The 2024 energy transition investment playbook

July 2024

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Moving forward with NETR

Driving Malaysia's net zero aspirations through sustainable business growth

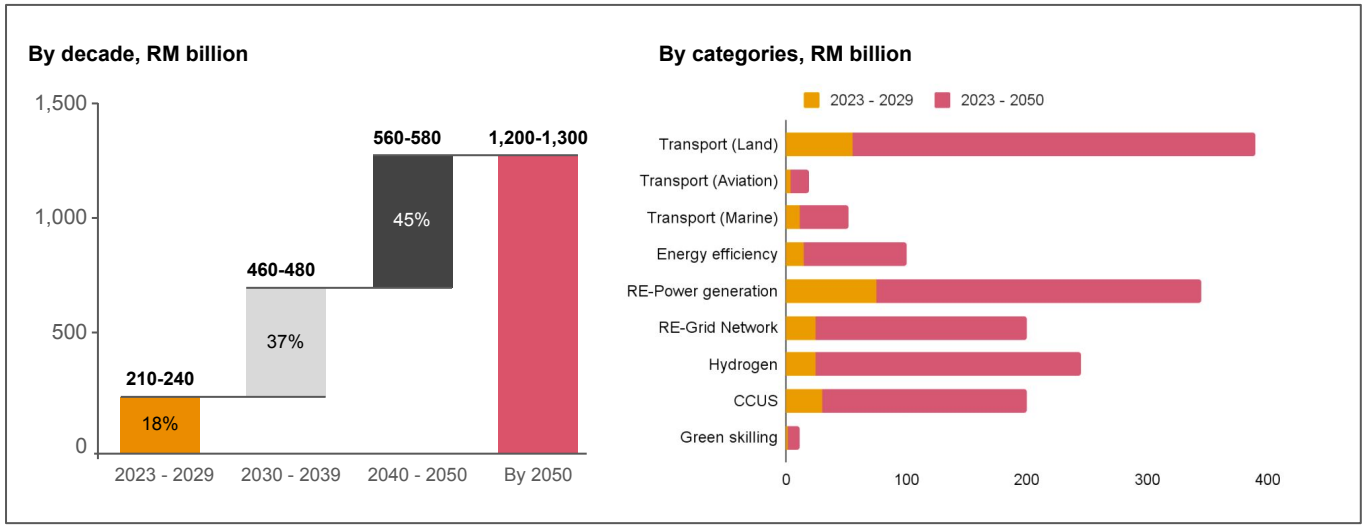
Launched in 2023, Malaysia's National Energy Transition Roadmap (NETR) is a strategic framework aimed at accelerating the country's race to net zero. It outlines key policies and initiatives required to achieve a low carbon economy.

While NETR has reaffirmed the government's commitments, **businesses can play a pivotal role in the country's energy transition journey by seizing green investment opportunities**. The NETR isn't just a mandate - it is a chance for sustainable business growth.

NETR has provided a clear direction on energy transition investment opportunities for corporate Malaysia

NETR estimates that **energy transition initiatives are estimated to require up to RM1.85 trillion in financing by 2050**. Despite being a major undertaking for the country, there are value creation opportunities for forward thinking companies. But, **are Malaysian businesses ready to grab these investment opportunities?**

Malaysia's energy transition financing needs



18%

of funding is required primarily in **renewable energy (RE) power generation** and **green mobility**

Hydrogen and **Carbon capture, use and storage (CCUS)** technologies will also require significant investments

Source: Ministry of Economy, 2023. National Energy Transition Roadmap

Corporate Malaysia needs to accelerate current efforts to capitalise on energy transition opportunities

Based on **PwC's 27th Global CEO survey**,

85% of Malaysian CEOs are in progress of making energy efficiency improvements and innovation of new, climate-friendly products, services or technologies.

However, Malaysia's current decarbonisation rate is still at 2.5%

This is still behind what is required to meet the nationally determined contributions (NDC) target of 7.2%. The imperative to accelerate decarbonisation efforts is clear. In light of rising inflationary costs and investor pressure, companies will need to find the right areas to invest.

From our experience in supporting various Malaysian businesses' energy transition efforts, we found that:

59%

Of companies were in the **preliminary stage**

Tend to have only heard about energy transition and have no ot only very broad strategies and commitments to energy transition.

Key factors keeping companies at this stage are: Lack of resources | Lack of awareness | Not impacted by energy transition regulations | Lack of incentives

41%

Of companies were in the **intermediate stage**

Usually have a timeline and a defined strategy, and are in the process of transition planning towards low-carbon operations/energy efficiency.

However, they do not have sufficient level of understand in terms of skills/ jobs required to operate under a lower-carbon model.

0%

Of companies were in the **advanced stage**

Have implemented several initiatives with a comprehensive plan for energy transition and decarbonisation with targets - including allocation adequate resources

Source: PwC, 2023. Asia Pacific Net Zero Economy Index 2023

Investment opportunities

Understanding the state of play in Malaysia

Through our work with clients in Corporate Malaysia, companies still **face difficulties in developing and implementing their energy transition roadmap** even after the launch of NETR.

To start, organisations will need to understand the current state of play and identify strategic areas that the business can leverage on in Malaysia's energy transition journey.

Energy Efficiency

State of play in Malaysia

Market drivers:

1 Strong regulatory push

The recently passed Energy Efficiency and Conservation Act looks to promote demand-side energy management by regulating large energy consumers within the industrial and commercial sectors.

2 Rising consumer demand

Increasing energy costs have resulted in rising demand for facility energy management.

3 Increased focus on sustainability goals

As Malaysia gets closer to achieving 2050 net zero targets, companies will increasingly seek energy solutions aligned with their sustainability goals.

What are the market opportunities?

Development of smart buildings, especially with the increasing demand for green-certified structures.

Demand for data analytics in energy reporting will increase as sustainability reporting requirements tighten.

Green industrial parks such as the Karian Integrated Green Industrial Park, have strong investment potential in Malaysia.

