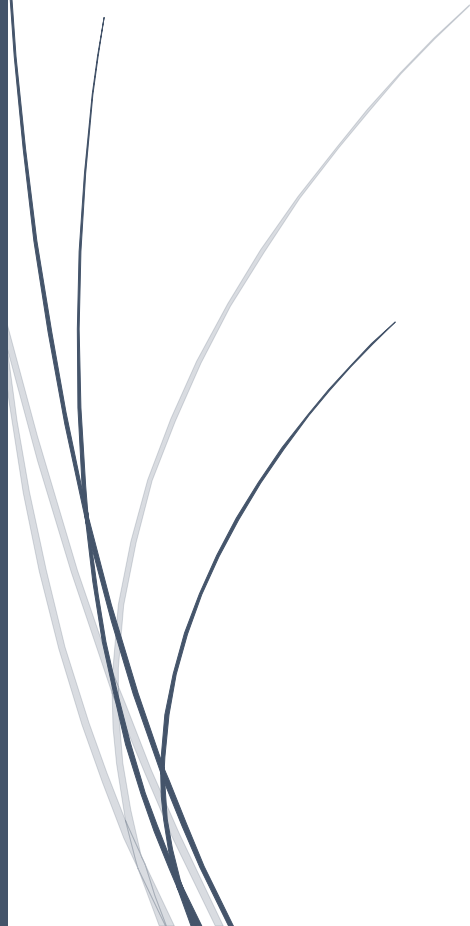


February 2020

# REPORT ON PENINSULAR MALAYSIA GENERATION DEVELOPMENT PLAN 2019 (2020 – 2030)



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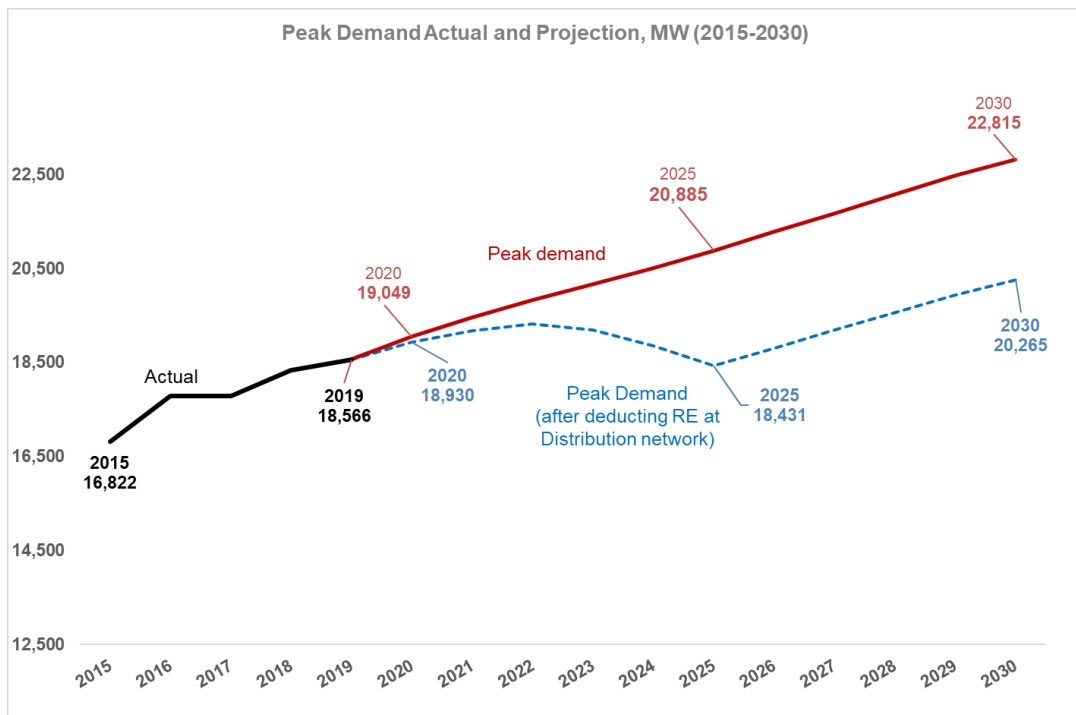
# 1. Introduction

