# SABAH ELECTRICITY SUPPLY INDUSTRY OUTLOOK 2019

Suruhanjaya Tenaga
Energy Commission

Published by:
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ISSN : 2232-0954
ST's Publication No. : ST(P)12/09/2019

PRINTED IN MALAYSIA

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# INTRODUCTION

# ABOUT THE ENERGY COMMISSION

## Vision

The Energy Commission is a world-class energy regulator that is effective and authoritative.

## Mission

The Energy Commission aims to balance the needs of consumers and providers of energy to ensure safe and reliable supply at reasonable prices, protect public interest, and foster economic development and competitive markets in an environmentally sustainable manner.

A statutory body established under the Energy Commission Act 2001, Suruhanjaya Tenaga (ST) or the Energy Commission is responsible for regulating the energy sector, specifically the electricity and piped gas supply industries, in Peninsular Malaysia and Sabah.

Taking over the role of the Department of Electricity and Gas Supply, the Energy Commission started its operations on January 1, 2002. The main focus of the Commission are reliable electricity and gas supply, reasonable costs and safety.

The Energy Commission has three primary roles, namely:

### Economic Regulation

To promote economy in the generation, transmission, distribution, supply and use of electricity and in the reticulation and use of gas; promote competition; enable fair and efficient market conduct and prevent the misuse of monopoly or market power in the electricity and piped gas supply industries.

### Technical Regulation

To ensure security, reliability, efficiency and quality of supply and services in the electricity and piped gas supply industries.

### Safety Regulation

To protect industry, consumers and the public from dangers arising from the generation, transmission, distribution, supply and use of electricity and the distribution, supply and use of piped gas.

# ORDERLY SUPPLY AND USE OF ENERGY

Energy Commission, a statutory body established under *the Energy Commission Act 2001*, is responsible for regulating the energy sector, specifically the electricity supply and piped gas supply industries in Peninsular Malaysia and Sabah.


**Advises**
Ministers on all matters concerning national policy objectives for energy supply activities, the supply and use of electricity, the supply of gas through pipeline and the use of gas.

**Regulates**
electricity and piped gas tariffs and the quality of supply services, as well as promotes competition and prevents misuse of monopoly power.

**Licenses and certifies**
electricity and piped gas suppliers, competent electricity and gas personnel, training providers, contractors, equipment and installations, energy service companies and energy managers.

**Promotes**
good practices, as well as research, development and innovation in the electricity and piped gas industries.

**Monitors and audits**
performance and compliance of licensed and certified suppliers, service providers, installations, equipment importers, manufacturers and retailers.

**Plans and develops**
laws, regulations, rules, codes, guidelines, programmes for the orderly development and functioning of the electricity and piped gas industries.

**Investigates**
complaints, accidents, offences and industry issues; arbitrates and enforces compliance.

# ABOUT THIS REPORT

The "Sabah Electricity Supply Industry Outlook" is the Commission's initiative to provide an annual performance overview of the electricity industry with an outlook for the following year, and to keep track of progress in the 10-year energy outlook.

The first two editions focused on an overview of Sabah's electricity supply chain as a reference for various stakeholders such as the public in general and ministries, Government departments, energy industry players, academicians, fund managers and investors in particular. This is the third edition of the Sabah Electricity Supply Industry Outlook, and the focus is on Energy Security.

## A BRIEF HISTORY

The North Borneo Electricity Board was formed in 1957 which had been supplying electricity to North Borneo since 1910.

After the formation of Malaysia in 1963, the North Borneo Electricity Board was renamed Sabah Electricity Board (SEB), and the State Government of Sabah took control of electricity supply regulation and its management, largely through the statutory board or by owning corporation shares.

Later, it became known as the Sabah Electricity Sdn. Bhd. (SESB) after being incorporated in 1998, as part of Malaysia's Privatisation Master Plan and a subsidiary of Tenaga National Berhad (TNB), when 80% of its shares were acquired.

In the early 1990s, the Federal Government introduced Independent Power Producers (IPPs) to increase supply reliability and adequate reserve. Their role is to generate and sell electricity to the grid in accordance to the Power Purchase Agreements (PPAs). To date, there are six IPPs in Sabah with a total capacity of more than 800MW.

# MALAYSIA AND THE ENERGY TRILEMMA

Global energy systems are being restructured in response to climate change, digitalisation and changing consumer behaviour. The World Energy Council analyses this transition across three core dimensions called the Energy Trilemma, which spans Energy Security, Environmental Sustainability and Energy Equity.

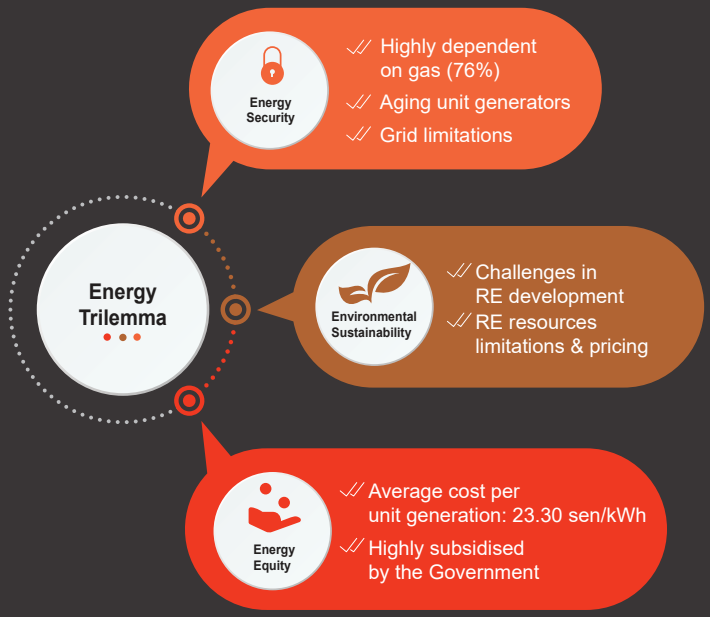
Every year, the World Energy Council publishes the Energy Trilemma Index that measures the overall performance of countries in achieving a sustainable mix of policies and the balance score highlights how well a country manages the trade-offs in the Trilemma.

In 2018, Malaysia moved up four places to rank 37 in the index. It is ahead of Australia (38) and Qatar (39) and behind Hong Kong (34), South Korea (35) and the UAE (36).

This ranking is based on the performance of the overall energy sector, in which the electricity and gas supply and the oil and gas industries are key players.

In its analysis, the World Energy Council noted: "Malaysia scores well across all Trilemma dimensions, with a slightly lower score received on environmental sustainability. Malaysia also continues to face challenges when it comes to developing renewable energy (RE)."

# THE ENERGY TRILEMMA
## SABAH'S CHALLENGES AND ACTION PLAN




Sabah is a mountainous state with many protected national parks. Most of the population centres are along the West and East Coasts with a spine of mountains between them. There are also remote villages nestled among the highlands and rainforests. This is one of the primary challenges of electrification here.

Currently, the grid is divided into the West Coast Grid and the East Coast Grid that are connected via the 275kV Kolopis-Segaliud transmission line. This provides electricity to the East Coast, while other areas rely on off-grid connections. The lack of connectivity is a key issue here and there is a need to meet growing demand to boost economic activities especially in major towns and tourist attractions.

Demand for electricity in Sabah will continue to rise and there is a need to find long term solutions for the electricity supply industry to ensure reliable and sustainable quality supply to consumers. Based on the challenges in managing the Energy Trilema, the Commission, together with the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC), the State Government and SESB, are looking at economically viable long term solutions as indicated in the action plan towards a reliable and sustainable electricity supply industry.

# Towards a Reliable & Sustainable Electricity Supply Industry

## ENERGY SECURITY

**Goal**

To ensure reliable and efficient supply of electricity across the state and to boost economic activities.

**Actions**

To improve supply with network reinforcement and interconnections by:

- Enhancing West Coast-East Coast power transfer;
- Tapping into the Sarawak interconnection; and
- Improving efficiency and quality of supply in the Central Region of the Kota Kinabalu conurbation.

## ENVIRONMENTAL SUSTAINABILITY

**Goal**

To diversify the fuel mix and increase RE penetration.

**Actions**

- To focus on increasing solar power generation; and
- To manage the emission intensity level.

## ENERGY EQUITY

**Goal**

To ensure a sustainable and equitable electricity supply industry based on electricity tariffs that benefit both consumers and producers.

**Actions**

To create a sustainable tariff framework by:

- Introducing Incentive-Based Regulation (IBR) as implemented in Peninsular Malaysia;
- Introducing Key Performance Indicators (KPIs) to improve industry performance; and
- Implementing Service Level Agreements (SLAs) to improve the performance of SESB power plants.

## Challenges of Electrification in Sabah: A Terrain of Mountains and Protected Areas

Sabah's geographical structure is a mix of mountainous regions, beaches and tropical rainforests. The western side is mostly mountainous with three of Malaysia's highest mountains being a part of it. Most of the urban centres are located along the coastal areas while small villages and towns form the interiors. There are also other protected wildlife areas other than Kinabalu, such as Maliau Basin, Danum Valley, Tabin, and Sepilok.

With these challenges, there is insufficient infrastucture connecting major towns in Sabah. This has made the implementation of electrification to be very difficult and expensive because land access is far from the main grid connection.

# Sabah Electricity Supply Industry Landscape

## 2016

Task Force 150 (TF150) launched:
- SAIDI Sabah targets 150 minutes by 2018
- SAIDI Sector 1 targets 100 minutes by 2018

Oct 2016

SAIDI at 311 minutes at the end of 2016

## 2017

SAIDI 100 Lab launched

Jul 2017

SAIDI at 241 minutes at the end of 2017

## 2018

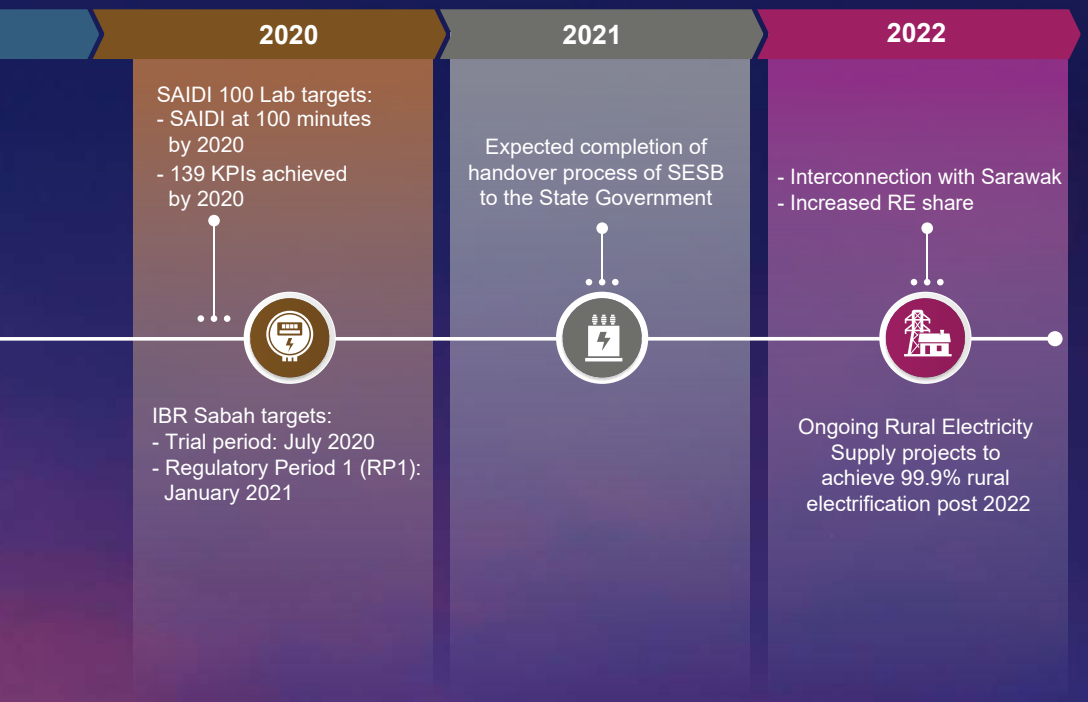
MESTECC announced the handover of the regulation of the state electricity supply industry to the State Government

SAIDI at 267 minutes at the end of 2018

## 2019

Sustainability of SESB:
- Due diligence study on the handover of SESB to the State Government

SAIDI: System Average Interruption Duration Index




Further to the above milestones, in 2019 MESTECC announced energy sector initiatives for the Sabah Electricity Supply Industry (SESI). They were:

- To achieve 20% RE by 2025
- To achieve 8% savings from Energy Efficiency (EE) initiatives by 2025
- To ensure sustainability of SESI by:
  i. Improving SESB's ownership structure;
  ii. Improving system reliability in Sabah;
  iii. Improving SAIDI in Sector 1 to 200 minutes/customer/year; and
  iv. Planning for micro grid frameworks and project monitoring for rural electrification.

*Source: MESTECC Policies and Road Maps 2019*

# ENERGY OUTLOOK

# GLOBAL - AN ELECTRIFYING FUTURE

Major transformations are underway in the global energy sector, from growing electrification to the expansion of renewables, upheavals in oil production and globalisation of natural gas markets, states the International Energy Agency's (IEA) "World Energy Outlook (WEO) 2018" report. "Across all regions and fuels, policy choices made by Governments will determine the shape of the energy system of the future," it adds.

What is significant is that for the first time, this IEA flagship publication includes a section entitled "Special Focus on Electricity" that says the future is electrifying, with low-carbon technologies on the rise and electricity demand set to grow at twice the pace of energy demand as a whole. It also sheds light on what tomorrow's power sector could look like, highlighting key uncertainties that have implications for energy security, investment and environment concerns.


*World Energy Outlook 2018 released in November 2018.*

According to WEO 2018, oil markets are entering a period of renewed uncertainty and volatility, including a possible supply gap in the early 2020s. Demand for natural gas is on the rise, erasing talk of a glut as China emerges as a giant consumer. Solar photovoltaic (PV) is charging ahead, but other low-carbon technologies and especially efficiency policies still require a big push.

"In all cases, Governments will have a critical influence in the direction of the future energy system. Under current and planned policies, global energy demand is set to grow by more than 25% by 2040, requiring more than $2 trillion a year's worth of investment in new energy supply."

A WEO-based analysis went on to show that oil consumption will be growing in the coming decades, due to rising petrochemicals, trucking and aviation demand. However, meeting this growth in the near term means that approvals of conventional oil projects need to double from their current low levels.

