBA. The increase in noise level which is the difference between predicted future noise level and existing measured noise level is 11.7dBA. This increase in noise level is considered high but still well within the DOE boundary noise limit of 65dBA. Meanwhile, the residents of the Kg. Soaiun will be relocated away from the project site, the area become a buffer and there is no residents closer to the project site.

COASTAL HYDRAULICS AND HYDRODYNAMICS

The shoreline in Silam area is made up rocky headlands surrounded by corals. Where there are deposits of fine silt and mud, disturbed or regenerating mangroves can be found along the coast. The area is in a bay within a bay. Therefore, there is very little wave action and currents due to tides. There is no evidence of erosion due to waves or currents along the shoreline around the site. The spring tide range is 1.68 m while the neap tide range is around 0.42 m. These low tide ranges account for the slow currents that occur in the bay. In situ data collection shows that the current speeds rarely go beyond 0.04 m/s and in most cases the current speeds are around 0.02 to 0.03 m/s.

At the outlet, 21 m^3/s of water at 8ºC above ambient will be discharged. Since the intake seawater temperature is not expected to exceed 31ºC at this location, this will ensure that the cooling water discharge will not exceed 40ºC.. The movement of the plume was modelled for 2 scenarios. The first scenario was for wind from the north at 2.5 m/s and the second scenario was for the wind blowing from the west at 2.5 m/s. The first scenario would be important for the cooling water intake while the second scenario would be important to check the impact on the nearest aquaculture farm to the project site. In both cases it was found that the water temperature at the intake point and the fish cages are not more than 1ºC above ambient, therefore, it was advised to extent the cooling water intake further south around 100 m from the current location.

Modelling of chlorine for both arrangements were carried out. The modelling assumes a concentration of 2mg/l at the CW discharge point. This only occurs when chlorine is put into the system to prevent marine fouling. This situation will occur for 24 hours every 7 days. It is found that for both cases of wind, the chlorine plume will not travel very far due to the slow currents in the area. The chlorine will stay just around the discharge point and the decay process will reduce the concentration as the chlorine diffuse and dissipates away from the the discharge point. The level of concentration at the fish cages will be close to zero and therefore negligible.

Some soil erosion will occur during construction. It is important that the suspended sediments due to the soil erosion do not escape into the main bay and cause environmental damage. It is assumed that appropriate measures to reduce concentration of the su spended sediments such as stilling basins, sediment traps and silt curtains have been provided at site. The measures taken will ensure that the suspended sediment concentration at the point of discharge is 50 mg/l. It was also assumed that the point of dis charge would be the mouth of the small stream that discharges into the bay. Modelling was carried out for similar wind conditions as used for the chlorine and temperature modelling. It was found that the sediment plume will mainly be concentrated in the waters just off the site and will not affect the nearest fish cage culture.

TERRESTIAL ECOLOGY

The project site which was formerly an integrated timber complex is surrounded by Sepagaya VJR on the north and Darvel bay on the south. The Sepagaya VJR was previously a Lowland Mixed Dipterocarp Forest (MDF). However, due to logging activities, after 1984, most parts of the virgin reserve had then become secondary forest. The land within the project site was cleared for factory and staffs settlement building. Therefore, there is no significant terrestrial habitats within the project site. The vegetation within the project site is dominated by *Acacia* spp. and grasses. *Macaranga tanarius*, *Lantana camara* and *Leucaena leucocephala* are also abundant. Residents also planted several fruits trees for example *Nephelium lappaceum* (rambutan) and *Artocarpus heterophylls* (nangka). Several dipterocarp trees (eg. *Shores* spp. and *Parashorea malaanonan* with dbh less than 50cm) are found in Sepagaya VJR around the project site. No wildlife was found within the project site. Some common reptiles such as monitor lizards (biawak) and small mammals such as rat (tikus) were seen within the site. Macaque (kera) and squirrel (tupai) were seen in the secondary forest outside the project site.

