



社会经济研究中心
**SOCIO-ECONOMIC
RESEARCH CENTRE**

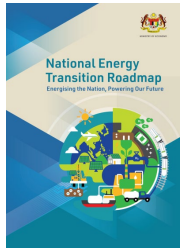
National Energy Transition Roadmap (NETR)

**Energising the Nation, Powering Our
Future**

29 August 2023

Transformation towards a clean energy landscape

In alignment with our commitment towards low-carbon development, the **National Energy Transition Roadmap (NETR)** was drawn up to **accelerate energy transition and transform the status quo (change the way energy is generated) to improve climate resilience.**



Part 1: Flagship Catalyst Projects and Initiatives
27 July 2023

Part 2: Energy Transition Ambition and Cross-cutting Enablers
26 August 2023



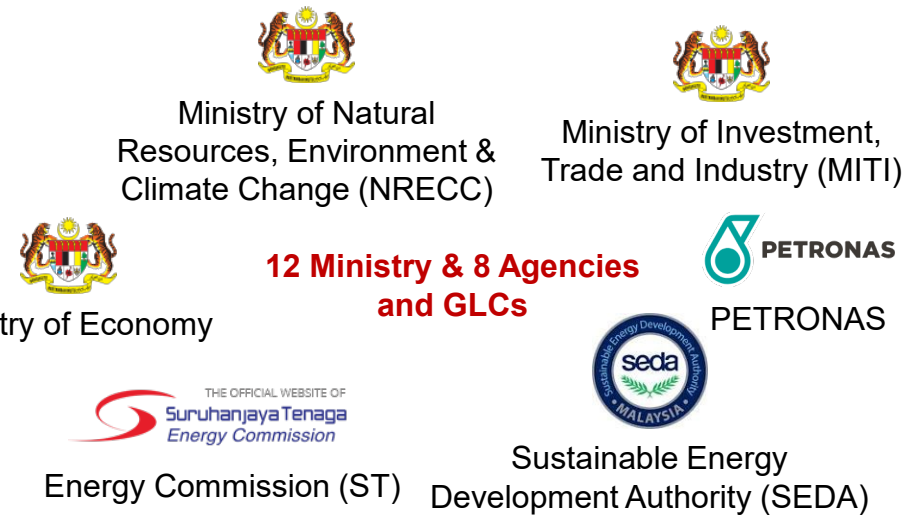
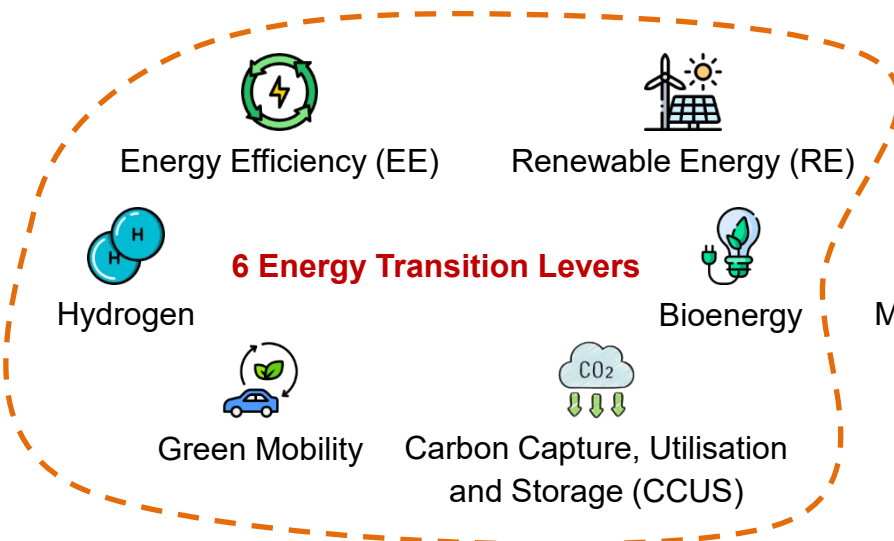
To support:



The Twelfth Malaysia Plan
National Energy Policy (DTN) 2022-2040

Malaysia is inspired to achieve a low-carbon nation in 2040 with net-zero GHG emissions by 2050

NETR involves:




Note: Only selected ministries and agencies are displayed here.


The National Energy Transition Roadmap (NETR)

Part 1

Identify flagship catalyst projects and initiatives

6 Energy Transition Levels

 **Energy Efficiency (EE)**

 **Renewable Energy (RE)**

 **Hydrogen**

 **Bioenergy**

 **Green Mobility**

 **Carbon Capture, Utilisation and Storage (CCUS)**

10 Flagship Catalyst Project

Efficient Switch

Renewable Energy Zone (RE Zone)

Energy Storage

Energy Secure

Green Hydrogen

Hydrogen for Power

Biomass Demand Creation

Future Mobility

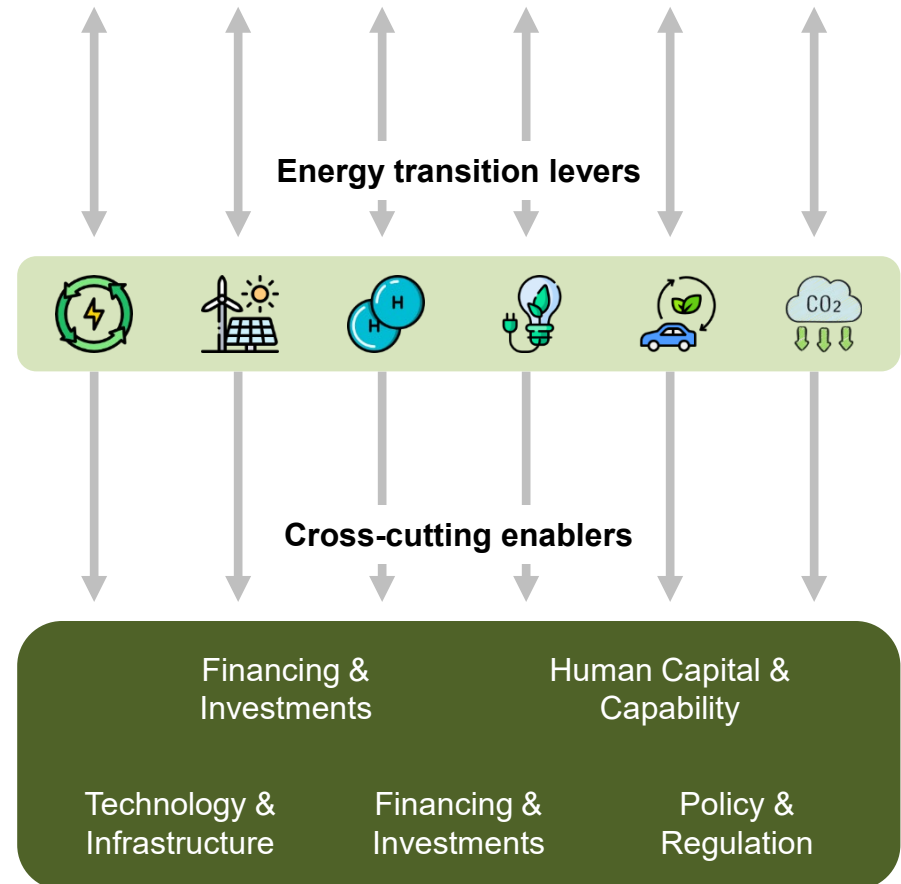
Future Fuel

CCS for Industry

Part 2

Establish low-carbon pathway, energy mix and emission target reduction for the energy sector

Energy transition ambition and macro position



There remain challenges to reduce GHG emission



Population growth

32.7 million (2022) → 40 million (by 2050)



Urbanisation rate

75% (2020) → 85% (by 2040)