In power markets, it says that "renewables have become the technology of choice, making up almost two-thirds of global capacity additions to 2040, thanks to falling costs and supportive Government policies. This is transforming the global power mix, with the share of renewables in generation rising to over 40% by 2040, from 25% today, even though coal remains the largest source while gas is the second-largest."

The report also cautions that while the expansion brings about major environmental benefits, it also creates a new set of challenges that policy-makers need to address quickly. It points out that with "higher variability in supplies, power systems will need to make flexibility the cornerstone of future electricity markets in order to keep the lights on. The issue is of growing urgency as countries around the world are quickly ramping up their share of solar PV and wind, and will require market reforms, grid investments, as well as improving demand-response technologies, such as smart meters and battery storage technologies."

Electricity markets are also undergoing a unique transformation with higher demand brought by the digital economy, electric vehicles and other technological changes, says WEO 2018. As part of its deep-dive into the electricity sector during the year, WEO 2018 examined the impact of higher electrification in transportation, buildings and industry. The analysis finds that higher electrification would lead to a peak in oil demand by 2030 and a reduction in harmful local air pollution. However, this impact would be negligible on carbon emissions without stronger efforts to increase the share of renewables and low-carbon sources of power.

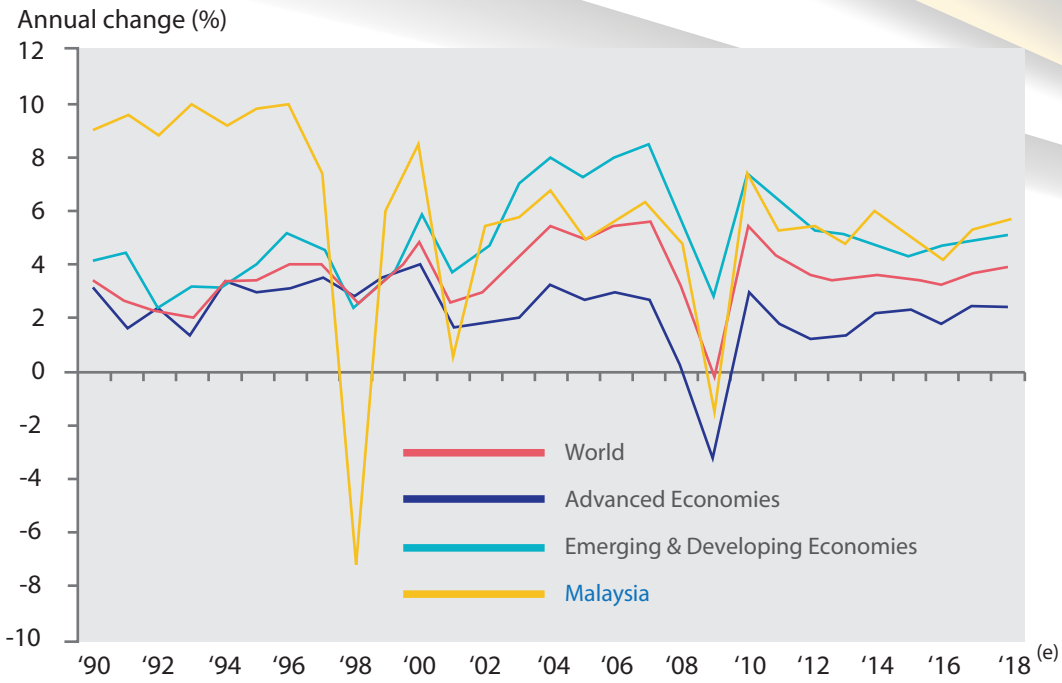

## MALAYSIA FORECAST

As an energy-dependent, export-oriented manufacturing economy, Malaysia is affected by the state of the global economy. According to the World Bank's "Global Economic Prospects 2019", global growth is expected to slow down to 2.9% in 2019. Downside risks have become more acute. Financial market pressures and trade tensions could escalate, potentially denting global activity.

Against this backdrop, East Asia and the Pacific region remains one of the world's fastest-growing developing regions, says the World Bank report. "Regional growth is expected to moderate to 6% in 2019, assuming broadly stable commodity prices, a moderation in global demand and trade, and a gradual tightening of global financial conditions. Growth in China is expected to slow down to 6.2% this year as domestic and external rebalancing continues. The rest of the region is expected to grow at 5.2% in 2019 as resilient demand offsets the negative impact of slowing exports," it notes.

Despite global and regional slowdown forecasts, Malaysia is expected to remain on a growth path all the way through to 2019, supported by its diversified economy and nature of exports, says the "Bank Negara Malaysia Report 2018". "Malaysia's policy stability and deep financial markets also allow the country to withstand external shocks and ensure growth," says Bank Negara, Malaysia's Central Bank.

## GROSS DOMESTIC PRODUCT (GDP) 1990-2018




Note : (e) Forecast
Source : Bank Negara Malaysia, Department of Statistics Malaysia and World Economic Update, July 2018 & World Economic Outlook, April 2018

The 2018 Bank Negara report also notes: "The domestic economy is likely to remain positive, spurred by robust private sector activity and moderate inflation. Favourable labour market conditions, namely a robust private sector with high employment growth and significant improvement in consumer sentiments, will underpin private consumption for the year."

On downside risks, Bank Negara says ongoing trade tensions between the USA and China (Malaysia's largest investor and trading partner) that could potentially disrupt global trade and growth will affect Malaysia's economy, but noted that financial intermediation is still at a healthy level. The country has the policy tools to liquidity in the financial system that is adequate to support intermediation activities and the current monetary stance is appropriate, conducive and supportive to growth.

Moody's Investors Service Hong Kong Ltd. is also positive about Malaysia's prospects. In its "Power-Asia: 2019 Outlook" report, it notes that the Asian power sector in 2019 is seen as stable on steady cash flows, gradual pace of regulatory changes, a gradual transition to a low-carbon economy and sufficient mitigants against capital market volatility. It also notes that the power sector, which has been stable since 2009, reflects its expectations for stable business conditions in countries such as Malaysia, among others.

# SABAH FOCUS - BALANCED REGIONAL GROWTH

According to the Mid-Term Review of the 11th Malaysia Plan (2016-2020): New Priorities and Emphases dated 18 October 2018, to ensure a balanced development among the six regions in the country, namely Northern, Eastern, Central, Southern, Sabah and Sarawak, three priority areas were identified, of which "Accelerating Development in Sabah and Sarawak" is one. Under this priority area, focus sectors, growth areas, and specific development projects and activities have been identified to be undertaken in the remaining plan period.

This implementation will see a surge in power demand and fittingly improving power supply services is one of the strategies under this priority area. The Mid-Term Review states:

"Improving power supply services in Sabah will be encouraged to establish a holistic power planning strategy, particularly to enhance security of supply, re-evaluate the tariff structure and improve the quality of service. The strategy aims to create a vibrant electricity industry in the state by ensuring a resilient power grid and financial viability. In this regard, SESB needs to undertake appropriate reforms, including tariff structure, to become financially sustainable. Meanwhile, efforts will be intensified to address electricity supply deficit in the East Coast of Sabah, particularly through the reinforcement of the existing grid."

The review identified high impact programmes and projects in the following focus areas: agriculture (forestry, fisheries and oil palm), mining and quarrying (oil and gas), logistics (transportation and storage), tourism (arts, entertainment and recreation) and education. Meanwhile, growth areas, where growth will be driven by increased business and employment opportunities are the Kota Kinabalu Conurbation (covering the areas around Kota Kinabalu, Tuaran, Putatan, and Papar); Keningau, Sandakan, Lahad Datu, Tawau and Labuan, which have been identified as the Promoted Development Zones; and Kudat, Kota Belud, Kota Marudu, Ranau, Kimanis, Beaufort, Tenom, Sipitang, Kota Kinabatangan, Tongod, and Semporna, which are identified as the Catalyst Centers.

Specific projects identified for implementation in the remaining period of the 11th Malaysia Plan include the expansion of Sapangar Bay Container Port to become a transhipment hub in the Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area (BIMP-EAGA) sub-region; and boosting investment in higher value-added downstream processing activities in the Palm Oil Industrial Cluster (POIC) in Sandakan and Lahad Datu.

Under rural electrification projects, the target is to reach 41,160 houses, as well as to improve the electricity supply and internet access to schools, especially in rural areas. These rural electrification projects will be executed via off-grid generation complemented by RE such as solar hybrid, micro- and pico-hydro and biomass to enable a wider coverage.

Affordable housing and improved broadband services are also in the works, with 106 communication towers to be constructed and 400 upgraded in Sabah and Sarawak during the remaining plan period.

Peninsular Malaysia's IBR, an electricity tariff-setting mechanism successfully implemented that is now in Phase 2 (2018 to 2020), is to be extended to Sabah during the remaining Plan period. The IBR mechanism is a transparent process to determine electricity tariffs that benefit both consumers and producers.

# 2018
## THE YEAR THAT WAS

**SESB Customers DEMAND CONTRIBUTORS Sales (%)**

**0.6%** Minor rebound from 2017 contraction
**INDUSTRY 21%**

**1.4%** Mainly due to tourism sector
**COMMERCIAL 44%**

**-1.2%** Low weather temperature
**DOMESTIC 34%**

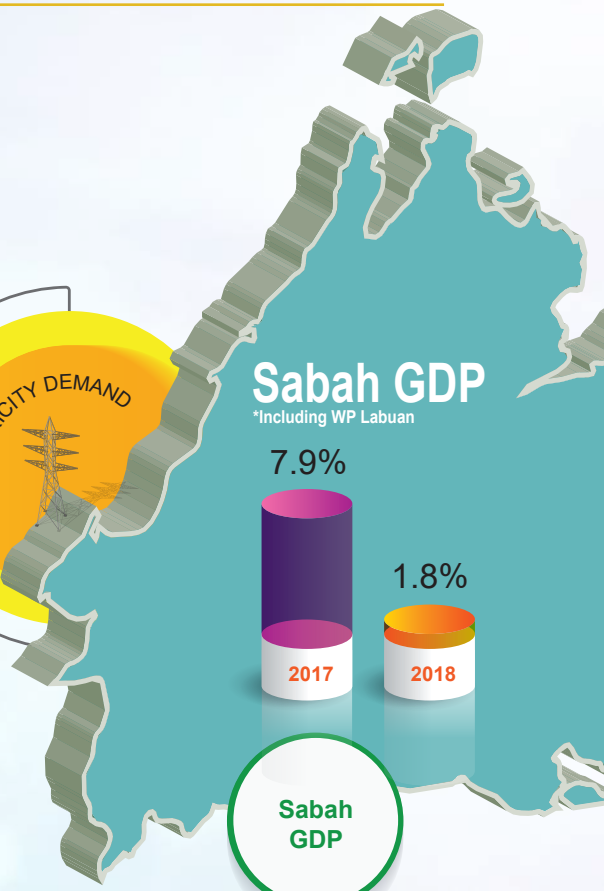
**-2.2%** Energy efficiency Impact
**OTHERS 1%**

Sabah MD
955MW 2018
945MW 2016
938MW 2017

WC MD 651MW

EC MD 311MW

ELECTRICITY DEMAND




**Sabah GDP**

Sabah is the second largest state in Malaysia, located on the island of Borneo.

- Land area : 73,904 sq. km
- Population : 3.9 million
- Key economic activities : Tourism and services
- GDP : RM92.2 billion

*Source: Department of Statistics Malaysia, 2018*

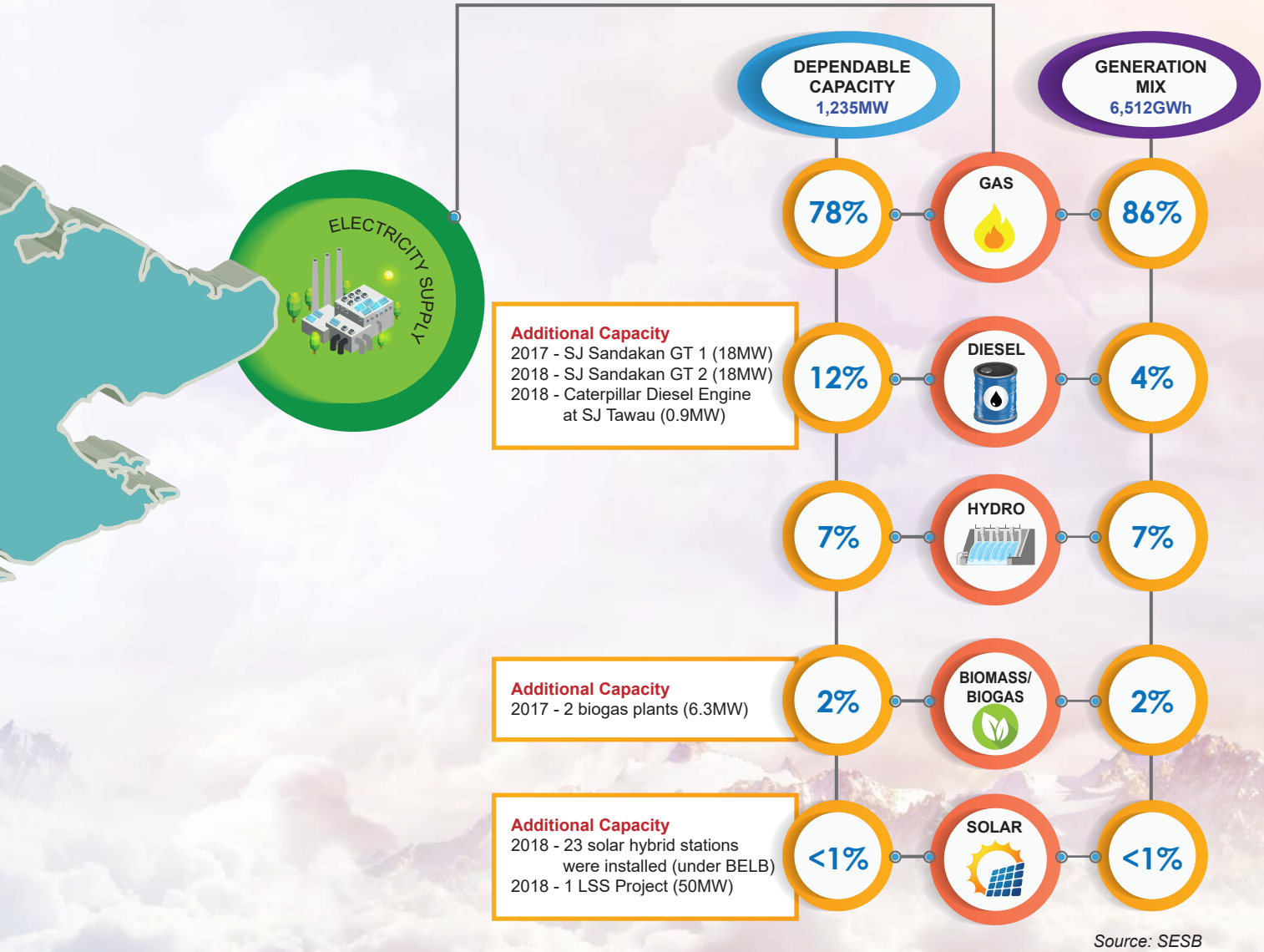
**Customers supplied by CO-GENERATION SELF-GENERATION Capacity (MW)**
767MW

WC: West Coast
EC: East Coast
MD: Maximum Demand
LSS: Large Scale Solar

**Government Initiatives**

**SAIDI REDUCTION**

- TF150, set up on 17 October 2016 and to be carried out in three phases - planning and preparation, implementation and execution as well as monitoring and sustainability - completed in 2018 with 215 projects and a SAIDI reduction of 91.71 minutes/consumer/year.
- Sabah SAIDI 100 Lab, a joint initiative between the Government and Pemandu Associates Sdn. Bhd. (PEMANDU) aims at providing quality power generation to Sabah's consumers and at reducing Sabah's SAIDI to 100 minutes by 2020.




