Suruhanjaya Tenaga
Energy Commission

Sabah Electricity Supply

Industry Outlook

2014

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PREFACE

The first edition of Sabah Electricity Supply Industry Outlook is an initiative by Suruhanjaya Tenaga to inform the public on precarious position of the present electricity supply chain in Sabah, initiatives that are currently undertaken to correct the situation and the prospect for the future. The Outlook is for the period of 10 years from 2014 to 2023.

Blessed with abundant natural resources, distinct cultural heritage and ecological beauty, Sabah development potential is vast and diverse. On the other hand, the potential is yet to be fully tapped as Sabah presently ranks sixth highest with GDP contribution of 5.9% to overall national GDP despite being the second largest and third most populous state. Going forward, under Sabah Development Corridor blueprint, quality of life of all Sabahan will be enhanced through development of targeted sectors. Pre-requisite to realisation of the planned development is adequate and more reliable electricity supply to customer.

In the past, expanding supply coverage was prioritised in order to elevate standard of living and eliminate poverty. However, electricity tariff in Sabah remained unchanged for 25 years until the revision being made in July 2011. Subsidies in various forms were given to cushion the impact of rising cost of services as cost of supply became higher than revenue generated from the operation. As a result, SESB as the main utility in Sabah, become insolvent and unable to source its own fund for infrastructure development. With the support from Government funding through 9th and 10th Malaysian Plan, the electricity supply infrastructure and performance have improved tremendously. Over the years, it is still lagging compared to Peninsular Malaysia.

Going forward, initiatives have been rolled out to improve adequacy and reliability of the electricity supply with the long-term objective to bring it to the level at par with Peninsula. In addition, generation options to reduced high dependency on natural gas need to be properly assessed so that the choice of fuels for power generation can be in line with the State's development aspiration.

INDUSTRY OVERVIEW

INDUSTRY OVERVIEW

Economic Review

Sabah, one of the member states in Malaysia, is located in the northern region of Borneo Island bordering Sarawak on its southwest and North Kalimantan province of Indonesia on its south. With the population of 3.496 million in 2012, Sabah is the third most populous state in Malaysia after Selangor and Johor. In terms of urbanisation rate, Sabah with the rate of 64% is still below national average rate of 71%, which necessitate the drive for rural electrification programme. Major township areas such as Kota Kinabalu, Sandakan and Tawau are located in the coastal area and connected through road network, airport and seaport.

The state's economy relies heavily on services (47.4%), agriculture (20.8%) and mining / quarrying (20.7%) sectors. Contribution from manufacturing sector is relatively small at 7.9% and that too with reliance on palm oil and timber industries. Petroleum and palm oil remain the two most exported commodities, while Sabah imports mainly automobiles and machinery, petroleum products and fertilizers, food and manufactured goods.

Sabah's economic development has performed credibly in the last decade attributed by increase in export products particularly saw logs and crude petroleum as well as investment from both Government and private. The state recorded GDP growth of 4.1% in 2012 compared to 1.3% in 2011 driven by oil and gas development activities to offset the decrease in palm oil sector.

Sabah Development Corridor

Going forward, the state's strategic location, abundant natural resources, rich cultural heritage and access to mega biodiversity resources need to be capitalised to greater effect. To that, Sabah Development Corridor (SDC) was launched on 29th January 2008 with goal to turn Sabah into a leading economic region and a preferred destination for investment, work and living. Sabah Economic Development and Investment Authority (SEDIA) is the agency responsible to oversee the overall development of the SDC which span the period from 2008 to 2025. The establishment of SDC is in line with the State Government development agenda which aim to ensure that economic progress benefits everyone in the state.

SDC is implemented across three sub-regions namely the Western Sub-Region, Central Sub-Region and Eastern Sub-Region with road map as follows:

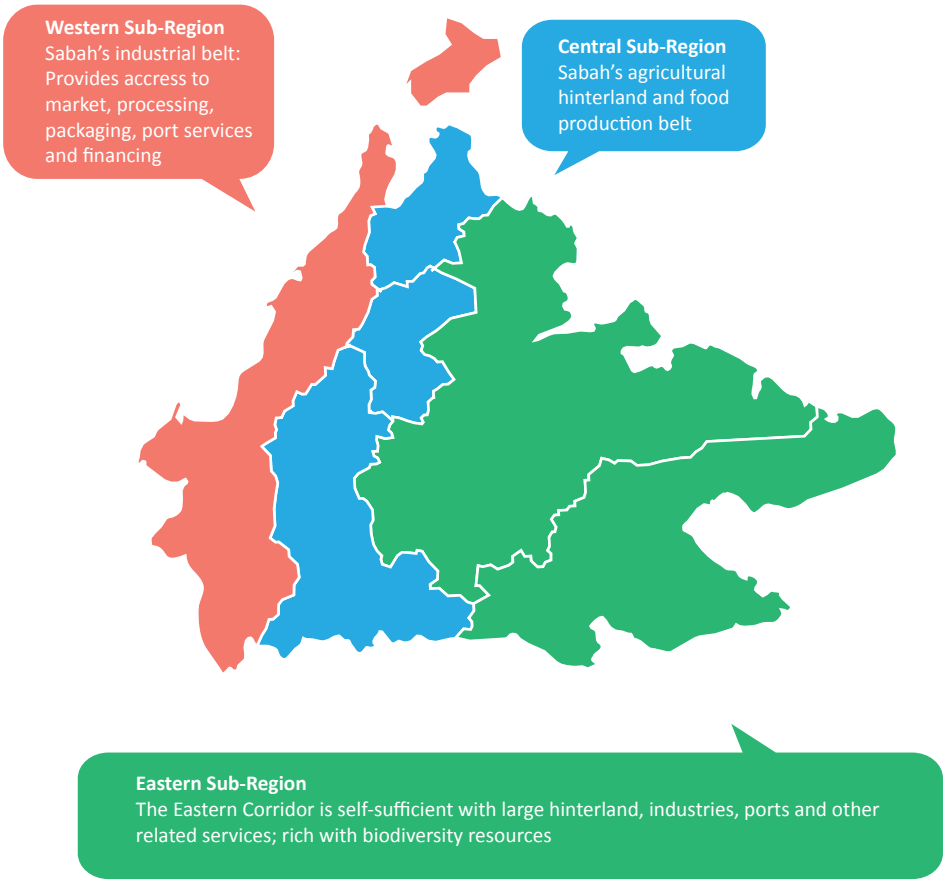
- Phase 1 (2008 - 2010) - mainly focuses on building the foundation for growth via infrastructure development as well as initiating high impact economic and poverty eradication projects. This has already been done through various SDC incentives, development programme and project tender and so forth.

- Phase 2 (2011 - 2015) - will see economic growth accelerating through intensified higher order value-added economic activities, with the presence of global companies and a strong base of local SMEs.

- Phase 3 (2016 - 2025) - is the expansion period where Sabah is expected to emerge as an attractive destination for Foreign Direct Investment (FDIs) with strong supporting infrastructure, global companies and knowledge workforce.

Details about SDC can be obtained from SEDIA at www.sedia.com.my

Figure 1: Sub-regional development



History on Electricity Supply Industry in Sabah

Use of electricity in Sabah reported to take place as early as 1910. However, utility-scale supply only began in 1922 with supply by the Sandakan Light & Power Co. Ltd. to Sandakan town through a 1,964kW timber waste-fired power station followed by Kota Kinabalu and Labuan with supply from Jesselton Ice Co. Ltd. and Labuan Rural Board respectively. Consolidation of electricity supply functions in Sabah began in 1957 when North Borneo Electricity Board was formed and took over roles previously performed by various organisations.

The Northern Borneo Electricity Board (NBEB) was renamed Sabah Electricity Board (SEB) in 1963 and administered under the Sabah State Government after formation of Malaysia. With the enactment of Lembaga Letrik Sabah Act 278, Sabah Electricity Board was renamed as Lembaga Letrik Sabah (LLS) in 1984, and its administration was placed under the Federal Government with the intention to ensure better allocation of fund for infrastructure development in line with the state's economic growth.

Through the Privatisation Agreement dated 26th August 1998, LLS was privatised and subsequently changed its name to Sabah Electricity Sdn. Bhd. (SESB) on 1st September 1998. Tenaga Nasional Berhad holds 80% equity in SESB while Sabah State Government the remaining 20%. At the point of privatisation, SESB power stations accounted for 57% of total installed generation capacity of 489MW. However, over the years, SESB's position as the largest electricity producer in Sabah was taken over collectively by Independent Power Producers (IPPs) with SESB's capacity share of 40% out of 1,133MW.

Infrastructure Development

Electricity supply system has evolved exponentially since the privatisation of the utility in 1998. By end of 2014, generation capacity will be increased threefold from 489MW in 1998 to 1,615MW with completion of 385MW CCGT plants in Kimanis. In terms of transmission network, both overhead and underground supply lines were increased significantly from a mere 605 km-circuit in 1998 to 2,387 km-circuit in 2013. The expansion in supply system was made to correspond with increased number of customers from 262,696 to 503,975.

Peak demand for electricity from 2014-2023 is expected to grow at a rate of 5.13% per annum. Historically, peak demand growth from 2007-2013 was at an annual average of 6.78%. The highest peak demand recorded in the system was 874.4MW on 23rd September 2013, an average increase of more than 7% per annum since West Coast and East Coast Grids were interconnected on 28th July 2007. In terms of sales, demand is projected to grow at average rate of 5.79% annually in 2013-2023 compared to annual growth of 6.53% recorded in 2007-2012.

Before completion of the 275kV East-West Interconnection, the grid system in Sabah is generally divided into two, West and East Coast Grids with pockets of off-grid installations to serve populations especially in remote areas. Upon completion of the project, 90% of the SESB's customers were interconnected to the common system.

Interconnection provides means and ways to utilise the generation assets in more effective and cost efficient ways. This is especially significant as gas-fired power plants in the West Coast are cheaper (relatively due to subsidy) than oil-fired power plants. However, operational reliability and cost efficiency that can be potentially derived from the investment was somewhat curtailed by lack of reliable generators especially in the East Coast. While energy transfer from west to

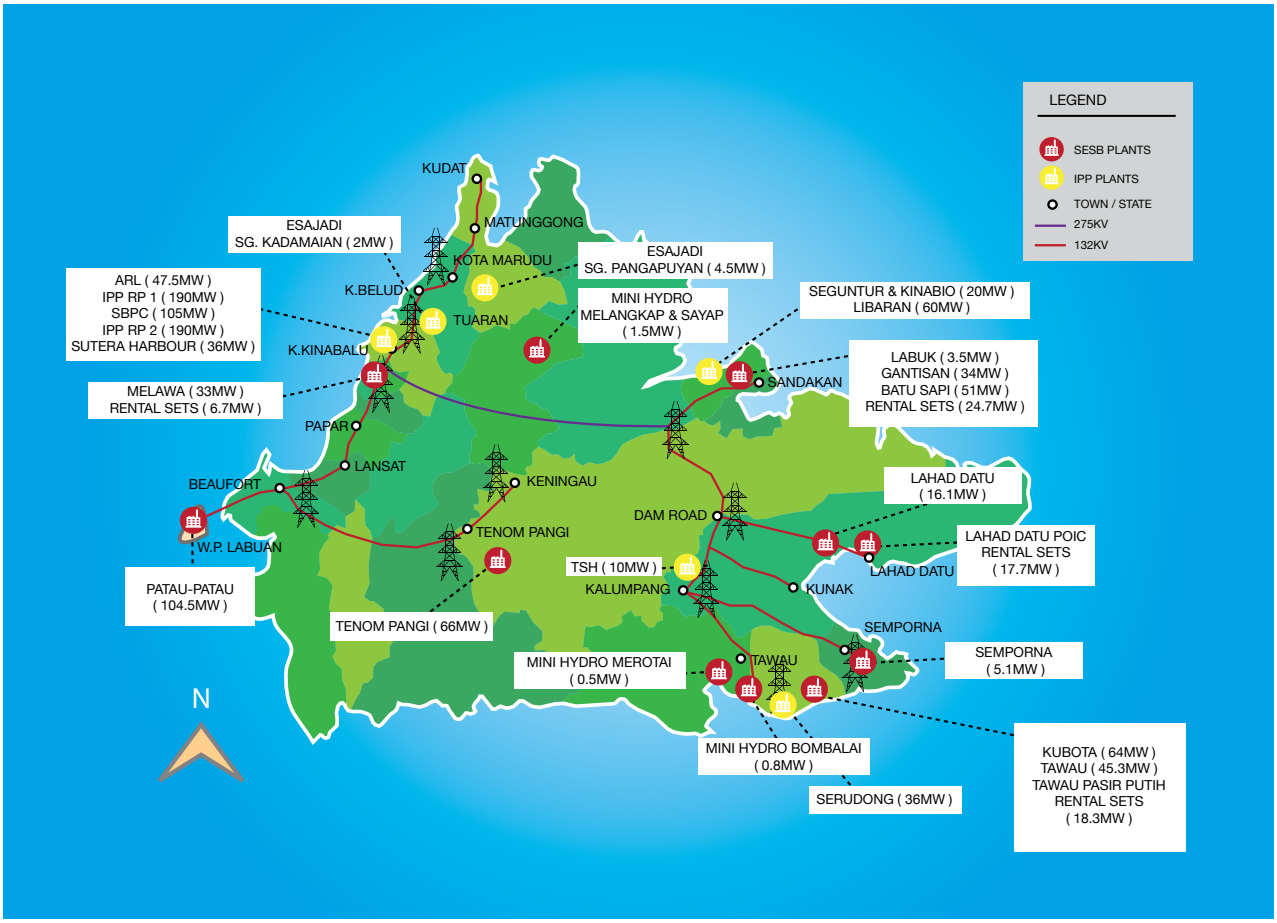
east is feasible in the context of fuel price disparity in Sabah, it has to be augmented by reliable generation capacity so that any disruption can be quickly addressed with no or very minimal impact to customers. Until generation capacity problem is resolved, the interconnection's role will be restricted to its business-as-usual role i.e. primarily as back up to local generators.

Over the years, electrification target of at least 90% of population resulted in increase in electricity coverage especially at lower voltage distribution systems. This was achieved by rural electrification initiatives implemented through Ministry of Rural and Regional Development (KKLW). With intensifying industrial activities especially in western sub-region, the demand for reliable electricity supply becoming more pressing. To that, various generations, transmission and distribution projects are planned to be implemented in stages. Evolution of electricity supply system expansion from year 1984, 1998 and up to 2013 can be visualised as follows:

Figure 2: Electricity coverage in Sabah in 1984

Figure 3: Electricity coverage in Sabah in 1998

Figure 4: Electricity coverage in Sabah in 2013



Electricity Supply Industry Governance in Sabah

Authorities and Institutions

Electricity supply industry governance in Sabah follows similar pattern to Peninsular Malaysia. Overall, Federal Government is in charge of policy, planning and implementation of electricity supply with active consultation and participation by the State Government. Economic Planning Unit of Prime Minister's Department (EPU) is responsible for overall national macro-economic planning while Ministry of Energy, Green Technology and Water (KeTTHA) formulates the electricity supply policy. At the state level, State Economic Planning Unit, an agency under the Chief Minister's Department plays an important role in devising the policy and strategy for socio economic development.

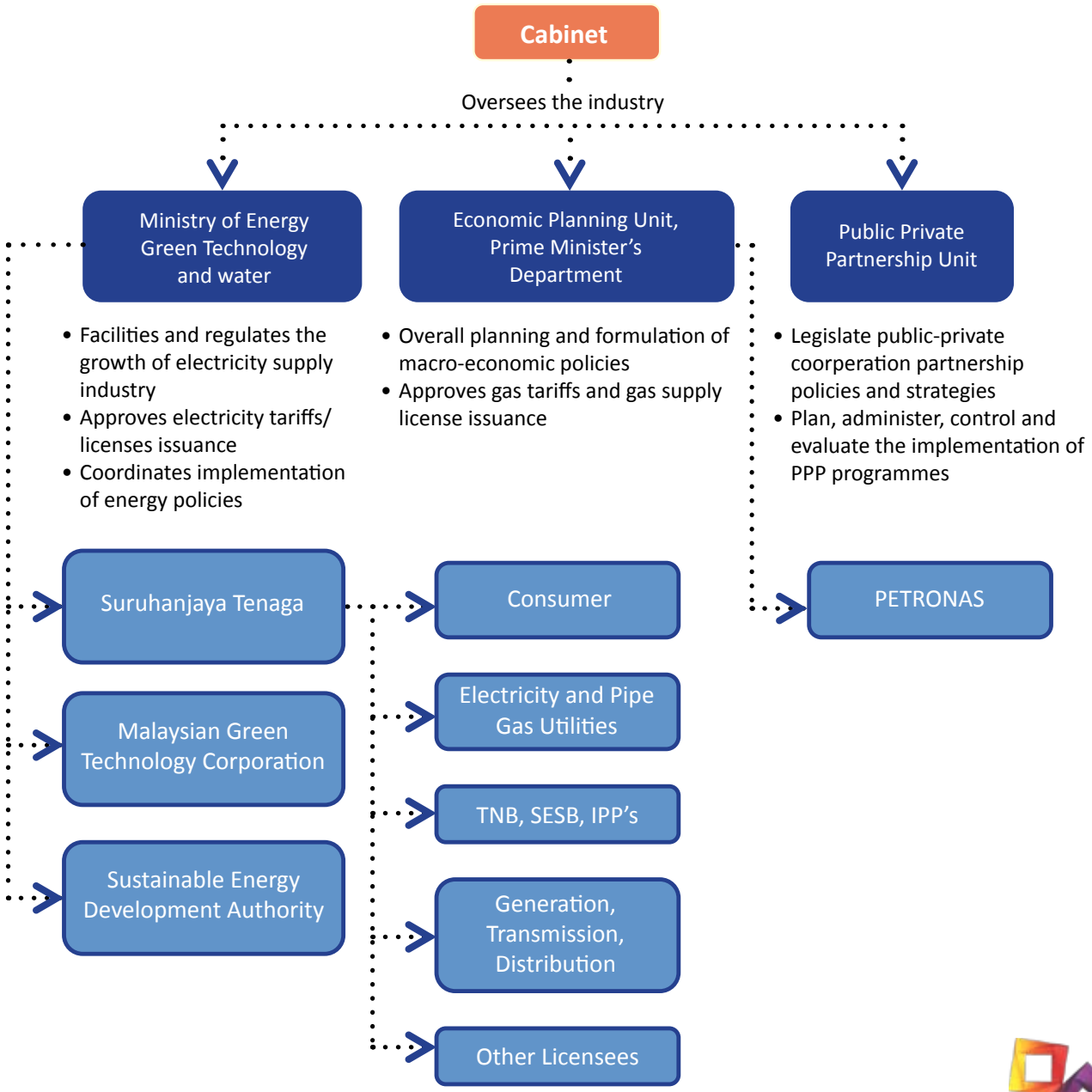
The collective responsibility to plan for electricity supply development falls within the purview of Committee for the Planning and Implementation of Electricity Supply and Tariff (JPPPET). The Committee is chaired by the Minister of Energy, Green Technology and Water and comprises of agencies and parties responsible for every facet of electricity supply chain. The Committee is task to evaluate the supply demand situations and proposed plant-up programme, tariff revision, fuel supply situation and other issues related to electricity supply planning. In the absence of competitive bidding process in Sabah, procurement of new generation capacities will also be decided by JPPPET.