WETLAND ECOLOGY

There is no important or gazetted wetland either in or around the 5 km radius of the project site. There are some disturbed or regenerating mangrove can be found along the coast of project area. The mangrove areas within and around the project site are disturbed and logged over. Most of the mangrove trees are small due to constant clearance and cutting. The most common mangrove plants found are *Rhizophora mucronata*, *R. apiculata*, *Sonneratia* sp. and *Avicennia* sp. No wildlife was found in the wetland area within and around the project site. The nearest wetland forest reserve is Kuala Tingkayu Forest Reserve (Class V Mangrove Forest Reserve) which is 7 km to the south-east of the project site.

MARINE ECOLOGY

The Silam area is a unique geographical location in Darvel Bay consisting of many islands (P.Baik, P. Laila P. Saddle, P. Saga) with rich marine organisms. The coastline of Silam area is covered with regenerated secondary mangrove. Occurrence of seagrass (*Enhalus sp* and *Halophila sp*) are patchy or in scanty condition. However, *Halophila sp* meadow was found in Station 2. Seaweed consists of *Sargassum sp* and *Padina sp* are found at most of shallower areas. Good coral reef can be found at deeper water around islands but some coral at shallow area were destroyed by destructive fishing methods in the past. Dominant species in phytoplankton and zooplankton were *Cheatoceros spp.* (84%) and *nauplius* stage (33%), respectively. Commercial fishing gears (e.g bagang and gill net) and coastal communities often spotted fishing in this area.

Suitable weather and rich plankton community are the main factors for fast development of fish cages culture in this area. Currently there are 9 commercial fish cages culture activities found within this area. Most of these aquaculture fishes are exported to Hong Kong, China and Taiwan. The success of this project has attracted foreign investors. The seaweed projects by Fisheries Department, Lahad Datu District and Sabah Ministry of Rural Development are located within 5 km radius of the project site. Potential area for marine eco-tourism development is mainly located in the nearby island. Diving and snorkelling activities are located at a shipwreck in Baik Island and shallow water around the island, respectively. Currently, the Department of Fisheries has identified three zones (Dewata, Silam and Bakapit) in Darvel Bay as a part of the National Aquaculture Centre (PAN).

The impact on marine ecology during the construction phase can be effectively controlled as discussed in the water quality section. Similarly, the impacts during the operation phase. The impacts discussed in the water quality section would have direct impact on marine ecosystem due to water quality deterioration. However, the main issues of concern during the operation phase are the discharge of cooling water with increased temperature and residual chlorine. The "once through" cooling water discharged from the outlet pipes of the power plant will have a slightly higher temperature than at the intake point (present ambient water temperature is in the range of 29°C - 31°C). The cooling water system must be efficient and capable of reducing the temperature of the discharged water. The design of discharge sea water temperature shall not exceed 40°C in compliance with DOE requirement. Similarly, the chlorine concentration in the discharge water should be below the concentration that affects the physiological mechanisms of marine biota.. The dispersion modelling study indicated that the temperature will be contained within the Soaiun bay with maximum temperature 1degee C at the nearest aquaculture farm. The chlorine dispersion will also be contained within the Soaiun bay and not reach the nearest aquaculture farm.

SOCIO-ECONOMY

The study area has five major settlement areas – Kg. Teluk Soaiun, Kg. Silam / Silam Lama, Kg. Lamak, Kg. Bumiputera and Taman Maju Jaya with estimated population size of around 4,500 people. The population works as labourers, smallholders, fishermen, and self-employed. The main economic activities in the area are palm oil plantation / smallholders and fishery / aquaculture. It is estimated about 800 fishermen live in the area especially in Kg. Silam / Silam Lama. They catch fish like *lumahan, kulisi, tulai, kulapuk, a kung and squid* which are sold at local markets. Offshore in the nearby islands, there are 9 aquaculture farms (cages) covering about 500 ha area and involving around 400 workers. The annual turnover is about 80 metric tonnes valued more than RM120 millions (2006 & 2007). The fish are exported to Hong Kong, China and Taiwan.