*Source: SESB*

**NETWORK REINFORCEMENT**

- 57 projects to strengthen existing transmission and distribution lines are in progress. RM385 million (16.8% of the RM2.3 billion allocated under SAPADU) spent so far.
- Six major transmission projects targeted for completion in 2022.

# SABAH ELECTRICITY SUPPLY INDUSTRY OUTLOOK 2019

# ENERGY SECURITY – NETWORK REINFORCEMENT AND SARAWAK INTERCONNECTION

Sabah's economy is currently driven by the services and mining sectors. There are, however, national plans to boost the state economy with industries and this will generate new demand and the need for more secure, efficient and reliable power supply.

The Federal Government is currently reinforcing the state's network infrastructure to improve electricity supply across the state. Successive Malaysia Plans have made allocations for this purpose, which also includes targeted remedial works to reduce SAIDI to 200 minutes/customer/year in Sector 1 in 2019.

## HERE AND NOW

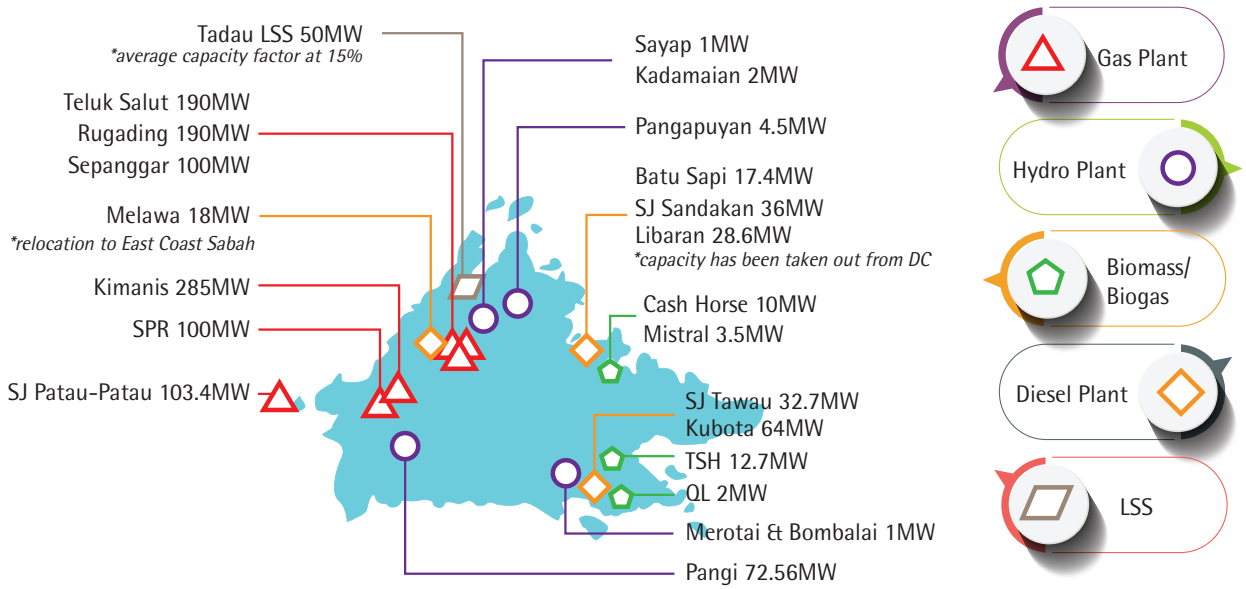
In 2018, Sabah's electricity demand was higher than forecast. Demand by the state's 3.9 million population was met by way of 1,235MW of dependable capacity from more than 20 generation plants serving the grid, with a reserve margin of 29%.

The Sabah grid is divided into the East Coast Grid and the West Coast Grid and there are significant gaps of supply and demand between the two coasts despite being connected by the Kolopis-Segaliud 275kV transmission line.

Power generation in the West Coast region is highly dependent on gas while the less populous East Coast relies mainly on diesel. Overall, Sabah's generation mix consists of 86% gas, 7% hydro, 4% diesel/MFO, 2% biomass/biogas and less than 1% solar.

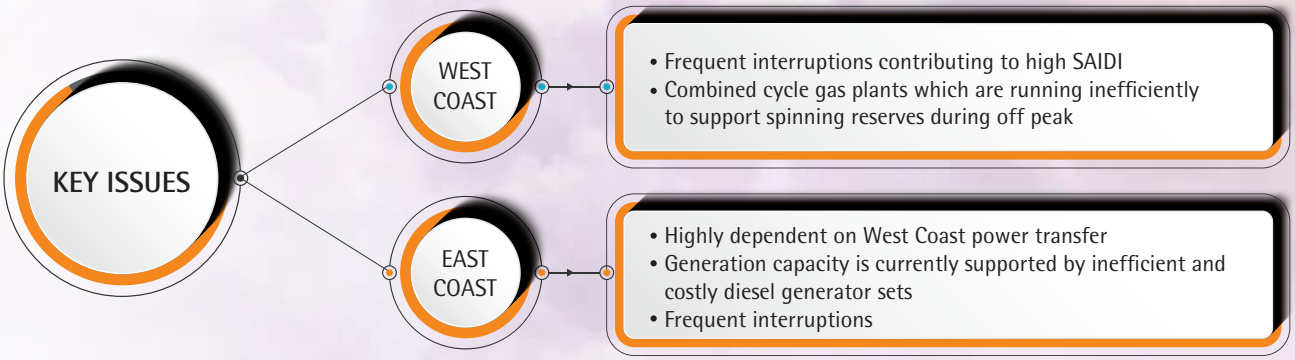
To date, the highest maximum demand recorded for the West Coast and the East Coast are 651MW and 311MW respectively. During this period, 224MW of supply was transferred to the East Coast through the 275kV Kolopis-Segaliud line and the balance was from local generation.

**Power Plants In Sabah**

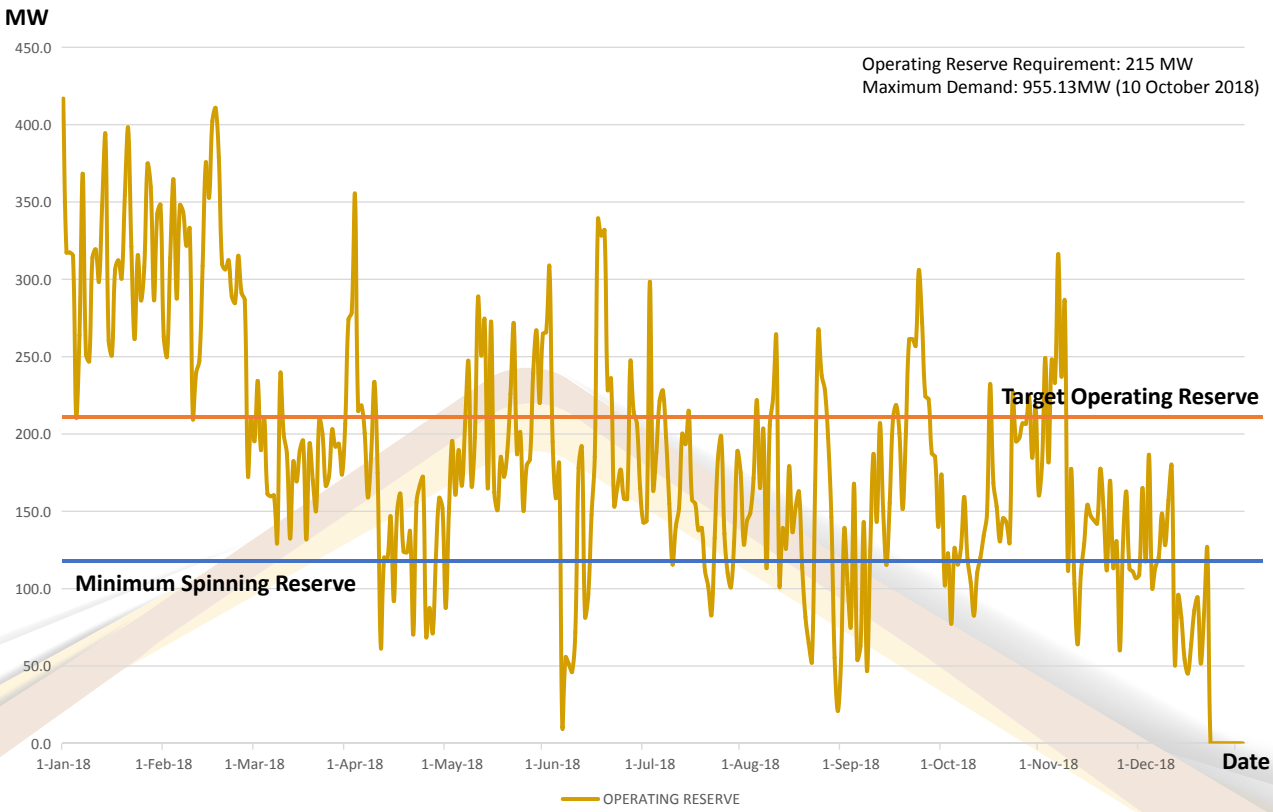


## Power Flow In Sabah (2018)


A strategy for long-term generation is necessary to ensure that not only can future demand be adequately met but also to address this gap. One of the key challenges is that the West and East Coasts of Sabah face different issues. The diagram below highlights these key issues.



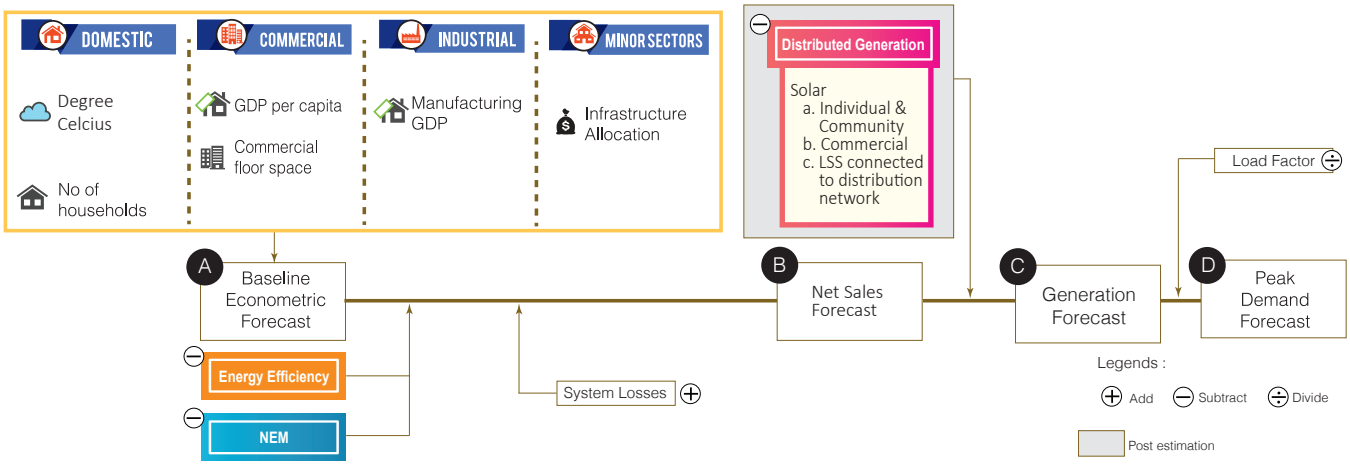
Operating Reserve, 2018

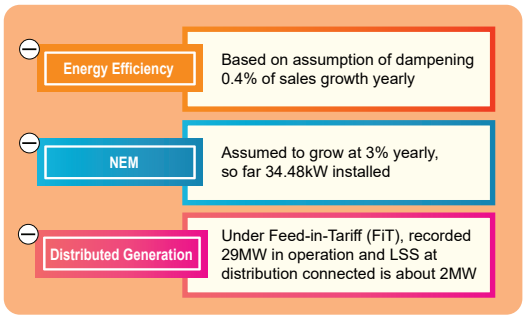



The target Operating Reserve is 215MW while the target Spinning Reserve is 120MW. Throughout 2018, there were 70 days of operating reserve that was less than 100MW due to incidents such as gas terminal interruptions or forced outages of gas plants.

# 20-YEAR FORECASTING MODEL

A number of demand drivers are used in planning the demand forecast such as the economy, population, weather, number of households, commercial floor space and electricity tariff.