- 1.1. *Jawatankuasa Perancangan dan Pelaksanaan Pembekalan Elektrik dan Tarif* (JPPPET) was established on 14 November 1997 with the aim to plan, coordinate and identify electricity supply requirements to meet electricity demand in Peninsular Malaysia through an annual committee meeting. The committee is chaired by the YB Minister of Energy, Science, Technology, Environment and Climate Change and comprises of representatives from relevant ministries, agencies and utilities.
- 1.2. The Cabinet has agreed with the Peninsular Malaysia Generation Development Plan approved by JPPPET on 21 November 2019. The key consideration of the plan is not only limited to projection of demand and generation capacity, but also to monitor the progress of the implementation of transmission projects and to support the Government's initiatives in achieving 20% RE capacity by 2025.
- 1.3. This report is issued as an update to the Peninsular Malaysia Electricity Supply Industry Outlook 2019 published on 11 February 2020. The objectives of this report are as follows:
  - To provide projection of electricity demand growth, taking into account economic parameters, disruptive technology and emerging trends.
  - To provide projection of capacity requirement to meet demand and ensure security of supply.
  - To address the energy trilemma – security, affordability and sustainability in economic and social needs, as well as sustainable environmental interests.

## 2. Demand Outlook

- 2.1. Demand forecast is reviewed annually at the start of the year where input from relevant stakeholders is gathered and deliberated through the Load Forecast Working Group (LFWG), chaired by the Single Buyer. The proposed demand outlook is presented and endorsed by the Demand Forecasting Committee (DFC), chaired by the Chairman of Suruhanjaya Tenaga (ST) and includes representatives from the ministries, consumer's association, utilities and research institutions.
- 2.2. Historically, the growth of demand from 2015 to 2019 is 16,822MW - 18,566MW, or at 2.5% p.a., For the year 2020 to 2030, demand is projected to grow by 1.8% p.a. **(Figure 1)**.
- 2.3. In the coming years, more Renewable Energy (RE) will be installed at the distribution network which will directly cater to the demand. After deducting the projected RE at distribution network, the net demand is projected to grow by 0.7% p.a. for the next 11 years. This net demand will be used for supply planning at the transmission side.

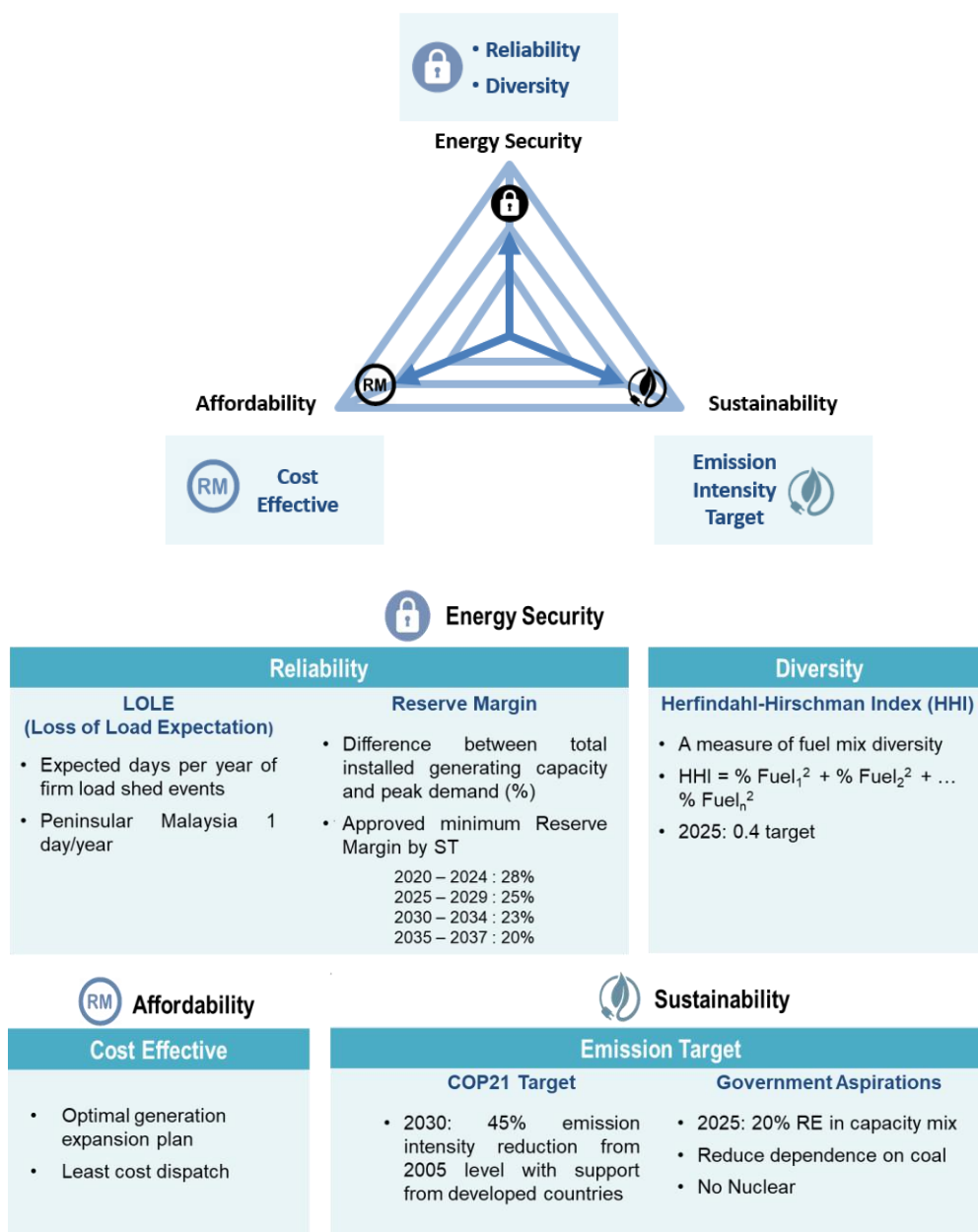
**Figure 1: Peak demand projection 2020-2030**