As the regulatory agency for electricity supply and piped gas supply industries in Peninsular Malaysia and Sabah, ST's main tasks are as follows:

- To advise the Minister on all matters relating to electricity and gas reticulation industry
- To develop legal framework for economic regulation
- To recommends and improve regulatory jurisdiction
- To implement policy on electricity and piped gas industries
- To issue licenses and approvals for electricity and piped gas supply activities
- To regulate the industry on matters pertaining to safety, quality and reliability of supply

By and large, upgrading and expansion of electricity networks are task to SESB, whereas KKLW plays a very important role in providing access of electricity in rural areas through off-grid electricity installations or connection to SESB's network.

Figure 5: Authorities and institutions in electricity supply industry in Sabah



Legislation, Codes and Standards

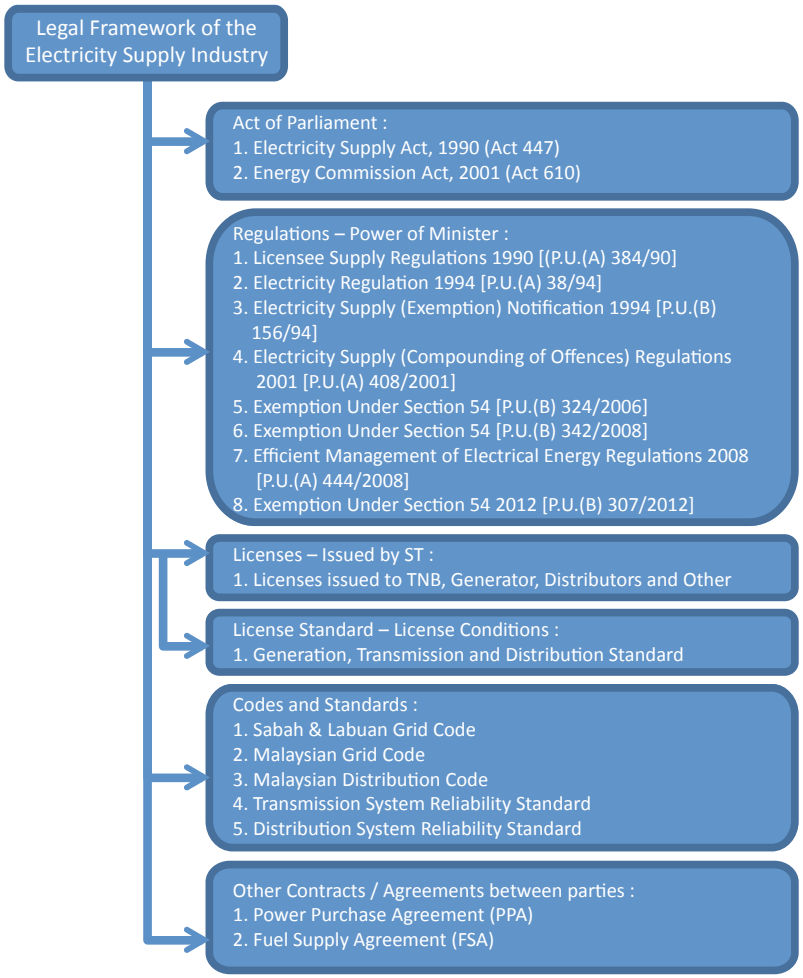
The electricity supply industry related law covers several acts and regulations:

- Electricity Supply Act 1990 is an Act to provide for the regulation of the electricity supply industry, the supply of electricity at reasonable prices, the licensing of any electrical installation, the control of any electrical installation, plant and equipment with respect to matters relating to the safety of persons and the efficient use of electricity and for purposes connected therewith.

- Energy Commission Act 2001 is an Act to provide for the establishment of the ST with powers to regulate the energy supply activities in Malaysia, and to enforce the energy supply laws, and for matters connected therewith.

- Sabah and Labuan Grid Code 2011 contains guidelines, criteria and procedures to permit the equitable management of the electricity sector in Sabah and Labuan, particularly in Grid operation and management, taking into account a wide range of operational conditions likely to be encountered under both normal and exceptional circumstances.

Figure 6: Legal framework of the electricity supply industry



Rural Electrification Programme

Since independence, improving quality of life through increasing electrification programme is top on the agenda of the Government. As pre-condition for rural development, rural electrification programmes helps to bridge the income gap, eradicate poverty and elevate the standard of living. By providing electricity supply to rural areas, mechanisation and automation in agriculture is then made possible, which resulted in productivity increase.

Rural Electrification Programme or Bekalan Elektrik Luar Bandar (BELB) is implemented with the purpose of providing electricity to houses in traditional villages which are outside the areas under the operation of local authorities throughout Malaysia including long-houses in the remote areas of Sabah and Sarawak, villages of indigenous people in Peninsular Malaysia, villages on islands and settlements in small estates which are less than 400 hectares (less than 1,000 acres). The programme comes under the responsibility of Ministry of Rural and Regional Development (KKLW), who are tasked to improve the well being of rural residents comprehensively and effectively by developing physical infrastructure and providing extensive basic amenities to rural citizens.

The BELB Programme is implemented through 2 methods: firstly, through the method of connection to utility grid lines and second through isolated on-site supply such as diesel generator, diesel-battery hybrid and solar-diesel-battery hybrid. Remote areas which are too far off the grid lines and therefore too costly to connect will receive supply through the second method. In terms of funding, the programme is mainly funded by the Government. However, SESB and Independent Power Producers also contribute a percentage of their revenue to the programme through a trust fund known as Akaun Amanah Industri Bekalan Elektrik (AAIBE).

By the end of 2012, electrification coverage has increased to 90.81% with total coverage of 335,626 out of 369, 578 identified rural houses in Sabah. Electrification coverage will be further widened to a targeted coverage of 95.03% by the year 2015. Nevertheless, challenges face in implementation of BELB programme will have to be addressed, such as reliability of existing interconnection to SESB grid, no proper access to villages, way leave issues and difficulty in getting right of way to construct the lines, and lack of information on the non-electrified villages from relevant authorities.

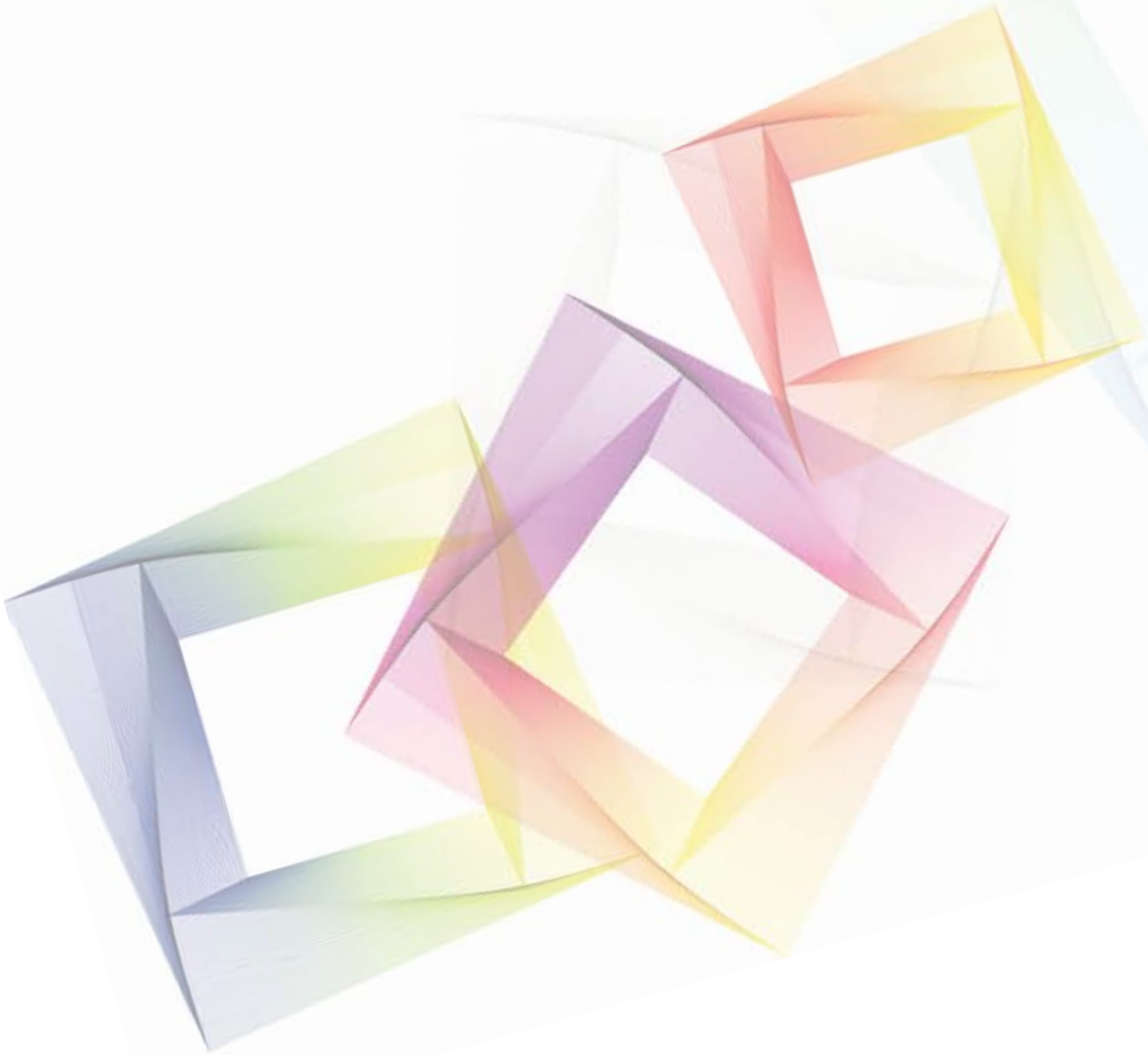
Table 1: BELB Sabah project achievements (year 2010-2013)

Year	Target (No. of houses)	Actual (No. of houses)
2010	12,236	14,194
2011	4,509	8,248
2012	15,455	15,563
2013	7,735	7,735
Total	39,935	45,740

Table 2: Target on the BELB Sabah project achievements (year 2014-2015)

Year	Target (No. of houses)	Actual (No. of houses)
2014	4,151	Ongoing
2015	3,584	-
Total	7,735	-

PERFORMANCE REVIEW



PERFORMANCE REVIEW

Technical Performance

As of 31st December 2013, maximum demand in Sabah was at 874MW, an increase of 44MW or 5.3% from previous record of 830MW in 2011. Annual maximum demand in 2012 was lower at 828MW, possibly due to situation of 'suppressed demand' as a result of inadequate generation capacity throughout the year that restricted the actual maximum demand potential. Meanwhile, electricity generation and sales for 2013 recorded growths of 2.6% and 5.9% respectively compared to generation and sales of electricity for 2012 with yearly growths of 3.9% and 4.8% respectively. The trends pointed out to steadily increasing overall electricity consumption pattern in the system.

In terms of generation capacities, 63.6% out of 1,303MW of grid-connected installed capacity is located in the west coast area. All the gas plants with installed capacity of 641MW (49.2%) are connected to gas receiving terminals in Teluk Sepanggar and Labuan in the west coast. Tenom Pangi, the biggest hydroelectric plant in the system with installed capacity of 66MW is also connected to the west coast grid.

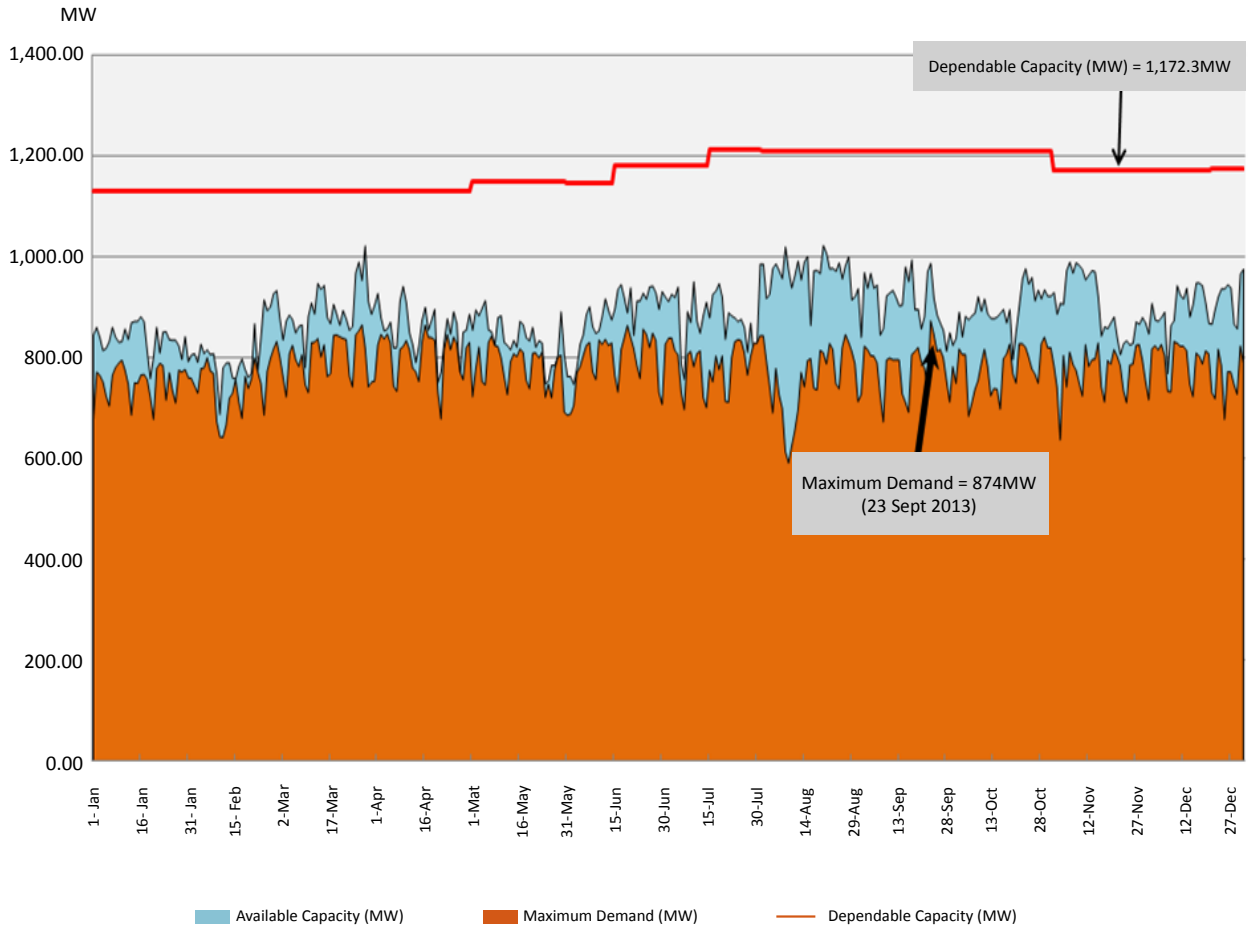
The east coast sub-grid currently receives supply mostly from MFO and diesel plants that accounts for 33.2 % or 432.6MW of total capacity. The success of biomass power plants has seen significant contribution of RE plants with total installed capacity of 40MW or 3.1%. However, actual operating capacity is much less due to overall low availability level of MFO and diesels plants, resulting in dependency on additional supply from west coast.

Table 3: Capacity by fuel type

Fuel	Installed Capacity (MW)	Dependable Capacity (MW)
Gas	641	598.5
MFO	151.9	143.5
Diesel	393.5	322.0
Hydro	76.6	75.3
Biomass	40.0	33.0
Total	**1,303**	**1,172.3**

While the existing installed capacity of 1,303MW should be sufficient to cater for system peak demand at any point of time, actual dependable capacity eroded by 10% due to permanent deration of ageing generating sets. The situation is compounded by long term outage and suspect reliability of these generating sets to the point where the actual daily availability rarely hits above 1,000MW. Closer look at demand and available capacity on daily basis pointed out to the slim operational margin throughout 2013.