Malaysia's facility management market is expected to reach

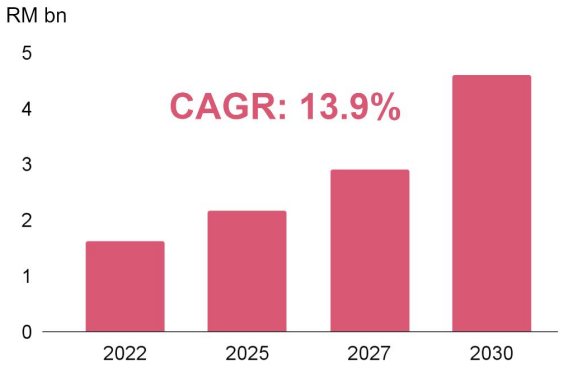
RM4.6 bn

by 2030, at a CAGR of

13.9%

between 2022 -2030

Malaysia's facility management market size (2022 to 2030)



Source: The Edge Malaysia, 2023. Dewan Rakyat Passes Energy Efficiency and Conservation Bill; Market Research Future, 2023. Malaysia Facility Management Market Research Report Forecast to 2030; PwC analysis

Opportunities for businesses

Area of focus		
Inception • Assess current energy usage and set goals • Develop a comprehensive energy management plan	**Execution** • Implement planned energy management initiatives • Roll out energy-efficient technologies and practices	**Monitoring** • Optimise daily operations for energy efficiency • Install monitoring systems and sensors

Ecosystem players		
Facility energy management	Original equipment supplier	Operations and maintenance service provider
	General/ Main contractor	
Design & Engineering firm	Solution provider	
	System integrator	

Source: SEDA, 2013. Method to Identify Building Energy Index (BEI); PwC analysis

Emerging practices

Retrofitting existing buildings to meet energy efficiency standards, such as Building Energy Index (BEI) and thermal transfer values, presents substantial market opportunities.

The unique requirements of each building necessitate bespoke systems that effectively address the needs of both owners and occupants.

*Note: A lower BEI is ideal. It is calculated by dividing the total energy consumption of a building by its total floor area

What you should know

Energy Efficiency

Key issues

To achieve NETR's Energy Efficiency aspirations by 2050, at least **RM80 billion worth of investment** is required. Green Building Index certification for 10,000 to 30,000 sqm projects will incur a RM 20,000 initial fee, adding to the significant upfront cost.*

Lack of knowledge and awareness about existing incentives and support for green building investments hinders energy efficiency initiatives in Malaysia. Many stakeholders are unaware of available assistance, preventing them from taking full advantage of opportunities.

The **growing convergence of digital tech and energy efficiency heightens cybersecurity risks.** For example, smart metres, while allowing real-time energy monitoring, can be hacked, leading to data theft and attacks on energy infrastructure.

Our point of view

- Investing in energy efficient technologies are essential for emissions reduction and significant cost savings.
- Government needs to engage businesses more to raise awareness on support/incentives available.
- Presently, developers and companies benefit from a wide array of government tax incentives. However similar incentives have yet to be seen for-homeowners who often lack support for energy saving retrofitting, hindering wider adoption.

Note: * There are tax incentives available under the Green Investment Tax Allowance for own consumption which helps to encourage adoption of energy efficient initiatives
Source: Ministry of Economy, 2023. National Energy Transition Roadmap; Green Building Index. "GBI Registration fees". Accessed 1 July 2024, https://www.greenbuildingindex.org/how-gbi-works/gbi-registration-fees/; IEA, Casanovas, Marc, and Aloys Nghiem.Accessed 1 August, 2023. "Cybersecurity – Is the Power System Lagging Behind? – Analysis.". https://www.iea.org/commentaries/cybersecurity-is-the-power-system-lagging-behind.

Renewables

State of play in Malaysia

Market drivers:

1 Strong regulatory push

The Malaysian government has introduced various policies incorporating incentives like subsidies, tax exemptions and financing to boost the green industry like GITA, GITE and GTFS 4.0*.

2 Cost reduction

Costs for solar and wind energy technologies have reduced, providing insights into scalability and potential cost reduction for other renewables.

3 Solar to play a major role

Malaysia's relatively high solar irradiance, coupled with the ease of deployment for solar farms, both large scale and rooftop, has propelled solar as the single largest source of renewable energy in the country. By 2050, solar is expected to contribute up to 58% of the total installed capacity.

What are the market opportunities?

Grid modernisation
is needed to advance the nation's energy transition aspirations. The national grid must be ready to receive renewable energy with a focus on smart grid adoption.

Battery energy storage system
is a viable investment area. Hydro energy storage can be explored as well.**

Responsible disposal of out-of-commission devices
such as solar panels and batteries.

Malaysia's renewable energy consumption is expected to reach

6,365 ktoe

by 2028, at a CAGR of

7%

between 2022 - 2028

Malaysia's total renewable energy consumption (2022 - 2028)

Source: Economist Intelligence, 2023. Industry Report - Energy - Malaysia; International; Renewable Energy Agency, 2022. Renewable power generation costs in 2022; PwC analysis; International Renewable Energy Agency, 2023. Malaysia Energy Transition Outlook

Note:
* Green Investment Tax Allowances (GITA), Green Income Tax Exemption (GITE), Green Technology Financing Scheme 4.0 (GTFS 4.0)
**Based on NETR, the Hybrid Hydro-Floating Solar PV project plans to use hydro infrastructure for energy storage as opposed to battery energy storage system and solar.