Energy demand

- 2% annually
- until 2050

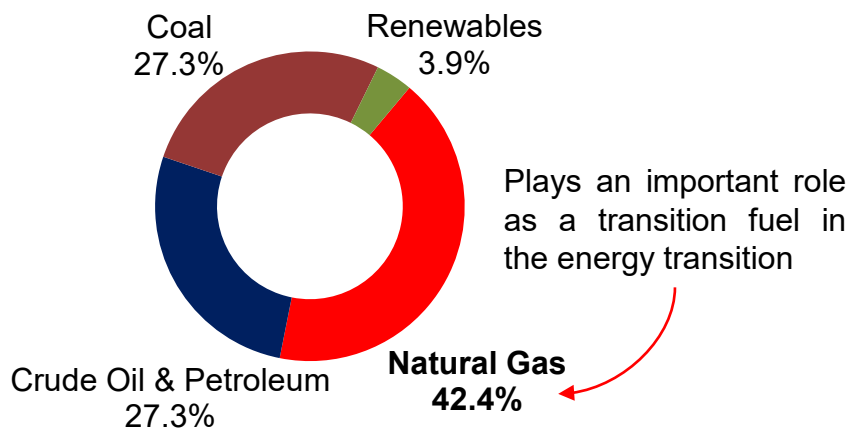


Finite quantities of oil and gas

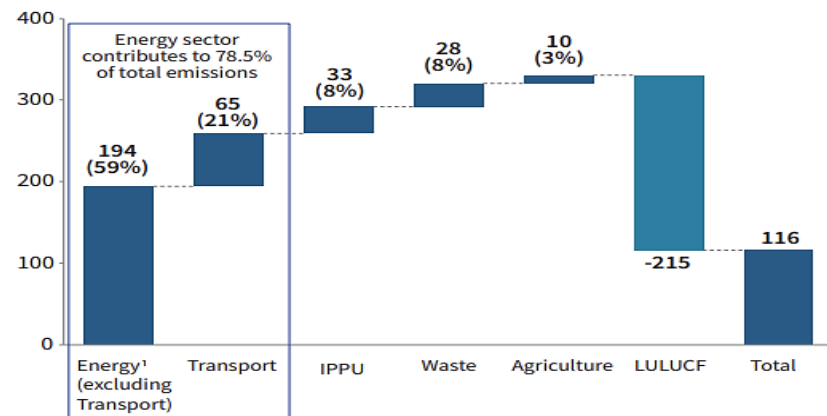
- Approx. 13% of GDP (2021)

The energy sector contributed to 28% of GDP & 25% of total workforce but with 78.5% OF TOTAL EMISSIONS!

Total Primary Energy Sector (2020)







Malaysia's GHG inventory, MtCO₂eq (2019) from BUR4



1. Refers to emissions from energy industries, manufacturing industries and construction, other sectors and non-specified energy emissions, and fugitive emissions from fuels.

National Energy Policy (DTN) vs NETR

Sector and Key Driver

		2040 DTN	2050 NETR
 <p>Energy Efficiency</p>	Industry and Commercial energy efficiency savings (%)	11%*	23%
	Residential energy efficiency savings (%)	10%*	20%
 <p>Renewable Energy</p>	Coal share of installed capacity (%)	19%	0%
	RE share of installed capacity (%)	41%	70%
 <p>Hydrogen</p>	Green hydrogen production (MTPA)	N/A	Up to 2.5 MTPA
	Grey hydrogen feedstock phase off (%)	N/A	100%
	Hydrogen hubs (#)	N/A	3
 <p>Bioenergy</p>	Biofuel capacity (billion litres)	N/A	3.5
	Bioenergy power generation (GW)	N/A	1.4

Note: DTN refers to National Energy Policy 2022-2040 and NETR refers to National Energy Transition Roadmap

* NETR has also set its targets of energy efficiency savings by 2040, with 15% in residential and 22% in industry and commercial sector.

National Energy Policy (DTN) vs NETR (cont.)

Sector and Key Driver



Urban public transport modal share (%)

xEV (4W) share of fleet (%)

E2W share of fleet (%)

Light vehicle fuel economy

Heavy transport fuel economy

Biofuel blending for heavy transport (%)

Hydrogen penetration for heavy transport (%)

LNG penetration as alternative fuel in marine transport (%)

Green fuel penetration in marine transport (%)

SAF blending mandate by 2050 (%)



Number of CCUS cluster (#)

CO2 storage capacity (Mtpa)

2040
DTN

2050
NETR

50%

60%

38%

80%

N/A

80%

N/A

~30%

N/A

~24%

B30

B30

N/A

5%

25%

N/A*

N/A

40%

N/A

47%

N/A

3-6

N/A

40-80

Note: DTN refers to National Energy Policy 2022-2040 and NETR refers to National Energy Transition Roadmap. SAF denotes sustainable aviation fuel.

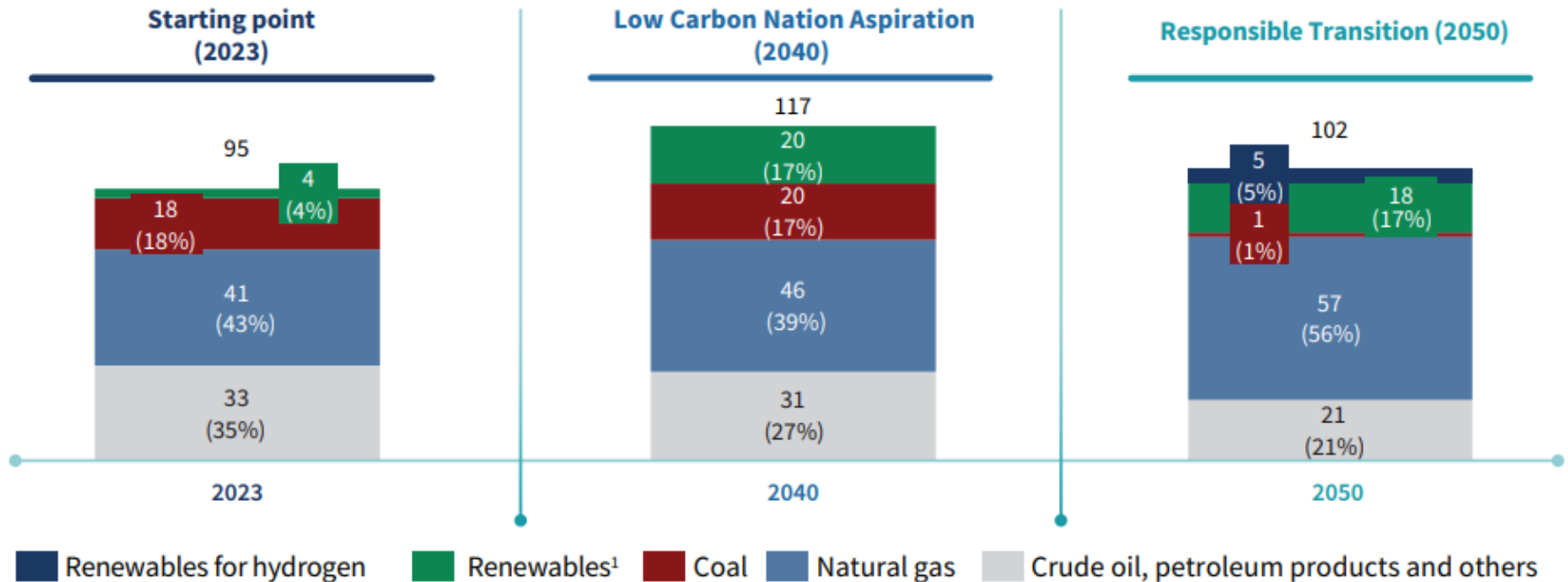
* Given that International Maritime Organisation (IMO) has shifted its focus from desulphurisation to decarbonisation, DTN's target will be dropped.

Energy system pathway: A responsible transition

Responsible transition is designed to **accelerate Malaysia's energy transition journey while balancing energy trilemma:**

- **Increased use of RE** in the power generation mix.
- **Close to fully phased-out coal** from the power generation mix.
- **Broad-based energy efficiency initiatives pursued**, particularly from the demand side management that includes optimising energy consumption across key sectors (incl. residential, commercial, industrial and transport).
- **The shift to electrification and biofuels** expedited in the transport sector.

Total Primary Energy Supply (Mtoe), by energy source



1. Includes bioenergy, solar, hydropower and hydrogen

Socioeconomic benefits of the NETR



Goal: Ensure energy security, energy equity and economic development, as well as improve Malaysia's environmental sustainability.