Figure 7: Sabah daily maximum demand and available capacity



Heavy reliance on gas-based generation is apparent both in terms of capacity and generation mix. In terms of capacity, gas-based plants will be even higher at 51% followed by MFO and diesel-based plants at 40%, hydroelectric at 6% and biomass-based plants at 3%. For the generation mix recorded in 2013, gas based generation had the highest share of 67%, followed by MFO and diesel at 21%, hydro at 8% and biomass at 4%. Details of capacity mix and generation mix based on fuels are shown in the following charts:-

Figure 8: Dependable capacity mix by fuel

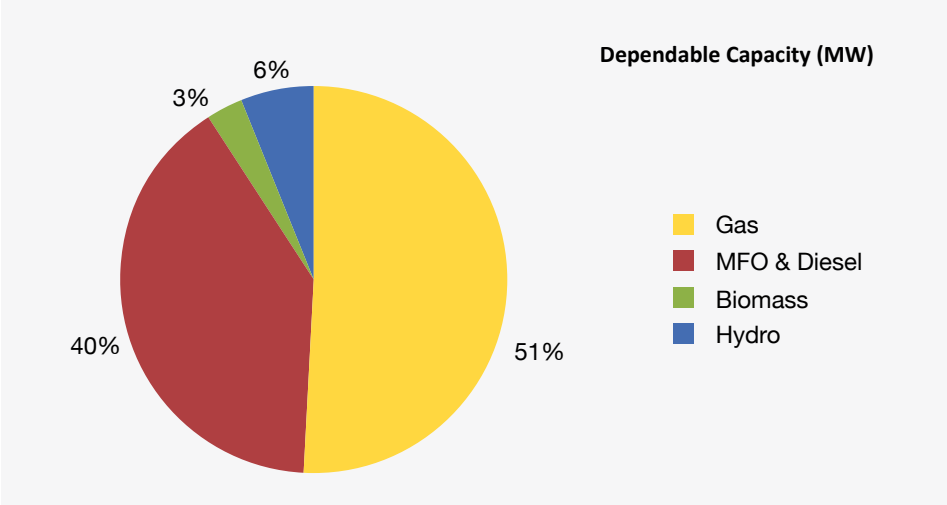
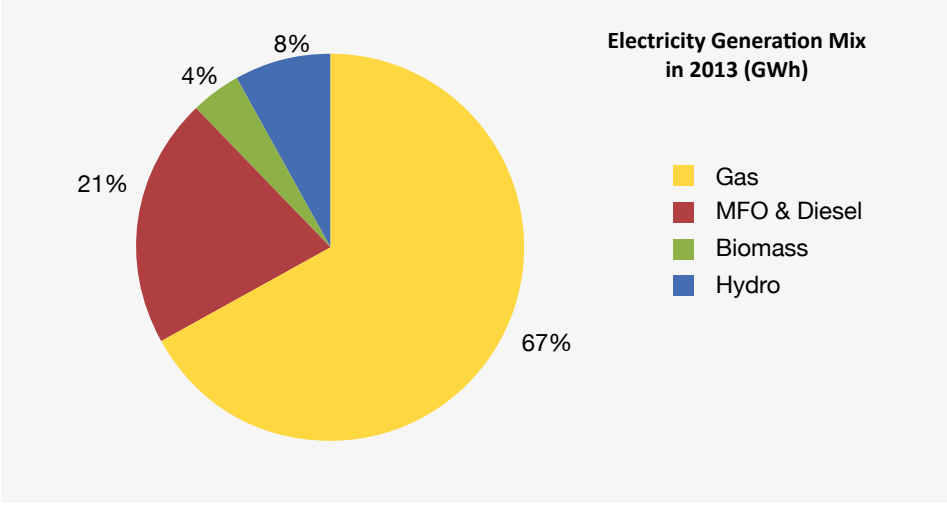


Figure 9: Generation mix by fuel



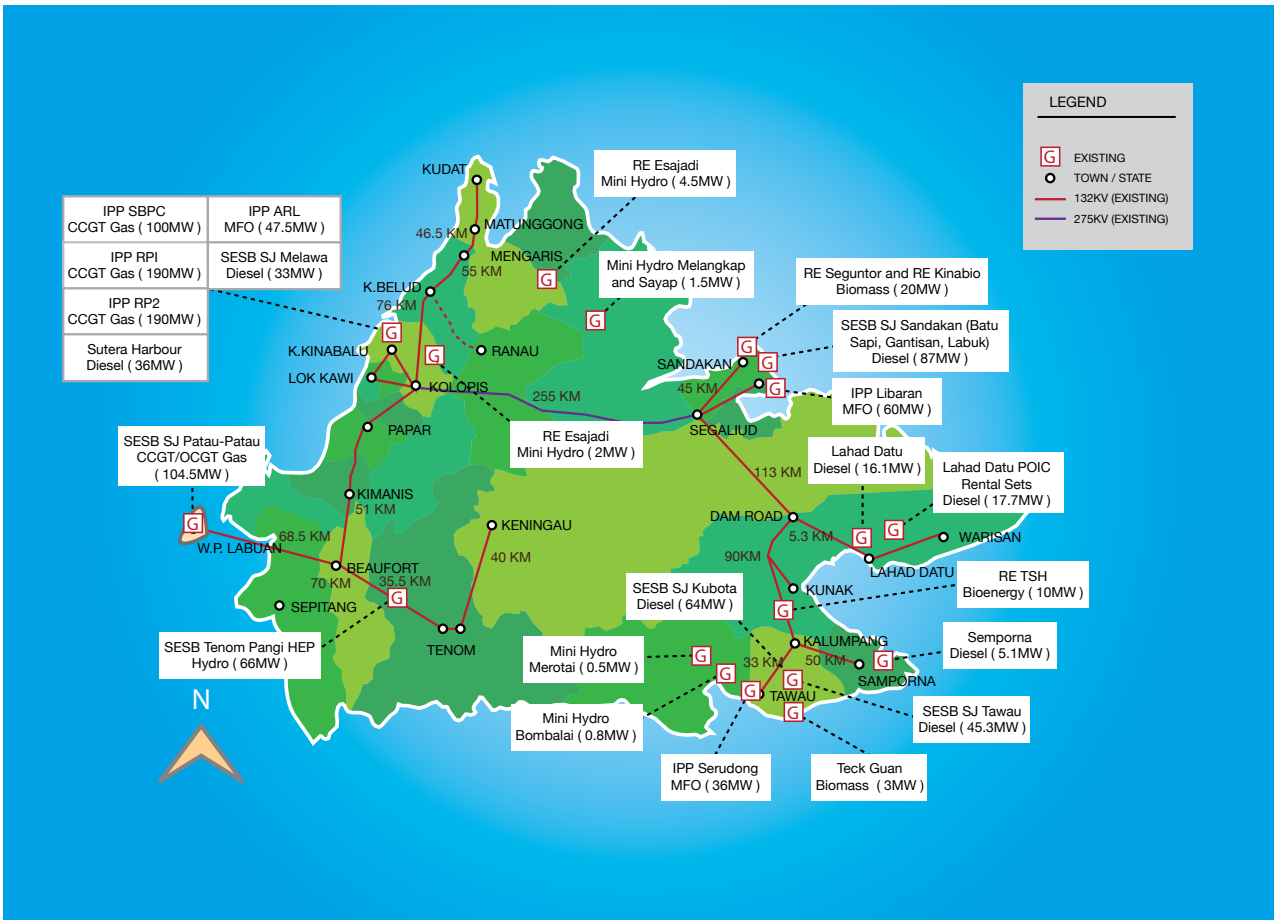
Details of the on-grid power plants are as depicted below:-

Table 4: Existing plants in Sabah

No.	Plant	Dependable Capacity (MW)	Owner / Fuel	Commissioning Year	Retirement Date/Year
1	ARL Power	47.5	IPP/Diesel	1996	Oct 2016
2	Melawa	33	SESB/Diesel	1992	DG1,2,3= Dec 2014 (15MW) GTM (Relocate to Sandakan) = Dec 2018 (18MW)
3	Teluk Salut / Ranhill Powertron	190	IPP/Gas	1998	Oct 2029
4	Rugading/ Ranhill Powertron II	199	IPP/Gas	2010	Sept 2032
5	Sepanggar Bay Power Corporation	105	IPP/Gas	2006	May 2029
6	Patau-Patau	104.5	SESB/Gas	1992	-
7	Tenom Pangi	66	SESB/Hydro	1984	-
8	Tawau Power Station	45.3	SESB/Diesel	1984	DG3B, 4B,5B,6B & GT1 = Dec 2014 (27MW) GT2= Dec 2018 (17MW)
9	Serudong Power	36	IPP/ MFO	1996	Dec 2018
10	TSH Bioenergy	10	IPP/Biomass	2004	2028
11	Gantisan	34	SESB/MFO	1996	Dec 2016
12	Libaran/ Stratavest	60	IPP/MFO	1998	Dec 2019
13	Batu Sapi	31	SESB/Diesel	1991	DG8 & 9=Dec 2014 (11MW) DG10 & 11=Dec 2016 (20MW)
14	Batu Sapi Rehab	20	SESB/Diesel	2013	Dec 2015

15	Labuk	3.5	SESB/Diesel	1997	Dec 2014
16	Sandakan Power Corporation	32	IPP/MFO	1999	Ceased Operation on 31st Dec 2011
17	Kina Biopower	10	RE/Biomass	2009	2028
18	Seguntor Bioenergy	10	RE/Biomass	2009	2028
19	Mobile Sets – Pasir Putih, Sim-Sim, POIC Lahad Datu, Labuk, Melawa	67.42	SESB/Diesel	2009	Dec 2014
20	Sutera Harbour	36	IPP/Diesel	1998	2014 (Ceased lisence -1st Oct 2013)
21	Lahad Datu	16.1	SESB/Diesel	1997	Dec 2014
22	ESAJADI Sg.Kadamaian	2	RE/Mini Hydro	2009	2028
23	ESAJADI Sg.Pangapuyan	4.5	RE/Mini Hydro	2011	2028
24	Melangkap and Sayap	1.5	RE/Mini Hydro	1990/1991	-
25	Kudat	2.5	SESB/Diesel	1987/1996	Dec 2014
26	Kota Belud	0.7	SESB/Diesel	1994	Dec 2014
27	Kota Marudu	0.7	SESB/Diesel	1996	Dec 2014
28	Teck Guan	3.0	RE/Biomass EFB	2011	-
29	Semporna	5.1	SESB/Diesel	1995/1996	Dec 2014
30	Kubota	64	SESB/Diesel	2013	2023
Total Dependable Capacity (Without Sutera Harbour and SPC)			**1,172.3 MW**		

Figure 10: Existing power plants in Sabah



Power Plants Performance

Thermal efficiencies for IPP power plants were generally better compared to SESB power plants. Similarly, availabilities of power plants operated by SESB measured through equivalent availability factor (EAF) were lower compared to power plants operated by IPPs. This is due to the fact that most of IPPs in Sabah, particularly the gas based combined cycle power plants (CCGT) are relatively new and more efficient compared to SESB-owned power plants which mostly consists of ageing diesel-fired plants, which have been in operation for more than 20 years.

However, closer examination of EAF for the IPPs according to plant type reveals polarising performance between CCGT and Diesel power plants. While EAF for CCGT plants was more than 90%, Diesel plants recorded much lower EAF at an average of 71%. In addition to plants age, technical problems due to operational regime, fuel and parts obsolescence contributed to decaying performance of these plants.

For SESB, lower EAF was recorded with CCGT and diesel plants at 77% and 63% respectively attributed to the age factor and frequent breakdown as well as maintenance activities. Meanwhile, hydroelectric plants reached higher EAF at 89% due to consistent water flow and good technical conditions.

Table 5: Sabah's power plant performance in 2013

Plant Type	Average Thermal Efficiency (%)		EAF (%)		EUOF (%)	
	SESB	IPP	SESB	IPP	SESB	IPP
Combined Cycle	25	39	77	77	6	4
Diesel	21	35	63	71	28	29
Hydro	-	-	89	-	2	-

Figure 11: Plants efficiency (%) of Sabah's power plant

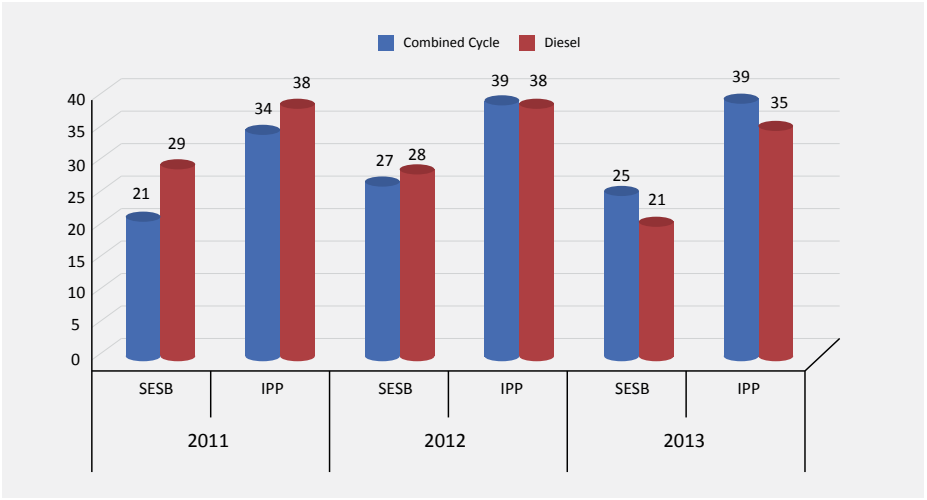


Figure 12: Equivalent unplanned outage rate (%) of Sabah's power plant

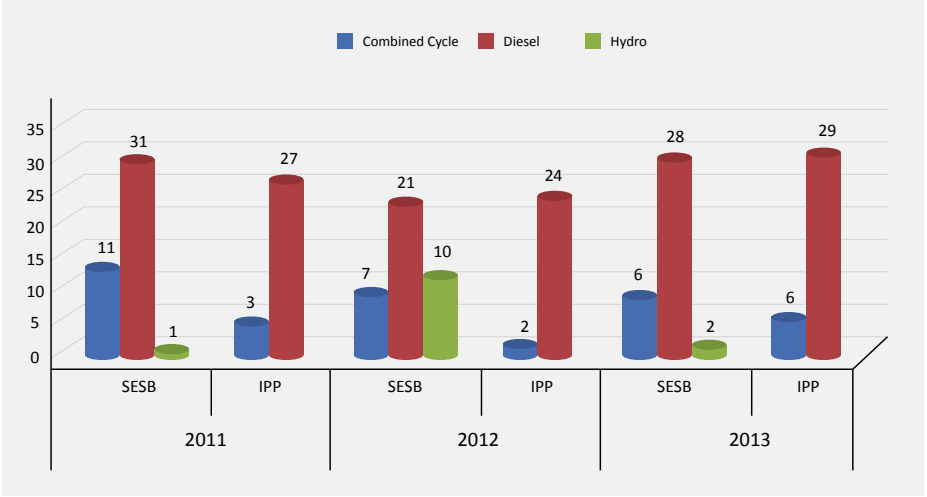


Figure 13: Equivalent availability factor (%) of Sabah's power plant

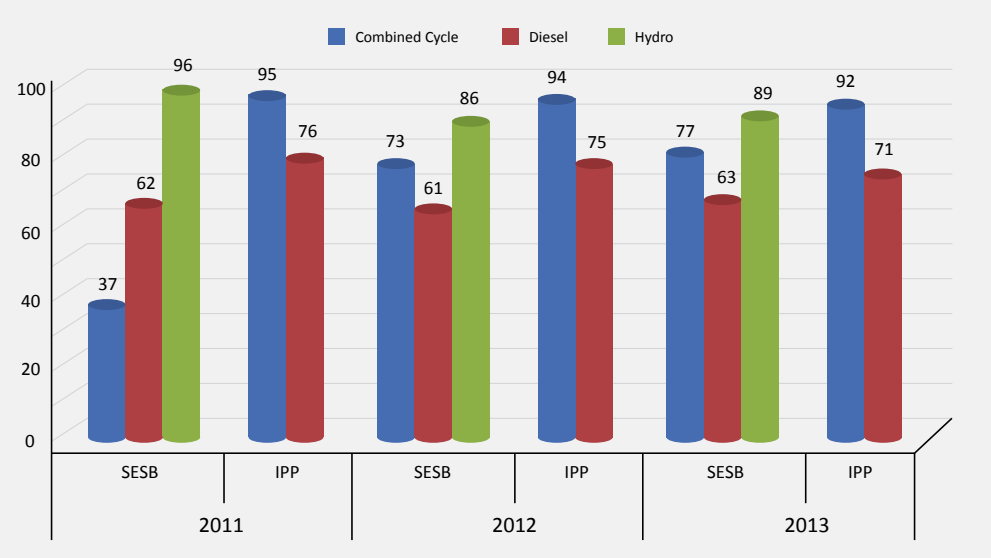
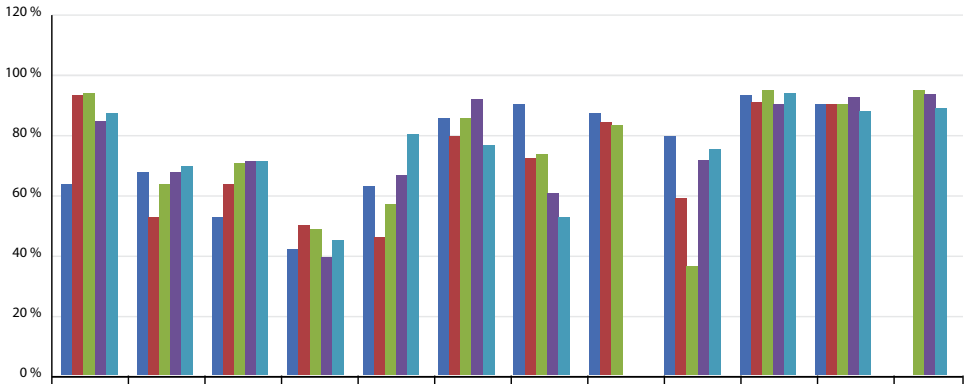


Figure 14: Average annual availability for major power stations in Sabah



	Tenom Pangi	Melawa	Tawau	Sandakan	ARL Power	Serudong	Stratavest	SPC	Patau-Patau	SBPC	Ranhill I	Ranhill II
2009	65%	69%	54%	43%	64%	87%	92%	89%	81%	95%	92%	0%
2010	95%	54%	65%	51%	47%	81%	74%	86%	60%	93%	92%	0%
2011	96%	65%	72%	50%	58%	87%	75%	85%	37%	97%	92%	97%
2012	86%	69%	73%	40%	68%	94%	62%	0%	73%	92%	94%	96%
2013	89%	71%	73%	46%	82%	78%	54%	0%	77%	96%	90%	91%

System Average Interruption Duration Index (SAIDI)

System Average Interruption Duration Index (SAIDI) is a reliability indicator used by power utilities to measure the average outage duration experienced by each customer in a year. The Ministry of Energy, Green Technology and Water (KeTTHA) has set overall SAIDI target for Sabah of not more than 450 minutes/customer/year for 2013, a reduction of more than 19% from 557 minutes/customer/year recorded in 2012. Various initiatives were implemented in order to achieve the target, such as adding more generation capacity in the system, improving network protection and defence mechanism and devising mechanism for faster supply restoration. With more coordinated and focused efforts by all parties especially SESB, SAIDI for 2013 was reduced by 24% to 424 minutes/customer/year. For 2014, a target of 350 minutes/customer/year is set as the supply system in Sabah is working towards achieving performance on par with Peninsula.