Opportunities for businesses

Energy sources	Energy production and generation			Usage/ Utilisation
	Power generation	Commissioning	Energy source procurement	
Solar	**Rooftop solar panels, concentrated solar plants, solar farms (inclusive of floating solar)**	The complexity of each solution requires a web of different components within the value chain 1. Material and component supplier (e.g. PV panels, turbines, generators) 2. Component integrator 3. Front End Engineering and Design (FEED) 4. Construction and commissioning 5. Operator	1. **Onsite Renewable Energy System** • Outright-purchase • Solar Power Purchase Agreement (PPA) 2. **Virtual Power Purchase Agreement** • Operated under Corporate Green Power Programme. Project owners are responsible for delivering Renewable Energy Certificates (RECs) 3. **TNB Green Energy Tariff** for bundled REC 4. **Unbundled RECs**	**Electricity consumption**
Hydro	**Hydro power plants (includes mini hydro)**			**Logistics**
Wind	**Relatively low wind speed have limited wind farm development in Malaysia, but further research could expand the country's RE portfolio.**			**Heating for industrial usage**
	Feedstock procurement	Transport	Conversion	
Biomass	**Availability of biomass feedstock in Malaysia,** including plantation (e.g. oil palm), forestry, agriculture, livestock and fisheries industries	• Feedstock is usually transported by **truck with** a **platform/ container** for solids or by **tank** for liquids. • Distances or transportation costs are dependent on factors such as energy density, the biomass/ biogas hub's scale and location	**Biomass plant uses technologies for biomass conversion,** e.g. • Pyrolysis, gasification, anaerobic digestion or pelletisation	**Biofuels/ Green fuels** **Biofertiliser**
Biogas	Biogas is mainly produced from **organic waste and residues**. Its biomass feedstock can be **liquid** (concentrated and diluted)**, solid or slurries.**		**Biogas power plant** • Energy generated from biogas, e.g. burning of methane gas and anaerobic digestion can be used for heat and power generation	**Biodegradable materials**

*non-exhaustive

Sources: International Renewable Energy Agency, 2018. Biogas for road vehicles - Technology brief , Ministry of Plantation and Commodities, 2023. National Biomass Action Plan 2023-2030 , Saxon Renewables, 2023. Decoding Renewable Energy Procurement in Malaysia, MRANTI, 2023. Solar powers Malaysia's renewable energy push, World Economic Forum, 2020. Why transmission and distribution are the clean energy transition's secret weapons

Emerging practices

The current value chain stops at the user level. This indicates a high-potential market for responsible disposal of out-of-commission products like solar panels and batteries.

Besides that, an increase in energy generation from cleaner sources needs to be accompanied by an increase in suitable transmission and distribution networks.

What you should know

Key issues

Capital expenditure is still high and return on investments are rather uncertain, which can make it difficult to obtain **loans and to attract investors.** However, blended finance blended finance—the combination of public- and private-sector capital—can help bridge the risk gap

There is a need to **retrofit Malaysia's current grid system** as it was designed for conventional energy transmission.

The **maturity of the market is highly dependent on the regulatory framework** (e.g. carbon tax, carbon pricing) which is currently unclear.

Our point of view

- An inadequate transmission and distribution network and storage facility could lead to constant congestion and curtailment issues, which affect the economic viability of RE projects.
- Costs of transitioning to green technologies are falling as global R&D initiatives increases, with solar PV experiencing the most rapid cost reductions. The levelised cost of electricity (LCOE) of newly commissioned utility-scale solar PV projects fell by 89% between 2010 and 2022.
- First-mover advantage still applies in Malaysia with investment set to double.

Sources: International Renewable Energy Agency, 2022. Renewable power generation costs in 2022; International Energy Agency, 2024. Electricity - Analysis and forecast to 2026

Hydrogen

State of play in Malaysia

Market drivers:

1 Strong regulatory push

The recently launched Hydrogen Economy & Technology Roadmap aims to transform the country into a leading green hydrogen export hub and projects that Malaysia's green hydrogen market could grow to RM14.7 billion by 2050.

2 International market demand

Several energy players in Malaysia have already committed to becoming hydrogen supply hubs to key demand countries in Asia, such as Japan and the Republic of Korea.

3 Rising domestic demand

Domestic demand for hydrogen could reach 213PJ by 2050, representing around 5% of total final consumption, with the potential to be used in the industrial and transport sector.

What are the market opportunities?

Transportation sector can be a strategic investment area as hydrogen demand is expected to reach RM3.7 bn in 2050, primarily from light passenger vehicles and public transport.

Green bonds are becoming a popular option for companies to fund their hydrogen production initiatives.

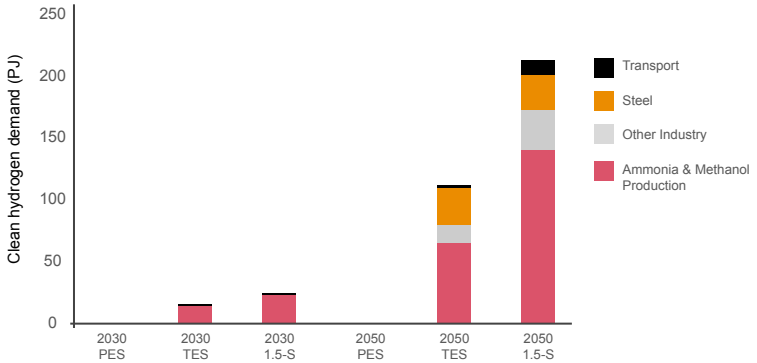
Sarawak could be a strategic location for hydrogen production due to its hydropower capacity.