# 3. Supply Outlook

3.1. In managing the energy trilemma under the long-term supply outlook, the Government has set several policies and planning criteria as illustrated under **Figure 2**. The energy security is managed through the diversification of fuel mix with a target to achieve a Herfindahl-Hirschman Index (HHI) of 0.4 by 2025 and provide enough reserve margin for the day to day generation and system balancing.

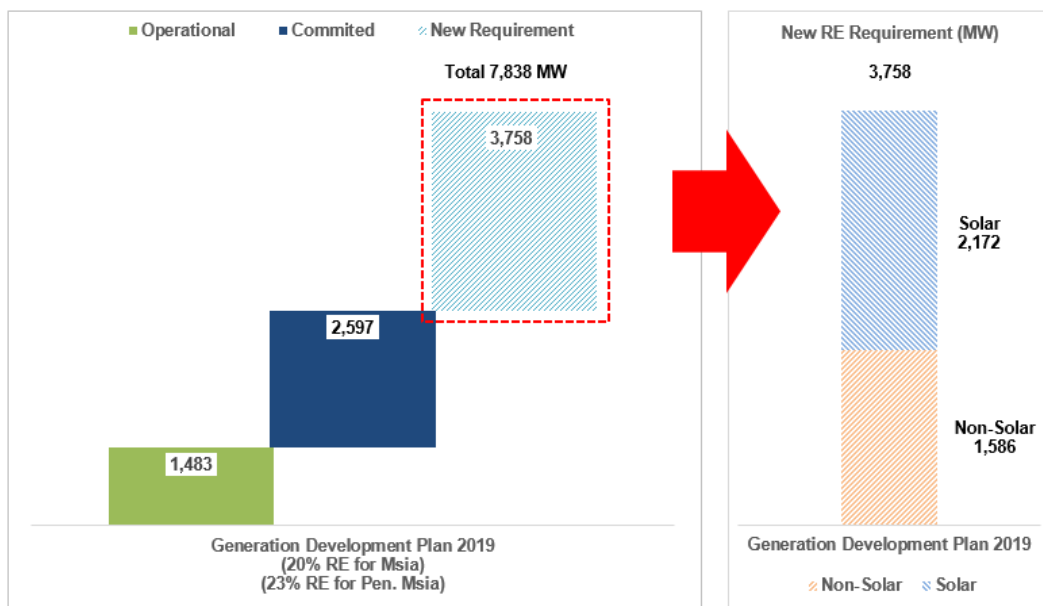
**Figure 2: The Energy Trilemma**



Note: COP21 = Conference of Parties #21, Paris, 2015

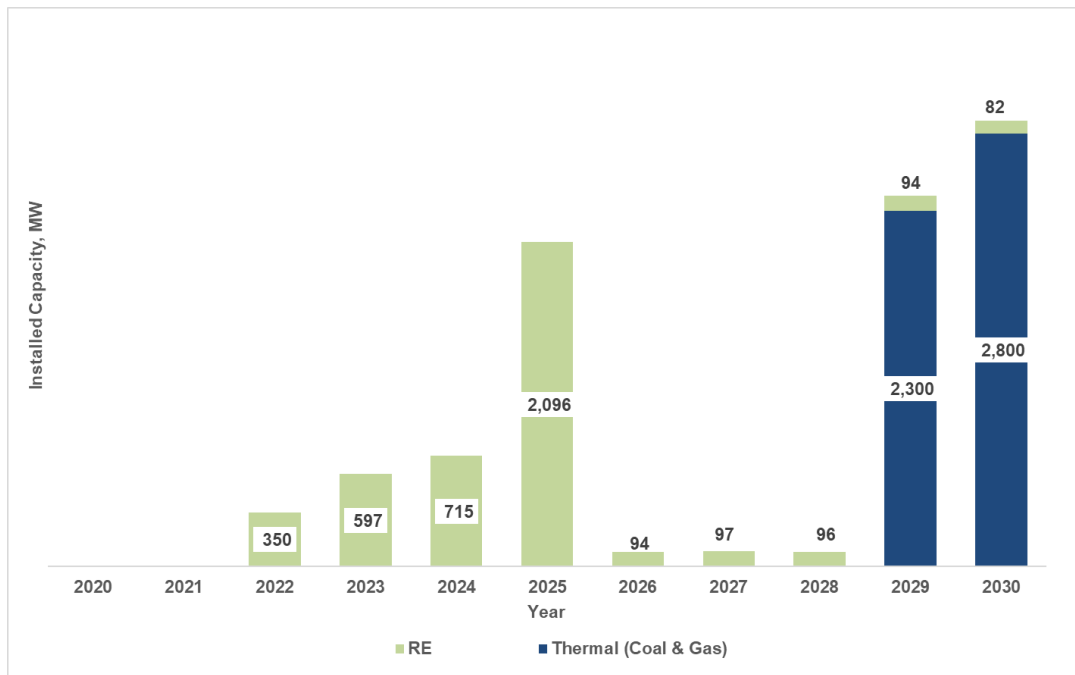
- 3.2. At the 21<sup>st</sup> Conference of Parties (COP21) in 2015, Malaysia pledged to reduce its carbon emission intensity per Gross Domestic Product (GDP) by 35% in 2030 relative to the 2005 level, or 45% with support from developed countries. This Nationally Determined Contribution was ratified at the Paris Agreement and overwhelmingly adopted by the United Nations member states to counter the damaging impacts of climate change.
- 3.3. In achieving the 20% RE capacity mix target for Malaysia by 2025, 3,758MW of new RE capacities need to be developed in Peninsular Malaysia starting 2020. This consists of 2,172MW of solar and 1,586MW of non-solar (**Figure 3**). The 20% RE capacity mix maintains system stability with solar penetration limited to 24% of the peak demand. Post 2025, the RE capacity mix will be maintained at 20% for Malaysia.

**Figure 3: New RE requirement to meet the 20% RE capacity mix by 2025**



- 3.4. By the end of 2030, the system will require 9,321MW of new capacity to meet the demand growth, maintain the optimum reserve margin for system reliability and replace retired plants (**Figure 4**).

**Figure 4: New capacity projection (2020-2030)**



3.5. Based on the approved Generation Development Plan (**Figure 5**), new thermal plant (combined cycle gas turbine) of 2,100 MW is required in 2029 in Central region (1,400MW) and Eastern region (700 MW).