Figure 15: Progressive improvement for SAIDI

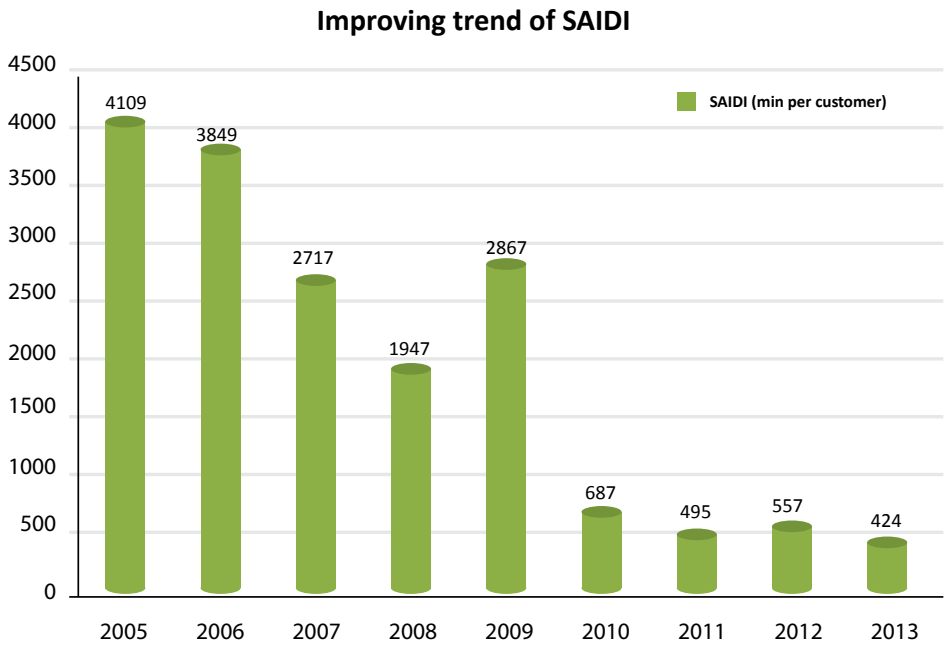
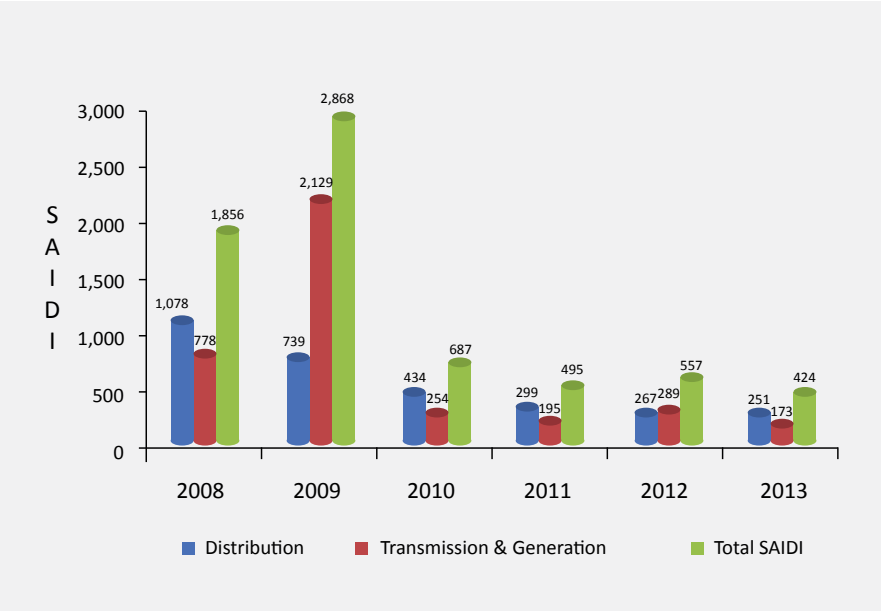


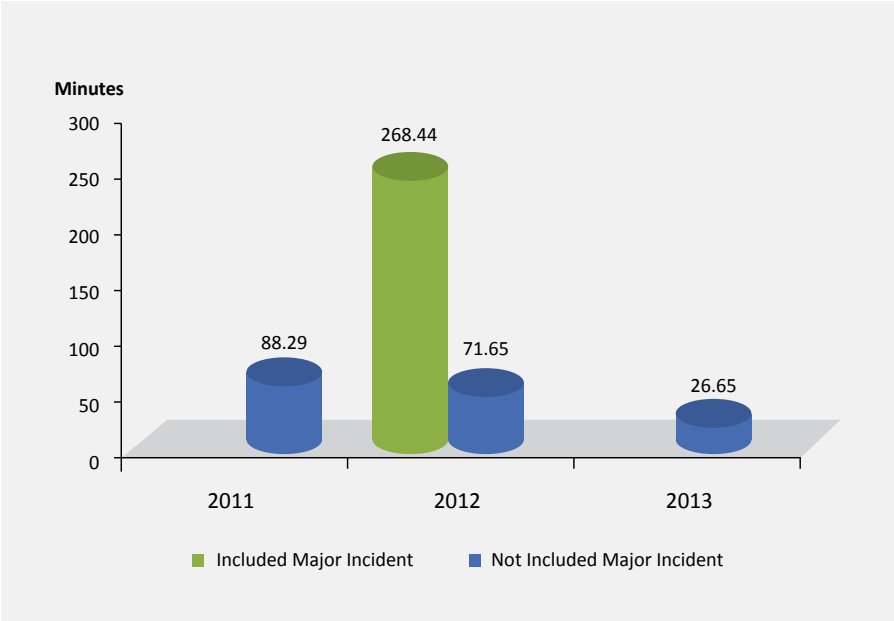
Figure 16: Breakdown of Sabah SAIDI (minute/customer/year) for year 2008 to 2013



System Minute/Delivery Point Unavailability Index (DePUI)

System minute or Delivery Point Unavailability Index (DePUI) is the unreliability index to relatively measure energy not served to customers, in terms of duration of total system wide blackout. One system minute indicates an equivalent interruption of total system for 1 minutes at the time of annual system peak. System minutes of the grid system in Sabah in 2013 decreased by 62.8% to 26.65 minutes from 71.65 minutes in 2012 (excluding major incidents). Reduction in system minutes reflects the improved performance of SESB and in line with the 2013 target of not more than 25 minutes. Factors contributing to the improved performance were development of new injection points such as PPU Labuk and PPU Menumbok and construction of additional conductor lines to the distribution substations that was previously served by only one line.

Figure 17: Sabah system minutes (DePUI)



In 2013, there were several tripping incidents for Sabah grid system which caused a loss of load of 50MW and above. The largest incident took place on August 9, 2013 with a loss of load of 59.79MW, and the amount of unsupplied energy of 3,758.06MW/min. This single incident had contributed 4.30 minutes to the system minutes in 2013.

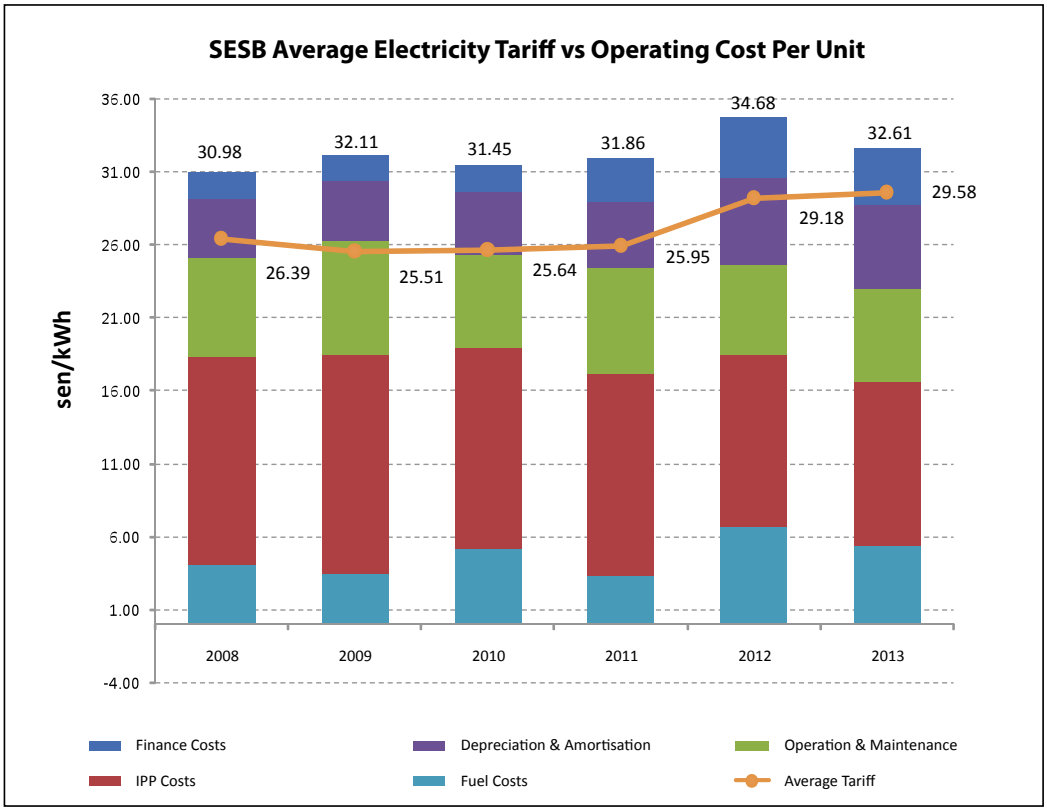
Financial Performance

Financial Performance of SESB

SESB commenced operation on 1st September 1998 and ended the first financial year on 31st August 1999. Since inception, SESB recorded negative cash flow from operation even though there were gradual increases in revenue every year. With compounded annual growth rate for revenue of 12.44% from financial year (FY) 2008 to 2013, SESB's revenue increased every year and rose to RM1.43 billion in FY 2013. The revenue increased to 3.7% compared to last year (FY 2012), was due to demand growth as well as the average electricity tariff increased in July 2011.

During the previous tariff revision in July 2011, the average electricity tariff of 29.52 sen/kWh, is only able to cover 80% of SESB's operation costs and does not reflect SESB's true cost of electricity generation, which is 43.46 sen/kWh. SESB's low electricity tariff has constrained efforts to improve the quality of electricity supply in Sabah.

Figure 18: Comparison of SESB's average electricity tariff and subsidised operating cost per unit (sen/kWh)



Based on current audited financial report, in FY 2013, SESB's sales of electricity grew by 6.2% to reach RM1.37 billion compared to RM1.29 billion in the previous financial year. Total unit sold amounted to 4,635GWh in FY 2013 compared with 4,428GWh in FY 2012.

SESB's operating expenditure, however, decreased marginally from RM1,352 million in FY 2012 (restated) to RM1,337 million. SESB received substantial diesel and medium fuel subsidies from the Malaysian Government, the amount presented being the net total subsidy.

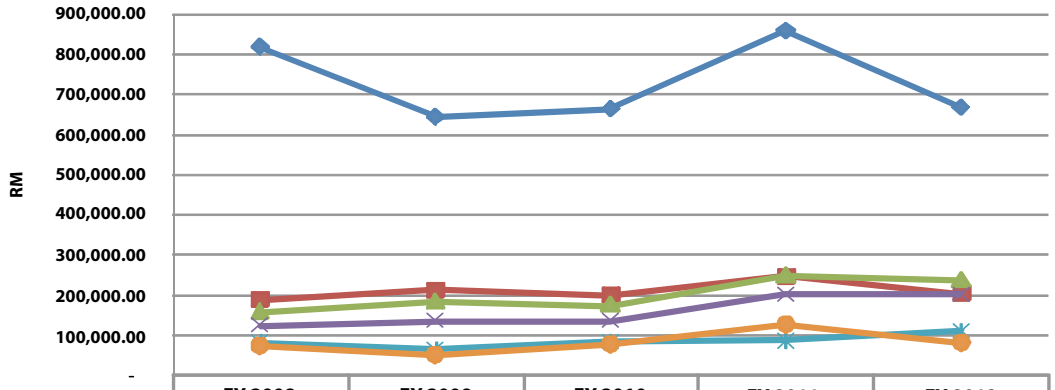
Total profit for FY 2013 stood at RM13.86 million, while total finance costs and foreign exchange losses amounted to RM174.3 million compared to RM181.34 million in FY 2012. This is due to the fuel subsidy for FY 2012 being claimed in FY 2013 amounting RM32.0 million.

In FY 2013, SESB's subsidized operating cost per unit (CPU) was at 32.61 sen/kWh and the average tariff was at 29.58 sen/kWh. Meanwhile, the operating CPU without fuel subsidies was at 48.47 sen/kWh.

Financial Performance of IPP

Collectively, revenue for the existing operating IPPs in Sabah was at RM667 million in 2012, reduced from RM856 million in 2011. Subsequently, decrease in revenue resulted to decrease in net profit from RM127 million in 2011 to RM82 million in 2012.

Figure 19: Profitability of IPPs in Sabah



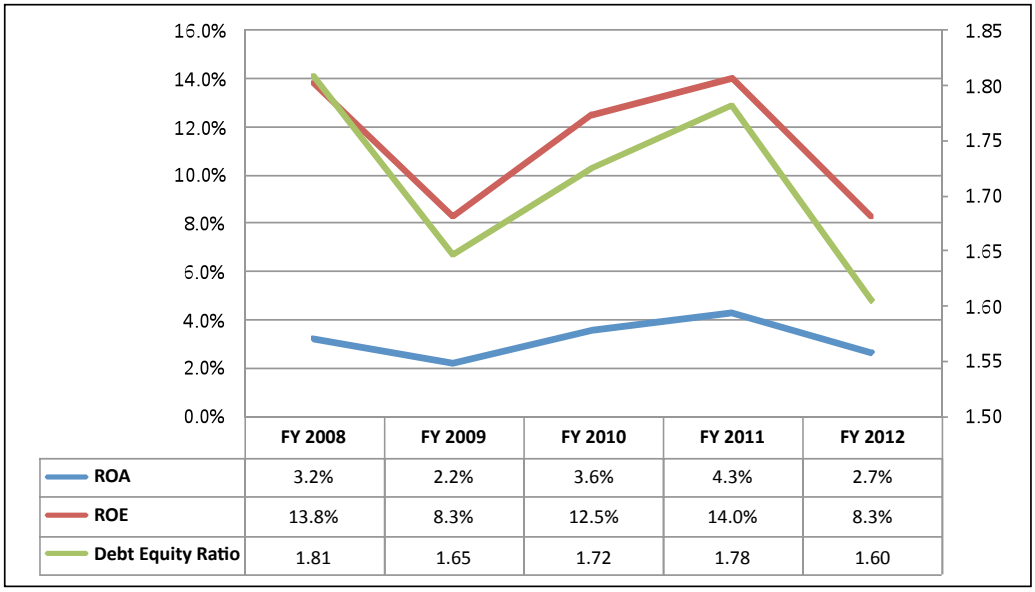
	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Revenue	816,921.20	644,061.07	644,713.87	856,875.03	667,786.40
Gross Profit	189,264.61	213,735.48	199,726.40	247,857.81	205,246.32
EBITDA	158,722.06	183,438.93	175,506.04	249,952.78	237,106.60
EBIT	124,509.86	135,516.40	135,582.50	201,621.89	201,636.34
Profit before tax	82,569.26	66,166.21	83,337.85	86,840.23	110,183.89
Profit for the financial year	74.037.55	51,121.52	78,181.82	127,317.99	82,269.08

Return on Assets (ROA) is an indicator of asset utilisation in order to generate returns. Higher ratios generally indicate better ability in converting investment into profit. ROA for IPPs in Sabah is showing a downward trend, where it fell to 2.7% in 2012 from 3.2% in 2008.

Return on Equity (ROE) measures how well a company used business equity to generate profits. A high ROE number directly translates into strong company growth. However, ROE for IPPs in Sabah is decreasing to 8.3% in 2012 from 13.8% in 2008.

Debt to Equity (DE) Ratio is a measure of the company's financial leverage or indebtedness by comparing what is owed to what is owned. Generally, ratios of higher than 1 indicate more risk in financing assets. Debt to Equity Ratio for IPPs in Sabah decreased to 1.60 in 2012 from 1.81 in 2008.

Figure 20: ROA, ROE & DE ratio of IPP in Sabah



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
ROA	3.2%	2.2%	3.6%	4.3%	2.7%
ROE	13.8%	8.3%	12.5%	14.0%	8.3%
Debt Equity Ratio	1.81	1.65	1.72	1.78	1.60

Fuel Price Movement

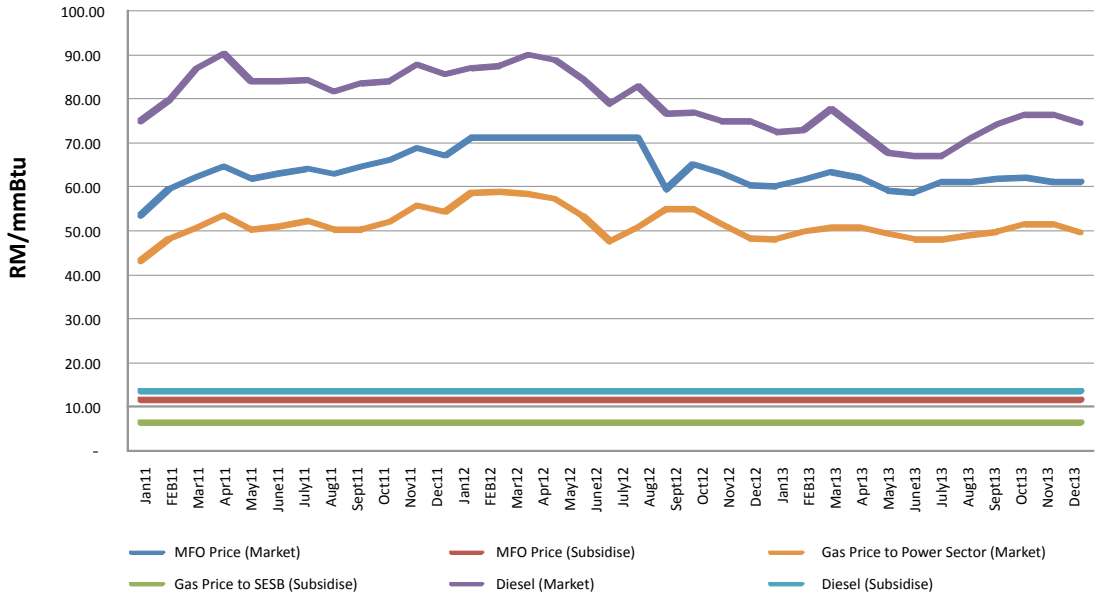
Electricity generation in Sabah is fuelled mostly by gas (67%) followed by MFO & diesel (21%), hydroelectric (8%) and biomass wastes (4%). The piped gas price for power sector in Sabah is controlled at RM6.40/mmBtu compared to the price for power sector in Peninsula, which recently increased from RM13.70/mmBtu to RM15.20/mmBtu. Based on prevailing market price as published by Statistic Department, the gas price is still markedly below the market price and itself represent an indirect subsidy to the customers.

The Federal Government will continue to subsidise the MFO price in excess of RM0.42/litre and diesel price in excess of RM0.495/litre. Currently the average market price for MFO and diesel is RM2.30/litre and RM2.44/litre. Based on the current situation, even with such assistance, SESB's operating cost per unit is still higher at of 32.61 sen/kWh with fuel subsidy and 48.47 sen/kWh without fuel subsidy, as compared to the average electricity tariff of 29.52 sen/kWh which approved in July 2011.