A survey was done on 196 respondents from the area. The respondents are mostly between 36-45 years (35.2 percent), males (65.8%), Muslim (79.6), Malays (47.4 percent), married (87.8 percent), have secondary level education (39.8 percent), labourers (54.6 percent), with monthly income between RM500-RM1199 (53 percent) and have stayed in the area between 21 to 30 years (21.9 percent). On the environmental awareness and perception, curren tly there are issues such as flies nuisance, mosquito, dust, odour problem, traffic noise, bird nuisance, dirty surface water and rat nuisance.

Perception and awareness of the proposed project was also assessed. The survey findings show that about 65.3 percent of the respondents do not agree with the project, 18.4 percent agree and 16.3 percent are indifferent. The reason for them not to agree with the project is not because of the project itself, but rather on the issue of relocation of villagers especia lly at Kg. Teluk Soaiun, the former staff quarters for Pacific Hardwood Sdn. Bhd. which had ceased operation in the area. They demand the authorities to provide them with new houses at a new location if they were to be directed to move out from the village .

Stakeholders analysis are also conducted among the planters / smallholders, fishermen, aquaculturists, environmentalists and local authorities. The environmentalists show strong rejection to the project due to aquaculture, marine ecology particularly p erceived impact on coral and fishery, perceived impact on Danum Valley and perceived impact on public health. The other groups do not show much worries about the project and some of them are giving full support for the proposed power plant to help the deve lopment of Lahad Datu as major palm oil hubs and aquaculture zone.

Minimum impacts can be expected during the construction phase of the project which includes dust, noise and traffic which can effectively be minimized to acceptable level with appropriate mitigation measures. Similarly, impacts during the operation phase are mainly positive impacts which include uninterrupted power supply to East Coast of Sabah,

employment opportunities, business opportunity to locals, investment opportunity and increase in revenue to District and State. The other perceived negative impacts especially on water quality, air quality, noise, marine ecology, public health, etc are addressed in the relevant sections.

PUBLIC HEALTH

The existing health status of the population residing near the proposed coal-fired power station was determined through health survey and review of secondary data from the nearest health facility. The health survey was conducted in November 2007 and January 2008 by trained interviewers using a standardised questionnaire. A total of 196 respondents from six residential areas within 5km radius from the proposed station site were surveyed. Majority of these respondents were men (66%) and of Malay ethnicity (48%). Their basic amenities were fairly good. Majority of them (95.4%) sought medical treatment from the government health facilities. A total of 90.9% respondents claimed to be in healthy conditions. The most common acute illnesses among the family members were fever, cold and asthma with the prevalence rates of 2.55%, 1.84% and 1.53% respectively. The prevalence rate of asthma among the respondents was 3.6%. The secondary data from the nearest health clinics showed increasing number and rates of respiratory diseases and conjunctivitis cases from 2 004 to 2006, however with a decreasing trend of cardiovascular diseases. Their main infectious diseases based on the surveillance data were tuberculosis, malaria and dengue fever.

The potential health impacts from the proposed station were assessed using the health risk assessment (HRA) methodology. The criteria pollutants such as PM_{10}, SO_2 and NO_2 (acute and chronic effect) are the major hazards of concern. Inhalation is the most important exposure route for these pollutants. The health risks for these pollutants were estimated based on the estimated ground level concentration (GLC) that were compared to the health reference values. A value more than 1 indicates a significant health risk to the exposed population. During construction, with the normal dust control measure, the GLCs of the criteria pollutants are unlikely to affect the health (acute and chronic) of the population.