Domestic demand for hydrogen in Malaysia could reach

213PJ

by 2050 based on IRENA's analysis

Projected hydrogen demand for Malaysia, IRENA*



Note:*PES - Planned energy scenario; TES - Transforming energy scenario; 1.5-S - 1.5°C Scenario

Sources: Ministry of Science, Technology and Innovation, 2023. Hydrogen Economy & Technology Roadmap; International Renewable Energy Agency, 2023. Malaysia Energy Transition Outlook; Government of Singapore, 2020. Study of Hydrogen Imports and Downstream Applications for Singapore

Opportunities for businesses

Energy supply	Hydrogen production	Storage and distribution	Usage
Wind Solar Hydropower Bioenergy	**Green hydrogen:** Referred to as 'clean hydrogen' as it is produced using clean energy from surplus renewable energy sources	**1. Electrolysis:** The process of using electricity to split water into hydrogen and oxygen **2. Electrolysis types:** – Alkaline Electrolyzer – PEM – SOEC (in R&D stage)	**Storage forms:** • Compressed hydrogen • Liquid organic hydrogen carriers • Cryogenic storage • Metal hydrides **Distribution methods:** • Tank • Pipeline • Train, ship, truck	**Chemical & petrochemical** **Power & heat generation** **Iron & steel** **Transportation** **General manufacturing**
Methane	**Turquoise hydrogen**: Solid carbon is usually generated in the process and can be used in other applications like tyre manufacturing or soil improver	**Methane pyrolysis:** The thermal decomposition of methane into its components		
Coal	**Grey hydrogen:** Most common form and is produced without capturing the resulting carbon emissions	**Steam methane reforming:** The hydrogen atoms are separated from carbon atoms in methane.		
Natural gas	**Grey hydrogen** or **Blue hydrogen:** Referred to as carbon neutral. The carbon generated is stored underground through carbon capture and storage			

*non-exhaustive

Emerging practices

The broad application potential of hydrogen has fueled a growth in interest across different primary and secondary economic sectors.

Accessibility to clean energy and established logistical infrastructure that can support hydrogen would benefit greatly from this growth.

What you should know

Key issues

Besides challenges in **standardising feedstock price**, cost of production is still expensive (large capital expenditures, CAPEX, and operating expenses, OPEX). For green hydrogen, 70% of the cost stems from power cost.

Hydrogen's role in power generation remains limited, and the infrastructure necessary for its widespread adoption by end users is not yet fully developed.

While the global trade route for hydrogen is still under development, transportation of hydrogen (in liquid and gaseous form) often **entail high costs and are energy intensive processes**.

Our point of view

- Taking into account estimated cost parity within a decade, the need for less CAPEX intensive solutions would be necessary. For instance, facilities with vehicles that operate within a closed system (e.g. cargo ports, airports) have a higher likelihood of adopting hydrogen energy on a large scale compared to public hydrogen networks.
- Usage of hydrogen in heavy industries/ energy intensive sectors (e.g. steel mills) is mostly nascent, but has already been proven to be a suitable replacement for traditional fossil fuel-based solutions.

Source: Ministry of Science, Technology and Innovation, 2023. Hydrogen Economy & Technology Roadmap

Bioenergy

State of play in Malaysia

Market drivers:

1 Strong regulatory push

Malaysia has implemented various policies to support the country's bioenergy market, including the National Biofuel Policy and National Biomass Industry Action Plan.

2 Abundant resources

Malaysia's status as a leading global biofuel supplier is supported by extensive oil palm plantations covering around 5.9 million hectares as of 2021.

3 Technological advancement

Bioenergy technologies such as gasification, pyrolysis, and torrefaction, are developing rapidly and have significant potential to scale up by 2050.

What are the market opportunities?

Malaysia's National Biomass Industry Action Plan
identified 5 potential areas of growth: Plantation, wood, agricultural, livestock industry and fisheries.

Empty fruit bunches pellets industry
while still in the infancy stage, is expected to scale up further in anticipation of overseas demand from Japan or biomass co-firing initiatives as outlined in NETR.