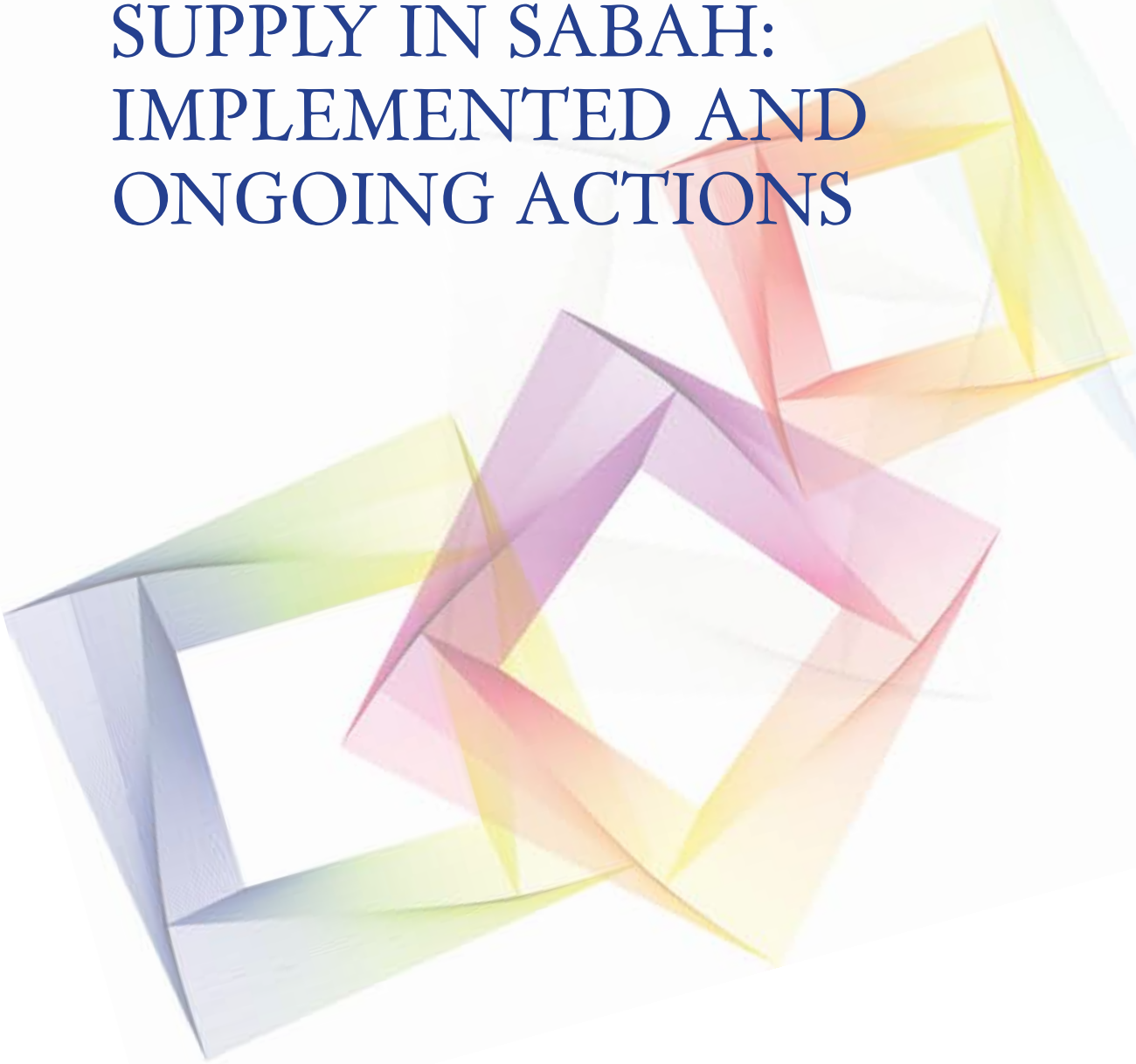
Going forward, as the Government mulls over the possibility of having regassification terminal to supply LNG to power plant in the East Coast, generation cost will reduce slightly as utilisation of LNG will offset the higher cost of MFO and diesel. While cheaper than MFO or diesel, with indicative price of more than RM45/mmBtu, LNG usage still requires long term support in terms of fuel subsidy as generation cost is higher than electricity selling price. LNG price is relatively more expensive as it includes liquefaction, freight, regassification process costs as well as capital cost for the construction of receiving terminal.

However, the Government is also exploring the possibility of gas pipeline connecting from Kota Kinabalu to Sandakan in lieu of LNG regassification terminal in POIC Lahad Datu. To construct the pipeline, various factors need to be considered such as higher capital expenditure (CAPEX), fuel price, lead time required due to the land acquisition issues (way leave, location, terrain and so forth) as well as long term tariff support from the Government to make this project viable.

Figure 21: Comparison of various fuel prices



ACTION PLAN TO ENHANCE THE RELIABILITY OF SUPPLY IN SABAH: IMPLEMENTED AND ONGOING ACTIONS



ACTION PLAN TO ENHANCE THE RELIABILITY OF SUPPLY IN SABAH: IMPLEMENTED AND ONGOING ACTIONS

Introduction

After 15 years of privatisation, electricity supply coverage improved tremendously as the two previously isolated systems in West and East Coast was interconnected in May 2007. Enhanced supply coverage resulted in demand increase, both in terms of number of customers and energy requirement, as areas previously isolated were connected to the main grid. The system became more stable as power can be transferred from west to east and vice versa.

However, improvisation of electricity supply coverage and delivery did not translate to more profit to SESB. In fact, financially SESB is getting worse as a business entity as the company is still unable to recover much of its operation costs through tariff. For 25 years starting from 1986, SESB was denied tariff revision despite fuel and maintenance costs increase over the years. The tariff was only increase in July 2011 by 15% and again 16.9% starting from January 2014. Based on the LLS privatisation agreement in 1998, it was agreed that the tariff was to be increased by 28% in 1999, 20% in 2004 and 3.58% in 2008.

While west coast plants are primarily driven by natural gas, east coast on the other hand continues to rely on oil and diesel as main fuels. To help bridge the revenue gap due to higher oil price and inadequate tariff level, SESB was and is still getting subsidy on MFO and diesel fuels from Federal Government.

Simply put, SESB will be technically insolvent without assistances as the company is unable to generate sufficient operating profits to meet its capital requirements. The main reason is inadequate tariff to cover operating expenses as the current tariff rates do not reflect the basic operating costs. Based on the current situation, there is imbalance/ mismatch between the revenue and the cost structure i.e. average tariff of 29.52 sen/kWh (tariff revision in July 2011) versus the actual cost per unit in FY 2013 (without fuel subsidies) of 48.47 sen/kWh, resulting in a deficit margin of 18.95 sen/kWh. Apart from that, most of the transmission and distribution network development projects have to be supported by Government due to inability of SESB to raise financing for the projects through its balance sheet.

Government Fiscal Assistance

The critical role plays by SESB to ensure reliable and affordable supply of electricity cannot be understated. The utility is grappling with the problems of aging facilities, years of under investment and financial difficulty, while at the same time is not only required to serve existing demands, but also planning and executing projects to meet future requirements. Recognising the constraints faced by SESB, Government through various ministries are channelling development funds and operational assistance to help SESB to move forward with the plan.

This funding or substantial financial support by Government through Malaysia Plan (RMK) can be seen in terms of Government grant and soft loans which might help in a way to reduce the power outages and also to upgrade the electricity supply infrastructures in Sabah. Various projects were implemented using fund from the Government such as enhance generation capacity, upgrading and enhancing the reliability of transmission and distribution system by building more new transmission lines and create more sources of injection points i.e. Transmission Main Intake Station and Main Switching Station.

The Government allocated RM573.5 million in the form of financial assistance to SESB from year 2009 until 2012. The impact from the investment was obvious as SAIDI reduced from a whooping 2,868 minutes in 2009 to 557 minutes in 2012. In addition, Government also allocated fuel subsidies (diesel and MFO) to SESB amounting of RM2,573 million from 2008 to 2012.

Assistance to SESB continues for 2013 and 2014 as the Government approved additional allocation of RM230.6 million meant for SAIDI projects, upgrading works of Patau-Patau Power Station and construction of new Main Distribution Substation in Labuan. This is in line with the objective of reducing overall SAIDI to 450 minutes (target) in 2013 and further down to 350 minutes in 2014. As long as generation fuel mix remains unchanged, fuel subsidy will continue to feature as one of critical elements in ensuring continuity of electricity supply by SESB to consumers.

Apart from that, SESB also received soft loans from Government for upgrading and maintenance works of installations with the objective to reduce power outages rate. For RMK-8 and RMK-9, an amount of RM1,530.9 million was allocated to SESB whereas for the RMK-10, RM1,017.1 million with the bulk of allocation is meant for the implementation of 275kV Southern Link transmission line project.

Table 6: Impact of grants allocated to system performance (2009-2015)

Year	Total SAIDI Grant (RM Million)	SAIDI Performance (Minutes)
2009	186.90	2,868
2010	133.00	687
2011	156.00	495
2012	97.60	557
2013	117.80	428
2014	112.80	-
2015	131.00	-
Total	**822.30**	

Table 7: Disbursement of loan under Malaysia Plans

Soft Loan	
RMK-8	RM728.0 million
RMK-9	RM802.9 million
RMK-10 RP1-RP3 (2011-2014)	RM321.8 million
RMK-10 RP3-RP4 (2014-2015)	RM695.3 million
Total	**RM2,548.0 million**

Figure 22: Summary of financial assistance to SESB (2009-2015)

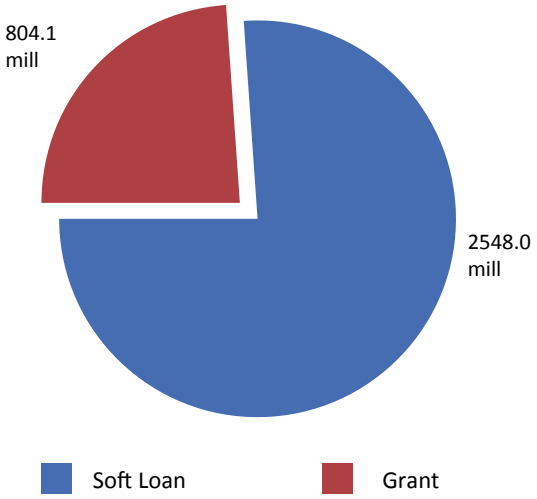


Figure 23: Total grant given to SESB

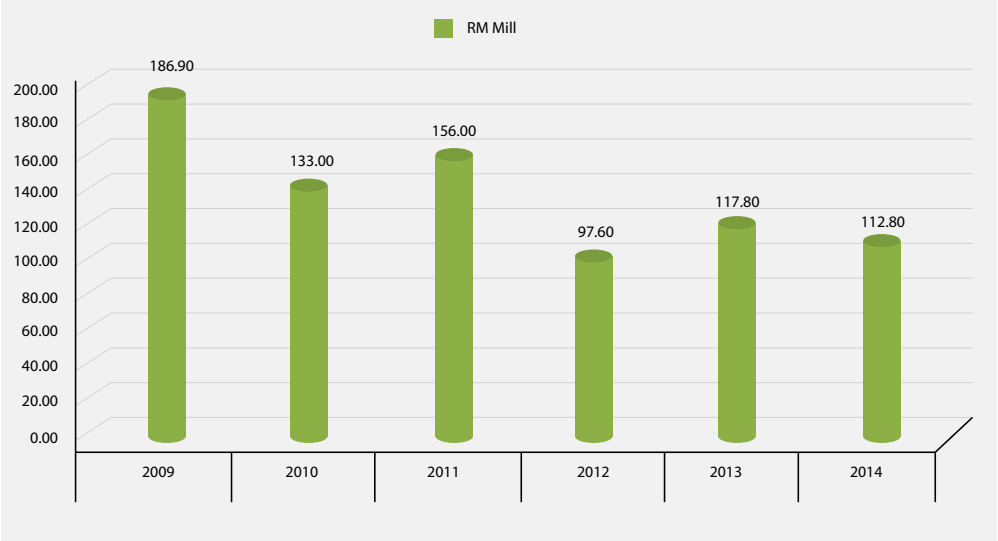


Table 8: Allocation for electricity supply projects in Sabah

Financial Assistant to SESB	
Soft Loan	
RMK 8	RM728.0 million
RMK 9	RM802.9 million
RMK 10 RP1-RP3 (2011-2014)	RM321.8 million
RMK 10 RP3-RP4 (2014-2015)	RM695.3 million
TOTAL	**RM2,548.0 million**
Grant	
PRE (2009)	RM160.90 million (Gen Set: RM100 million) (East West Grid: RM60.9 million)
Emergency Grant (2009)	RM26 million – Gen Set: 20MW (Melawa and Tg. Aru)
SAIDI 700 (2010)	RM133.0 million
SAIDI 477 (2011)	RM156.0 million
SAIDI 367 (2012)	RM97.6 million
SAIDI Fasa 2 (2013-2014)	RM169.0 million
Upgrading SJ Patau-Patau and build a new PMU in Labuan	RM61.6 million
TOTAL	**RM804.1 million**
TOTAL (Soft Loan & Grant)	**RM3,352.1 million**

The financial assistance from the Government is expected to continue for the foreseeable future without intervention especially to the existing generation portfolio. As the system getting bigger in the future, such assistance will be more costly and ultimately not sustainable. Therefore, any remedial solutions will have to consider long term operational viability and sustainability of SESB, the affordability of the people of Sabah particularly in trying to reduce subsidies and increasing the tariff, the ability of the Government to source for enough funds and its impact on the overall national economy, as well as factors such as environmental protection and potential impact to population livelihood.

Initiatives for Improvement of Electricity Supply in Sabah

Due to distinct issues faced in the electricity supply system in Sabah, any plan must take into account the short, medium and long term solutions.

Short Term

The immediate concern for Government and SESB is to make available to the system more reliable generation units. After years of unreliable supply, customers' confidence must be restored by providing them with more stable supply of electricity. To that, following generation projects were implemented:

Table 9: New generation project

No.	Project	Capacity (MW)	Year
1.	Batu Sapi GT Rehabilitation	20	2013
2.	Kubota	64	2013
3.	SPR	100	2014
4.	Kimanis	285	2014
5.	Cash Horse	10	2014
Total (MW)		**479**	

The unreliability problem was not limited to generation sector alone, as the transmission and distribution network in general were also underperformed. Therefore, robust protection and defence mechanisms have to be in place so that large scale disturbance or total system blackout can be avoided and faster supply restoration can be conducted to the affected areas.

Under the immediate mitigation measures jointly reviewed by SESB and TNB, scheme such as automatic Under Frequency Load Shedding is being reassessed as it is the only system defence against severe loss of generation. Reconfiguration exercises especially to the sub-transmission network are also being considered to allow for better control, protection operation and coordination while reducing risk of cascading tripping. At lower voltage level, protection scheme for the distribution feeders is also being reviewed.

Medium Term

Assistance in terms fuel subsidy will further reduced with expiration of Power Purchase Agreements for the first generation IPPs in 2016-2020. To replace the expiring capacities, development of a new combined cycle gas turbines plant by Eastern Sabah Power Consortium (ESPC), is planned to be built in Lahad Datu for operation starting from 2017. Discussion is still ongoing on the LNG price to be charged to the project. However, the project is currently under review due to uncertainty surrounding the project particularly on the LNG price, the electricity selling price to the off-taker and assistance from the Government. The Government is now exploring the possibility of constructing gas pipeline from Kota Kinabalu to Sandakan.

Implementation of Upper Padas Hydroelectric Project for operation beyond year 2020 will alleviate system dependency on gas. Also, this project provides more competitive energy cost and operational flexibility as the generators are designed to meet intermediate and peaking requirements. With commencement of Feed-in-Tariff mechanism in 2014, development of renewable energy power plants are expected to intensify and further strengthen the already significant RE presence in terms of fuel mix.

In terms of network operation, as new generators and lines will be added to the existing system, review on voltage control, reactive compensation and defence scheme is required to enable safe and effective control and to address risks such as aging equipment, regional supply-demand balance and generation loss.

Long Term

The focus for now is to increase reliable and cost-efficient generation capacities so that retirement of older, unreliable diesel and oil generating units can be done in stages. While system load factor is considerably lower as compared to Peninsula, the urgent need for reliable and cheaper generating units resulted in the system having plenty of base load gas plants. Thus, development of intermediate and peaking generation capacities will be the focus beyond year 2020.

The sources of these new capacities are targeted to come from:

1. Development of hydroelectric potentials in Sabah
2. Power transfer from Sarawak and Kalimantan
3. Development of renewable energy plants

The need to further strengthen the transmission network in anticipation of future demand growth and higher inter-regions power transfer remains. Implementation of 275kV Southern Link connecting Sipitang and Tawau will pave the way for interconnection with northern part of Sarawak, subsequently will make interconnection with Sarawak main grid and Brunei possible.

In the long run, remaining potential from Padas or nearby river basins and possible power transfer from Northern Sarawak and neighbouring countries and vice versa can then be realised. On the east coast, North Kalimantan is still relatively under developed at the moment and could benefit from sharing of reserve cost with Sabah.

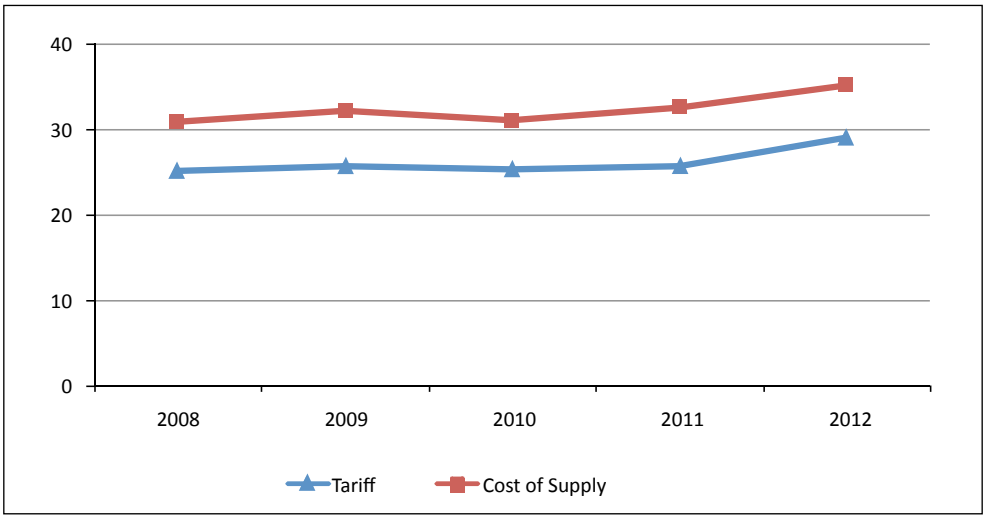
SESB Turnaround Plan

The electricity supply problem in Sabah is well documented. After 15 years of privatisation, despite all efforts over the years, the supply problems still persist since the critical issues are not satisfactorily addressed. Various studies were conducted to address the electricity supply issues. In all the studies, the main findings pointed out to:

1. Cost of supply which is higher than revenue generated from operation
2. Unreliable generation capacities
3. Transmission and distribution networks are not robust enough

In spite of recent tariff revision and financial support already meted out by Government totalling RM5.34 billion, SESB will still depends on financial assistances in order to execute the much needed transmission and distribution projects. In addition to technical assistances, TNB as the main shareholder also did their part financially with equity injection and cash advances totalling RM1.6 billion. Still, the average tariff is lower than cost of supply.