**Improvements for Load Forecast Development 2018**

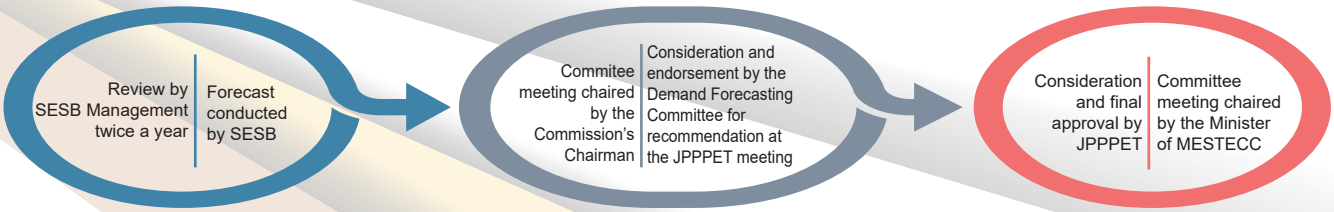
- ✓ Based on tariff categories (Domestic, Commercial, Industry, Others)
- ✓ Using weather temperature

Re-simulate FY2017 forecast - improve forecast error from 2.8% to 0.5%

- ✓ Publish monthly report on Load Forecast achievement
- ✓ Conduct Mid-Year Review

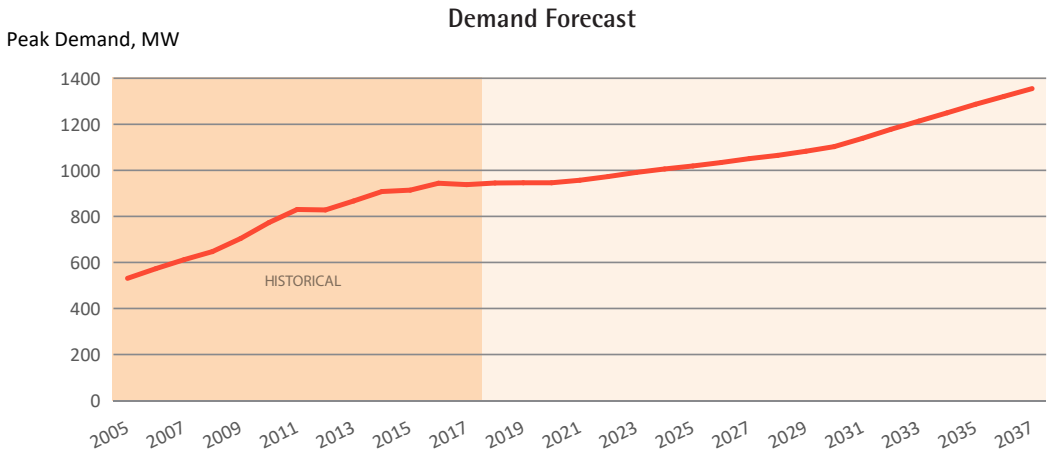
SESB reviews the Demand Forecast twice yearly and submits it for endorsement to the Demand Forecasting Committee chaired by the Commission's Chairman. Upon endorsement, the forecast is then submitted for final approval to the Planning and Implementation Committee for Electricity Supply and Tariff (JPPPET) chaired by the Minister of MESTECC upon which this forecast becomes the basis for planning and implementation of Sabah's energy system.

Demand Forecast Process Flow



## FORECAST

Electricity demand in 2018 had a projected growth of 0.7% for peak demand and 1.6% for sales. The commercial segment continues to be the main driver with 44%, followed by the domestic (34%) and industrial (21%) segments. The Commission proposes revisiting this forecast to align it to economic development as proposed by the State Government.




## SIX THINGS TO CONSIDER FOR GENERATION CAPACITY EXPANSION

### DEMAND FORECAST

| CAGR | % |
|---|---|
| 2018-2020 | 0.1 |
| 2020-2030 | 1.5 |
| 2030-2037 | 3.0 |

### MALAYSIA TRANSMISSION SYSTEM RELIABILITY STANDARD

The Generation Planning Criteria uses a LOLE value of 1.5 day/year. By 2019 the LOLE value shall be reduced to 1 day/year.

### OPTIMUM RESERVE MARGIN

The Reserve Margin required to achieve LOLH 24 hours/year:

| | | | |
|---|---|---|---|
| 2020-2024 | 30% | 2030-2034 | 24% |
| 2025-2029 | 30% | 2035-2037 | 24% |

### COP21: CLIMATE CHANGE AGREEMENT

45% CO2 emission intensity reduction target by 2030, from base year 2005

### NEW GOVERNMENT DIRECTION & ASPIRATION

- Review of TSGP implementation project
- 20% RE target by 2025

### OTHER TECHNICAL CRITERIA

- HHI : More diversified fuel
- UOR : Three years average
- Fuel price policy

LOLE : Loss of Load Expectation
LOLH : Loss of Load Hour

TSGP : Trans Sabah Gas Pipeline
HHI : Herfindahl-Hirschman Index

UOR : Unplanned Outage Rate
CAGR : Compound Annual Growth Rate

# 10 YEAR PLAN: TO IMPROVE SUPPLY SECURITY AND RELIABILITY

Prior to the completion of ongoing network reinforcement works, some generation repowering activities need to be expedited to support demand growth in the East Coast. This involves the installation of generators and rehabilitation of plants to strengthen the East Coast Grid's power generation capacity.

JPPPET, which is co-chaired by the Minister of MESTECC and the Chief Minister of Sabah, is responsible for determining and approving the Generation Development Plan for Sabah. The approved plan from 2018 to 2027 (refer to the diagram below) concentrates on improving the transmission network and exploring new generation (including RE) in the medium and long term plan.

As approved at the JPPPET meeting in 2018, a generation capacity of around 100MW to 200MW is required by 2024 to support new demand growth. This plan is reviewed periodically, subject to changes in demand forecast, generation requirement, completion of committed projects and government policies.

**10 Year Generation Plan (2018-2027)**

| YEAR | WEST COAST | EAST COAST | RETIREMENT |
|---|---|---|---|
| 2018 | Tadau LSS (48MW) | - | - |
| 2019 | - | GT Melawa (18MW), Tawau Rehab (13MW) | - |
| 2020 | One River HEP (30MW) | - | - |
| 2021 | Enhanced Kolopis-Segaliud Line (400MW) | - | Tawau (47MW), TSH (10MW) |
| 2022 | Sarawak Interconnection (50MW) | - | - |
| 2023 | - | - | - |
| 2024 | - | New Capacity of 100MW | Diesel Genset (135MW) |
| 2025 | - | New Capacity of 100MW | - |
| 2026 | - | - | Patau-Patau (103MW) |
| 2027 | Upper Padas HEP (192MW) | - | - |

## ENHANCE WEST COAST TO EAST COAST TRANSFER

As a licensee, SESB's Grid Division conducts the Annual Transmission Development Plan (ATDP) over a rolling 10-year period to identify issues and risks associated with the growth in load/demand levels and new generation plant up in the grid system.

This is in line with its responsibility to:

- Ensure sufficient capacity and capability are available to enable the system to return to normal operation under normal and under secured contingency, and
- Plan, design and develop its transmission system that is compliant with the Sabah and Labuan Grid Code and Transmission System Reliability Standard (TSRS).

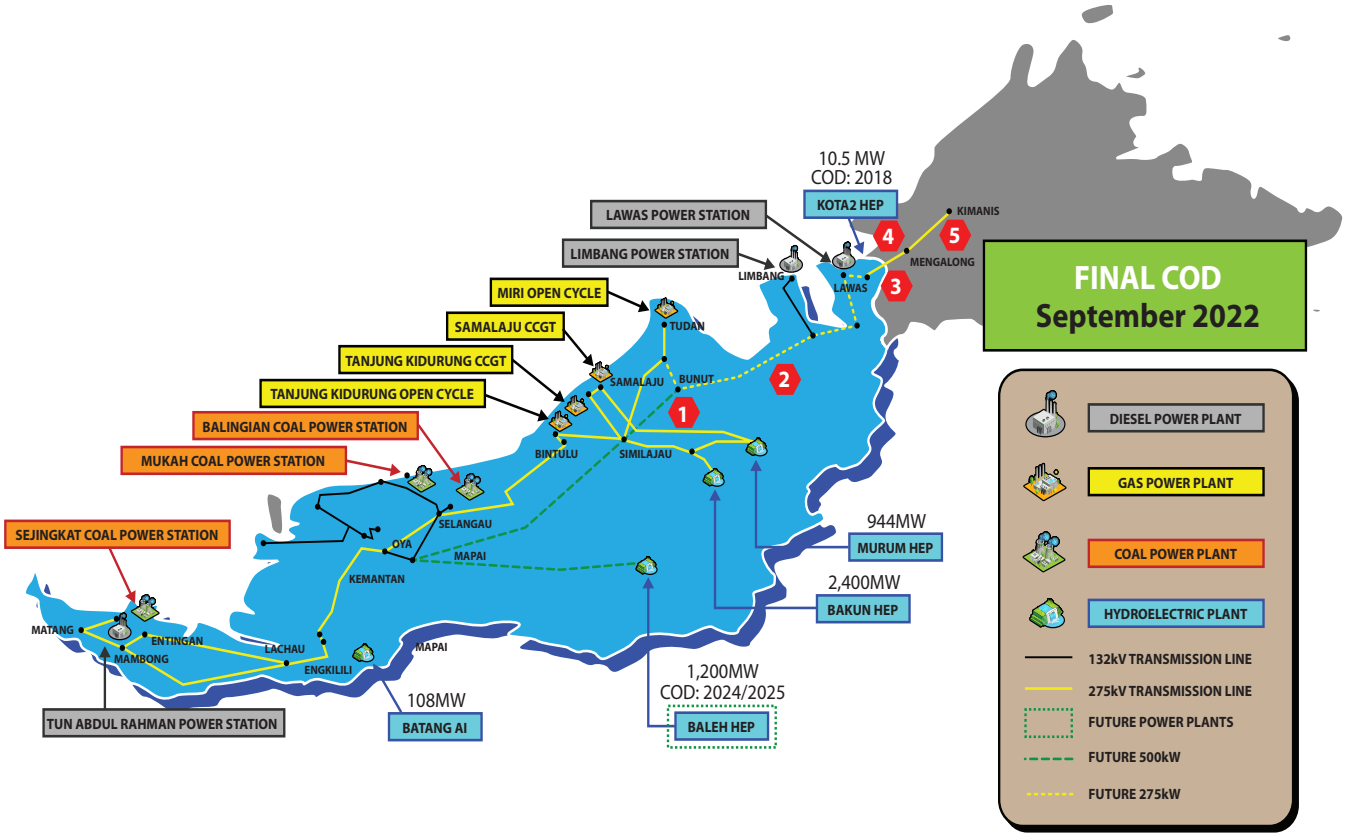
One of the ATDP outcomes is to enhance the 275kV Kolopis-Segaliud line by installing a new transformer of 240MVA at the PMU Damroad. Upon completion of this work, the Kolopis-Segaliud line will be able to transfer up to 400MW from the West Coast to the East Coast of Sabah.

## TAPPING INTO THE SARAWAK INTERCONNECTION

The integrated plan is looking into the cost benefit analysis of importing power through the Sarawak interconnection. The interconnection involves the development of several new transmission lines, from Similajau to Lawas in Sarawak and extending beyond the Sarawak-Sabah border up to Mengalong, Sabah.

The interconnection with Sarawak is a strong and economical option for system security and stability to cater to future demand. Discussions are ongoing to arrive at terms agreeable to the parties involved. The Commission and SESB are analysing the potential and foreseeable barriers of having electricity interconnections. The proposed establishment of a fully integrated 275kV backbone system in Sabah will enable further improvement of the system grid's reliability and provide flexibility for cross border interconnection. In addition, interconnecting with Sarawak means that the state generation capacity can be reduced, along with a reduced under frequency load shedding, larger allowable generator sizes and improved generation and operational costs.

Sarawak Transmission Network and Interconnection Linkages



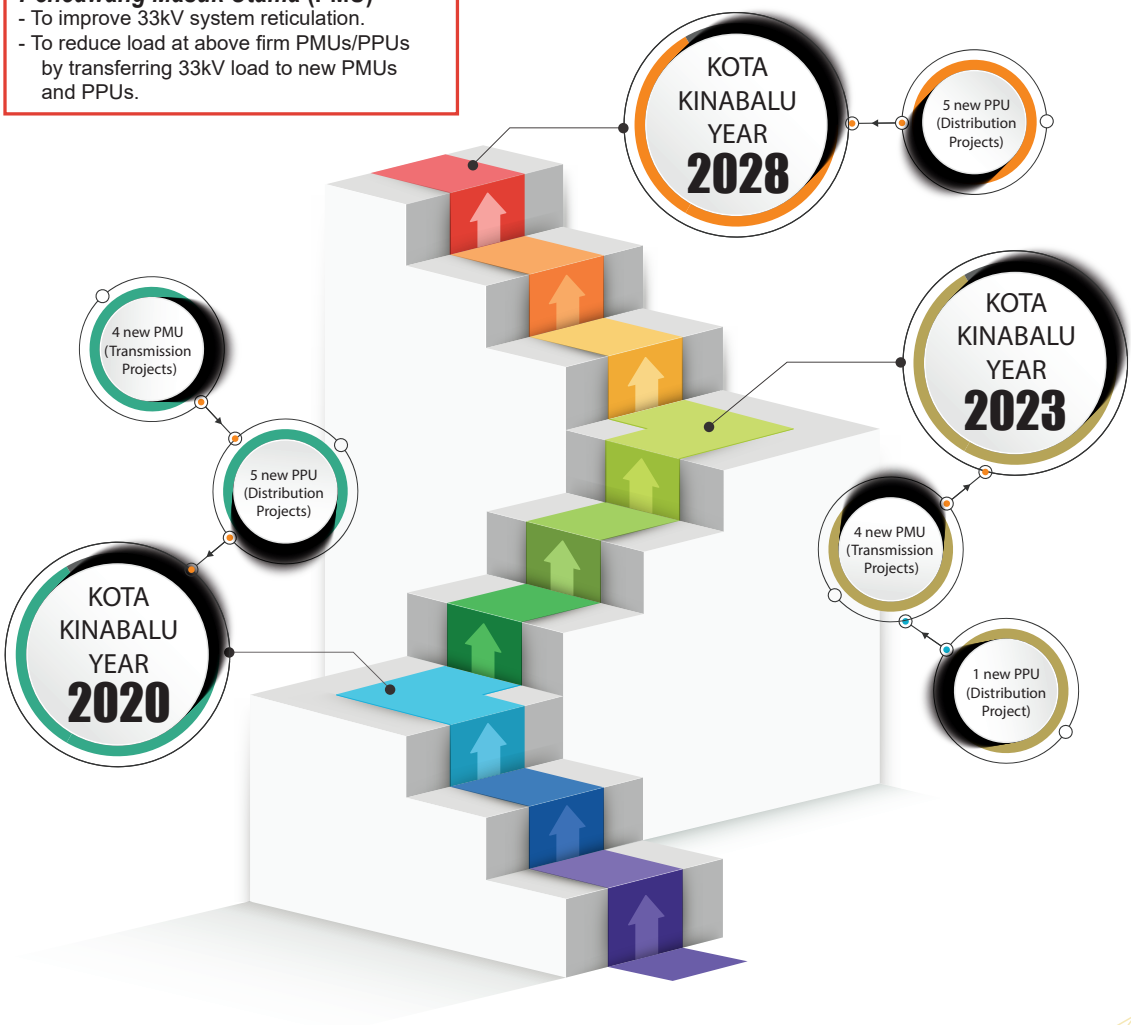
## CENTRAL REGION FOCUS

At present, there are about 598 circuit-km of 275kV lines, 2,150 circuit-km of 132kV lines and 112 circuit-km of 66kV transmission networks connecting all major townships in Sabah. The central region is identified as the Kota Kinabalu conurbation covering an area of 351 sq. km.

