MALAYSIA

1. INTRODUCTION

Malaysia, with a population of 32.7 million in 2022, had a total primary energy consumption of 4.17 Exajoules. Despite its relatively modest population, the country's CO2 emissions reached approximately 291 million metric tons (MT), resulting in a high per capita emission rate of 8.6 MT, comparable to countries such as China and Japan. In 2022, the energy sector emerged as Malaysia's largest contributor to greenhouse gas (GHG) emissions. The country's energy mix was dominated by natural gas (47%), crude oil and petroleum products (25.2%), coal (23.6%), and renewables (4.2%).

Fossil fuels power close to 96% of Malaysia's energy system in 2023. Over the past decade, the country has increasingly relied on imported coal for electricity generation. By 2023, coal accounted for over 43% of electricity production, followed by natural gas at 36%, and hydropower at nearly 17%.

Despite the current energy outlook, Malaysia has been recognized as the leading Southeast Asian country in the 2023 Energy Transition Index by the World Economic Forum, highlighting its progress in shifting towards a more sustainable and green economy. The country has set ambitious goals, including achieving net-zero GHG emissions by 2050, as outlined in the Twelfth Malaysia Plan. In the near term, Malaysia aims to reduce its carbon intensity by 45% by 2030 from a 2005 baseline. This plan reflects Malaysia's commitment to balancing the energy trilemma - energy security, energy equity and economic growth as well as environmental sustainability.

Additionally, Malaysia's National Energy Policies 2022-2040 focus on promoting low-carbon strategies, including:

- Restricting the development of new coal power plants while the renewables share is being increased
- Driving energy efficiency (EE) practices
- Encouraging the adoption of Electric Vehicles (EVs)
- Increasing public transport's modal share
- Improving carbon footprint accounting and sustainability reporting

To accelerate its energy transition, Malaysia launched the National Energy Transition Roadmap (NETR) on August 29, 2023. The NETR is vital to transitioning from a fossil fuel-based economy to a thriving green economy. It is underpinned by four guiding principles:

- Based on national aspirations and commitments
- Just, inclusive and cost-effective
- Effective governance and whole-of-nation approach
- High-impact job opportunities, SME involvement in the ecosystem

The NETR's ten flagship catalyst projects, unveiled on July 27, 2023, target six energy transition levers: energy efficiency, renewable energy, hydrogen, bioenergy, green mobility, and carbon capture, utilization, and storage (CCUS). These projects are expected to attract over RM25 billion in investments, create 23,000 jobs, and reduce GHG emissions by over 10,000 Gg CO2eq annually.

Additionally, the NETR introduces the Responsible Transition (RT) pathway, guiding Malaysia's energy mix, GHG emission reduction, and energy transition initiatives towards 2050. The pathway projects a modest increase in total primary energy supply (TPES) from 96 Mtoe in 2023 to 102 Mtoe in 2050 (a 2% CAGR). By 2050, renewable energy is expected to contribute 70% to installed power capacity, with the energy sector achieving a 32% reduction in GHG emissions compared to 2019, reaching 4.3 MT CO2eq emissions per capita.

These initiatives underscore Malaysia's firm commitment to net-zero emissions by 2050, despite contributing only 0.8% to global GHG emissions.

2. ENERGY SECURITY

There are growing concerns about Malaysia's increasing dependence on fuel imports, particularly natural gas. With the anticipated rise in reliance on natural gas and crude oil by 2050, as Malaysia gradually phases out coal from its power generation mix, ensuring energy security has become a pressing issue.

To mitigate the potential risks associated with over-reliance on natural gas, efforts are focused on enhancing renewable energy (RE) capacity and developing energy storage solutions to address RE intermittency. However, projections under the current Responsible Transition (RT) pathway show only slight diversification in the power mix by 2050 compared to 2030, with fossil fuels still expected to account for 78% of the total primary energy supply (TPES) in 2050.

Proactive measures are being undertaken to secure natural gas, including the development of necessary infrastructure and long-term commercial agreements for fuel importation to stabilize supply. Ensuring that natural gas prices for domestic consumers reflect market parity is also critical. This approach will enhance Malaysia's attractiveness as an investment destination for the upstream sector and incentivize third-party suppliers to enter the domestic gas market, supporting the operationalization of Third-Party Access (TPA) for gas.

Additionally, Malaysia is exploring other non-carbon energy sources, including renewable energy imports through regional interconnectors, to further diversify its energy portfolio.

3. ENERGY EQUITY

The power sector has seen significant liberalization efforts aimed at attracting investment, improving efficiency, and boosting productivity to ensure a reliable energy supply. A key milestone was the introduction of Third Party Access (TPA) in 2017, which facilitated a shift toward market-based pricing in both the power and non-power sectors. TPA encompasses fuel supply, grid infrastructure access, and the retail electricity market, along with electricity tariff restructuring initiatives. These measures are designed to ensure cost-reflective pricing, support greater integration of renewable energy (RE), and enhance Malaysia's competitive position in the energy market.

By 2050, Malaysia is anticipated to face higher system costs due to the substantial investments needed to scale up RE capacity within the power generation mix. This rise in costs is seen as unavoidable, especially given the potential increase in reliance on imported natural gas as Malaysia's domestic gas reserves are projected to decline by 2050.