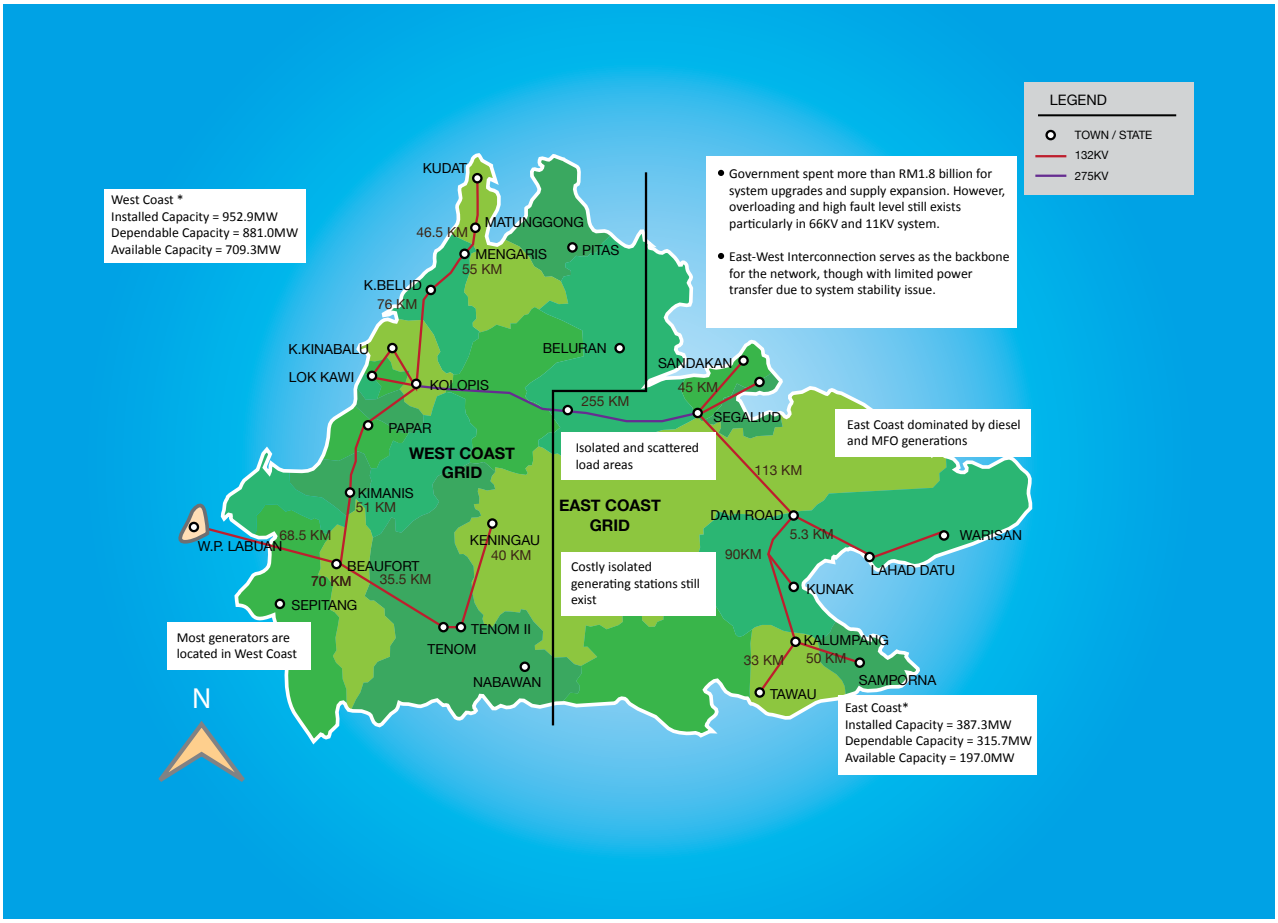
Figure 24: Comparison between average tariff and cost of supply



In terms of fuel subsidy, as long as MFO and diesel continues to play important part in energy mix, direct fuel subsidy from Government is still required together with controlled gas price at RM6.40/mmBtu. Electricity generation from MFO/diesel plants need to be reduced in order to ease commitment from Government in terms of operational assistance. For comparison, gas price in Peninsula is already increased from RM13.70/mmBtu to RM15.20/mmBtu and expected to gradually reach market parity in the next few years.

Operationally, inefficient and near-obsolete generation capacities led to high cost of supply. Load shedding or demand side management are frequent due to unreliable capacities. SESB was also suffered from income losses due to illegal connections.

Figure 25: Illustration of Sabah supply infrastructure



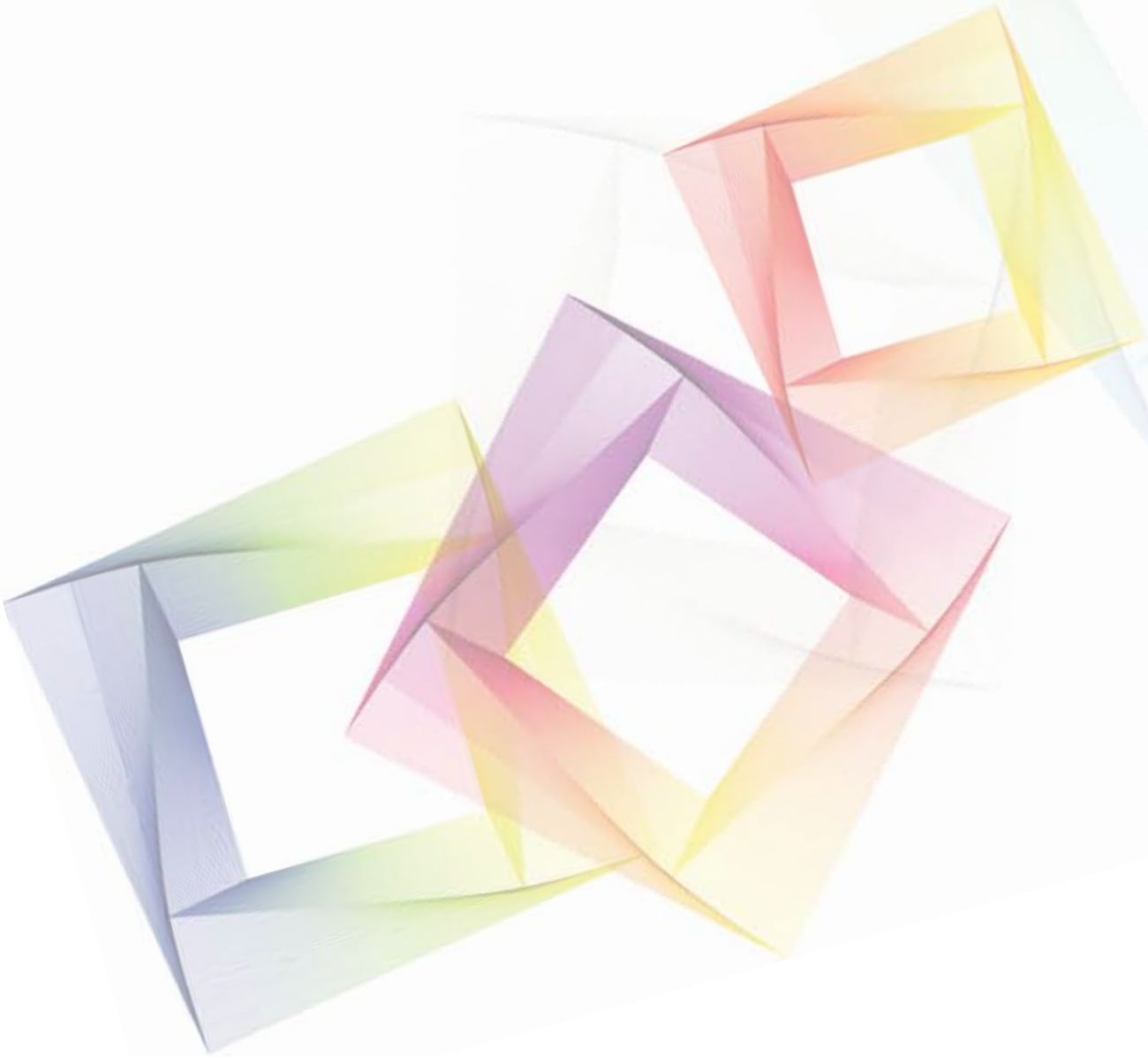
With all these issues, some of the recommendations to improve the operational and financial health of SESB, which will subsequently allowing the utility to be self-sufficient, are as follows:

1. Gradual tariff increase in order to reduce the gap with supply cost
2. Continue Government financial support especially for fuel subsidy (medium term) and networks improvement projects
3. Expedite RE development to minimise MFO/diesel subsidies
4. Implement 275kV Southern Link transmission project
5. Implement 180MW Upper Padas Hydroelectricity Project
6. Improving fuel diversity through interconnection with Sarawak or Kalimantan

TNB- SESB Planning Working Group (TSPWG)

Subsequent to the 30th April 2012 blackout, TNB has been supporting SESB to enhance its security and reliability through formation of two task force which focuses on the initiatives of 66kV system and below (Task Force No.1) and on the long term solution for the grid system (Task Force No.2). Apart from that, in the third quarter of 2013, TNB-SESB Planning Working Group (TSPWG) was formed with the objective to appraise the long term electricity supply development plan for Sabah. TSPWG is a 7 months project to review the four main aspects of planning i.e. load survey, demand forecast, generation plan and transmission plan. TSPWG membership consists of TNB personnel as well as SESB personnel with expertise in various aspects of planning. Through this project , the outcome can be a benchmarked to reaffirm and/or formulate a comprehensive long term plan for SESB.

OUTLOOK FOR 2014-2023



OUTLOOK FOR 2014-2023

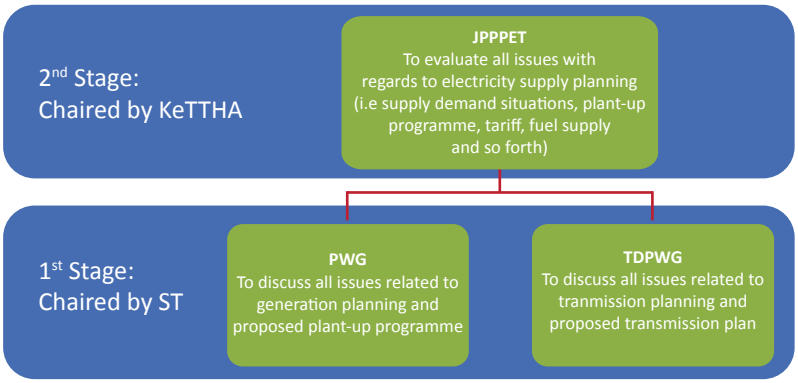
Introduction

Electricity supply planning comes under the purview Committee for the Planning and Implementation of Electricity Supply and Tariff (JPPPET), chaired by Minister of Energy, Green Technology and Water. The Committee, comprises of stakeholders as shown in the following diagram, is responsible for planning and implementing policies associated with electricity supply particularly in generation and transmission sectors.

There are two working groups namely Planning Working Group (PWG) and Transmission Development Planning Working Group (TDPWG) formed under JPPPET. Planning Working Group is responsible to prepare Generation Development Plan which is the generation planning document that will be presented to JPPPET for approval. The Plan is prepared after taking into consideration latest demand projection, planning criteria and related Government policies.

TDPWG is responsible to ensure transmission system capacity is adequate to cater for demand and generation capacity increase, network strengthening and minimising system constraint. TDPWG works to ensure transmission system development is implemented as planned and in compliance to regulatory and legal requirements. The working group is responsible to recommend to JPPPET should there be requirement for additional transmission system development.

Figure 26: Stage of planning process



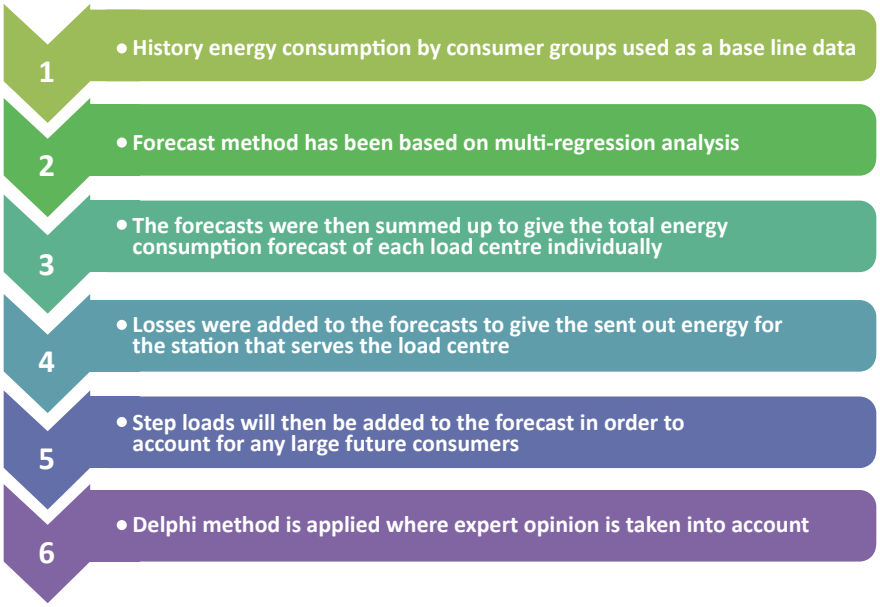
Demand Forecast

Demand forecast is prepared by the Load Forecast Unit of SESB which focus on the annual total sales, energy generation and peak demand with up to 20 years ahead projection. The forecast is conducted on annual basis and with mid-year revision, which is in line with the License Condition of SESB. This forecast is one of the main inputs to be used in the generation and transmission development plan.

There are long standing review and approval processes within SESB before the plan is table to PWG for further discussion. The PWG then will deliberate on the results of latest study by SESB before recommending for approval by JPPPET on the demand forecast to be used for generation planning.

The key input of the study is the GDP forecast. Other input parameters used are load factor, losses, electricity prices, population and energy efficiency potential. In order to prepare the load forecast, the methodology used by SESB is as follows:-

Figure 27: Load forecast methodology



Historical Demand Trending

The following charts illustrate the trend of peak demand from year 2008 to 2013. It can be seen that the growth recorded is still strong, indication of encouraging performance of overall state's economy. However, the demand is mainly driven by commercial and domestic customers while industrial consumption shrinks for two years in a row.

Generally, peak demand and highest daily energy will occur in May to October due to hot weather and economic activities' intensity. As of year 2013, the highest MD recorded was at 874.4MW on 23rd September 2013 compared to the forecasted MD of 907MW. Highest daily energy recorded was at 16,696.8MWh on 20th June 2013, an increase of 4.0% compared to highest energy recorded of 16,056.2MWh in 2012.

Figure 28: Peak demand comparison

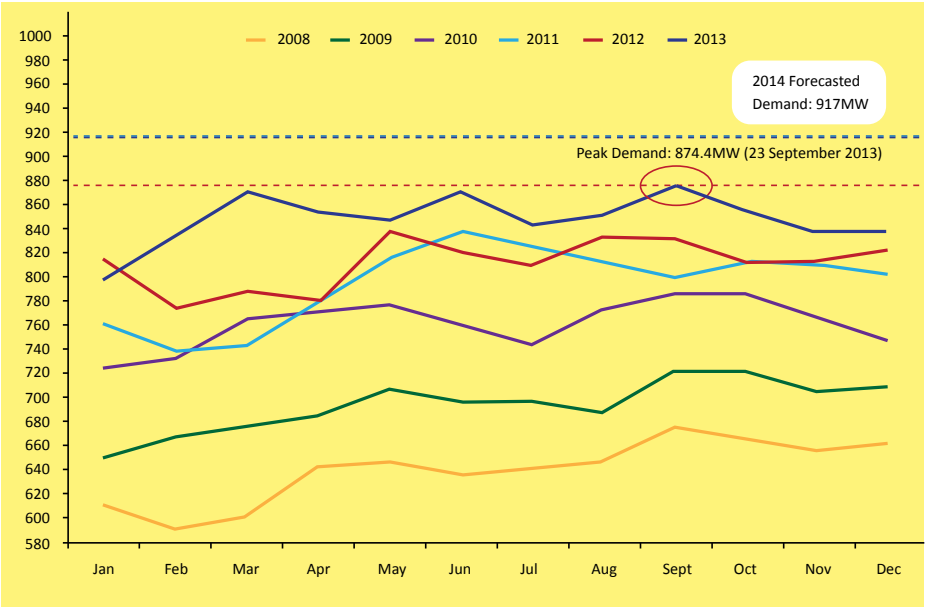


Figure 29: Sales of electricity (GWh)

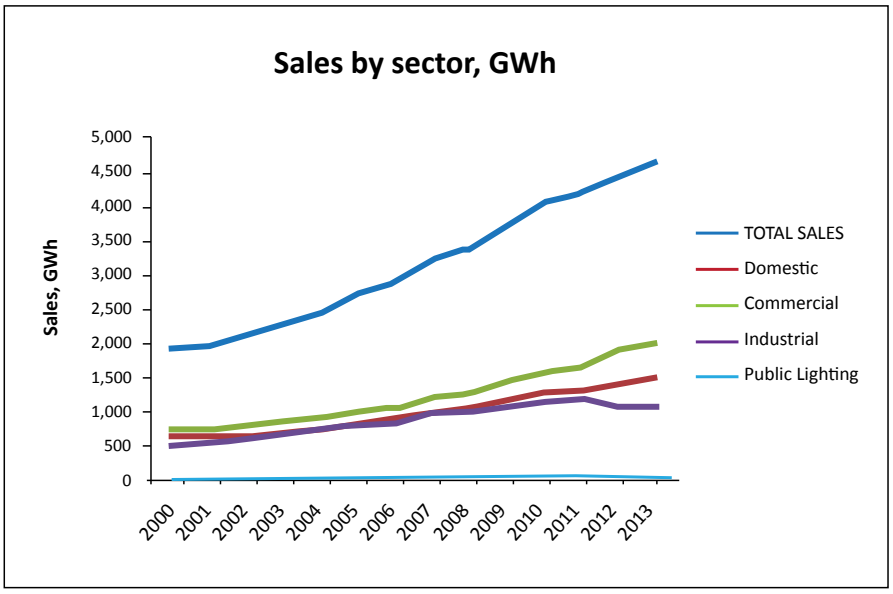
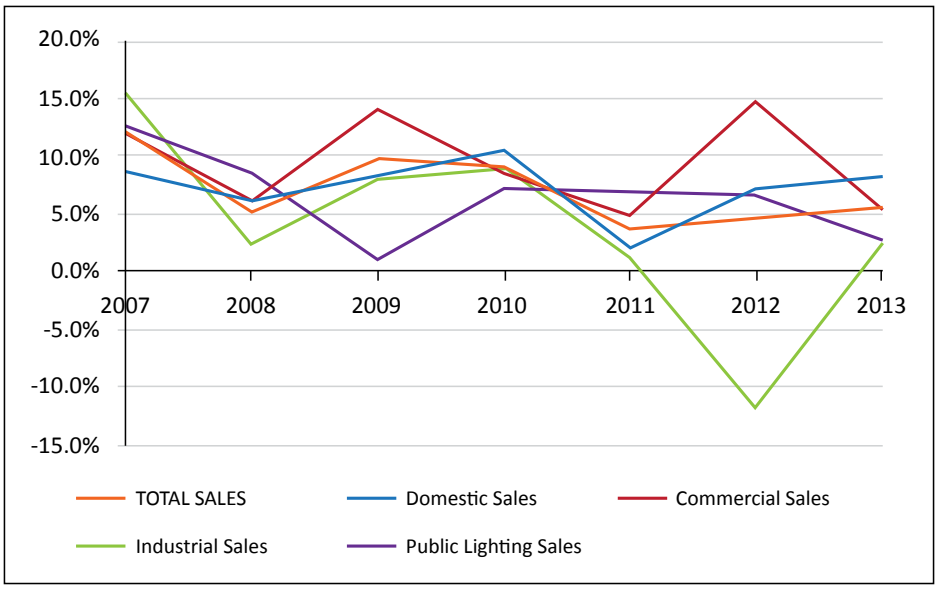


Figure 30: Growth in sales (%)



Long Term Load Forecast

Average growth recorded from 2007-2013 for sales was 6.3%. Going forward, an average electricity sales growth of 7.5% per annum (p.a.) and 6.0% is forecasted for 2014-2017 and 2018-2023 period respectively, exceeding 8,000GWh by year 2022.