High SAIDI rates recorded in the Central Region has prompted several projects to alleviate the possibility of high fault level and to cater for future load growth. The Central Region Network Reinforcement from 2020 to 2028 will cater to the following scope, subject to Government approval:

***Pencawang Pembahagian Utama* (PPU)**
- To cater for load growth.
- To improve reliability of transmission system

***Pencawang Masuk Utama* (PMU)**
- To improve 33kV system reticulation.
- To reduce load at above firm PMUs/PPUs by transferring 33kV load to new PMUs and PPUs.



# WHAT'S ON THE GROUND

## SIX GRID PROJECTS

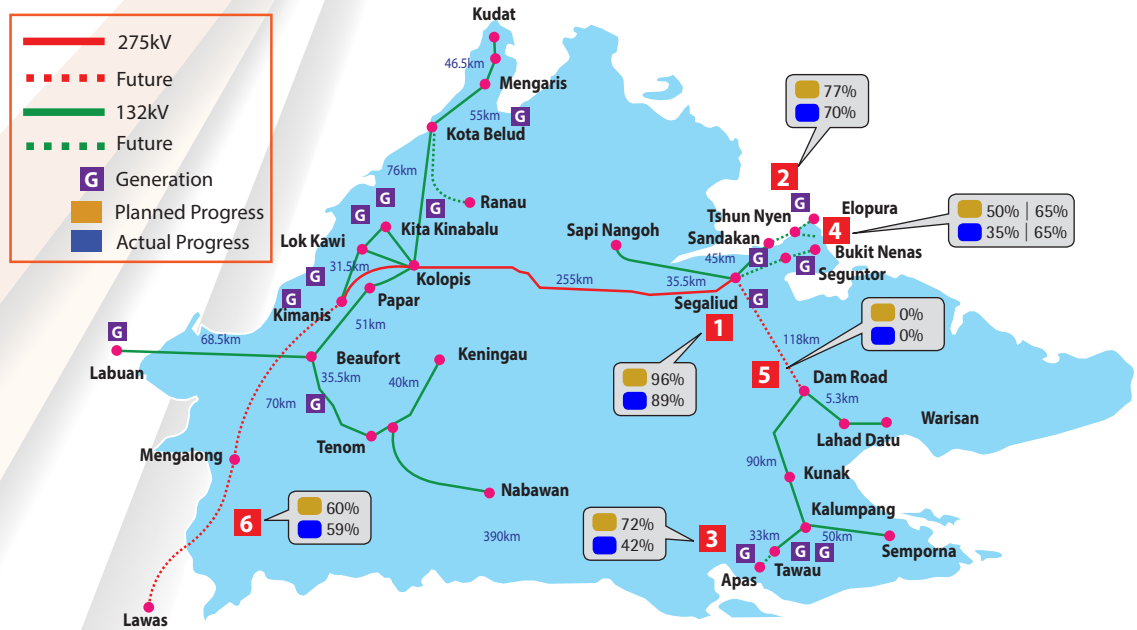
According to the Malaysia Energy Statistics Handbook 2017, Sabah's average SAIDI which is upwards of 200 m/y/c compared to 50 m/y/c and 112 m/y/c in Peninsular Malaysia and Sarawak respectively. This is attributable, among others, to the aging (20 years or more) grid network that is fast approaching its design load limits.

This weakness is being addressed by ongoing network reinforcement works that will not only improve power distribution efficiency, but also directly reduce SAIDI rates.

Currently, there are six major transmission projects costing RM840 million and targeted for completion in late 2021 or early 2022. The projects involve upgrading works, new transmission lines and PMUs. These projects have been identified as critical to achieve a distribution capacity of 200MW to 400MW. The six projects are:

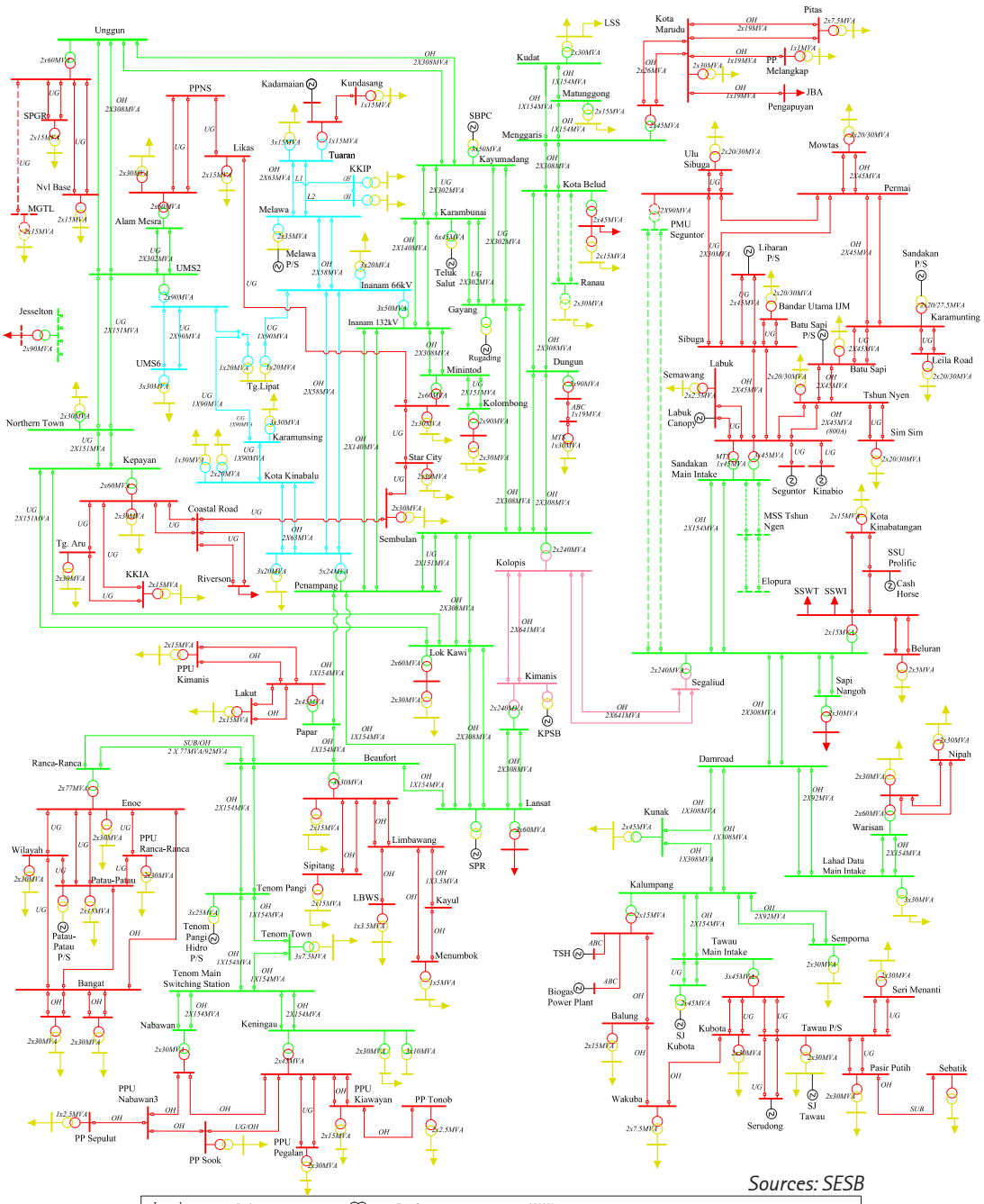
| | Projects | Target Completion Date |
|---|---|---|
| 1 | New line 132kV (Segaliud to Seguntor + 15MVA transfomer) | October 2018 |
| 2 | New line 132kV (Sandakan - Elopura) | November 2019 |
| 3 | New PMU and new line132kV Apas | November 2019 |
| 4 | New PMU and PPU Bukit Nenas \| New line 132kV (Tshun Nyen - Sandakan - Seguntor) | June 2021 |
| 5 | Upgrading 132kV to 275kV (Segaliud to Damroad) + 240MVA at Damroad | September 2021 |
| 6 | New line 275kV (Kimanis - Mengalong) | September 2019 |

Six Ongoing Grid Projects

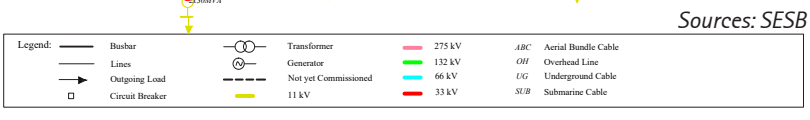


Currently, there are about 598 circuit-km of 275kV lines, 2,180 circuit-km of 132kV lines and 112 circuit-km of 66kV transmission networks connecting all major towns in Sabah. A single line diagram for the existing network is shown below:

## Sabah Grid Network




*Sources: SESB*



## SAIDI REDUCTION PROJECTS

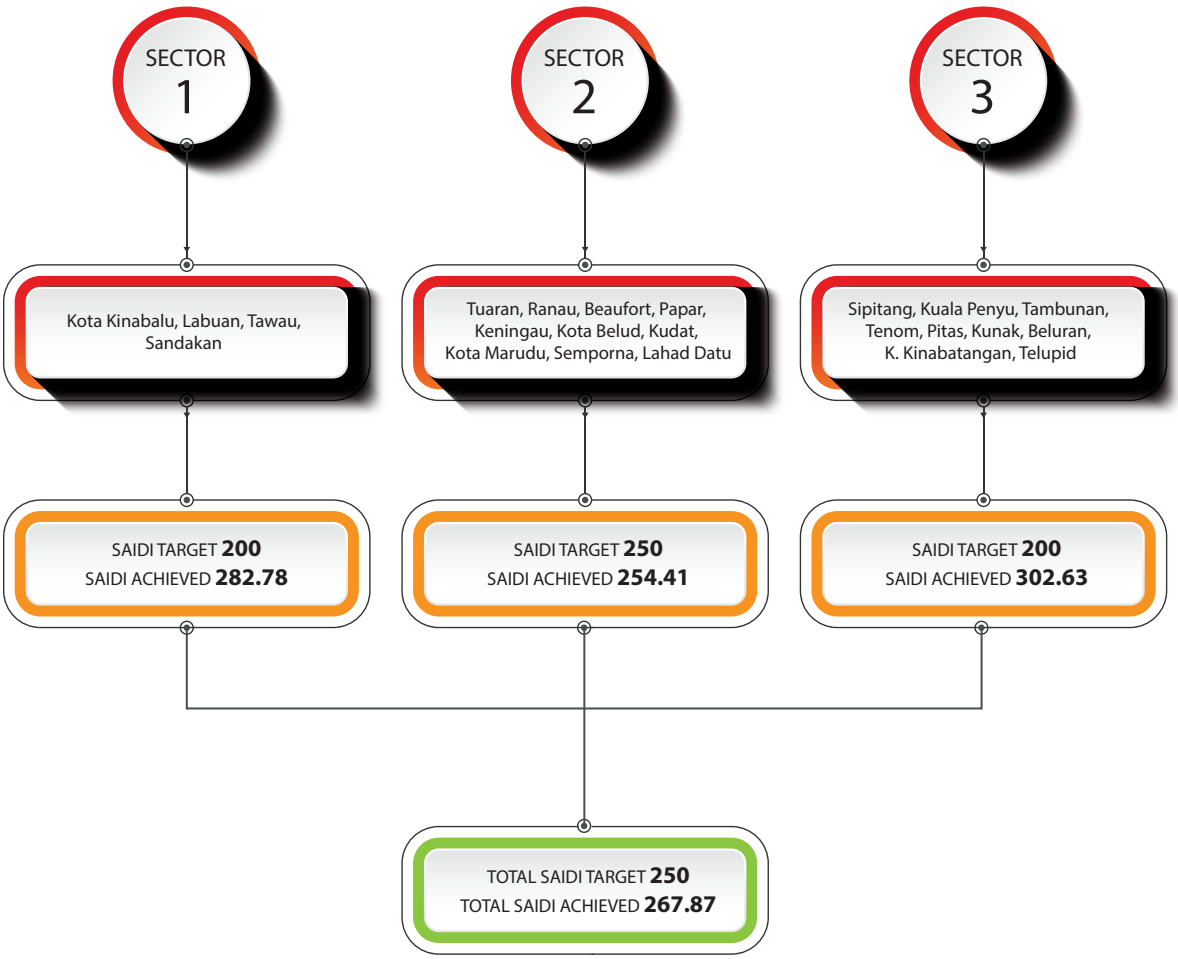
The Government has introduced SAIDI Sabah 100 and Taskforce 150 of which the implementation of these projects has resulted in a decline in Sabah's SAIDI rates.

As at 31 December 2018, SAIDI in Sabah was around 267 minutes/customer/year. The Government's target is as follows:

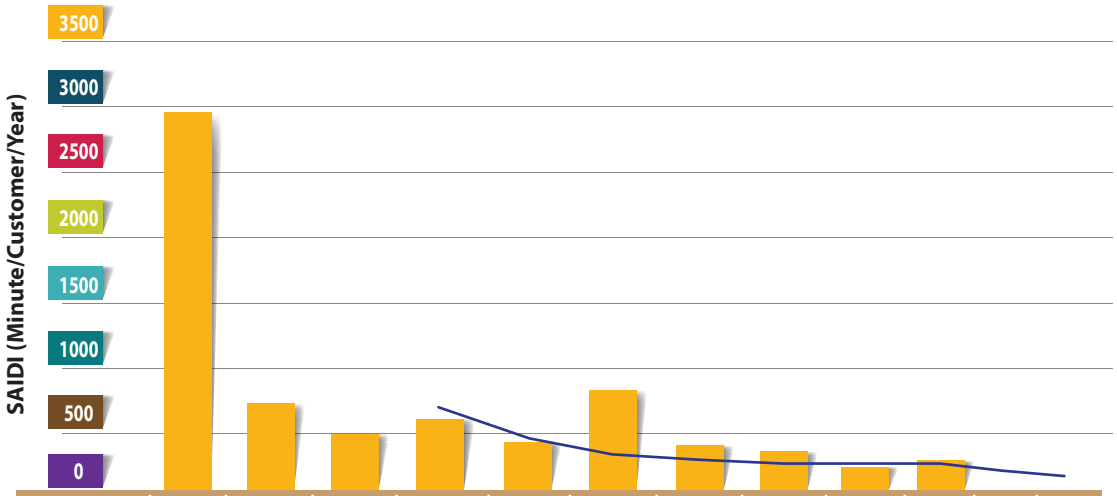
- 200 minutes by 2019 for Sector 1
- 100 minutes by 2021 for the whole state

The diagram below shows the SAIDI status as at the end of 2018.

