

Energy storage for grid stability malaysia

Malaysia's National Energy Transition Roadmap (NETR) sets an ambitious commitment for the country to reach 70% renewable capacity in the energy mix by 2050, with solar power as the dominant source and gas utilised as the transitional fuel away from baseload coal.

From data provided in the NETR, Ember estimates that the generation share of renewables will contribute to about 52%, and gas will account for the remaining 48% of the mix in 2050. This could leave Malaysia's power sector vulnerable to global fuel price volatility and domestic reserve depletion. Hence, the government could look to raise renewable energy ambitions for the power mix to be better diversified.

By utilising more of its abundant solar power resources, Malaysia can unlock affordability and security benefits in the power sector. Technically, solar power can reliably meet Malaysia's daytime demand, while the non-solar hours demand could be addressed by utilising hydropower and building more storage facilities over time. Despite the high cost, investing in energy storage solutions such as battery energy storage systems (BESS) is critical. Efficiently managing the increasing solar loads requires upgrading the current grid infrastructure.

A gradual increase in solar power could also strengthen affordability in Malaysia's power sector, insulating the country from the risk of rising electricity tariffs, which may be caused by fossil fuel price volatility. Therefore, policies to further support solar growth and BESS adoption across Peninsular Malaysia, Sabah and Sarawak regions can allow each region to excel in its solar power adoption and contribute to the national power transition target.

Malaysia's deployment plans for battery energy storage systems (BESS) could benefit from policies integrating solar and BESS technologies. Conducting feasibility studies to analyse the economic and technical viability of BESS could be a stepping stone. Existing programmes, such as Large Scale Solar and Corporate Green Power Programme, could be further enhanced by integrating BESS technologies and offering a different tariff scheme for BESS services, broadening flexible grid development responsibilities beyond utilities to other market participants.

Malaysia is an upper-middle-income country in Southeast Asia. It ranked third among the Association of Southeast Asian Nations (ASEAN) members in Gross Domestic Product per capita (\$11,993 USD) in 2022. As the economy grows, electricity generation in the country has also shown a steep growth during the last two decades, adding 116 TWh of power generation from 2000 to 2023.

Much of the electricity generation is sourced from coal and gas. In 2023, coal and gas accounted for 43% and 37% of total generation, respectively. The renewable share in 2023 was 19.5%, and most of the generation

comes from hydropower (17%, 32 TWh). Solar and bioenergy each contributed 1.7% and 0.6%.

As a parliamentary democracy with a constitutional monarchy, the Federation of Malaysia was formed following the merger of the Federation of Malaya, Singapore, North Borneo (Sabah) and Sarawak on 16 September 1963.

Across Peninsular Malaysia, Tenaga Nasional Berhad (TNB) operates as the sole publicly listed electricity provider, with the government owning a 66% stake. The region implements a single buyer market structure whereby independent power producers generate almost half of the electricity. Single Buyer is assigned to manage electricity procurement to fulfil demand in Peninsular Malaysia.

A regulatory transfer of Sabah's power supply from the federal government to the state government began in early 2024, slated for completion by 2030. Prior to this, Sabah's power sector was governed by the federal government and, along with Peninsular Malaysia, adhered to the Electricity Supply Act of 1990. Therefore, some of Peninsular Malaysia's renewable energy programmes were extended to Sabah.

Meanwhile, Sarawak has managed its electricity-related affairs under its own self-governance. The state's electricity supply is provided by Sarawak Energy Berhad (SEB), fully owned by the State Government of Sarawak. This arrangement allows Sarawak to establish its own power-related targets instead of following the federal targets.

About three-quarters of Malaysia's electricity demand is driven by Peninsular Malaysia where most of the population inhabits, amounting to 118 TWh in 2020 (the latest year available) and 137 TWh in 2023 (estimated). Even though the highest demand is in Peninsular Malaysia, Sarawak has seen the most significant demand growth compared to Sabah and Peninsular Malaysia in recent years, with 13% annual growth from 2010 to 2020.

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