Malaysia's total biomass consumption reached

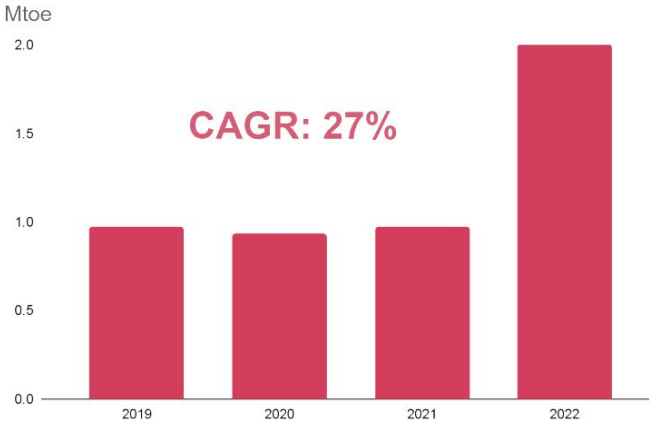
2 Mtoe

by 2022, at a CAGR of

27%

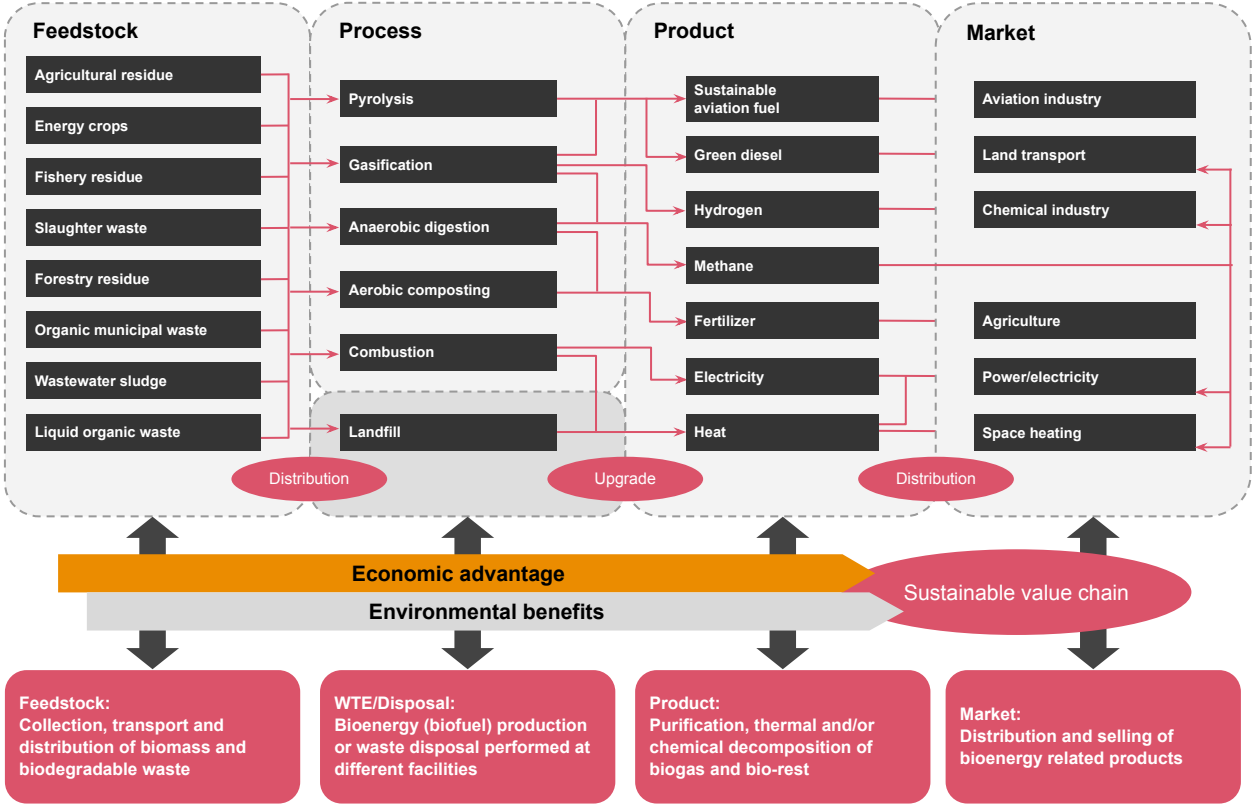
between 2019 -2022

Malaysia's total biomass energy consumption (2019 - 2022)



Source: Enerdata, 2023. Country Energy Report - Malaysia

Opportunities for businesses



Emerging practices

Rather than being discarded in landfills, solid biomass holds potential as a valuable raw material for bioenergy production via a Waste-to-Energy (WTE) process.

Besides that, embracing liquid biofuel and biogas usage has the potential to significantly reduce reliance on fossil fuels, enhance energy security, and lower greenhouse gas emissions in land transport and aviation.

What you should know

Key issues

High cost of conversion into usable fuels and feedstock. For example, pelletising biomass feedstock nearly doubles energy density and improves combustion efficiency, but also increases fuel costs for biomass power plants.

Lack of access to affordable finance for bioenergy projects is further compounded by the lack of interest by institutional investors due to the lower returns on investment.

Bioenergy policy-making involves various jurisdictions like agriculture, forestry, rural development, waste management, and energy which can hinder bioenergy deployment.

Limited information on bioenergy products and their benefits may impact the engagement of stakeholders (e.g. potential users or feedstock providers) along the supply chain.

Our point of view

- Domestic interest is evident as seen in the intense competition for limited Feed-in-Tariff (FIT) quotas.
  For example, in 2021, Sustainable Energy Development Authority (SEDA) received a 3:1 bid ratio from 14 bidders for available generation capacity.
- Incentives such as California's low carbon fuel standard are essential to boost the commercial appeal of biofuels like green diesel and sustainable aviation fuel over their fossil fuel counterparts.
- Separation at source remains a key enabler to secure dry waste feedstock, which has a higher energy density than wet waste, for commercial viability of Waste-to-Energy plants.

Sources: SEDA, 2022. Annual Report 2022; IMARC, 2024. Biomass Pellets Manufacturing Plant Project Report 2024: Industry Trends, Plant Setup, Machinery, Raw Materials, Investment Opportunities, Cost and Revenue; State of Oregon Department of Environmental Quality; Karmakar, Arijeet, Trisha Daftari, et al. 2023. A Comprehensive Insight into Waste to Energy Conversion Strategies in India and Its Associated Air Pollution Hazard; California Air Resources Board. "Low Carbon Fuel Standard", Accessed 1 July, 2024, https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard

Green mobility

State of play in Malaysia (Land transport)

Market drivers:

1 Strong regulatory push

Malaysia has existing incentives to promote electric vehicle (EV) ownership, including exemptions on excise duty, import duty, as well as income tax relief for charging facility expenses.

2 Demand shift

With growing uncertainty in global fuel prices and concerns about energy security, consumers are increasingly looking for alternative fuel sources.

3 Technological advancements

Advancements in EV technology increase efficiency in fuel cell systems effectively, increasing fuel flexibility.

What are the market opportunities?

Malaysia's potential as a regional EV hub
Besides investing in manufacturing plants, companies can enhance R&D efforts in ancillary areas as well*.

Need for robust infrastructure
presents an opportunity for collaboration between private players to develop a network of charging stations across the country.

Sales of battery electric vehicles (BEV) for Malaysia in 2032 is expected to reach