**Saidi Reduction Targets and Actual Performance**



SAIDI in Sabah (2009-2018)




| YEAR | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAIDI | 2868 | 687.39 | 494.64 | 556.86 | 423.99 | 777.26 | 379.26 | 311.01 | 240.9 | 267.87 | | |
| TARGET | | | | 650 | 450 | 350 | 280 | 250 | 250 | 250 | 200 | 150 |

## TF150 Programme

SAIDI 150 (TF150) is a TNB and SESB joint initiative geared to reduce SAIDI to 100 minutes in focus areas, namely, Sandakan, Tawau, Labuan, Kota Marudu, Kota Belud, Tuaran, Papar, and Kota Kinabalu. A total of 215 projects involving 45 TNB experts and 15 SESB experts were deployed to these focus areas to execute and fast track upgrading projects.

Other TF150 tasks include:
- Finding solutions to existing problems (such as replacing bare cables with aerial bundled cables - ABCs); and
- Reducing customer complaints related to reliability by 2018.

All 215 projects under TF150 have been completed and the SAIDI reduction target of 91.71 minutes/customer/year was achieved.

## Formation of SAPADU

The Sabah Special Project and Delivery Unit (SAPADU) under the then Ministry of Energy, Green Technology and Water was established in 2015 to implement 44 electricity supply, mainly consisting of transmission and distribution projects, from 2015 to 2020.

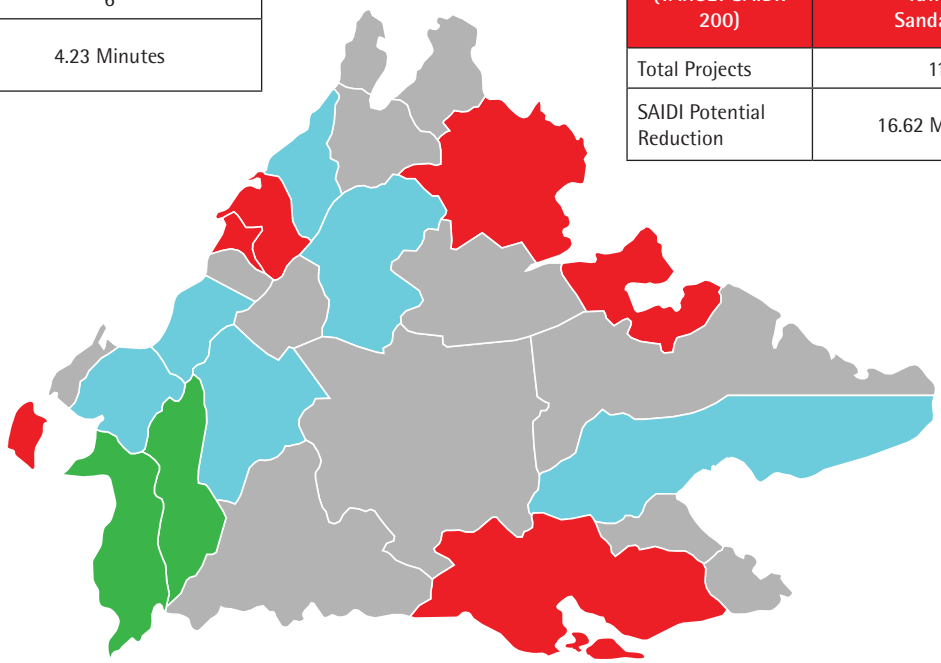
These network reinforcement projects aim to reduce Sabah's SAIDI to 157.64 minutes/customer/year (from 178.69 minutes/customer/year) by the year 2021.

## Projects under the 10th Malaysia Plan and 11th Malaysia Plan

In addition to TF150, other Government initiatives to reduce interruptions include those under Malaysia Plan allocations fo projects worth RM2.3 billion to be used to strengthen the existing transmission and distribution system. Under this programme, which is being monitored and supervised by SAPADU, 19 projects were identified:

| SECTOR 2 (TARGET SAIDI: 210) | Tuaran, Ranau, Beaufort, Papar, Keningau, Kota Belud, Kudat, Kota Marudu, Semporna, Lahad Datu |
|---|---|
| Total Projects | 6 |
| SAIDI Potential Reduction | 4.23 Minutes |

| SECTOR 1 (TARGET SAIDI: 200) | Kota Kinabalu, Labuan, Tawau, Sandakan |
|---|---|
| Total Projects | 11 |
| SAIDI Potential Reduction | 16.62 Minutes |



| SECTOR 3 (TARGET SAIDI: 170) | Sipitang, Kuala Penyu, Tambunan, Tenom, Pitas, Kunak, Beluran, K. Kinabatangan, Telupid |
|---|---|
| Total Projects | 2 |
| SAIDI Potential Reduction | 0.2 Minutes |

Distribution, transmission and generation all contribute towards Sabah's SAIDI that stands at 258.54 minutes/customer/year, 2.88 minutes/customer/year and 6.46 minutes/customer/year, respectively. The overall SAIDI target in Sabah is 200 minutes/customer/year.

As at 31 December 2018, 57 projects were in progress, with 16.8% of the RM385 million allocated spent so far on strengthening the existing transmission and distribution system.

## STAKEHOLDER ENGAGEMENT

The Commission monitors the implementation and delivery of major transmission projects to ensure their timely delivery. For this, it engages with relevant stakeholders, project developers and the grid owner to resolve issues that may delay project delivery.

Among the common issues affecting transmission projects are community concerns over transmission projects affecting their homes, health and livelihood. Land acquisition and environmental concerns are also key issues.

26 September 2018 - Site visit to PMU Beaufort and Load Dispatch Centre Penampang with technical experts to discuss on options of PMU Beaufort upgrading project.

23 October 2018 - Briefing to YAB Datuk Seri Panglima Haji Mohd Shafie Bin Haji Apdal, Chief Minister of Sabah on the electricity supply situation in Sabah. Continuous engagement with the state is done to ensure smooth project development and sustainability and adequacy of Sabah's electricity supply industry.

## CHALLENGES

Upgrading works in the Central Region is a daunting task as the existing network is made up of 132kV and 66kV lines that may not be adequate to meet the power transfer required in 20 years. These lines need to be upgraded to 275kV, wherever possible.

Moreover, procuring the right of way can be difficult within city limits and projects need to be identified and optimised in order to complete the grid reinforcement plan on time.

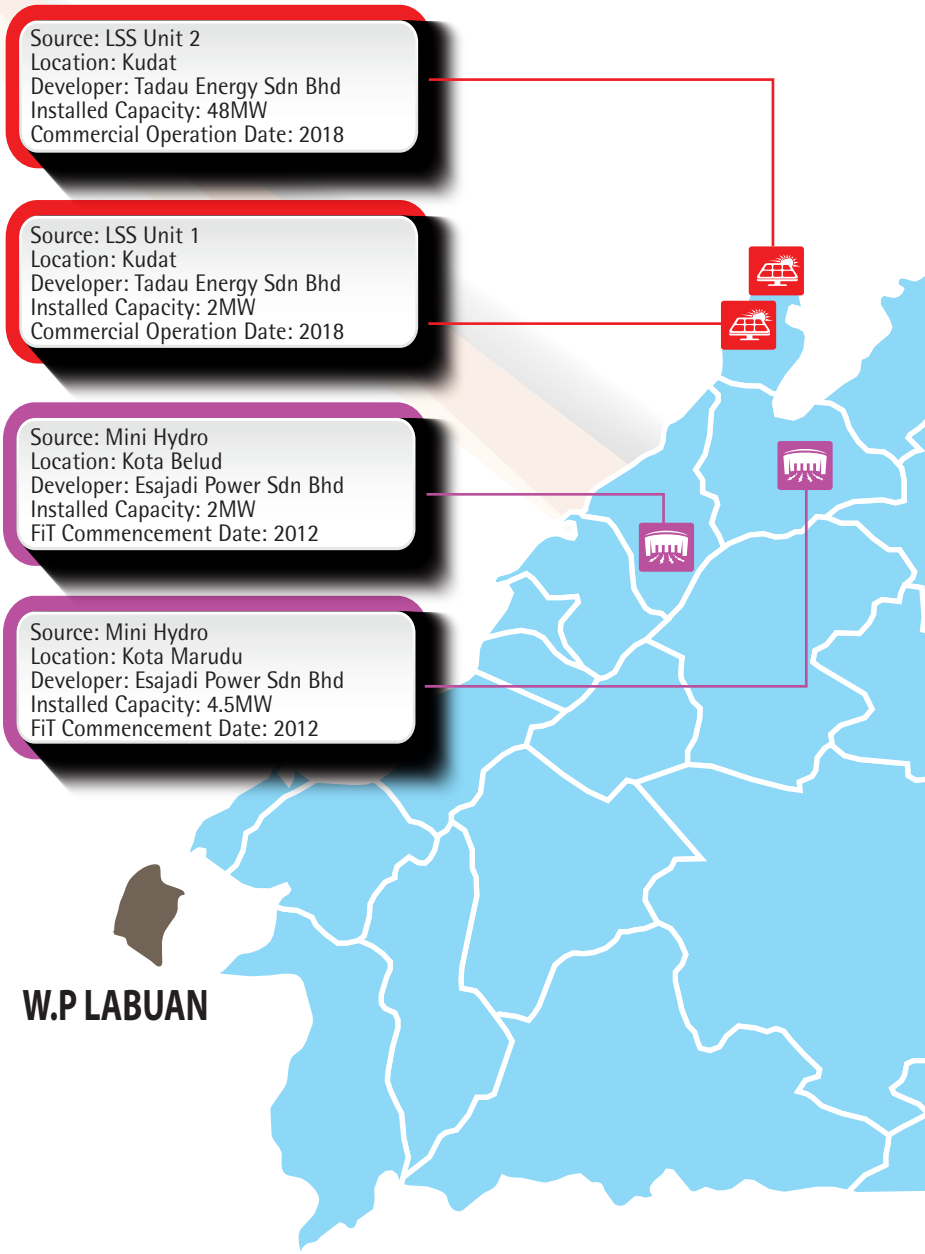
SAIDI reduction projects, meanwhile, face challenges arising from the heavy dependence on unreliable diesel-powered plants on the East Coast. Also, there are unstable connecting lines and power distribution. There is also the issue of power theft that contributes towards electricity outages, especially in Sandakan and Tawau.

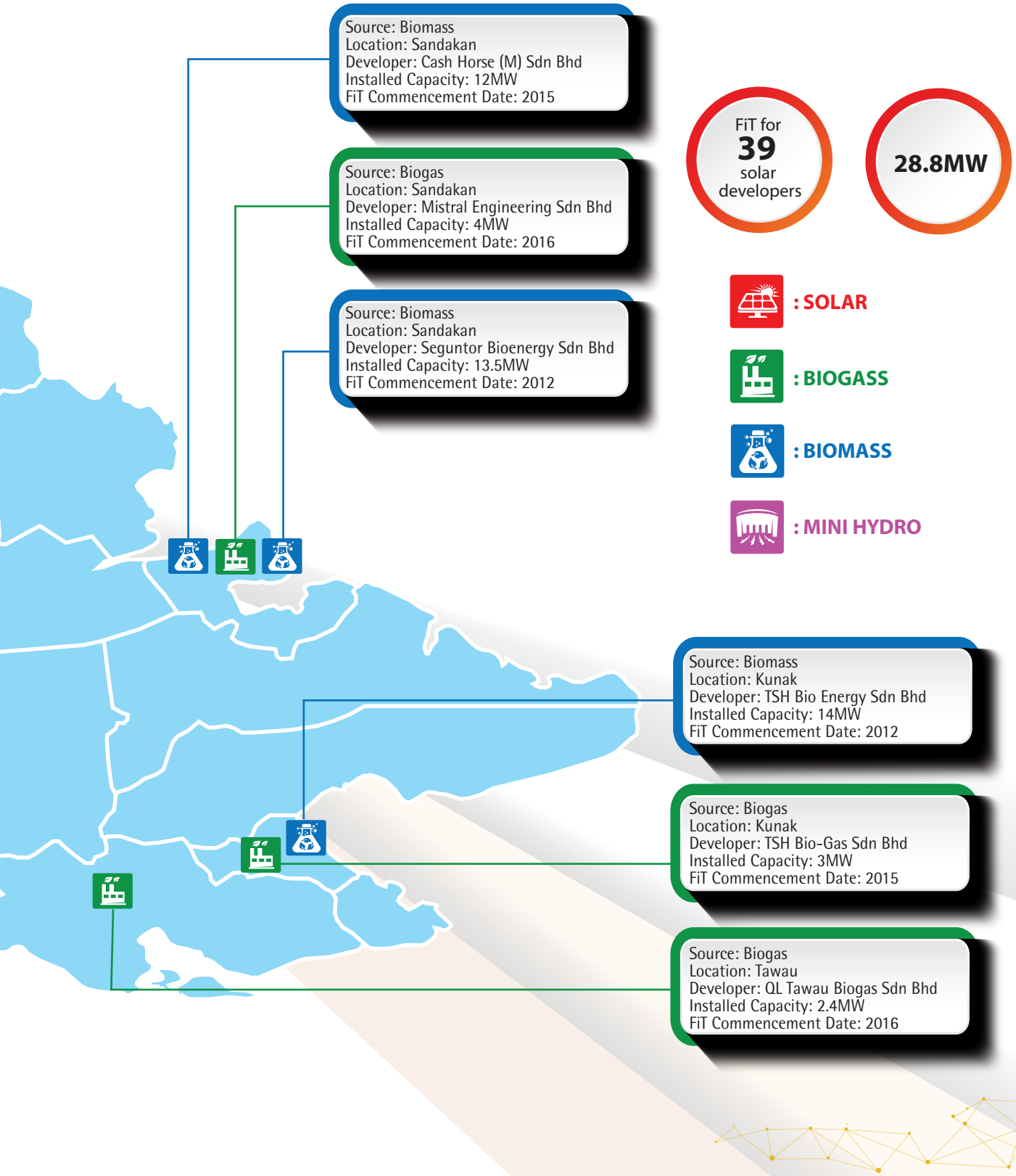
# ENVIRONMENTAL SUSTAINABILITY – FUEL MIX DIVERSITY

Sabah is promoting RE as part of its strategy for fuel mix diversity. This is in line with Malaysia's goal to have a generation mix of 20% RE by 2025. As at the end of 2018, installed RE capacity in the state stood at 134.2MW, produced by solar, mini hydro, biomass and biogas sources.