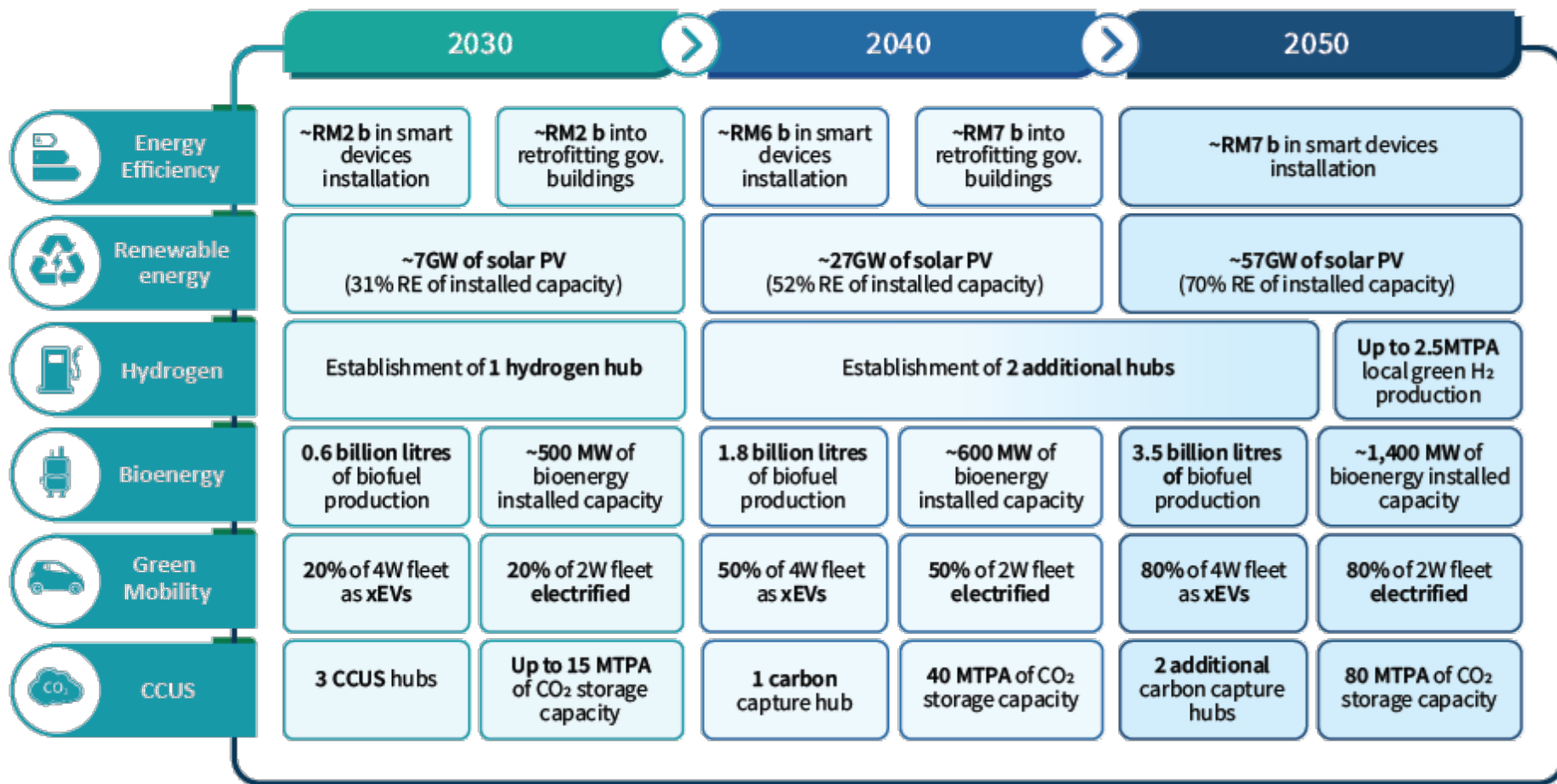
		2023	2030	2040	2050	Total
1 Energy Security	Power system HHI ¹	0.36	0.32	0.30	0.35	-
	Import dependence	-	↓ Reduce imported coal with indigenous natural gas	↑ Increased import of natural gas	↑ Increased import of natural gas (and potentially RE)	↑ Increased import of natural gas
2 Energy Equity and Economic Development	Incremental system costs (RM per kW)	-	1,476	3,097	1,924	-
	Total investment required ² (RM b)	~10-20	~200-220	~460-480	~560-580	~1,200-1,300
	Direct job creation vs. 2022 ³ (jobs)	~ 110,000	~270,000	~350,000	~310,000	-
	GDP impact vs. 2022 (RM b)	~20-25	~60-80	~150-170	~200-220	-
3 Environmental Sustainability	GHG emissions reduction (% MtCO ₂ e _q reduced vs. 2019)	-	(4%)	(26%)	(32%)	(32%)
	Emissions per capita (MtCO ₂ e _q per capita)	7.5	6.8	4.9	4.3	-

1. HHI = Herfindahl-Hirschman index, which is a measure of market concentration. Lower is better as it indicates higher diversity in the power system mix;

2. 2030 investment refers to 2024-2040 investment refers to 2031-2040, 2050 investment refers to 2041-2050. Job creation includes key new growth areas such as low carbon transport (EV ecosystem build-out), energy efficiency, power system transition and grid updates (solar, gas, hydro), and supply chain impacts.

Potential investment opportunities and impact of NETR's RT

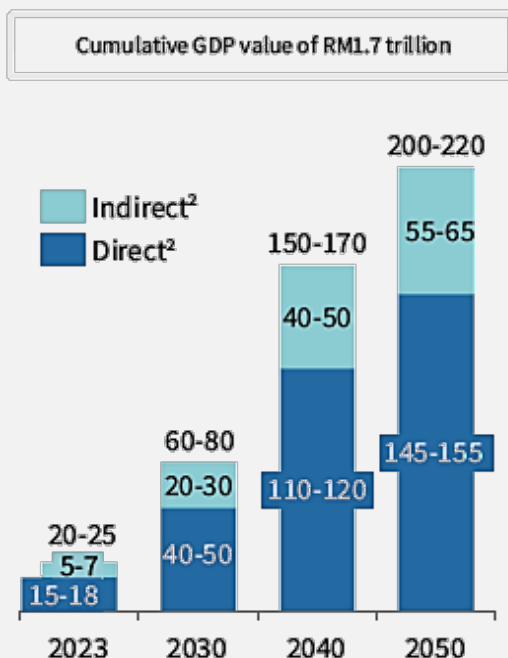
The NETR's Responsible Transition (RT) is estimated to generate investment opportunities totalling between RM1.2 trillion and RM1.3 trillion by 2050.



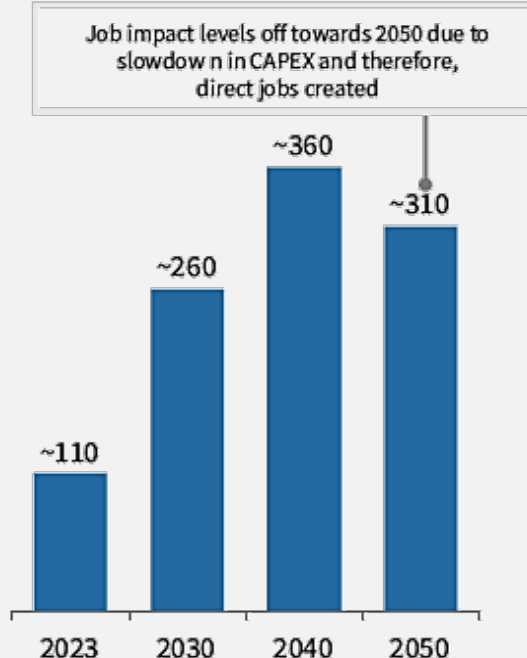
The economic benefits of NETR

- The successful implementation of NETR will **uplift GDP value from RM25 billion in 2023 to RM220 billion and generate 310,000 jobs in 2050.**
- Economic benefits will be felt across the social spectrum, with medium- and low-income households expected to be the biggest beneficiaries of income gains.

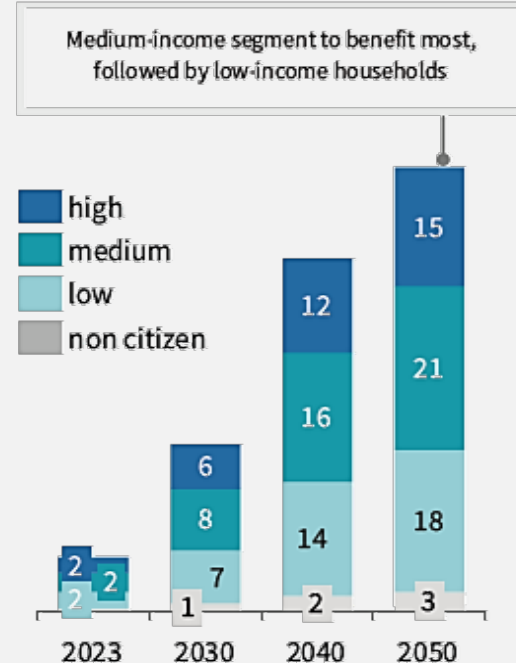
Annual GDP impact vs. 2022 baseline¹
(RM b)



Direct jobs created vs. 2022 baseline
(FTE '000)



Income impact by household segment vs. 2022 baseline (RM b)



1. Cumulative GDP for 2023-2029, 2030-2039 and 2040-2050 are RM ~RM115 b, ~RM520b and ~RM1,030 b totalling up to ~RM1,700 b by 2050;

2. Indirect impact includes induced (resulting increase in incomes to households due to the increased labour and capital demand from the direct and indirect effects) and indirect effects (subsequent ripple effects in the interlinked sectors of the economy resulting from changes in demand and production induced by the initial direct shock on the primary sector).