**Figure 5: Generation Development Plan (2020-2030)**

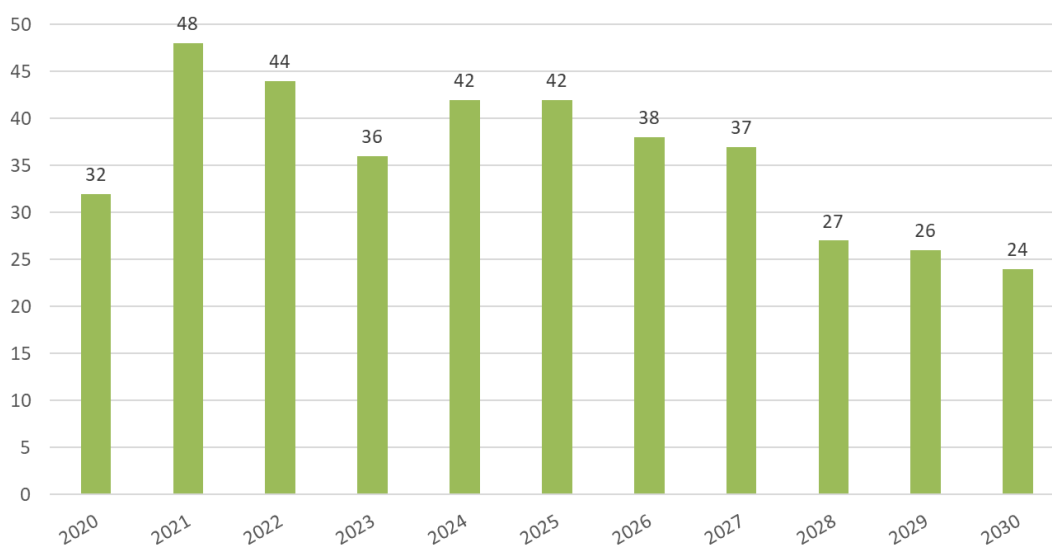
Year	Generation Capacity (20% RE Capacity Mix for Malaysia)	Retiring Plants
2020	Southern Power Generation (2x720 MW) RE (462 MW)	Pahlawan Power (322 MW)
2021	Edra Energy (3x747 MW) RE (688 MW)	YTL Power (585 MW)
2022	RE (672 MW)	TNB Pasir Gudang (275 MW) GB3 (640 MW)
2023	RE (763 MW)	Panglima (720 MW)
2024	TADMAX (2x600 MW) RE (975 MW)	SKS Prai CCGT (350 MW) TTPC (650) TNB Gelugor (310)
2025	RE (2,227 MW)	TNB Putrajaya GT4 & GT5 (249 MW)
2026	THB (2x600 MW) RE (94 MW)	KLPP (675 MW)
2027	Nenggiri (300 MW) RE (97 MW)	Segari Energy Ventures (1,303 MW)
2028	RE (96 MW)	TNB Tuanku Jaafar PD1 (703 MW)

Year	Generation Capacity (20% RE Capacity Mix for Malaysia)	Retiring Plants
2029	CCGT (3x700 MW) OCGT (2x100 MW) RE (94 MW)	KEV Gas U1 & U2 (564 MW) KEV Coal U3-U6 (1,486 MW)
2030	CCGT (4x700 MW) RE (82 MW)	TNB Tuanku Jaafar PD2 (708 MW) TNB Janamanjung (2,070 MW)
<b>TOTAL</b>	<b>17,732 MW</b>	<b>11,610 MW</b>

Note: CCGT = Combined cycle gas turbine; OCGT = Open cycle gas turbine

3.6. Taking into account the existing (and retirement) capacity, the committed capacity and the new capacity, the reserve margin is projected to reach below 25% by 2030 (**Figure 6**). Although the reserve margin is high before reaching the year 2025, the Government has actually saved a total of RM 11.4 billion (for 20 years) from cancellation of 6 direct award projects, which 5 of them were in Peninsular Malaysia.