Meanwhile, the electricity generation is projected to grow at the average of 6.9% p.a. and 5.7% p.a. respectively for the period of 2014-2017 and 2018-2023 compared to historical growth of 5.9% in 2007-2013.

Peak demand is also projected to grow strongly at the average of 6.9% and 5.6% for the period of 2014-2017 and 2018-2023 compared to historical growth of 6.1% in 2007-2013, surpassing 1,000MW mark in 2016 and 1,500MW in 2023.

Table 10: Long term load forecast

	Year	Sales (GWh)	Growth (%)	Generation (GWh)	Growth (%)	Peak Demand (MW)	Growth (%)	MW increase
HISTORICAL	2007	3,221	12.0%	3,908	10.1%	612	6.8%	39
	2008	3,385	5.1%	4,131	5.7%	647	5.7%	35
	2009	3,713	9.7%	4,412	6.8%	704	8.8%	57
	2010	4,051	9.1%	4,726	7.1%	773	9.8%	69
	2011	4,199	3.7%	4,940	4.5%	830	7.4%	57
	2012	4,401	4.8%	5,147	4.2%	828	-0.2%	-2
	2013	4,650	5.7%	5,506	7.0%	874	5.6%	46
FORECAST	2014	4,957	6.6%	5,831	5.9%	917	4.9%	43
	2015	5,344	7.8%	6,253	7.2%	983	7.1%	65
	2016	5,744	7.5%	6,687	6.9%	1,050	6.8%	67
	2017	6,156	7.2%	7,132	6.7%	1,119	6.6%	69
	2018	6,584	7.0%	7,593	6.5%	1,190	6.3%	71
	2019	7,028	6.7%	8,068	6.3%	1,263	6.2%	73
	2020	7,447	6.0%	8,511	5.5%	1,331	5.4%	68
	2021	7,896	6.0%	9,003	5.8%	1,407	5.7%	76
	2022	8,344	5.7%	9,492	5.4%	1,483	5.4%	76
	2023	8,812	5.6%	10,001	5.4%	1,562	5.3%	79
	2024	9,297	5.5%	10,528	5.3%	1,644	5.2%	82
	2025	9,802	5.4%	11,076	5.2%	1,728	5.2%	85
	2026	10,295	5.0%	11,612	4.8%	1,811	4.8%	83
	2027	10,803	4.9%	12,163	4.8%	1,896	4.7%	85
	2028	11,334	4.9%	12,739	4.7%	1,985	4.7%	89
	2029	11,884	4.9%	13,334	4.7%	2,077	4.6%	92
	2030	12,455	4.8%	13,951	4.6%	2,172	4.6%	95
	2031	13,021	4.5%	14,561	4.4%	2,266	4.3%	94
	2032	13,603	4.5%	15,187	4.3%	2,362	4.3%	96
	2033	14,201	4.4%	15,829	4.2%	2,461	4.2%	99
Average period growth rates, % pa:								
2014-2023			6.6%		6.2%		6.1%	
2024-2033			4.8%		4.6%		4.6%	

Generation Development Plan

Generation Development Plan studies are carried out from time to time in order to continually assesses adequacy and robustness of recommendation in planning for future capacities. Planning criteria is based on Loss of Load Equivalent (LOLE) of not more than 1.5 day/year. Established analytical tools are used extensively to carry out simulations incorporate all important parameters such as fuel price, fuel mix, technology employed and demand profile.

In line with the Government's effort to reduce direct fuel subsidy to the power sector, the approved Generation Development Plan already taken into consideration removal of the diesel and MFO subsidies by 2015. At the moment, diesel and MFO price of 49.5 sen/litre and 42 sen/litre for power sector in Sabah are heavily subsidised. Piped gas price is at the rate of RM6.40/mmBtu compared to Peninsula at RM15.20/mmBtu.

The approved Generation Development Plan up to 2023 is as follows:

Table 11: Generation development plan

Year	West Coast	East Coast
2014	Kimanis (285MW), SPR (100MW)	Cash Horse (10MW)
2015	Tenom Pangi Upgrade (8MW) IPP SBPC Additional Capacity Extension (5MW)	Melawa GTM Relocation (18MW)
2016	-	Tawau Green Energy (30MW) New Engine (2x 17MW)
2017	IPP Ranhill Powertron II Additional Capacity Extension (9MW)	OCGT (2 x 60MW) New Engine (5 x 17MW)
2018	-	IPP Serudong Extension until Dec 2018 (36MW) New Engine (5 x 17MW)
2019	-	CCGT (2 x 60MW GT + 60MW ST)
2020	-	OCGT 2017 Convert to CCGT (+ 60MW ST)
2021	CCGT (50MW)	-
2022	-	CCGT (50MW)
2023	Upper Padas (180MW) Sabah Hydro/Sarawak Import (100MW)	-

The entire grid connected diesel plants in West Coast with total capacity of 157.9MW (including mobile sets, 86MW) will be retired upon completion of SPR Energy (100MW) and Kimanis Power (285MW) CCGT plants in 2014. In East Coast, extension of diesel-fired plants owned by SESB cannot be avoided due to uncertainty of new generation project (i.e previously involved with the ESPC project). However, the plan is to retire all existing diesel-fired/MFO capacities of 315.1MW after the commissioning of new CCGT of 180MW in 2019.

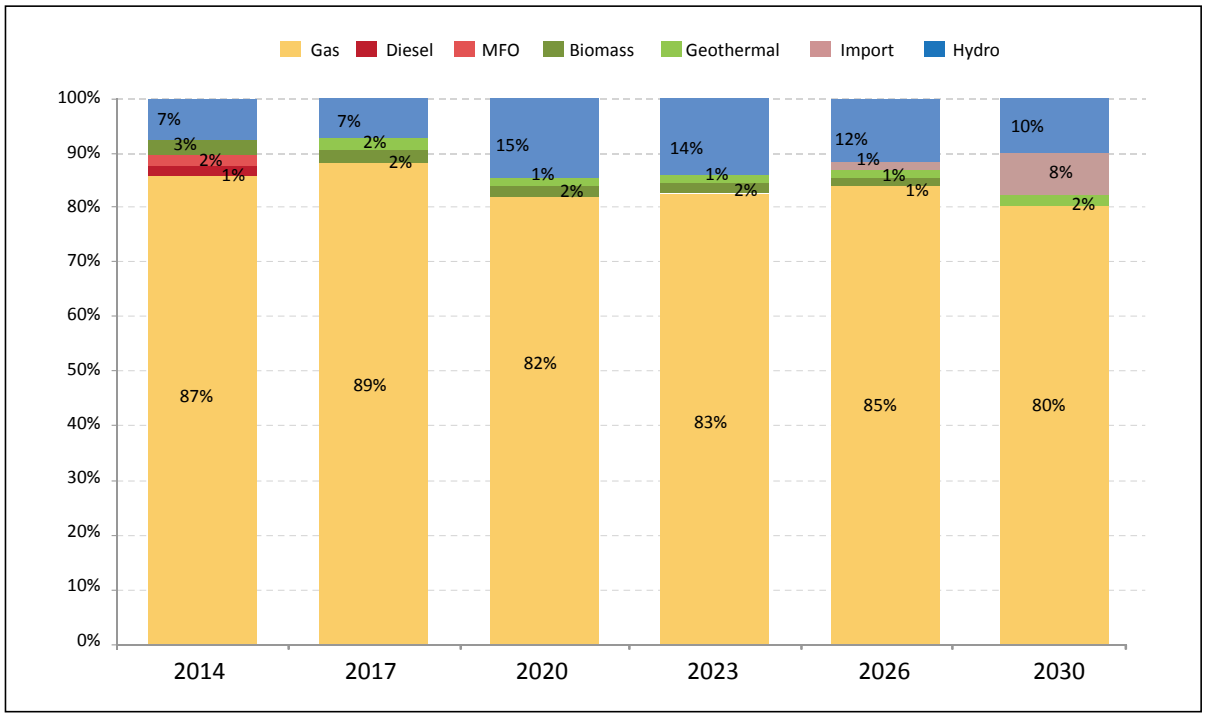
Table 12: Retirement plan up to 2023

Year	Retirement Plan
2014	Melawa DG (15MW), Mobile Sets (86MW), Lahad Datu (15.4MW), Labuk (3.5MW), Batu Sapi DG8 & 9 (11MW), Tawau DG & GT1 (27MW)
2015	-
2016	Batu Sapi DG10 & 11 (20MW), Gantisan (34MW), Sandakan GT (18.5MW), Tawau GT2 (17MW)
2017	ARL (47.6MW)
2018	Serudong (36MW), Melawa GT (18MW), SBPC Additional Capacity (5MW), Ranhill Powertron II Additional Capacity (9MW)
2019	Stratavest (60MW)
2020	-
2021	-
2022	-
2023	Kubota (64MW)

Generation Fuel Mix

The generation fuel mix for Sabah based on the approved Generation Development Plan is as follows:-

Figure 31: Generation mix



Gas set to be the dominant fuel in power generation for many years to come due to lack of viable alternative option. Gas share is projected to increase from 67% in 2013 to 87% in 2014 with addition of SPR Energy (100MW) and Kimanis Power (285MW). By the end of 2023, gas-fired capacity will be 1,486MW (installed capacity), an increase of 132% from 641MW (installed capacity) in 2013.

Shares of diesel and MFO fuels in the grid system are projected to decrease from 21% in 2013 to 3% in 2014 and further reduce until 0% in 2023. The dwindling share is in line with the projected gradual retirement of diesel and MFO power plants with total capacity of 493MW during the period. By 2018, the use of diesel/MFO will be limited to being a back-up fuel for gas-fired power plants.

Upper Padas Hydroelectric Project will boost hydro energy share from 7% in 2013 to 14% in 2023. Installed capacity will increase from 81MW in 2013 to 269MW in 2023. If the Government decided to harness the remaining local potential estimated at 535MW (potential Liwagu and Padas basins), shares of hydroelectric will increase further to provide renewable and stable energy in the long run.

Implementation of Feed-in-Tariff (FiT) delivered major boost to implementation of renewable energy power plants. FiT addresses the current uncertainty faced by existing RE power plants while provides impetus for development of new plants. In addition to palm oil wastes and mini hydro, Sabah is also blessed with geothermal potential estimated at 100MW. Currently, 30MW capacity is being developed and scheduled for commissioning in 2016. Prospects of RE is deliberated in detail in the next chapter.

Beyond the state border, potential of power transfer through interconnection with Sarawak is being discussed and expected to feature as part of the long term solutions. In addition, possible interconnection with neighbouring country is also being explored as the systems are relatively small and still need to be developed. Realisation of such elaborated schemes required further transmission network strengthening.

New Generation Projects

New generation programme, to cater for imminent capacities retirement and system growth, is reviewed on annual basis through JPPPET. The Committee will evaluate and recommends to the Government on the new generation projects that are required to meet future demand. List of generation projects approved through JPPPET is as follows:-

Table 13: New generation projects

Projects	Installed Capacity / Fuel	Year
S.J. Kubota, Tawau (Relocation)	64MW/Diesel	2013 (Commissioned in July 2013)
S.J. Batu Sapi (Rehabilitation)	20MW/Diesel	2013 (Commissioned in March 2013)
SREP Cash Horse	10MW/Biomass	2014
SPR Energy (M) Sdn. Bhd.	100MW/Gas	2014
Kimanis Power Sdn. Bhd.	285MW/Gas	2014
SREP Kalansa	5MW/Biomass	2015 (Under Review)
SREP Afie Power	8.9MW/Hidro	2015 (Under Review)
SREP Eco-Biomass	20MW/Biomass	2014 (Under Review)
S.J. Tenom Pangi (Upgrade)	8MW/Hidro	2015
SREP Tawau Green Energy	30MW/Geothermal	2016
Eastern Sabah Power Consortium	300MW/LNG	2017 (Under review)
Upper Padas HEP	180MW/Hidro	2023

Transmission Network Capability

Transmission networks which form a Grid System in Sabah consists of 275kV, 132kV and 66kV system voltage levels. As of 31st December 2013, the network consists of 123 circuit-km of 66kV lines, 1780 circuit-km of 132kV lines and 492 circuit-km of 275kV lines. The transmission network covers all major townships including F.T. Labuan, Beaufort, Papar, Kota Kinabalu, Keningau, Tenom, Kota Belud, Kudat, Sandakan, Lahad Datu, Kunak, Tawau and Semporna.

As both the Grid Owner and Grid Operator, SESB is responsible to plan and develop the Grid System in order to maintain adequate grid capacity. The key requirements of these networks are based on Sabah and Labuan Grid Code (SLGC) and Transmission System Reliability Standard (TSRS).

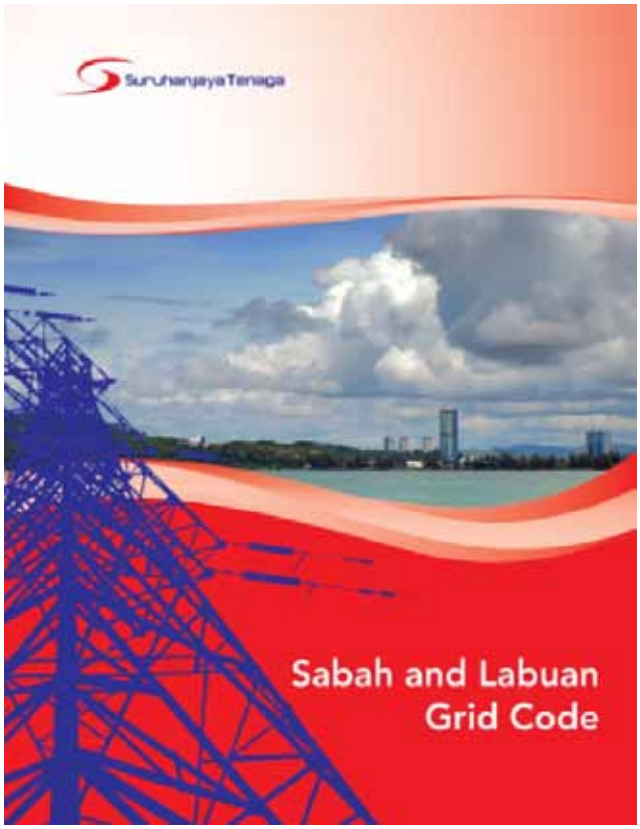
Figure 32: Sabah grid connection in 2013

Sabah and Labuan Grid Code

The Sabah and Labuan Grid Code (SLGC) is a regulatory instrument established to set out the procedure which regulates all users of the various power systems in the state of Sabah and the Federal Territory of Labuan. The users comprise of the transmission network, distribution network and isolated rural networks for electrical power and energy along with the power stations connected to these networks. The Code provides criteria guidelines and procedures for users of a power system to provide information necessary for the co-ordination, planning, development, maintenance and operation of the power system.

The following figure illustrates the front page of SLGC which can be downloaded from ST's website.

Figure 33: Sabah and Labuan grid code



Transmission Development Plan

Transmission Development Plan is developed to ensure adequacy and secure supply of electricity transmission from power plants to load centres. The Plan is reviewed on annual basis to reflect the changes in economic situation and opening up of new economic areas. The review is carried out annually by SESB as the Grid Owner before further deliberation in TDPWG. Condition in license issued by ST requires SESB to produce 10-year rolling Transmission Development Plan.

By having the 10-year rolling plan, adequacy and security of the transmission system is assessed under normal operating conditions as well as under (N-1) contingency conditions, in compliance with the License Conditions, TSRS and SLGC requirements. The Plan incorporate latest demand forecast including regional forecast and recommended Generation Development Plan as approved by JPPPET. Established planning tools are used to carry out both Generation Development Plan and Power System Simulation Studies.

Figure 34: Future network until year 2023

Major Transmission Projects under Construction

Transmission network development can be classified into two main categories; either related to generation plant-ups or associated with load growth and system development. For generation plant-ups, transmission developments are required in order to facilitate connection of new generations into the system. The needs were identified by taking into account the maximum generation capacity per site as well as the minimum transmission reinforcement required to evacuate the power. Network reinforcements are required to strengthen the backbone of transmission network as supply coverage expanded and also in order to meet the demand growth; either due to organic growth or opening up of new development areas.