NETR benefits the whole nation



Rakyat

- Addition of **310,000 jobs** in future-proof sectors across the country
- Balanced economic outcomes with **70% of income** gains to benefit **medium- and low-income households**
- **Better quality of life** and **health outcomes** with lower emissions
- **Greater empowerment** to reduce carbon footprint
- **Up-skilling support** for just transition



Business

- **RM120-180 billion investment opportunities** in co-funded government facility for energy transition
- **Investment opportunities** for green growth across energy transition value chain, up to **RM1.2-1.3 trillion**
- Lower carbon footprint with cleaner **energy mix** and **energy efficiency** to future-proof trade and investment position
- **Enhanced talents** with up-skilling of the workforce



Government

- **10-15% uplift** in GDP value with spurring of new growth areas
- **32% reduction in energy sector emissions**, supporting climate change commitments
- Enhanced **energy self-sufficiency**
- Enhanced **diversification of fiscal income** with new growth
- Carbon footprint reduction to **future-proof industries** and generate **Green FDI**

1st energy transition lever: Energy efficiency



Challenges

- A lack of awareness regarding energy-efficient appliances' benefits and availability.
- Disconnect between building owner and tenants.
- A narrow range of appliances in the Minimum Energy Performance Standards (MEPS).
- Limited returns on investment as well as lack of demand and viable funding opportunities among energy service companies (ESCOs).



Key Targets

Overall energy savings

(compared to business-as-usual scenario)

- **Residential**
- **Industrial and commercial**

	2040	2050
Overall energy savings	21%	22%
• Residential	15%	20%
• Industrial and commercial	22%	23%

Energy efficiency offers effective long-term solutions to lower energy intensity and reduce CO2 emissions.

National Energy Efficiency Action Plan (NEEAP) is on track to achieve its target of reducing electricity demand by 8% by 2025.



Initiatives

- ✓ Improve energy-efficient awareness.
- ✓ Improve existing Minimum Energy Performance Standards (MEPS) and 5-star rating bands.
- ✓ Enforce mandatory audits for large commercial and industrial buildings.
- ✓ Establish green building codes for energy-intensive residential and commercial buildings.
- ✓ Establish an ESCO platform.
- ✓ Launch a major energy-efficient retrofit initiative amongst government buildings.

2nd energy transition lever: Renewable energy



Challenges

- Scalability and efficiency of large-scale-solar (LSS) development are hindered.
- Regulatory barriers and a technology-agnostic LSS bidding mechanism impede the growth of innovative solar technologies.
- Prolonged land acquisition processes and the exclusivity of the Net Offset Virtual Aggregation (NOVA) programme limit the adoption of RE.
- A lack of common alignment on timing, qualification and funding mechanism of grid investment.
- The absence of RE exchange platform and transparent price discovery mechanisms.



Key Targets



70% RE installed capacity share by 2050



No new coal power plant



Initiatives

- ✓ Establish solar parks for accelerated deployment of utility-scale solar
- ✓ Promote floating sector and agrivoltaic technology
- ✓ Expand virtual aggregation model for rooftop solar
- ✓ Develop plan for accelerated investments of transmission and distribution
- ✓ Develop Third Party Access (TPA) framework for sourcing of RE
- ✓ Set RE exchange hub to enable cross-border RE trading



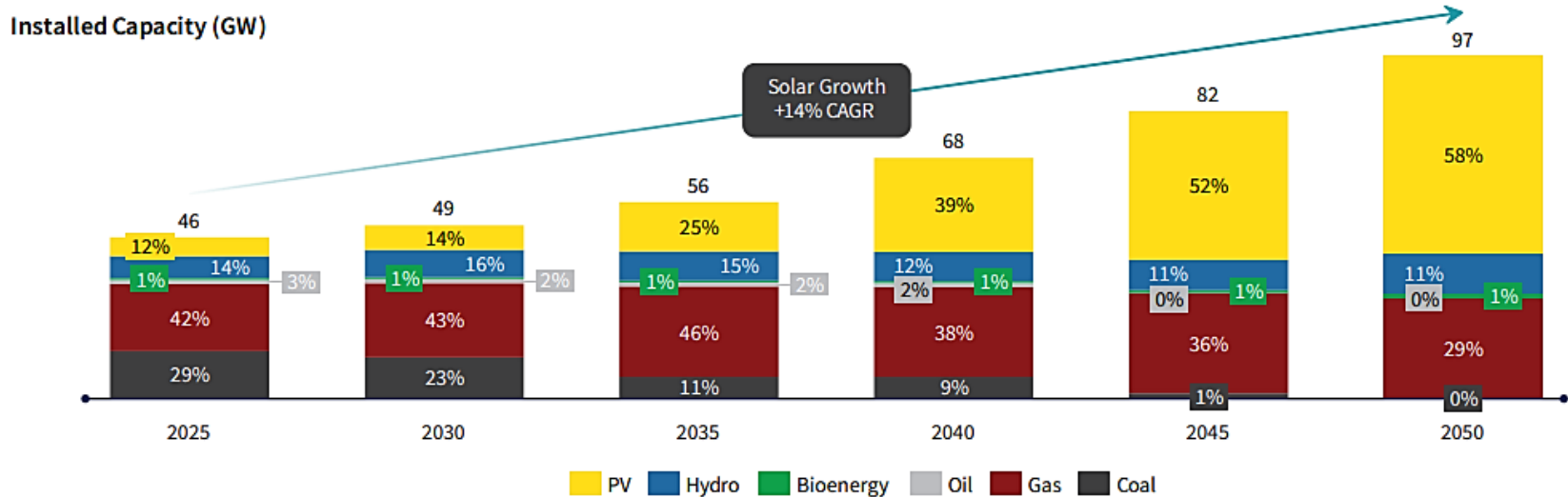
Fossil fuel sources still dominate the national power landscape with the contribution of 33% on Malaysia's GHG emissions in 2019.



2nd energy transition lever: Renewable energy (cont.)



Projected power system installed capacity mix 2050



Key observations:



Renewables will constitute the majority share of installed capacity by 2050.



The contribution of RE to the total generation mix will be comparatively lower than fossil fuels, particularly natural gas, given the inherent low-capacity factor associated with solar.



No new coal-fired power generation will be developed, leading to an almost complete phase by 2045.



Gas is expected to act as a lower-carbon transition fuel away from baseload coal and become a dominant source of fuel for baseload power.



70% RE share of installed capacity by 2050 will be achieved, predominantly driven by solar PV installation (with an expectation of 59 GW of installed capacity).

3rd energy transition lever: Hydrogen

Challenges



Technical and commercial feasibility



Production limitation:

- Supply of electrolyzers in the global market
- Technical capabilities and expertise
- High CAPEX

Need improvements in electrolyser efficiency or reductions in overall costs



Policy and regulator limitation:

- Policy Support
- Defined Standards
- Regulations

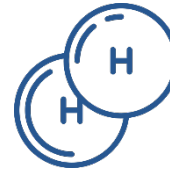
*Gas Supply Act 1993
Renewable Energy Act 2011*

Initiatives

- ✓ Establish low-carbon hydrogen standards and regulations
- ✓ Develop domestic green electrolyser manufacturing capabilities
- ✓ Reduce Levelized Cost of Hydrogen (LCOH) for low-carbon hydrogen
- ✓ Stimulate demand for low-carbon hydrogen

Target

2050



Blue Hydrogen

Complete phase out of grey hydrogen as a feedstock



Green Hydrogen

Produce up to 2.5 Mtpa of green hydrogen from RE



Low-carbon Hydrogen Hubs

2030

One low-carbon hydrogen hub

Additional two hubs – total 3 hubs

4th energy transition lever: Bioenergy

Challenges

Agriculture-related bioenergy

- Supply challenges include:
 - Potential concentration risk of bioenergy feedstock
 - Negative global perception
 - Acceptance of palm oil biomass
 - Supply security of biomass
 - High aggregation cost of bio-based feedstock

Demand challenges include limited local demand for bioenergy.

Non-agricultural waste

- Low used cooking oil (UCO) collection rate
- High usage of open landfills
- Unattractive economics of waste-to-energy plants
- Low national recycling rate



Initiatives

- ✓ Explore alternative bioenergy feedstock
- ✓ Enhance attractiveness of palm oil biomass
- ✓ Address challenge of supply security
- ✓ Improve solid waste management policies

Target

Bioenergy acts as a key enabler to support energy transition. Given this, NETR outlines two key targets to support and enable other energy transition levers:

- Increase biorefinery capacity to 3.5 billion litres by 2050
- Increase biomass and biogas power generation capacity to 1.4 GW by 2050

5th energy transition lever: Green mobility

Land transport (Light vehicle)

Challenges

- Inadequate public transport infrastructure and connectivity; slow adoption of sustainable public transportation and the need to comply with the ASEAN fuel economy standards.
- Lack of affordable EV models and slow expansion of charging infrastructure as well as disparity in upfront costs between E2W and internal combustion engine (ICE) 2W

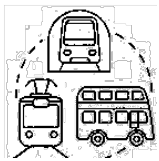
Initiatives

- ✓ Drive public transport modal share shift to 40% by 2040 and 60% by 2050
- ✓ Improve light vehicle fuel economy
- ✓ Accelerate electrification of light vehicles segment (E4W)
- ✓ Accelerate electrification of light vehicles segment (E2W)

Targets

Build on existing national targets outlined by the Low Carbon Mobility Blueprint (LCMB) and the DTN targets

By 2050:



Public transport modal share

60%



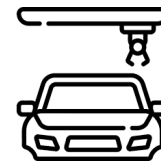
xEV (4W) share of fleet

80%



Electric two-wheelers' (E2W) share of fleet

80%



Local xEV manufacturing

90%

Continue improvements in internal combustion engine (ICE) fuel economy

5th energy transition lever: Green mobility (cont.)