Of the 134.2MW generated, 78.8MW was from solar (59%), 6.5MW from mini hydro (5%), 9.4MW from biogas (7%), and 39.5MW from biomass (29%).

It is encouraging to note that 28.8MW was generated via Feed in Tariff (FiT) consisting of 39 solar developers who accounted for 21.5% of RE supply as at the end of 2018.




Source: Biomass
Location: Sandakan
Developer: Cash Horse (M) Sdn Bhd
Installed Capacity: 12MW
FiT Commencement Date: 2015
Source: Biogas
Location: Sandakan
Developer: Mistral Engineering Sdn Bhd
Installed Capacity: 4MW
FiT Commencement Date: 2016
Source: Biomass
Location: Sandakan
Developer: Seguntor Bioenergy Sdn Bhd
Installed Capacity: 13.5MW
FiT Commencement Date: 2012
FiT for 39 solar developers
28.8MW
: SOLAR
: BIOGASS
: BIOMASS
: MINI HYDRO
Source: Biomass
Location: Kunak
Developer: TSH Bio Energy Sdn Bhd
Installed Capacity: 14MW
FiT Commencement Date: 2012
Source: Biogas
Location: Kunak
Developer: TSH Bio-Gas Sdn Bhd
Installed Capacity: 3MW
FiT Commencement Date: 2015
Source: Biogas
Location: Tawau
Developer: QL Tawau Biogas Sdn Bhd
Installed Capacity: 2.4MW
FiT Commencement Date: 2016

## MORE SOLAR POWER

Malaysia's RE focus is on solar power in Peninsular Malaysia and this also applies to Sabah, where solar power generation is expected to partially replace retiring power plants to meet the growing power demand.

The Government is also taking steps to increase RE capacity in the form of awards under the FiT mechanism and an additional 50MW solar PV from Tadau Energy that has been in operation since September 2018.

The primary obstacle to RE power production is the overrun cost. The Minister of MESTECC, YB Yeo Bee Yin, acknowledged the financial constraints faced by some RE developers and has established the Green Financing Taskforce. The taskforce's objectives are to mobilise affordable financing for RE developers and to spawn an RE ecosystem that will support the RE agenda.

### New Strategies to Boost RE

In March 2019, the Minister of MESTECC, YB Yeo Bee Yin announced a new RE roadmap that is being developed for Malaysia. The Renewable Energy Transition Roadmap (RETR) 2035 will explore possible strategies and action plans to achieve the target of 20% RE in the national power mix by 2025. RETR 2035 is still in the early planning stage and is targeted to be ready by the end of 2019.

A few potential strategies are being explored. The first one is Peer-to-Peer Energy Trading where solar prosumers can sell their excess electricity to consumers and by extension expand the benefits of the Net Energy Metering (NEM) scheme to a wider customer base. The second strategy is to provide consumers with the option to buy 100% RE electricity from power utility companies. This will meet the growing trend of corporate sourcing of RE electricity to meet Malaysia's environmental obligation. Lastly, the roadmap will explore the cost benefits and effectiveness of establishing a mandatory Renewable Energy Certificate (REC) market.

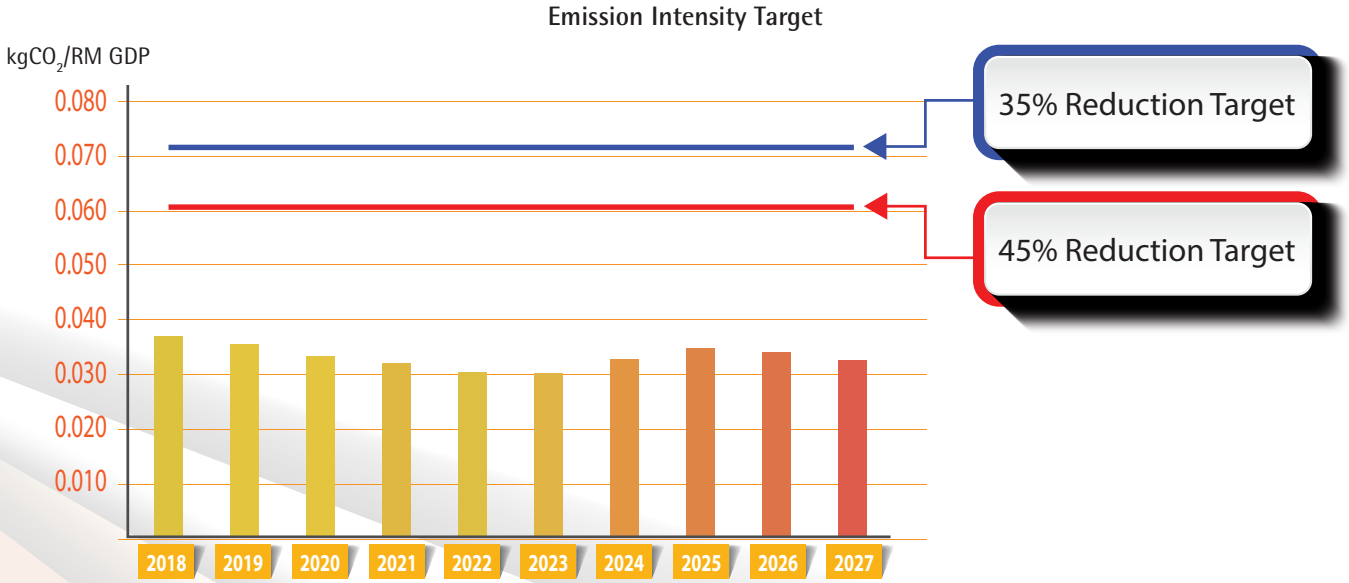
*Source: Bernama*

# MANAGING EMISSION INTENSITY LEVEL

Under the Paris Agreement (COP 21), Malaysia is committed to reduce its overall carbon emissions through measurement under its Nationally Determined Contribution by 2030 as follows:

- 35% unconditional reduction of Green House Gas (GHG) emission intensity per GDP, with 2005 baseline; and
- Up to 45% reduction, conditional to assistance from developed countries.

Currently, Sabah has a gas-dependent fuel mix, with a HHI of 0.79. The HHI is expected to decline to 0.52 in 2027 with the diversification of the fuel mix, either through the introduction of new fuels (especially solar power) or by increasing the share of other fuel sources.




Compared to Peninsular Malaysia, Sabah has a good emission intensity record, with approximately 80% of its power generation based on natural gas, the cleanest of fossil fuels, while the rest of its power is generated by diesel, hydro and RE sources. As a result, the state's emission intensity for its power generation sector is below the national emission target of 45%.

# CHALLENGES

While RE is being promoted to diversify the fuel mix, its implementation faces a number of challenges, namely, the sourcing of RE fuels and capital costs.

Sabah's oil palm plantations are a large source for biomass. However, biomass has better value as feedstock in export markets rather than as a fuel source. This has led to the closure of biomass-based power plants in 2018. In addition, most RE projects are located in remote areas, some distance away from the grid. Due to this, the sale price for FiT is considered low by RE developers to cover their transmission cost to the grid.

# ENERGY EQUITY – CREATING A SUSTAINABLE TARIFF FRAMEWORK

The Commission is committed to balancing the needs of consumers and power producers to guarantee secure and reliable electricity supply at reasonable prices. To achieve this, the IBR, a transparent tariff setting mechanism will be introduced in Sabah. IBR is considered a breakthrough mechanism that resulted in the establishment of a sustainable tariff framework and is now into its second regulatory period in the Peninsular.

## INTRODUCING INCENTIVE-BASED REGULATION (IBR)

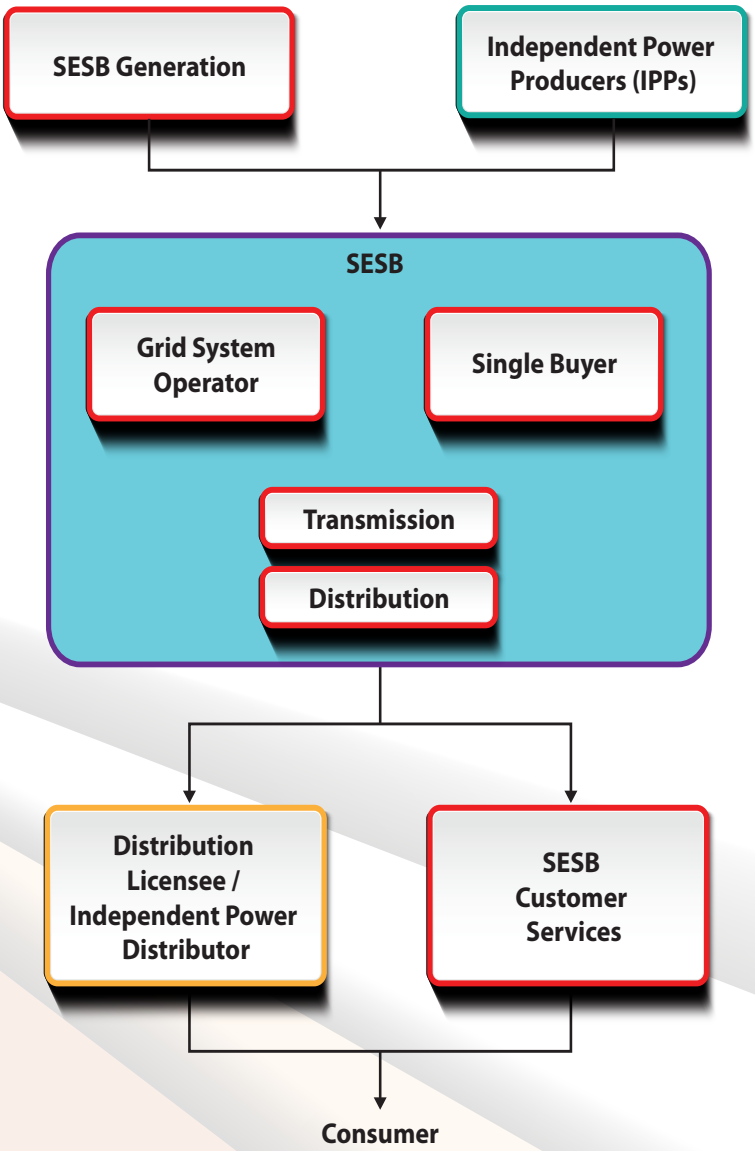
Following the successful implementation of the IBR mechanism in Peninsular Malaysia, the Commission has embarked on initiatives to introduce the same mechanism to regulate SESB. The mechanism serves as a policy for electricity tariffs determination, and provide the avenue to further improve the financial viability and technical operation of SESB.

The Commission, in exercising its mandate as conferred by Sections 26 and 50C of the Electricity Supply Act 1990 [Act 447], published the guidelines on tariff determination framework under IBR for SESB in May 2016. The guidelines describe the methodology, principles, procedures and requirements that shall be complied by SESB in the submission of the electricity tariff proposal or revision as required under Section 26 of the Electricity Supply Act 1990.

The framework for tariff determination shall be based on 11 Regulatory Implementation Guidelines (RIG). They are:

i. RIG1 : which defines the business entities of SESB;
ii. RIG 2 : which defines the tariff setting framework;
iii. RIG 3 : which sets the revenue requirement principles;
iv. RIG 4 : which sets the Weighted Average Cost of Capital of SESB;
v. RIG 5 : which establishes the operating cost, asset and consumption templates;
vi. RIG 6 : which establishes the incentive framework for operational performance;
vii. RIG 7 : which defines the cost allocation principles;
viii. RIG 8 : which establishes the imbalance cost pass through mechanism;
ix. RIG 9 : which defines the tariff design principles;
x. RIG 10 : which establishes the regulatory accounts process; and
xi. RIG 11 : which establishes the process for determining the revenue requirement and tariff.

As in Peninsular Malaysia, three business entities - Generation, Transmission and Customer Services (Distribution) - will be ring fenced with separate accounts. The Managed Market model will be adopted due to its consistency with SESB's operation as well as to enhance transparency between SESB and IPP generation. This is broadly consistent with the recommendations for the IBR implementation in Peninsular Malaysia.



# KEY PERFORMANCE INDICATORS (KPIs) FOR BETTER PERFORMANCE

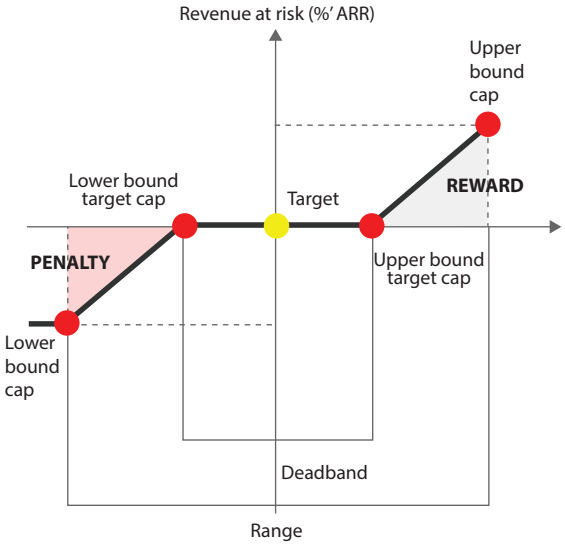
As part of the IBR mechanism, a set of standards and incentives to improve operating performance was introduced. This is to avoid compromising operational performance at the expense of cost and financial efficiency. A total of 16 key performance indicators and two sub performance indicators were identified for all business entities using Symmetrical, Asymmetrical and Monitoring methods to determine incentives (rewards), penalties, and for monitoring.