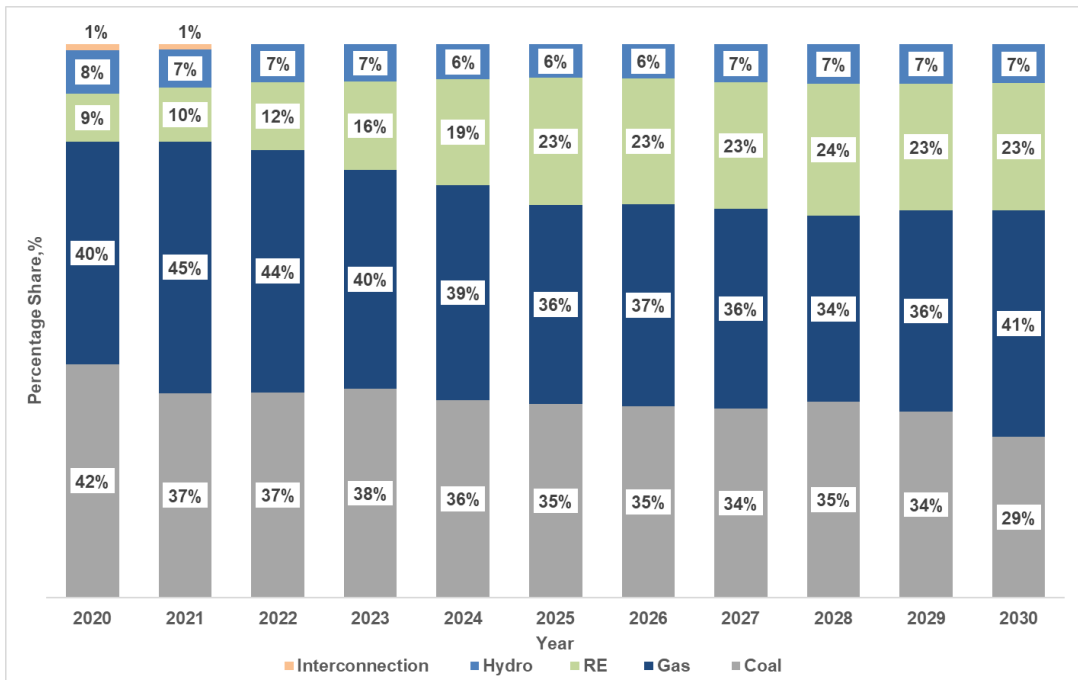
**Figure 6: Reserve margin projection 2020-2030 (%)**



3.7. For the same period, the projected capacity mix for Peninsular Malaysia is shown in **Figure 7**. The RE capacity is projected to increase from 9% to 23%, in tandem with the reduction in thermal (gas and coal) capacity share from the total of 82% to 70% by the end of the horizon.