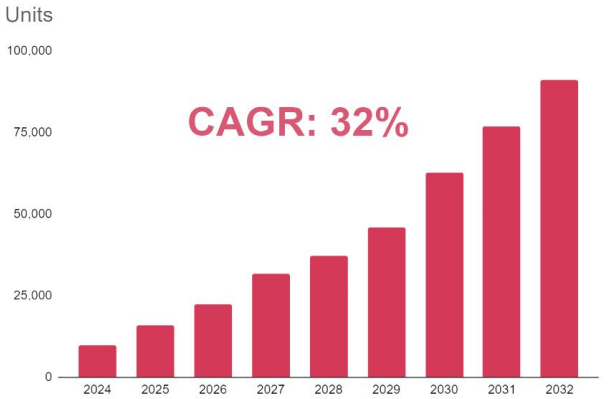
91,218 units

at a CAGR of

32%

between 2024 -2032

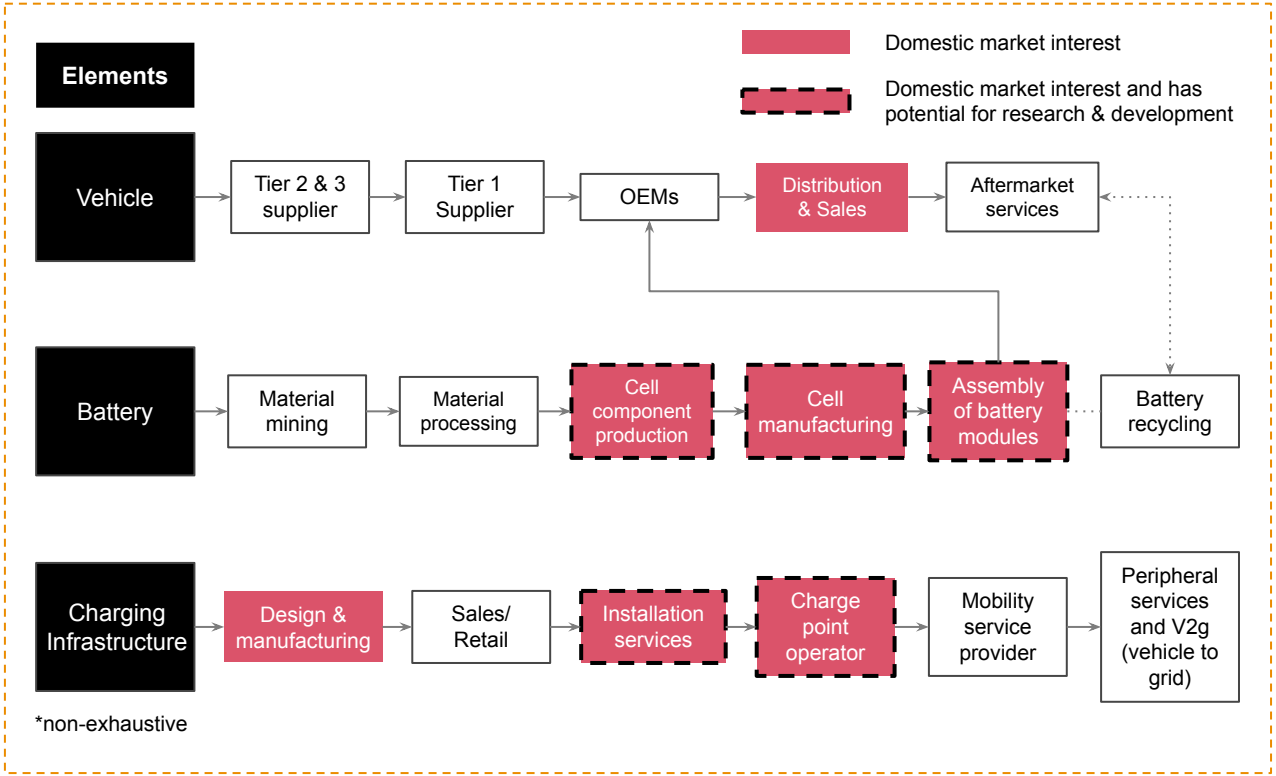
Forecasted BEV sales in Malaysia (2024 - 2032)



*Note: Ancillary areas include battery refurbishment, energy storage solutions and EV software

Source: BMI, 2024. Malaysia Autos Report

Opportunities for businesses (Land transport)



Source: PwC, 2019. Merge ahead: Electric vehicle and the impact on the automotive supply chain; Spendiff-Smith, Matthew. 2024. 800V Charging vs 400V: Comparing EV Architectures

Emerging practices

Within the domestic market, specific interests in the EV sector include leveraging Malaysia's robust electric and electronic industry to manufacture EV components (e.g. semiconductor, wiring loom for BEV architecture and charging infrastructure).

Besides that, as battery electric vehicles become predominant, so would its waste with the battery pack being the largest component, requiring specialist recycling.

State of play in Malaysia (Marine & aviation)

Market drivers:

1 **Feedstock resources**

Malaysia possesses a diverse range of feedstock resources that can be utilised for sustainable aviation fuel (SAF) production, including palm oil, palm kernel oil, jatropha, algae and agricultural residue.

2 **Existing biofuel industry**

Malaysia's biofuel industry, particularly in the production of biodiesel from palm oil, can be leveraged to transition greener fuels for both marine and aviation.

3 **Liquefied Natural Gas (LNG) bunkering**

LNG is becoming a popular marine fuel due to its lower emissions, making it an attractive choice for ship operators to meet stringent environmental standards.

What are the market opportunities?

International collaboration

Malaysian companies can benefit from international collaboration and partnerships in SAF research, developments and commercialisation*.

Increasing global demand

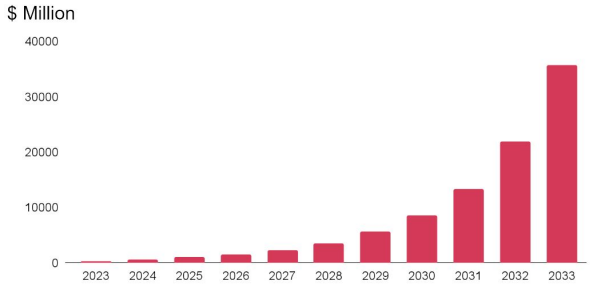
S&P Global Commodity Insights projects SAF demand to climb to 5.8% of global jet fuel demand by 2050, with most of it coming from Europe and the U.S.

New bunkering infrastructure for alternative fuel

New bunkering infrastructure will be needed to enable the use of alternative, zero-emission fuels for international shipping.

Asia-Pacific's SAF market is expected to grow at a CAGR of **59%** to **$35.7 bn** in 2033.