Land transport (Heavy vehicle)

Challenges

- Potential cost impact of increasing mandated biodiesel blend rates could affect industry player uptake abilities
- Limited visibility into optimal heavy vehicle powertrain
- Lack of available infrastructure to support new fuels of the future

Initiatives

- ✓ Enhance demand-side management with fuel economy
- ✓ Implement B30 biodiesel blending mandate
- ✓ Introduce future powertrains for heavy vehicles

Targets

Guided by the DTN and the Logistics and Trade Facilitation Master Plan



Heavy vehicles utilise hydrogen

5%

By 2050

Embrace emerging regional benchmarks pertaining to fuel efficiency

MAINTAINED



Share of rail freight modal utilisation

5%

By 2030



DTN's biodiesel blending targets

B30

By 2030

5th energy transition lever: Green mobility (cont.)

Aviation

Challenges

- Lack of clarity and guidance on the implementation of aviation decarbonisation levers
- Limited demand signals that could effectively catalyse the domestic production of sustainable aviation fuel (SAF)
- Argument surrounding the suitability of palm oil as a SAF feedstock due to concerns related to indirect emissions and other sustainability criteria

Initiatives

- ✓ Establish overarching aviation decarbonisation roadmap
- ✓ Implement SAF blending mandate
- ✓ Undertake palm oil-feedstock emissions study

Targets



Up to
47%

**Adopt ICAO's LTAG
of net-zero carbon
emissions by 2050
for international
aviation**

Marine

Challenges

- Availability of more sustainable fuel alternatives
- Limited capacity for biofuel production, compounded by the growing demand of sustainable biofuels for marine bunkering
- Early stage of development of e-ammonia technology and high cost of hydrogen
- Transitioning to e-methanol necessitates adjustments in vessel designs and engines

Initiatives

- ✓ Unlock market opportunities of biofuel in marine bunkering
- ✓ Unlock market opportunities of future fuels in marine bunkering

Targets



Low-carbon fuel
penetration in
marine transport

40%
By 2050

6th energy transition lever: Carbon Capture, Utilisation and Storage (CCUS)

Challenges

- Technology's nascent status
- Lacks regulatory framework and governance: Domestic policy not developed to allow for the integration of international regulations into domestic regulatory framework
- Utilisation of CO₂ still lacking and deserve exploration
- Strategic government incentives and specific mandates to act as catalysts

Initiatives

- ✓ Develop CCUS-specific policies and regulations
- ✓ Strengthen CCUS adoption through provision of incentives across all relevant sectors and facilitate hub development
- ✓ CC3 - Facilitate CCUS Hub infrastructure development
- ✓ Establish transboundary CO₂ agreement
- ✓ Promote local utilisation of CO₂ in industry

Targets

By 2030

Develop 3 CCUS hubs
(2 in Peninsular Malaysia;
1 in Sarawak)

Total storage capacity

Up to 15 Mtpa

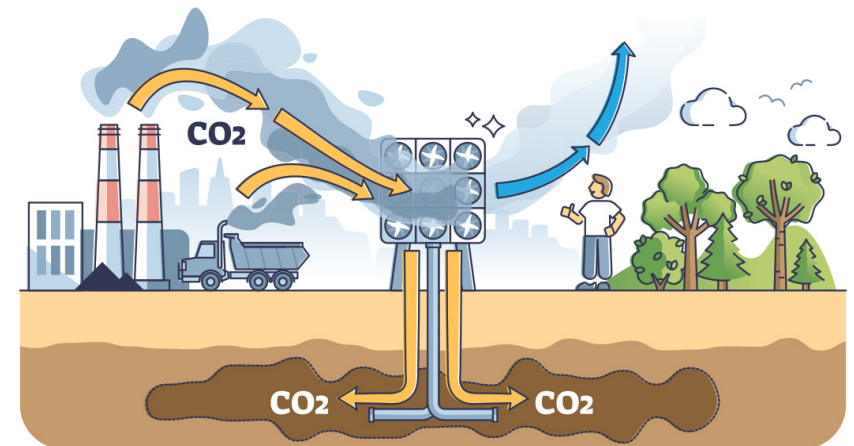
By 2050

Develop 3 carbon
capture hubs

Total storage capacity

40 to 80 Mtpa 

CARBON CAPTURE



6 Energy Transition Levers | 10 Flagship Catalyst Projects

6 Energy Transition Levers	10 Flagship Catalyst Projects	Modalities
Energy Efficiency (EE)	Efficient Switch	Energy Efficiency and Conservation Act (EECA) <ul style="list-style-type: none"> To be tabled in Parliament on 4Q 2023
		Energy Audit For Rail Sector <ul style="list-style-type: none"> Establish current energy consumption baseline, identify potential energy saving and lower utility cost
Renewable Energy (RE)	Renewable Energy Zone (RE)	Integrated RE Zone <ul style="list-style-type: none"> Large-scale, integrated sustainable development for entire supply chain
		Solar Park <ul style="list-style-type: none"> Centralised large-scale solar (LSS) parks
		Hybrid Hydro-Floating Solar PV (HHFS) <ul style="list-style-type: none"> Development of HHFS potential at hydro dam reservoirs
		Residential Solar <ul style="list-style-type: none"> Construction of 4.5MW solar capacity across 450 homes
Hydrogen	Energy Storage	Energy Storage System (ESS) <ul style="list-style-type: none"> Development of utility-scale ESS
	Energy Secure	Sabah Energy Security Initiative <ul style="list-style-type: none"> Integrated development of utility-scale ESS
Hydrogen	Green Hydrogen	Sarawak Hydrogen Hub <ul style="list-style-type: none"> Three integrated green hydrogen production projects
	Hydrogen for Power	Co-firing of Hydrogen and Ammonia <ul style="list-style-type: none"> Green hydrogen and ammonia co-firing

6 Energy Transition Levers | 10 Flagship Catalyst Projects (cont.)

6 Energy Transition Levers	10 Flagship Catalyst Projects	Modalities
Bioenergy	Biomass Demand Creation	<p>Biomass Clustering</p> <ul style="list-style-type: none"> • Development of potential biomass clusters with a centralised plant <p>Biomass Co-firing</p> <ul style="list-style-type: none"> • Co-firing initiative by burning biomass along with coal
Green Mobility	Future Mobility	<p>EV Charging Stations</p> <ul style="list-style-type: none"> • Installation of 10,000 EV charging stations by 2025 <p>Mobile Hydrogen Refueling Station</p> <ul style="list-style-type: none"> • First mobile hydrogen refueling station <p>Public Transport Electrification</p> <ul style="list-style-type: none"> • Electrification of first-last mile public transport & upgrading infrastructure <p>Solar Photovoltaic (PV) Installation Rail Operations</p> <ul style="list-style-type: none"> • The Rail Sector Energy Management and Renewable Energy (EMRE) Action Plan
	Fuel Future	<p>Biofuels Hub</p> <ul style="list-style-type: none"> • Bio-refinery development
Carbon Capture, Utilisation and Storage (CCUS)	CCS for Industry	<p>Regulatory Framework</p> <ul style="list-style-type: none"> • Development of policy and regulatory framework <p>Kasawari and Lang Lebah CSS</p> <ul style="list-style-type: none"> • Implementation of carbon capture and storage (CCS) catalyst projects

Cross-cutting enablers

Five key cross-cutting enablers and twelve initiatives that seamlessly align with enablers highlighted in DTN have been identified to expedite Malaysia's energy transition journey. These enablers assume a crucial role in addressing underlying structural impediments and disparities inherent in the nation's shift towards a low-carbon energy mix.