Table 14: Major transmission projects associated with generation plant-ups

No.	Description	Completion Date
1	IPP Kimanis Power Sdn. Bhd. (285MW) • 275kV injection point • Extended to Kolopis 275kV PMU • 275kV OH Lines double circuit Kimanis - Kolopis	2014 (Ongoing)
2	IPP SPR (100MW) • 132kV injection point • Extended to Lok Kawi PMU • 132kV OH lines double circuit SPR - Lok Kawi	2014 (Completed)
3	SESB SJ Kubota (64MW) • 132kV injection point injected to Tawau Main Intake	2013/2014 (Completed)
4	Eastern Sabah Power Corporation (300MW) • 275kV injection point to Dam Road and 132kV injection point to Lahad Datu POIC • 275kV OH line double circuit to Dam Road and 132kV OH line double circuit to Lahad Datu POIC	2016 (This project is KIV and latest decision, it has been relocated to Sandakan)

Table 15: Major transmission projects associated with system development or reinforcement

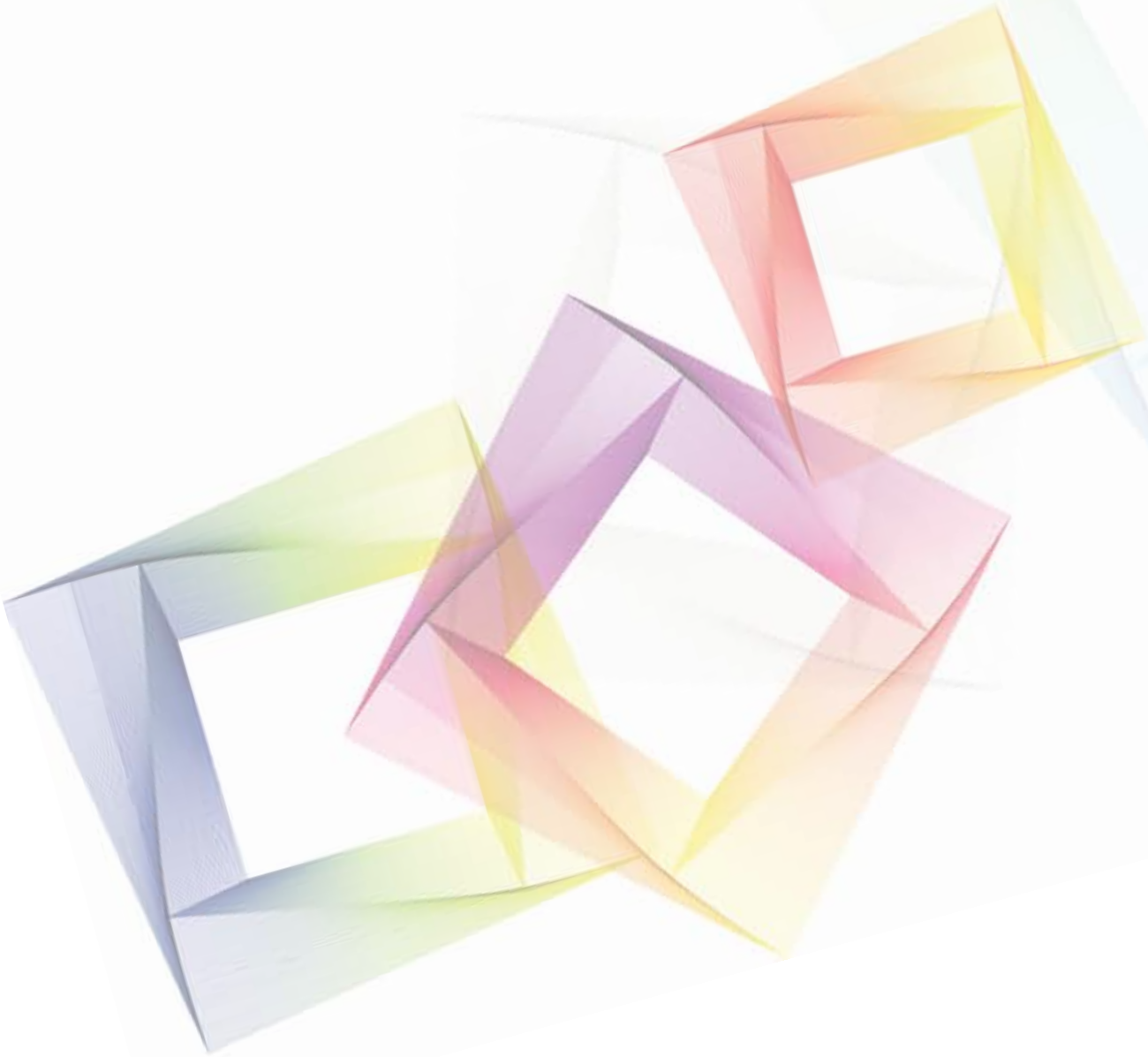
No.	Description	Completion Date
1	132kV Kota Kinabalu Outer Ring Phase 2 Kepayan PMU - Lok Kawi PMU - Kolopis PMU • 132kV OH Lines double circuit Kepayan – Lok Kawi-Kolopis	2014 (Completed)
2	Tuaran PMU • 132kV PMU 2 x 90MVA • Extended from 132kV Kolopis and 132kV Kota Belud • 132kV OH lines double circuit extended from Kota Kolopis and Kota Belud	2015 (Ongoing)
3	PMU Tenom • Additional 1 x 7.5MVA transformer	2014 (Completed)
4	Beaufort PMU • Additional 1 x 30MVA transformer	2014 (Ongoing)
5	Keningau PMU • Upgrade 132/33kV transformer capacity to x 60/90MVA	2015 (Ongoing)
6	Damai PMU • 132kV PMU 2 x 90MVA • Extended from 132kV Minintod and 132kV Alam Mesra • 132kV OH lines double circuit Minintod and Alam Mesra	2016
7	Sandakan POIC PMU • 132kV PMU 2 x 90MVA • Extended from Segaliud PMU • 132kV double circuit OH line extended from Segaliud PMU	2017
8	132kV OH line from Dam Road to Lahad Datu POIC	2017
9	Kunak PMU 132/11kV • Upgrade 132/11kV 2 x 15MVA transformer capacity to 2 x 30MVA	2014 (Ongoing)
10	Elopura PMU • 132kV PMU 2 x 90MVA • Extended from 132kV SMI and 132kV Sandakan POIC • 132kV OH line single circuit extended from SMI and Sandakan POIC.	2016
11	Sipitang PMU • 275kV PMU 2 x 240MVA • Extended from 275kV Kimanis • 275kV OH line double circuit extended from Kimanis	2017

Interconnection: Interconnections with Neighbouring Countries and Import Power from Sarawak

In order to secure adequate power to Sabah's system, apart from develop a new plant, another option that is being considered is to have an interconnection with neighbouring systems. SESB and Sarawak Energy Berhad are currently exploring the possibility of interconnection between Sabah and northern Sarawak so that the potential hydroelectric capacity of 700MW can be realised. This interconnection is also an important component to the development of Trans Borneo Grid that in the future will connect Sabah, Sarawak and Brunei Darussalam.

Other than interconnection in the west coast area with Sarawak, there is also potential interconnection in the east coast area with North Kalimantan province in Indonesia. At present, North Kalimantan is still relatively under developed. For the interconnection project to be viable, export of electricity to Sabah at least for the medium term need to be seriously considered. However, this option will be much depending on the requirement of the power systems and law and regulation governing the electricity business.

PROSPECT OF RE GENERATION IN SABAH



PROSPECT OF RE GENERATION IN SABAH

Introduction

Renewable energy (RE) contributed 5% of total on-grid electricity generated in Sabah. For off-grid application which has a total capacity of 705MW, 137MW utilised palm oil wastes. While the potential for further contribution is immense, the development is restricted due to the lack of incentives for RE plant developer as the selling price to SESB is capped at 21 sen/kWh.

With implementation of Feed-in-Tariff (FiT) mechanism in 2014, RE share is projected to increase further from the existing capacity of 36MW. There are 75.4MW capacity currently under construction consists of 36.5MW from palm oil wastes, 8.9MW from mini hydro and 30MW from geothermal.

Nevertheless, there are several challenges faced by RE developers such as long-term fuel supply commitment, securing financing for the project especially for newcomers with little financial backing and costly grid interconnection from power plant to main grid due to remoteness of the power plant. However, with proper planning and strategy, the project can still be implemented successfully.

Implementation of Feed-in-Tariff

The Feed-in-Tariff (FiT) mechanism as set out in the Renewable Energy Act 2011 (Act 725) obliges the utilities to buy electricity produced by RE power plants. Implementation of FiT mechanism comes under the purview of Sustainable Energy Development Authority (SEDA) which issues the feed-in approval certificate to individual or company. Holder of the certificate is eligible to sell electricity from RE at premium rate above the displaced cost sets by utilities for specific duration.

Through FiT mechanism, RE becomes a viable and sound long-term investment for companies and also for individuals as the mechanism guarantees developer not only favourable rate but also access to the grid. FiT is expected to drive forward the investment especially from private sectors. The mechanism is not only applicable for new projects, but also extended to the five existing SREP projects.

The fund for FiT is levied from electricity consumers based on 1% of total bill. However, the levy is exempted for consumers with monthly consumption under 300kWh. This funding mechanism is designed to encourage the development of renewable energy via cost-sharing among electricity consumers.

Details about FiT can be obtained from SEDA at www.seda.gov.my

Renewable Energy (RE) in Sabah: Implemented and Potential

RE has a long history in the electricity supply in Sabah, being part of the system since the start of utility-scale application in 1920s. For off-grid application, ST has issued 1005 private licenses with total installed capacity of 705MW, mostly fuelled by palm oil waste, wood waste and diesel. Indeed, these plants contributed in no small part to the off-grid electrification as some of them are located far from the main grid system and also serve the community's interest in localities. Currently, total capacity connected to the grid from biomass and mini hydro plants is 42.3MW of which 33MW is from biomass while the rest is from mini hydro.

Table 16: Biomass plant in Sabah

No.	Plant	Installed Capacity (MW)	Dependable Capacity (MW)
1	Teck Guan (Evergreen Intermerge)	6	3
2	Seguntor Bioenergy	11.5	10
3	TSH Bioenergy	14	10
4	Kina Biopower	11.5	10

Table 17: Mini hydro in Sabah

No.	Plant	Installed Capacity (MW)	Dependable Capacity (MW)
1	Mini Hydro Kadamaian	2.1	2.0
2	Mini Hydro Pangapuyan	4.8	4.5
3	Mini Hydro Melangkap and Sayap	2	1.5
4	Mini Hydro Merotai	1.1	0.5
5	Mini Hydro Bombalai	1.1	0.8

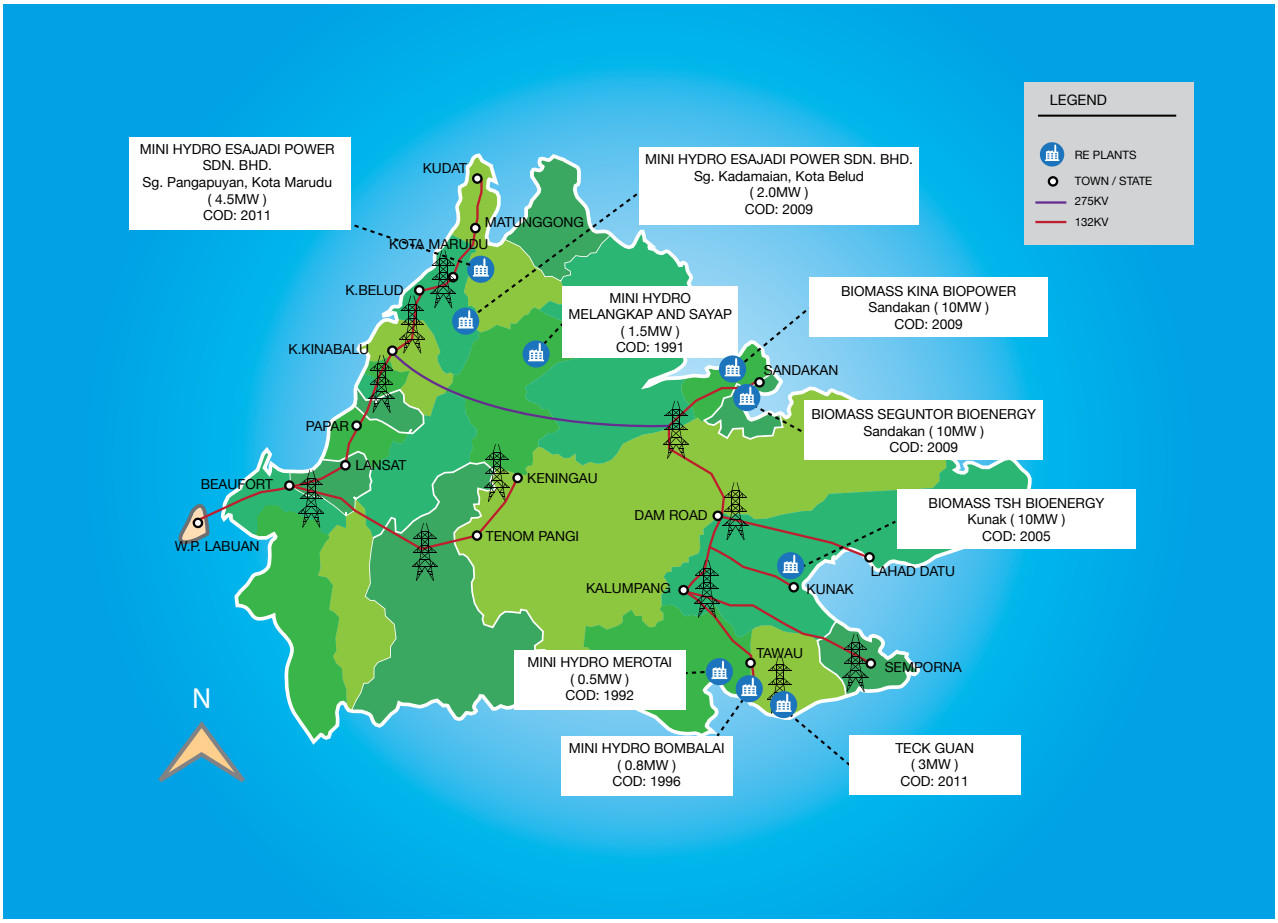
There are five more new plants coming on line in the next few years. However, the commissioning of these projects are delayed from the original target dates due to various implementation issues.

Table 18: Projects with REPPA

No.	Plant	Fuel Type	Capacity (MW)	Target Commercial Operation Date (COD)
1	Cash Horse	Biomass	10	October 2014*
2	Eco-Biomass	Biomass	20	28th February 2014**
3	Afie Power	Mini Hydro	8.9	1st September 2014**
4	Kalansa	Biomass	6.5	Quarter 2, 2015**
5	Tawau Green Energy	Geothermal	30	28th May 2016

* Postponed from Dec 2013
** Under review

Figure 35: Existing renewable energy in Sabah



Potential of Hydroelectric Resources in Sabah

Various studies on hydroelectric resources were conducted primarily to review and identify potential for power generation. With estimated realisable potential of 782MW (12 potential sites) hydro resources are one of the most promising solutions to address the long term electricity requirement in Sabah.

Based on the latest study conducted by SESB to review and identify the remaining potentials based on technical, economic and financial merits, a total of 59 sites out of 109 identified sites were ranked after site screening. From the 59 sites, 12 sites were deemed to be economically viable for hydro power development yielding Economic Internal Rate of Return (EIRR) of greater than 10% while the rest were uneconomical due to having EIRR of less than 10%.

Figure 36: Hydro potential mapping

Feasibility studies will be carried out to the top ranked potentials to confirm their economic viability and environmental acceptability so that realisation of these potentials can be planned to meet future power demand in Sabah.

Table 19: Twelve (12) potential sites for hydroelectric project

Rank	River	Catchment	Type*	Capacity (MW)
1	Padas	Padas	ROR	114
2	Pensiangan	Pensiangan	S	162
3	Telekosang	Padas	ROR	59
4	Padas	Padas	ROR	120
5	Liwagu	Liwagu	ROR	57
6	Padas	Padas	ROR	48
7	Wariu	West Coast	ROR	9
8	Tuaran	West Coast	ROR	41
9	Malingan	Padas	ROR	25
10	Kagibangan	Liwagu	ROR	45
11	Segama	Segama	ROR	35
12	Padas	Padas	ROR	67
			Grand Total	**782**
			Total for Liwagu and Padas Basins	**535**

* ROR: Run of River; S: Storage/Dam

Hydroelectric development on Liwagu and Padas Basins with the total potential capacity of 535MW will provide long term solution to the system. However, capital outlay for these projects are substantial and requires further deliberation on financial supporting mechanism. Also, implementation of any projects especially hydro requires acceptance especially the local populations so that maximum benefits can be gained by all parties.

Government Policy on Hydroelectric

Existing policy put preference for utility to develop the large scale hydro potential as lead time to execute the project is longer than conventional thermal projects and requires significant resources to implement. In addition, imposition of minimum environmental flow to protect wildlife and livelihood of dependant population will limit operational flexibility of the plant. Also, large scale hydroelectric plants are normally designed for peaking operations and therefore requires longer investment payback period. Due to large storage, hydroelectric dams also act to regulate river water flow and assist in minimising flood possibility in downstream areas.

Development of Upper Padas Hydroelectric Project is assisted by Federal Government through grant/loan amounting to RM569 million with the rest to be funded through commercial or soft loan arrangement. Similar arrangement is still required for future developments until SESB is able to raise its own finance or solution in the form of PFI/PPP need to be considered. However, preference should be given to utility to ensure optimal electricity output and other benefits that can be generated from the projects.

CLOSURE

The supply-demand cost imbalance, resulting from unexpected increase in fuel prices over the years and inability to review tariff to consumers, proved to produce negative consequences for Sabah electricity supply industry. Overall supply performance has yet to catch up with public expectation while the utility is saddled with soaring costs, responsibility in infrastructure investment and diminishing capital.

Recent tariff revision will reduce the cost imbalance. However, Government assistance in terms of direct and indirect fuel subsidy and infrastructure development will continue at least until all projects designed to reduce overall supply costs are implemented.

Assessment of electricity infrastructure needs will continue in the future, taking into consideration all factors such as technical, economic and social well-being. Integration of common supply objectives with local aspects is required in order to support system improvement initiatives especially in terms of overall development objective, tariff and generation fuel mix. As the electrification rate increase to the targeted level, the supply priority will shift from coverage to quality and reliability.

In terms of resources, Sabah owns all the basic energy ingredients for success. Natural gas, hydroelectric and renewable energy resources are expected to form the bedrock in which a sustainable power generation industry will be materialised. However, as Sabah continues to rely on natural gas, alternative generation modes including power transfer through interconnection facilities need to be considered in order to reduce heavy dependency on single fuel.

The situation in Sabah has long being the blot in otherwise highly reliable and progressive overall Malaysia electricity supply industry. The motivation to realise a sustainable and progressive ESI in Sabah could not be any higher as the imbalance situation will be widening if no concrete actions taken in immediate term. Efforts and common understanding by all stakeholders are required so that the industry is back on the right track.

NOTE

NOTE

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