Projected SAF market, Asia-Pacific (2023 - 2033)



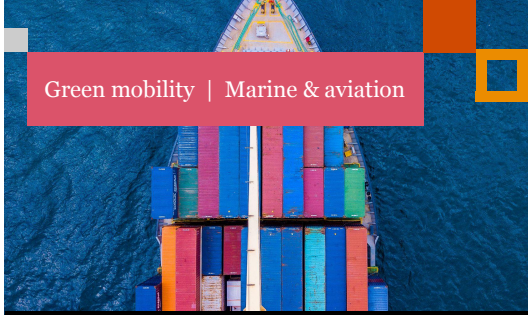
Note: *In 2023, PETRONAS and Idemitsu Kosan Co., Ltd collaborated to enhance capabilities and optimise route to market for SAF. Besides that, Air New Zealand has highlighted Malaysia's potential to emerge as a key provider of feedstock for SAF within the Asia Pacific region.

Source: BIS Research, 2023. Sustainable Aviation Fuel Market - A Global and Regional Analysis

Opportunities for businesses (Marine & aviation)

	Upstream	Downstream	End user
Green diesel & sustainable aviation fuel	• Waste management ecosystem (household, agriculture and used cooking oil) • Vegetable oil producers (e.g. palm oil, soy) • Plantation owners	• Conversion from biomass to fuel (e.g. Gasification, Fischer-Tropsch synthesis) • Hydrogenation of vegetable oils (virgin or used) to hydrogenated vegetable oil	• Commercial and cargo airlines • Civil services, including the Air Force • Private airport and jet owners • Diesel powered machinery and vehicle owners
LNG fuel	• Bunker fuel producers • Refinery operators • LNG suppliers	• Conventional fossil marine fuel suppliers • LNG bunker suppliers	• Ship and ferry owners/operators • Civil services including Navy and Marine Police • Private boat owners

Source: European Technology and Innovation Platform, 2020. Hydrogenated vegetable oil



Emerging practices

Malaysia has the opportunity to position itself as a regional green fuel hub across the different modes of transportation.

Besides being a major port destination in Southeast Asia - accounting for 24% to 25% of annual container destinations in the region. Malaysia can leverage its existing biofuel ecosystem to advance the development of sustainable aviation fuel and green diesel in the country.

What you should know

Key issues

The growth of electric vehicles in Malaysia is **hindered by insufficient infrastructure and a scarcity of charging stations**, especially in certain regions.

Biofuel production for transportation in Malaysia is constrained, as investor interest leans heavily toward EV. Besides that, the potential cost impact of increasing mandated biodiesel blend rates could affect industry players' uptake abilities.

The SAF market relies on certification. Producers and users face challenges in navigating complex criteria, insufficient standards and the need for third-party verification.

High capital costs hinder global LNG bunkering expansion. Challenges include initial and ongoing expenses for LNG-powered ships, larger tanks, bunkering stations, and retrofitting existing vessels.

Source: Ministry of Economy, 2023. National Energy Transition Roadmap

Our point of view

- Despite rapid growth from incentives and demand, greater adoption of EVs in Malaysia is hindered by affordability concerns with median prices at RM250,000*.
- As the 2nd largest palm oil producer in the world, Malaysia can advance biofuels, especially in aviation and heavy transportation.
- LNG bunker fuel is the low hanging fruit for clean bunker fuel as biofuel for bunkering is still in its experimental phase.

*Note: This compares with the over 40% of total industry volume (TIV) which is accounted by vehicle median prices between RM45,000 - RM55,000.

Carbon Capture, Utilisation and Storage (CCUS)

State of play in Malaysia

Market drivers:

1 Tax incentives

While there is still a need to introduce a robust framework for CCUS, there are tax incentives in place to encourage adoption under the Madani government.

2 Strategic resources

Malaysia is ideal to be developed into a regional CCUS hub as some major gas-producing fields are nearing the end of their lifespan for carbon storage*.

3 Technology push

Technological developments have significantly increased the prevalence of carbon capture (44% increase from 2021) despite most technology still being in their infant stage with significant room for growth.

What are the market opportunities?

Charging low-emissions goods at a premium
Decarbonisation efforts via CCUS allow companies to produce goods (e.g. steel and cement) with less emissions but can be sold at a premium.

Carbon credits and carbon offset markets
are receiving growing demands from abroad.