Cross-cutting Enablers



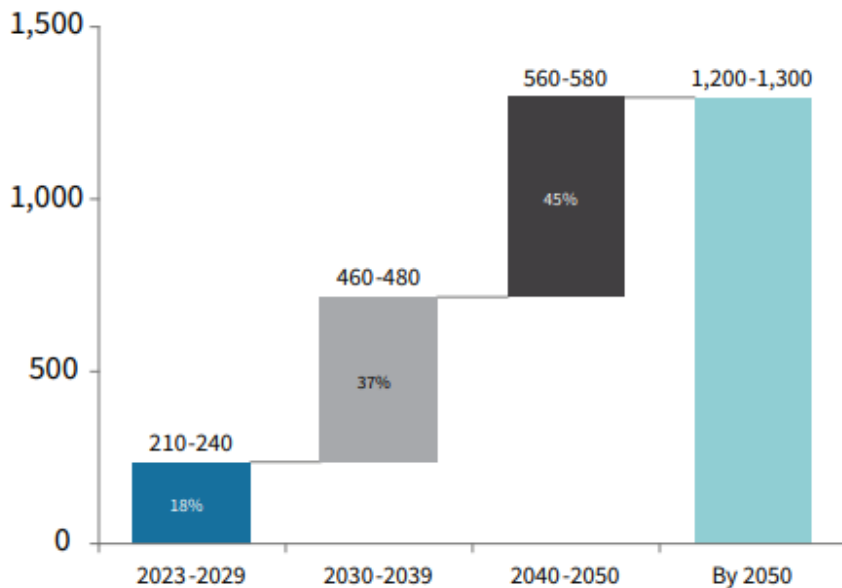
Initiatives

- 1 Establish National Energy Transition Facility
- 2 Mobilise and attract private capital flow for energy transition sectors
- 3 Roll out carbon pricing mechanism
- 4 Launch National Gas Roadmap
- 5 Rationalise energy subsidies
- 6 Establish green skills taxonomy and ensure strategic workforce planning
- 7 Develop and roll out targeted green skilling programmes
- 8 Develop and implement community support programmes
- 9 Enhance energy literacy and energy efficiency awareness among students, SMEs and energy consumers
- 10 Develop a National Energy Knowledge Hub for public access
- 11 Accelerate development of domestic industries for green manufacturing and adoption of green technologies
- 12 Establish National Committee on Energy Transition under the National Energy Council (MTN)

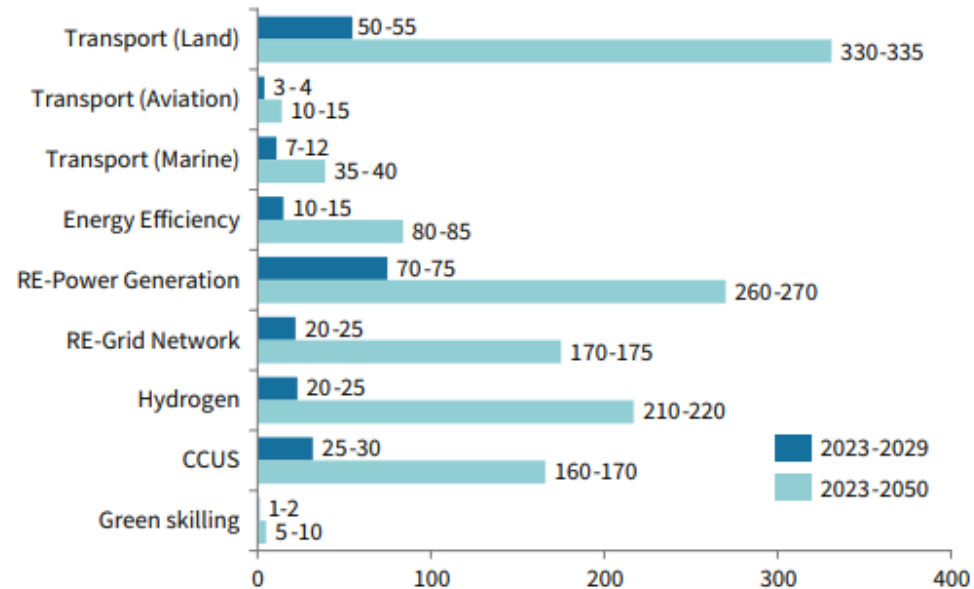
Energy transition's financing needs

- To effectively realise energy transition while upholding fiscal prudence, it is imperative to oversee financing across diverse channels.
- NETR outlines a **prospective investment of approximately RM1.2-1.3 trillion by 2050, allocating 18% of these funds within the current decade (2023-2029)**. This allocation predominantly focuses on advancing renewable energy power generation and eco-friendly mobility solutions.
- Considerable investment is essential for emerging technologies like hydrogen and CCUS (Carbon Capture, Utilisation, and Storage), given their innovative nature and the imperative to facilitate their significant upscaling.

By decade, RM billion



By categories, RM billion

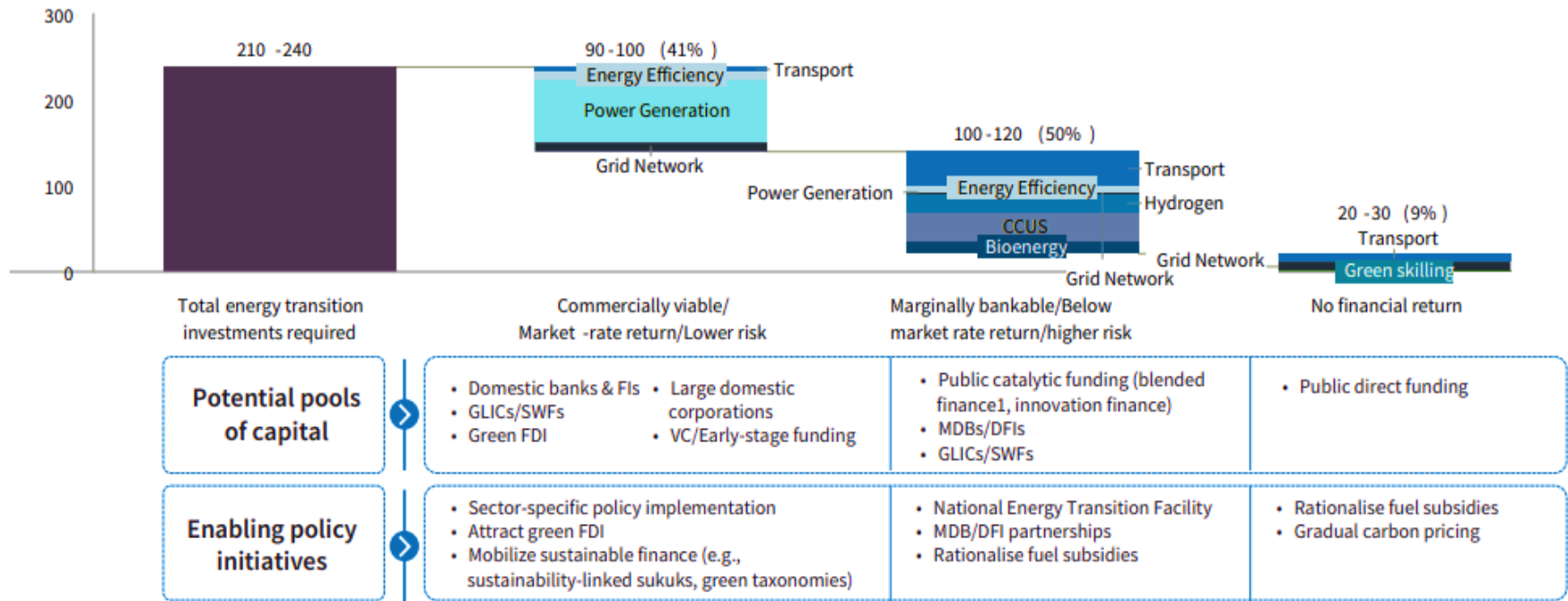


Note: NETR financing needs are additive and do not include business-as-usual investment required or projects already being financed (e.g., transmission and distribution, ongoing public transport projects).

Short-term national energy transition's financing news

A capital infusion of RM210-240 billion is imperative for fostering green energy advancements within this decade. This funding will emanate from diverse channels, encompassing private enterprises and government-linked corporations (GLCs), thereby actively contributing to steering the energy transition initiative. Facilitating green foreign and domestic direct investments necessitates pivotal national support measures. These encompass tax incentives and other catalysts that streamline expansion, enhance economies of scale, and ultimately reduce overall costs.