**16 KPIs**

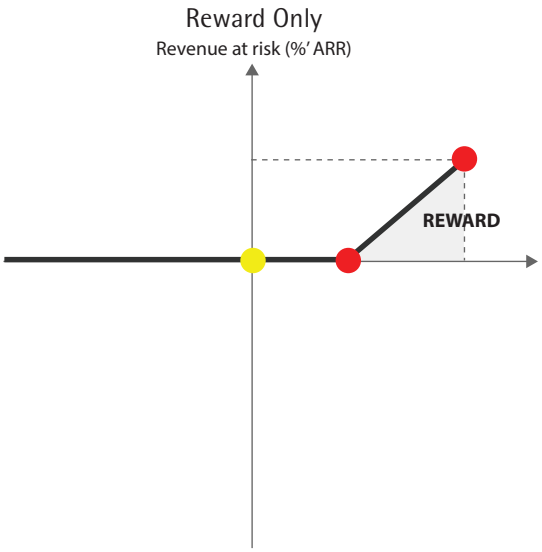
| BUSINESS | CODE | PERFORMANCE INDICATORS |
|---|---|---|
| Customer Service (CS) | CSPI1 | SAIDI |
| | CSPI2 | New Service Connection |
| | CSPI3 | Effective Safety Management Program |
| | CSPI4.1 | Project Delivery Index |
| | CSPI4.2 | Effective Maintenance Program |
| | CSPI5.1 | Customer Complaint |
| | CSPI5.2 | Reduction in System Losses |
| Transmission (TX) | TXPI1 | System Minutes |
| | TXPI2 | Project Delivery Index (PDI) |
| | TXPI3 | Effective Maintenance Program |
| System Operator (SO) | SOPI1.1 | Wide Area Loss of Supply Event |
| | SOPI1.2 | Total Blackout |
| | SOPI2 | Dispatch Adjustment |
| Single Buyer | SBPI1 | Day Ahead Load Forecast Deviation |
| | SBPI2 | System Average Cost |
| | SBPI3 | Monitoring on Initiative of System Reduction Losses Programes |

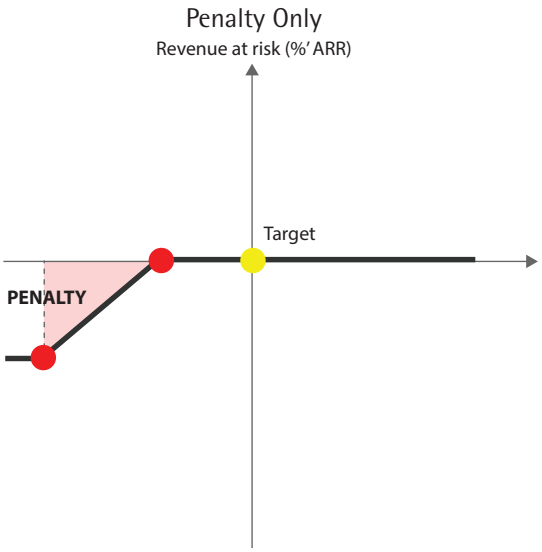
Note: Blue (Symmetrical), Orange (Asymmetrical) and Green (Monitoring)

Symmetrical performance incentive mechanism - KPI achievement based on reward and penalty measurement.




Asymmetrical performance incentive mechanism - KPI achievement based on reward only or penalty only.



# DEVELOPMENT OF SERVICE LEVEL AGREEMENTS (SLAs) FOR SESB PLANTS

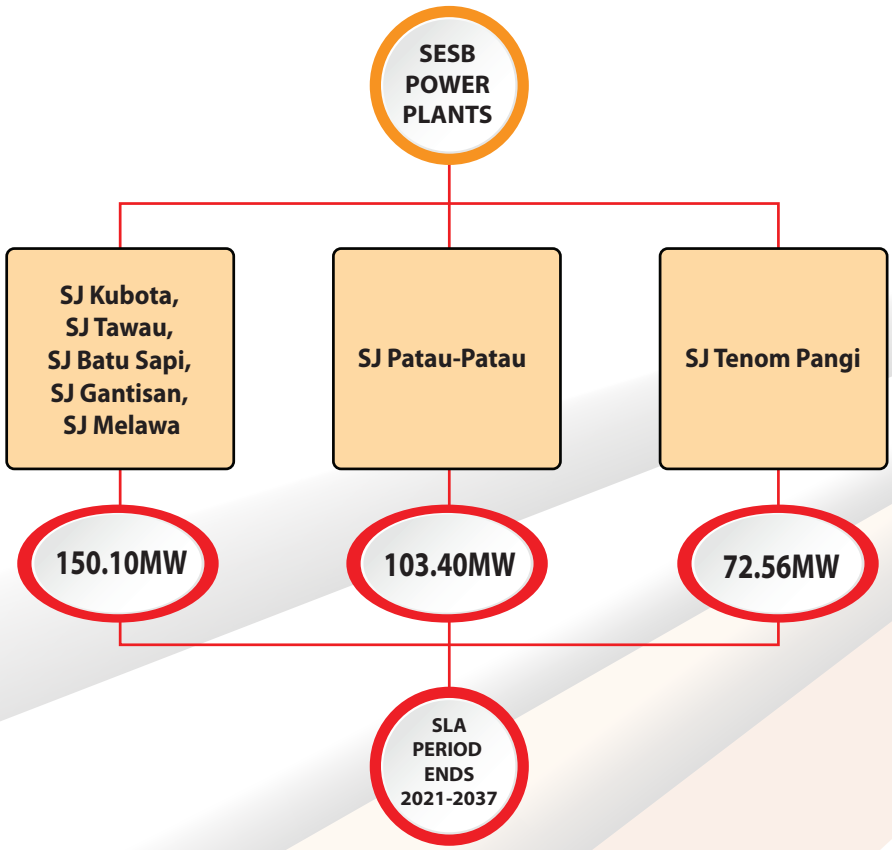
In exercising its functions under the Act, the Commission needs to approve any arrangement by the licensee for the procurement of electricity through the transmission network. Therefore, to regulate electricity generation activities, the Commission has taken the initiative to introduce SLAs for SESB's large power plants.

At the moment, SESB has seven large power plants with a total capacity of 326.06MW. They are:

i. Diesel-powered plants (150.10MW)
   - SJ Kubota, SJ Tawau, SJ Batu Sapi, SJ Gantisan and SJ Melawa

ii. Gas-powered plants (103.40MW)
   - SJ Patau-Patau

iii. Hydro-powered plants (72.56MW)
   - SJ Tenom Pangi



The SLA is a mechanism to enable the Commission to monitor the technical and financial performance of the plants, with effect from 2021 to 2037. The main components of the SLA are generation payments, technical requirements, default and termination, and scheduling and dispatch. The diagram below carries the highlights of each of these components.

**GENERATION PAYMENTS**
Consists of Capacity Payment (CP) and Energy Payment (EP)

CP: Fixed revenue for offering available generation capacity to the system. The components are Capital Rate Financing (CRF) and Fixed Operating Rate (FOR).

EP: Payment for energy produced such as fuel payment and variable cost (translated through Variable Operating Rate, VOR).

**DEFAULT AND TERMINATION**
Constitutes predefined circumstances (Events of Default) by each party involved.


**SCHEDULING AND DISPATCH**
Plant's proposed schedule which includes Annual Scheduled Available Capacity, Daily Available Capacity, Dispatch Instruction etc.

**TECHNICAL REQUIREMENTS**
Interconnection Facilities
- Responsibility for the operation and maintenance of interconnection facilities.

Protective Devices
- Responsibility for protecting its own facilities from possible damage caused by electrical disturbances or other problems arising from operation or non-operation.

Metering Devices
- Medium to measure electrical energy of the facility delivered to interconnection point.

Operation Maintenance and Testing
- Establishment of Net Dependable Capacity, Monitor Test, Re-Validation Test and other tests.

## CHALLENGES

Generation in the East Coast currently relies heavily on diesel power plants. Although historically this was the most practical solution here, increasing costs–fuel, lubrication and maintenance–combined with less efficiency under overload conditions for a long period and small amounts of power generated have made these diesel plants a costly option.

Due to the unique situation in Sabah, where commercial and residential consumers are the main energy drivers, sales at the current tariff rates are not cost-reflective and SESB is depending on Federal Government subsidy to cover generation costs. The Commission proposes the IBR as a framework to reform the power industry in Sabah and for SESB to be able to conduct itself as a business entity to ensure the sustainability of the Sabah electricity supply industry.

# CONCLUSION

In terms of infrastructure development, Sabah is progressing, albeit slowly, with the rest of Malaysia. This is largely due to geographical challenges in the mountainous 74,000 sq km state. The terrain hampers connectivity, and affects adequate and reliable supply of electricity between major towns.

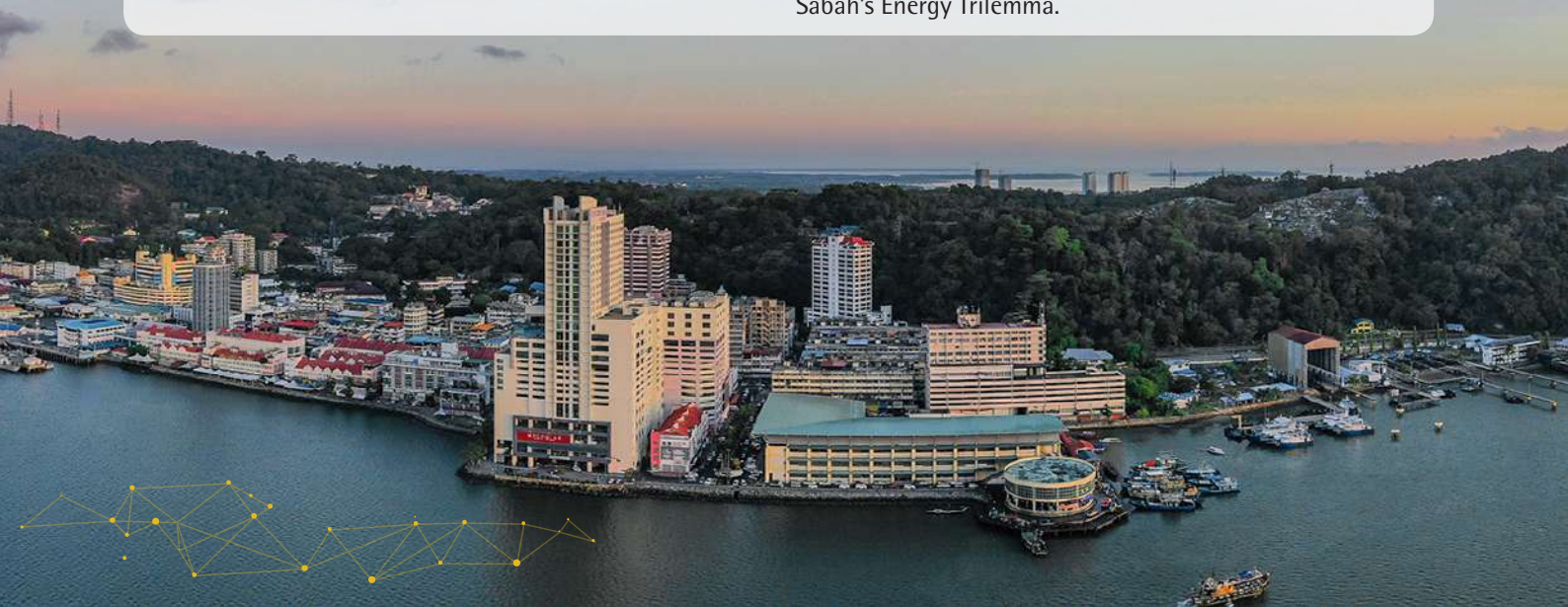
To address these issues, the Federal Government has embarked on six major projects to reinforce and upgrade especially the East Coast grid, which will then increase electricity supply from the West Coast to the East Coast of Sabah. The six projects are:

- New line 132kV (Segaliud to Seguntor + 15MVA transformer).
- New line 132kV (Sandakan - Elopura).
- New PMU and new line 132kV Apas.
- New PMU and PPU Bukit Nenas | New line 132kV (Tshun Nyen - Sandakan - Seguntor).
- Upgrading 132kV to 275kV (Segaliud to Damroad) + 240MVA at Damroad.
- New line 275kV (Kimanis - Mengalong).

Other ongoing grid reinforcement projects include SAIDI 100 and TF150 to assist in reducing power interruptions in the state. The Sabah Electricity Supply Committee Meeting (JKBES), a special committee that meets twice a year and is chaired by the Deputy Minister of MESTECC, aims to resolve any issues arising from the implementation of the electricity supply infrastructure projects. The cooperation from the Sabah State Economic Planning Unit (UPEN) will also help in ensuring smooth implementation of all projects and are delivered on time.

In terms of generation adequacy, the grid system in Sabah will be interconnected with Sarawak by 2022 under a Power Exchange Agreement (PEA) to improve system reliability. Additional capacity in the East Coast will also be added post 2020, to replace retiring diesel generator sets. With this new capacity, the reserve margin is expected to be maintained at its optimum value of 30% until 2030.

A gradual yet progressive development and improvement can be seen in the overall system performance in Sabah. Based on this Sabah electricity supply industry outlook, with concerted efforts from all parties, we can expect to see more improvement on the Energy Security dimension of the Sabah's Energy Trilemma.



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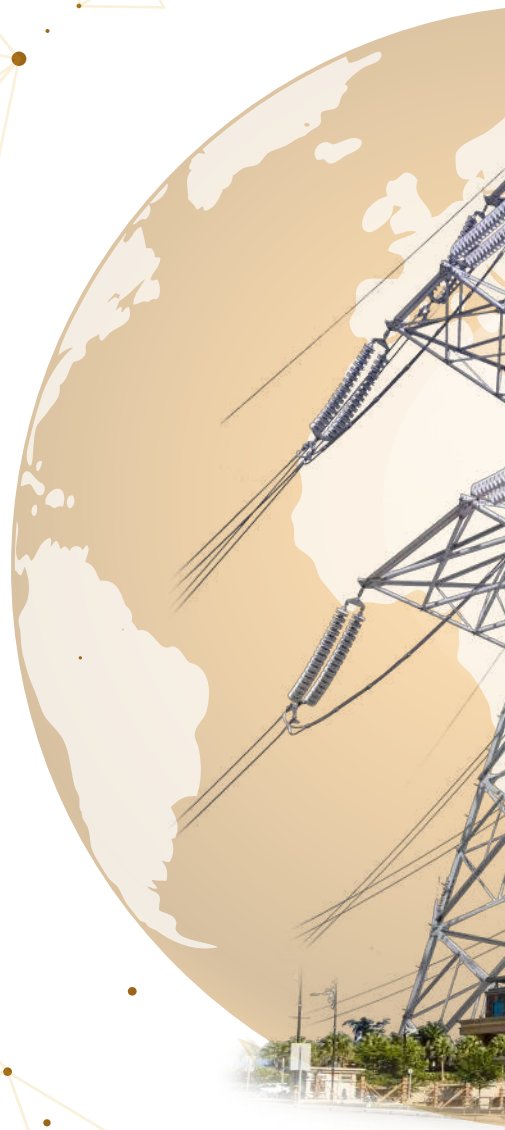

Suruhanjaya Tenaga
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