Based on NETR, Malaysia's carbon storage capacity should reach

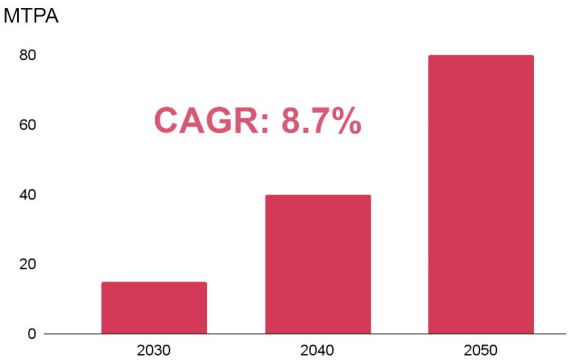
80 MTPA

by 2050, representing a predicted CAGR of

8.7%

between 2030 to 2050

Malaysia's carbon storage capacity based on NETR targets

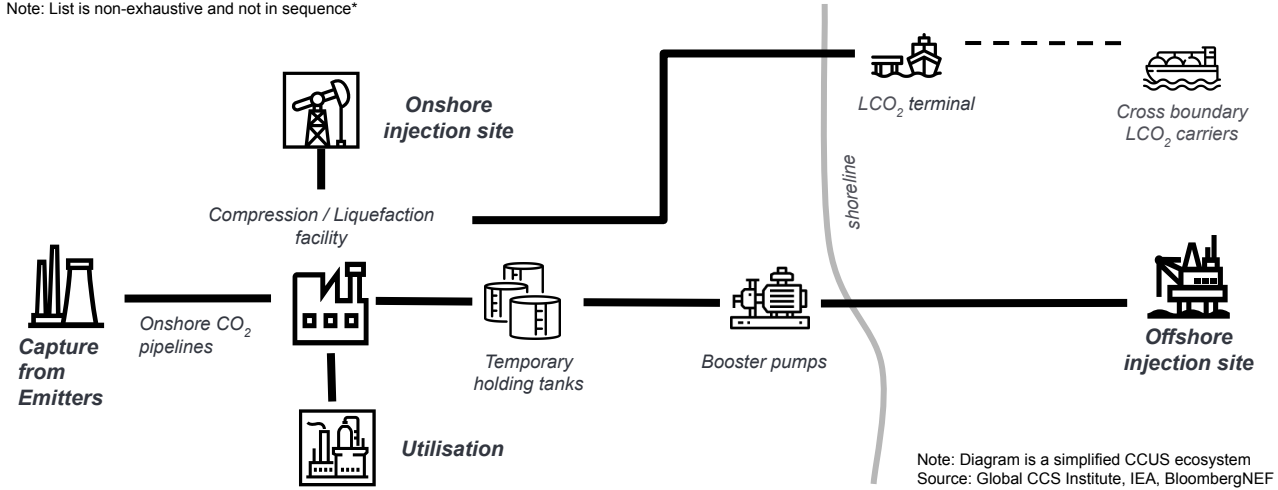


*Note: 2.4GT of potential storage capacity has been identified across 16 of Malaysia's depleted fields.

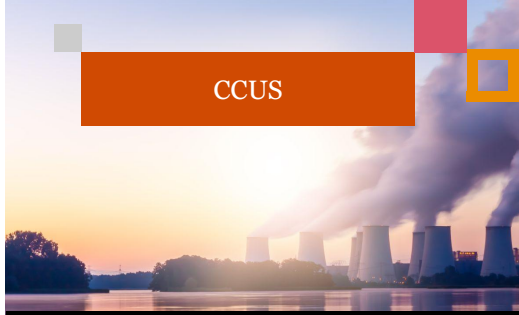
Opportunities for businesses

Capture	Transport	Storage
Capturing CO_2 from fossil or biomass-fuelled power stations, industrial facilities, or directly from the air	Moving compressed CO_2 by ship or pipeline from the point of capture to point of usage	Permanently storing CO_2 in underground geological formations, onshore or offshore, directly from the air
Plant design and engineering	Major plant fabrication	Pipeline transport	Ship transport of LCO_2
Equipment/machinery/ design & manufacture	Construction & commissioning	Marine loading and off-loading	Wells, subsurface & reservoir engineering
Operations & maintenance (O&M)		Marine & subsea contractors	Subsurface & reservoir monitoring, measuring & verification

Note: List is non-exhaustive and not in sequence*



Note: Diagram is a simplified CCUS ecosystem
Source: Global CCS Institute, IEA, BloombergNEF



Emerging practices

Multi-user Carbon Capture and Storage (CCS) networks allow shared transport and storage infrastructure to provide smaller emitters access to the required infrastructure.

This enables economics of scale and fosters growth in the sector. As CCUS matures with time, there will be a market for utilisation of carbon dioxide as most flagship projects in Malaysia are focusing on storage.

What you should know

CCUS

Key issues

Uncertainties around CCUS especially in large-scale commercialisation projects may make it challenging for banks or private investors **to obtain financing**.

The **risks associated with long-term storage of carbon** have yet to be fully studied as events like leakage come with their own set of challenges.

The **inadequacy of a clear carbon pricing mechanism** in Malaysia makes it difficult to create economic incentives and policies.

The technology for CCUS especially the new and more efficient ones are **not mature enough to ensure they are proven and reliable at scale**.

The maturity of the market is highly dependent on the **regulatory framework and transition incentives which are currently unclear**.

Our point of view

- Carbon capture is growing as an effective interim decarbonisation solution e.g. blue energy will support global efforts to transition to green energy.
- Hard-to-abate industries (e.g. steel foundries, cement production) will witness wide adoption of carbon capture to reduce carbon emissions from manufacturing processes.
- As countries look to introduce emissions trading systems (carbon markets) as a driver for GHG reduction, CCUS will increasingly be used as a bridging solution to meet reduction targets along with other initiatives.

How can we help?

> Investing in Malaysia's energy transition journey is not just about environmental responsibility - it's a strategic move towards long-term profitability and market leadership.
>
> Being a first mover in this transition offers a significant competitive edge, positions companies at the forefront of innovation and resilience, allowing companies to capture market share ahead of their peers.

Jasmine Voo

Energy Transition Lead
PwC Malaysia

Supporting your energy transition journey

PwC can develop and work with you through various stages of your energy transition journey. Whether you need support with roadmap development, market entry, business growth, or bringing your plans to life, we will work with you to address your energy transition needs.

Strategy

Market assessment

Understand industry trends and identify opportunities to carve out your value proposition in the market that aligns with your business's inherent capabilities

Competitive analysis

Conduct competitive analysis using key financial indicators supplemented by case studies to gain insights and key success factors

Future growth planning

Visioning, objective and goal setting for future growth that is aligned to your mission, including developing your net zero roadmap

Transformation

Value creation

Carry out capabilities gap analysis to support your energy transition and find alternative revenue sources/innovate existing business models

Capability assessment

Conduct financial modeling and cost analysis to ensure your transition initiatives are financially viable and deliver long-term value

Develop transformation roadmap

Create a high level implementation plan for the transformation through levers such as transition partnerships and financing opportunities

Execution

Develop project charters, prioritise your initiatives and reskill/upskill your workforce

Reporting

Target setting

Define and implement the right non-financial targets to address and manage stakeholder interest

Map energy and value chain footprint

Establish baseline energy usage, costs and emissions across company and value chain

ESG reporting

Make sure that your business is report ready with the proper tools to gain a competitive advantage and build trust with stakeholders

Contact us

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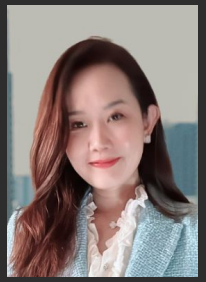

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