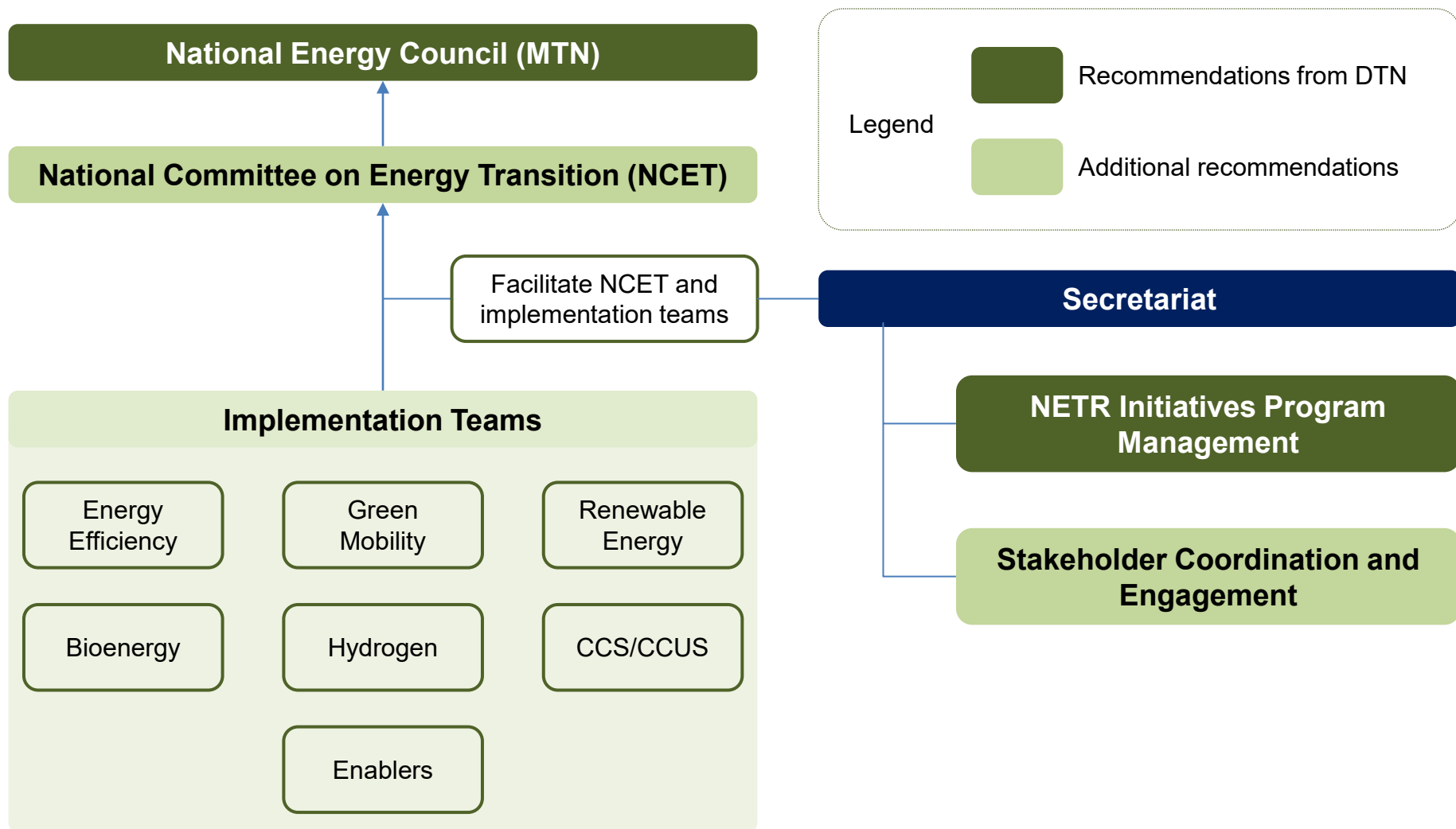
Estimated investments required (2023-2029), RM billion



Financial Institution (FI), Government Link Investment Company (GLIC), Sovereign Wealth Funds (SWF)
 Foreign Direct Investment (FDI), Venture Capital, Multilateral Development Bank (MDB), Development Finance Institution (DFI)

Governance of the National Energy Transition Roadmap

The National Committee on Energy Transition (NCET) will be established under the National Energy Council and responsible for monitoring the implementation of NETR projects, spearheaded by the Ministry of Economy.



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- The launching of the National Energy Transition Roadmap (NETR) marks an important transformational change in shaping how our energy is generated and used sustainably to meet our net-zero target.
- The document sets ambitious targets and investments to match, as well as outlines initiatives and modalities to achieve our sustainable energy and environment management while growing the economy. It has identified profitable energy and renewable energy ventures/projects that are good for the environment and economy.
- The NETR has outlined 50 initiatives under six energy transition levers and five cross-cutting enablers. Twelve (12) ministries and eight (8) government agencies and government-linked companies were identified as the spearheading champions to work together with all stakeholders to drive the energy transition and also catalytic projects.
- It is clear that the Government is committed to advancing the energy transition movement of Malaysia. There are massive opportunities totalling between RM1.2 trillion and RM1.3 trillion by 2050 for more projects to be developed by both foreign and local investors.
- A good monitoring and evaluation system is important to track the progress of the NETR, including periodical updates to the investors and public in a timely manner.
- Towards this end, we welcome the establishment of the National Energy Council to set forth high-level strategic directions and policies, allowing for the working committees to coordinate and report the progress of the NETR.
- The energy transition financing will be undertaken through a combination of grants, loans, rebates, incentives and other investors to support the whole-of-nation approach.

Commentaries (cont.)

a

- **An estimated capital infusion of RM210-240 billion in 2023-2029**, with the distribution coming from:
 - (a) 9% of total funding comes from public direct funding (Government), which is reasonable given the fiscal budget constraint.
 - (b) 50% from public catalytic funding, development financial institutions and GLICs/sovereign wealth funds (SWFs); and
 - (c) 41% of the total capital infusion will come from financial institutions, government-linked corporations (GLCs)/SWFs, large domestic corporations, and venture capital/early-stage funding.
- One of these projects is the integrated RE Zone that will be championed by Khazanah Nasional Berhad and carried out through a joint venture between UEM and ITRAMAS.
- At one gigawatt, this hybrid solar photovoltaic (PV) power plant is the largest of its kind in Southeast Asia. The scale of our ambition has attracted high-profile global investments from major economic blocs totalling RM6 billion.
- Green hydrogen is considered to be the fuel of the future. Private players are now also betting big on green hydrogen, which will assist in decarbonising other sectors like refining, fertiliser, and steel.
- NETR opens up the hydrogen gateway in Sarawak as it implements rounds of projects to emerge as the hydrogen hub in the country and put in place the framework of CCS (carbon capture and storage) so that catalyst projects could be implemented in these two years.

Commentaries (cont.)

- Supply growth will be predominantly driven by private players, with public sector taking the lead initially. The government's commitment to developing RE programs on a "willing buyer, willing seller basis" demonstrates its dedication to creating a conducive environment for private sector participation in the renewable energy sector.
- The energy industry has experienced a series of changes, such as the transition into a targeted subsidy mechanism for electricity prices, adjustment of renewable energy (RE) tariffs to reflect international pricing, lifting of the RE export ban, and expansion of the RE quota and installed capacity target to accelerate the industry transition.
- The establishment of an RE exchange by 2024 will act as a market aggregator that will enable price discovery and monetise excess power. It is necessary for the country to command the price premiums of RE that come from cross-border trading.
- Transition policies enabling communities to play an active role to take fuller advantage of the socio-economic benefits of the energy transformation, including jobs and local value creation.
- Long-term and effective carbon pricing and the removal of existing subsidies to fossil fuels are essential to speed up renewable energy deployment.
- Given the huge capital investment, we would like to raise the following questions :
 - (a) What is the rate of investment return to the producers of RE? We must have a mechanism to make the RE supply industry more reliable, efficient, sustainable and transparent.
 - (b) How much does the energy cost savings for households and businesses? How will the RE electricity tariff benefit consumers and businesses? How competitive compared to what we are paying today?
 - (c) How can we ensure no over-expansion of RE projects, resulting in overcapacity in power generation? The IPPs are a classic case of outsourcing electricity production to inefficient IPPs, which have caused a drain on the resources of Tenaga and a burden on consumers.

Commentaries (cont.)

- In conclusion, the NETR will help to reduce harmful air pollutants, improve public health, better quality of life, lower energy costs and the costs of compliance with air quality standards, create jobs, and improve the reliability and security of the nation's energy system.
- The Government has to make sure that households and businesses fully appreciate the multiple benefits associated with energy efficiency and renewable energy; and factor into the quantitative comparison of costs and benefits that often drive decision-making.
- Provide valuable information and analysis to help consumers and businesses to evaluate energy options in a more accurate manner by assessing the comprehensive benefits of proposed policies and programs, and not just the costs.
- Resistance to changes in energy transition may arise due to the Government's strict regulation of the energy sector. There are concerns about government's commitment towards renewable energy, and hence, a consistent and clear energy policy framework is needed for the buy-in of investors and stakeholders.
- The successful implementation of NETR requires the "whole-of-nation" collective responsibility to play their role in transforming Malaysia towards a greener and low-carbon economy. A holistic and integrated approach requires concerted efforts from government, businesses, communities, and individuals.