During operational phase, especially in the worst case scenario, the highest risks from PM10 were on the occurrence of respiratory symptoms, asthmatic attack among children, and hospital admission for respiratory diseases predicted at Kg. Soaiun, followed by Taman Maju Jaya and Kg Silam Lama. The systemic health risk of the lifetime average exposure to arsenic, cadmium and lead from the proposed station was calculated for hazard index. Hazard index exceeding 1, indicates a significant health risk. It was found that none of the hazard index exceeded 1. Therefore, there would not be any systemic health risk posed to the community within 5 km radius. Risk for cancer to residents was calculated by multiplying the predicted lifetime average concentration (LAC) of air pollutants with air URF. It is estimated

that the lifetime cancer risks for all receptors are all below the universally accepted risk level for lifetime excess cancer risk (<1 in a million populations) .

TRAFFIC AND TRANSPORTATION

The road Tawau and Lahad Datu highway is the only main road that is accessible to the proposed power plant in Silam. This is a major federal trunk road in Sabah and is officially known as Federal Road A5. The project site itself is about 2.4 km from the Tawau-Lahad Datu segment of the A5 federal road. It is now only accessible by a logging gravel track. The road surface is not smooth and ride quality on the road is very poor.

The marine approach channel to the power plant is via Darvel Bay. The bay where the coal carrying barges will unload their cargo and turn around for their return journeys is Soaiun Bay. The power plant itself will be located north of Soaiun Bay. There appear to be no physical encumbrances via this approach channel in Darvel Bay to the project site. The current traffic on the approach channel consists of foreign-owned log carriers parked in the open sea. Barges carry logs from the timber jetty in Soaiun Bay to these vessels moored in open sea. The volume of shipping traffic at Silam is very low with only 4 vessels were recorded as calling in Silam Harbour during the month of January 2007, which is considered the average monthly traffic by the Marine Department

QUANTITATIVE RISK AND HAZARD ASSESSMENT (QRHA)

A Quantitative Risk Assessment (QRA) was conducted on the proposed 300MW coal-fired power plant. The analysis involved hazard identification, QRA, probability estimation, consequence modelling, risk estimation and evaluation and risk management. Fuel used for the boiler at the power plant is sources for potential hazards. Among the potential hazards is fire outbreak at the coal storage yard and burner gallery, explosion at the crusher or pulverize coal silo, explosion at the boiler unit and fire outbreak at the fuel oil tankfarm. Results of the QRA concluded that the only potential occurrences of fire outbreak at the coal storage yard and at the fuel oil tank farm storage facility.

The damaging impact of a pool fire is thermal effect, primarily through the thermal radiation from the flame surface. The effects of fire are estimated based on the released conditions, flammability and / or properties of the material and local meteorological conditions. The risk associated with proposed facility is estimated based in the probability of occurrence of the identified incident outcomes and fatal probability of a receptor at some distance away from the facility. The result of the risk estimation is plotted in the form of risk contour. The voluntary and involuntary risk contour of the proposed project is within the compound of the

proposed plant and do not encroach into any sensitive areas. Thus, the risk level posed by the proposed facility satisfies The EIA Guidelines for Risk Assessment (2004) and should be considered safe to the surrounding population. Even though the risk level posed by the facility is acceptable, the project proponent should have a risk management system in place for safe operation of the facility.

ENVIRONMENTAL COST BENEFIT ANALYSIS

The proposed project is expected to positively contribute towards the state economy by meeting the needs of the growing population and expanding economy. Project implementation will, however, give rise to negative environmental impacts that cannot be completely mitigated thus justifying the need to quantify the degradation in services obtainable from the disturbed natural environment. The main goal of the ECBA is to provide an evaluation as to whether the project will bring a net overall gain or loss to society from the environmental stand point. This study adopts the impact pathway approach (IPA) where the physical environmental impacts are linked to an economic valuation process.