Despite the higher system costs, the Responsible Transition (RT) framework is expected to significantly enhance Malaysia's economic development. The energy transition will drive growth in emerging sectors such as green mobility, RE, energy storage, and alternative energy ecosystems. By taking a leading role in these areas, Malaysia can strengthen its competitive edge, resulting in positive impacts on GDP and job creation.

The RT is projected to create investment opportunities amounting to RM1.2 to RM1.3 trillion by 2050. These investments are expected to contribute an additional RM220 billion to GDP and generate approximately 310,000 green job opportunities by 2050. Economic benefits will be widely distributed, with medium- and low-income households projected to see the most significant income gains.

4. FINANCING AND INVESTMENT

Malaysia's energy transition is projected to require financing of RM1.2-1.3 trillion by 2050. In the near term, many of the projects supporting this transition will be classified as marginally bankable or offering below-market returns. However, investments in renewable energy (RE) generation—such as solar and hydropower—and grid enhancements are considered commercially viable, with market-rate returns. These projects are likely to attract funding from capital markets and domestic financial institutions, though strong policy support will be necessary to accelerate their adoption.

Public direct funding will be essential for projects that generate no financial returns, typically fulfilling public service obligations or aligned with social mandates. This includes initiatives such as upskilling and

reskilling programs to assist the workforce affected by the energy transition, as well as the development of public transportation infrastructure across the country.

Given the capital-intensive nature of the energy transition, many projects face concerns about their commercial viability. These challenges often relate to projects involving emerging technologies or those that have not yet reached commercial scale, such as Carbon Capture, Utilization, and Storage (CCUS), green hydrogen, Battery Energy Storage Systems (BESS), and Sustainable Aviation Fuel (SAF) in Malaysia.

Certain projects, particularly small-scale initiatives, struggle to attract interest from major investors and financial institutions. This leads to higher development costs, impacting project developers. Notable examples include energy efficiency and bioenergy projects, which often face scalability challenges. Additionally, some projects encounter implementation risks related to construction uncertainties, development risks, and the instability of offtaker agreements, as seen with hydropower and bioenergy, further complicating their deployment.

Another significant challenge is the limited pipeline of viable projects. Many energy transition initiatives lack clear, compelling opportunities for investors and financial institutions. This creates a gap between shovel-ready projects, such as solar farms, and the actual allocation of financial resources.

5. POLICY AND REGULATORY CHALLENGES

The energy transition is also confronted with complex policy and regulatory hurdles. Economic distortions, such as energy subsidies (Malaysia is currently undergoing petrol subsidy reform), can slow the adoption of sustainable energy practices and technologies. Ensuring energy equity for low-income households presents another challenge, requiring policies that provide access to clean energy without increasing financial burdens. Additionally, as the demand for natural gas rises, reducing reliance on fossil fuels will require carefully crafted regulations to guide the energy landscape toward sustainability.

The government acknowledges the need to manage the energy transition carefully, given its varying impact on jobs across the nation. While the transition is expected to create jobs, particularly in green growth sectors, other non-green areas may experience job losses. This underscores the importance of ensuring that the transition is fair and inclusive, particularly for communities most affected by the shift to a greener economy.

6. ENVIRONMENTAL SUSTAINABILITY

The Responsible Transition (RT) framework will greatly enhance Malaysia's environmental sustainability efforts. Without factoring in carbon capture in the energy sector, Malaysia is on track to achieve a 32% reduction in greenhouse gas (GHG) emissions from the energy sector by 2050, compared to the 2019 baseline. This will lower emissions to 4.3 $MtCO_2eq$ per capita, down from 7.9 $MtCO_2eq$ per capita in 2019.

By incorporating carbon capture and storage (CCS) technology in the energy sector, Malaysia can further accelerate its path toward net-zero emissions. CCS is projected to deliver an additional 5% reduction in GHG emissions, reducing per capita emissions to 4.1 $MtCO_2eq$. Scaling up CCS in energy will also drive its economic feasibility in other sectors, such as industrial processes and product use (IPPU).

In achieving its net-zero target, other sectors including IPPU, agriculture, waste, and land-use, land-use change, and forestry (LULUCF) will play vital roles. Malaysia will focus on adopting abatement measures in IPPU, agriculture, and waste management, while prioritizing the protection of natural assets in LULUCF, which serve as natural carbon offsets.

Moreover, Malaysia plans to introduce a carbon tax by 2026, targeting industries such as iron, steel, and energy. This move underscores the country's commitment to emissions reduction. Revenue generated from the tax will be reinvested into further decarbonization technologies.
However, implementing carbon pricing in Malaysia must account for several factors, including social costs, economic impacts, the country's competitiveness in the region, and business readiness. As Malaysia aims to expand energy-intensive industries like semiconductor manufacturing, artificial intelligence (AI) development, and data centers, carbon pricing will likely increase operational costs. These costs will be passed on by energy producers to industries and businesses reliant on energy, highlighting the need for careful policy and regulatory considerations.

WORLD ENERGY COUNCIL

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