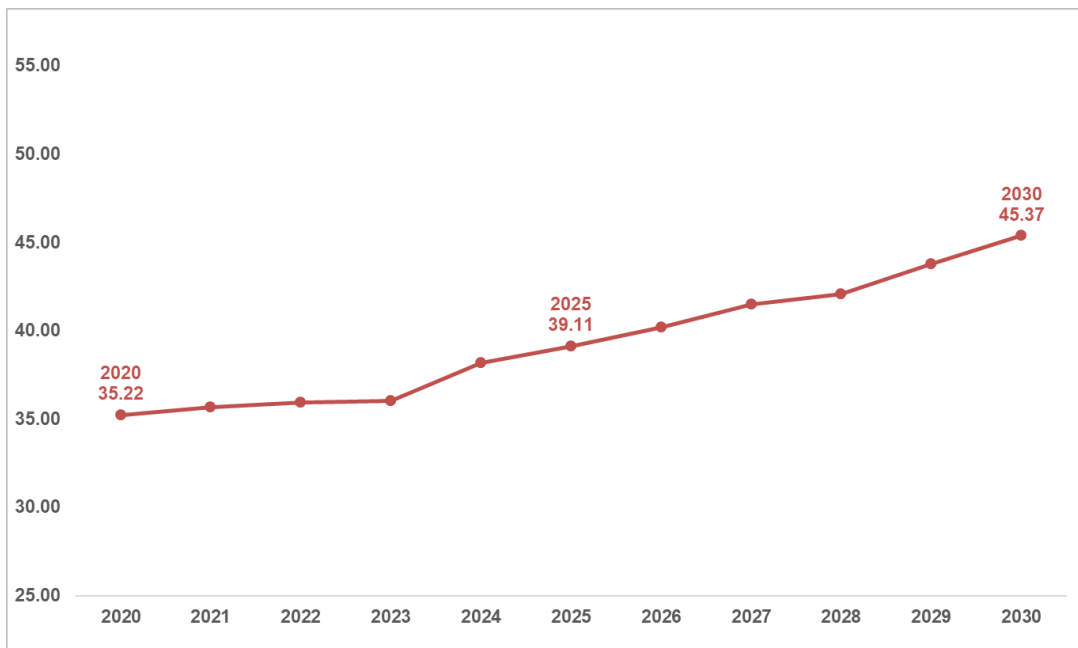


**Figure 7: Capacity mix (2020-2030)**



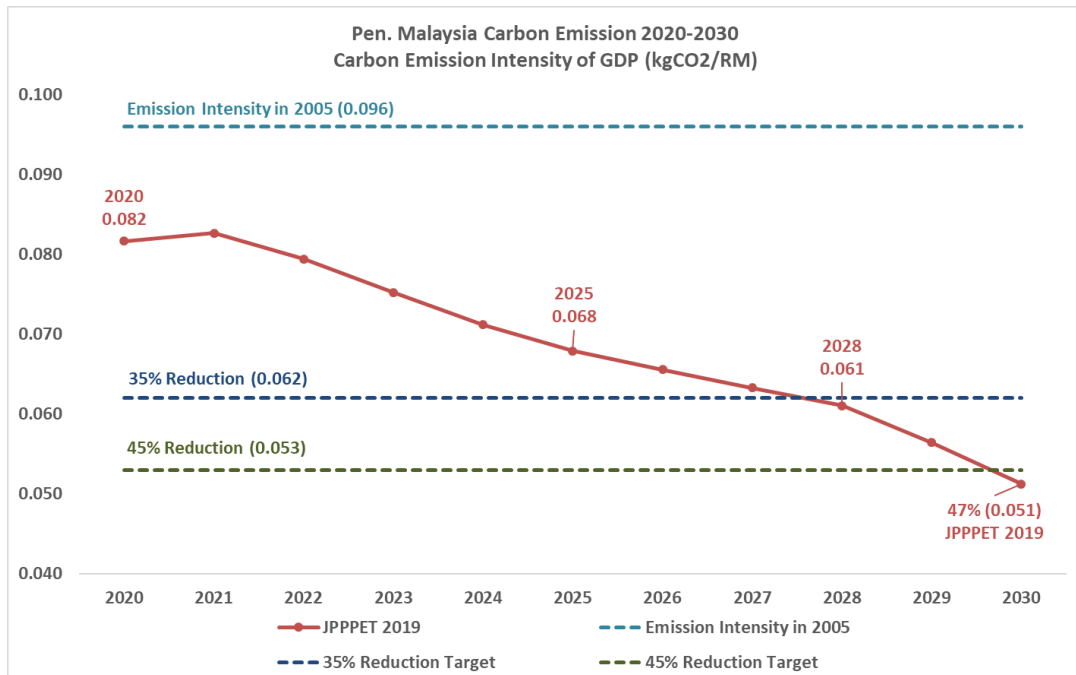
3.8. Following the demand growth and the additional supply capacity, the projected annual system cost for the Generation Development Plan (2020-2030) is estimated to range from RM 35.22 billion in 2020 to RM 45.37 billion in 2030 (Figure 8).

**Figure 8: Annual system cost (RM billion)**



3.9. In terms of CO<sub>2</sub> emission intensity (of GDP), the Peninsular Malaysia power sector is projected to have a downward intensity trend, with a reduction from 0.082 kgCO<sub>2</sub>/RM in 2020 to 0.051 kgCO<sub>2</sub>/RM in 2030 (Figure 9).

**Figure 9: Carbon emission intensity projection 2020-2030**



3.10. The emission intensity will reduce by 47% in 2030 compared to 2005 level, which is in line with Malaysia's commitment in COP21.

## 4. Conclusion

- 4.1. The Energy Trilemma has been an ongoing challenge for the electricity supply industry, which is continuously evolving, and requires judicious decision making and trade-offs to balance environmental sustainability, energy security and energy equity. The planning of power generation has considered this trilemma through the implementation and adoption of the Government's policies and planning criteria.
- 4.2. Based on the Generation Development Plan 2019, the electricity demand over the next 11 years is expected to grow at 1.8% p.a. Over the same period, 9,321MW of new capacity is required to meet demand growth, replacing retiring plants and ensuring system reliability, with the reserve margin projected to reach below 25% by 2030.
- 4.3. Supply capacity mix in Peninsular Malaysia will see an increase in RE share from 9% to 23%, whilst the thermal capacity share will reduce from 82% to 70% by the end of the horizon. The resulting annual system cost is estimated to range from RM 35.22 billion in 2020 to RM 45.37 billion in 2030.
- 4.4. Carbon emission intensity (of GDP) for the Peninsular Malaysia power sector is projected to be on the downward trend with a 47% reduction by 2030 compared to 2005 level, in line with Malaysia's commitment in COP21.
- 4.5. The Generation Development Plan is reviewed annually to take into account the latest economic, electricity demand, emerging technologies and development status of the planned projects.