Five environmental impacts have been identified to be significant enough to be considered for evaluation. These are increase in air pollution, increase in carbon emission, degradation in marine water quality, increase in noise level and higher exposure to risk of injury and death to surrounding population. The last impact is evaluated as a precautionary measure since the impact is not very likely. All impacts are negative. Of the five impacts, two were subsequently quantified (increase in air pollution and carbon emission), two were deemed to be insignificant while one (degradation in marine water quality) is considered to be extremely difficult to quantify because of the uncertainty in its consequence. After discounting at the rate of 8%, the project will bring about a net loss amounting to -RM20,976,664 over a 30-year period. The corresponding value is equal to -RM31,026,957 if a 4% rate of discount is used. The net negative benefit is mainly attributable to SO_2 emission that affects human health.

RESIDUAL IMPACTS

The residual impacts are defined as potentially significant long-term environmental impacts which remain even after mitigating measures have been introduced. These impacts are considered to be permanent and long-term, which might occur during the construction and operational phases of the 300MW Coal-Fired IPP Power Plant and are likely to affect the three major environmental components, i.e. physical, biological and human environment. Impacts of this nature are a consequence of the transformation in land use from the former to the proposed. These residual impacts require closer investigation and are managed by

developing a well-defined environmental monitoring programme which should be implemented during the construction and operational phases of the project.

ENVIRONMENTAL MANAGEMENT PLAN (EMP)

A comprehensive Environmental Management Plan (EMP) for the 300MW Coal-Fired Power Plant project shall be prepared to effectively manage all potential issues and impacts identified in this report and monitor the project activities and the implementation of mitigation measures at the site during both construction and operational phases of the project. This is to ensure environmental objectives are met and all activities relating to the implementation of the project are carried out in an environmentally sustainable manner. The document will provide specific guidelines on steps that need to be performed by the project proponent to ensure that mitigation measures recommended in this report, the EIA approval conditions and any other requirements imposed by the DOE are implemented.

EMERGENCY RESPONSE PLAN (ERP)

The ERP is a formal document that identifies the potential emergency conditions at the facility and specifies pre-planned actions to be followed to minimise property and environmental damages and loss of life. An Emergency Response Plan (ERP) is an essential component of a facility's safety and loss strategy. It provides an organized structure for a chain of action to be put into motion in the event of an emergency at the site. An emergency, in the context of the ERP, is defined as an incident which has the potential to cause injury or loss of life, and / or damage to property and the surrounding environment. A detailed EER need to be prepared and submitted for DOSH approval both for construction and operation phases of the project.

PROJECT ABANDONMENT

Project abandonment means when the whole project or a part of the project has to be abandoned for specific reasons. Abandonment could happen at any stage of the proposed project. Abandonment during the planning stage would not result in any significant financial losses other than costs incurred for undertaking various studies and planning. Abandoned structures and machinery could be a health hazard to the public and cause negative impacts to the surrounding environment if left exposed, such as soil erosion and surface run-off. The Project Proponent shall be responsible to institute all necessary remedial measures required for protection and conservation of environmental quality.

ENVIRONMENTAL LEGISLATIONS AND GUIDELINES

A review of the environmental laws, statutes and guidelines which protect three major environmental components of the biosphere, namely air, soil and water, and control of man-made pollutants, namely gaseous emissions, solid waste disposal, noise and vibration, and domestic and industrial waste discharge levels, are necessary for the project proponent to understand and institute follow-up measures during the project implementation stage. These norms or mandates will constitute the principal guidelines and criteria upon which project induced environmental impacts can be evaluated for severity, and levels of mitigation are proposed and implemented. The principal guidelines upon which possible significant and non-significant environmental impacts can be evaluated for their short-term, long-term or permanent effects on the environment are outlined in this section. The Standards, Regulations and Guidelines promulgated by the Malaysian Government Agencies are given precedence, and in the absence of existing guidelines those adopted by other countries can be considered.

CONCLUSION

The Detailed Environmental Impact Assessment study has attempted to identify and assess the environmental impacts with respect to physical, biological and socio – economic issues associated with the development of the 300MW Coal-Fired IPP project at Silam, Lahad Datu, Sabah. The deductions and interpretations made here are based on the best available information and the studies carried out specifically for the project as outlined in the chapters of this DEIA report.