Appendix 1: Key initiatives of six energy transitional levers

Energy Transition Lever: Energy Efficiency

Code	Initiatives	Champions
EE1	<p>Improve EE awareness</p> <ul style="list-style-type: none"> Promote awareness for energy-efficient appliances and equipment through public awareness programmes Redesign the 5-star labelling standards to emphasise monetary savings in addition to the technical energy savings 	NRECC; ST
EE2	<p>Improve existing Minimum Energy Performance Standards (MEPS) and 5-star rating bands</p> <ul style="list-style-type: none"> Increase the number of MEPS-covered equipment Establish an accelerated MEPS progression timeline for key critical appliances align with ASEAN Plan of Action for Energy Cooperation (APAEC) standards Revise the bands for appliances with high 5-Star ratings penetration through periodic reviews 	ST
EE3	<p>Enforce mandatory audits for large commercial and industrial buildings</p> <ul style="list-style-type: none"> Implement mandatory investment-grade audits focusing on high energy-consuming commercial and industrial sector Establish reporting protocol as well as a strict monitoring mechanism 	ST
EE4	<p>Establish green building codes for energy-intensive residential and commercial buildings</p> <ul style="list-style-type: none"> Establish a mandatory national standard that outlines EE parameters for both new residential and commercial buildings as well as retrofit for existing building to meet a minimum Building Energy Intensity (BEI) level Mandate disclosure of building energy performance for commercial buildings 	ST; SEDA
EE5	<p>Establish an ESCO platform</p> <ul style="list-style-type: none"> Establish a public ESCO platform to coordinate public building retrofits with private ESCOs Streamline funding and create a single financial mechanism in the form of a revolving fund through ESCO platform 	ST
EE6	<p>Launch a major EE retrofit initiative amongst government buildings</p> <ul style="list-style-type: none"> Identify energy inefficient public buildings (e.g., offices with BEI >200 = ~60-70%⁸ of existing building) Develop medium to long-term EE government building retrofit program and implement project via ESCO platform 	KKR; JKR

Energy Transition Lever: Renewable Energy

Code	Initiatives	Champions
RE1	<p>Establish solar parks for accelerated deployment of utility-scale solar</p> <ul style="list-style-type: none"> Identify suitable plots of land for development of solar parks through close collaboration among federal government, state governments and utility companies to enable decarbonisation of hard-to-abate industries Enhance current LSS mechanism to improve financial sustainability for developers 	NRECC; ST; MEESTy; ECoS; SEDA
RE2	<p>Promote floating solar and agrivoltaic technology</p> <ul style="list-style-type: none"> Remove existing regulatory barrier inhibiting floating solar and agrivoltaic (e.g. to amend existing hydropower power purchase agreements) Roll out clear guidelines for floating solar and agrivoltaic Adopt distinct bidding categories in future LSS auction to ensure fair competition 	
RE3	<p>Expand virtual aggregation model for rooftop solar</p> <ul style="list-style-type: none"> Expand virtual aggregation mechanism (e.g. NOVA program) to government and residential buildings for leasing and aggregation of rooftop space and sale to offtakers Scale-up corporate and industrial solar rooftop programme 	
RE4	<p>Develop plan for accelerated investments of transmission and distribution</p> <ul style="list-style-type: none"> Establish amount, timing and mode of funding for grid infrastructure investment to reduce grid constraints while balancing energy trilemma (Exhibit 5.3) Provide incentives for RE development and power storage facilities to improve system flexibility and address RE intermittency 	NRECC; ST; TNB; MEESTy; SEB; ECoS; SESB
RE5	<p>Develop TPA framework for sourcing of RE</p> <ul style="list-style-type: none"> Develop TPA framework with transparent mechanism for wheeling fee calculation to bridge demand-supply gap for green electricity Allow solar developers amongst Corporate Green Power Programme (CGPP) to sell excess power to the Single Buyer - unlocking additional sources of revenue and boosting investor interest 	NRECC; ST; TNB
RE6	<p>Set up RE exchange hub to enable cross-border RE trading</p> <ul style="list-style-type: none"> Establish physical enabler (e.g. special purpose vehicle) to act as the market aggregator Develop regulations for implementation of RE exchange hub and cross-border RE trading Establish new or upgrade interconnection with neighbouring countries o Monetise excess power generated through bi- or multi-lateral power trading arrangements with neighbouring countries 	NRECC; ST

Energy Transition Lever: Hydrogen

Code	Initiatives	Champions
HY-1	<p>Establish low-carbon hydrogen standards and regulations</p> <ul style="list-style-type: none"> • Adopt low-carbon hydrogen standard to ensure consistent definition of low-carbon hydrogen with global trading partners • Establish domestic guarantee of origin certification to meet the standards of importing countries • Introduce hydrogen-specific regulations relating to transportation and storage • Streamline permitting process for hydrogen projects for expedited approval 	MOSTI
HY-2	<p>Develop domestic green electrolyser manufacturing capabilities</p> <ul style="list-style-type: none"> • Fund electrolyser research and development (R&D) projects in local universities targeting efforts that reduce manufacturing costs • Provide financial incentives for electrolyser R&D activities by the private sector 	MOSTI
HY-3	<p>Reduce Levelized Cost of Hydrogen (LCOH) for low-carbon hydrogen</p> <ul style="list-style-type: none"> • Establish hydrogen hubs to optimize economics of low-carbon hydrogen (Exhibit 5.5) • Establish financial incentives for large-scale manufacturing of low-carbon hydrogen and electrolyser • Facilitate partnerships between foreign electrolyser technology providers and local manufacturers for knowledge transfer 	MOSTI; MITI
HY-4	<p>Stimulate demand for low-carbon hydrogen</p> <ul style="list-style-type: none"> • Explore bilateral agreements with key importing countries to develop low-carbon hydrogen value chain, catalyse project development and secure long-term green hydrogen offtakes • Provide incentives for development of hydrogen refuelling stations and purchase of hydrogen fuel cell vehicles • Explore hydrogen co-firing with coal as a technology to reduce GHG emissions in the short term 	MOSTI; MITI

Energy Transition Lever: Bioenergy

Code	Initiatives	Champions
BI-1	<p>Explore alternative bioenergy feedstock</p> <ul style="list-style-type: none"> • Explore bamboo as a feedstock • Support R&D of third-generation bioenergy (algae) 	KPK

Energy Transition Lever: Bioenergy (cont.)

Code	Initiatives	Champions
BI-2	<p>Enhance attractiveness of palm oil biomass</p> <ul style="list-style-type: none"> Enhance acceptance of palm oil biomass (e.g. crude palm oil and palm oil mill effluent) to reduce indirect land use change (ILUC) charges Obtain sustainable aviation fuel (SAF) certification from international bodies 	KPK
BI-3	<p>Address challenge of supply security</p> <ul style="list-style-type: none"> Facilitate biomass clustering to catalyse aggregation and reduce aggregation cost Scale-up UCO collection via increasing awareness campaigns and UCO collection facilities 	KPK
BI-4	<p>Catalyse local demand for bioenergy</p> <ul style="list-style-type: none"> Establish SAF blending mandates starting with 1% Establish B30 mandate for land transport by 2030 when palm oil gas oil (POGO) spreads are projected to be economically viable Upgrade nodal point at economically feasible clusters of mills Facilitate incentives through Feed-in-Tariff (FiT) or other mechanism for co-firing in coal power plant 	KPK; SEDA
BI-5	<p>Improve solid waste management policies</p> <ul style="list-style-type: none"> Explore landfill tax and quota or landfill ban to drive reduction in open landfills Explore expansion of de-risking revenue sources and co-funding of waste-to-energy (WtE) plants to ensure financial sustainability Accelerate recycling target and increase recycling infrastructure investments 	KPKT

Energy Transition Lever: Green Mobility (Land Transport – Light Vehicle)

Code	Initiatives	Champions
GM-LV1	<p>Drive public transport modal share shift to 40% by 2040 and 60% by 2050</p> <ul style="list-style-type: none"> Financially support the ongoing or future buildout of public transport infrastructure to facilitate modal share shifts Facilitate electrification of public transport 	MOT
GM-LV2	<p>Improve light vehicle fuel economy</p> <ul style="list-style-type: none"> Establish robust methodology to measure fuel economy Strengthen fiscal policy measures based on fuel economy Determine long-term fuel standards 	MOT

Energy Transition Lever: Green Mobility (Land Transport – Light Vehicle) (cont.)

Code	Initiatives	Champions
GM-LV3	<p>Accelerate electrification of light vehicles segment (E4W)</p> <ul style="list-style-type: none"> • Incentivise investments to build local manufacturing capacity and capability • Continue co-funding of public charging infrastructure • Implement stringent emissions standards to limit non-EEV manufacturing • Expand product awareness and model availabilities of EVs • Identify key localisation opportunities in EVs • Reduce regulatory challenges in ramping up EV adoption, including for setting up of charging infrastructure (e.g., right-to-charge regulation, approval process for charge point operator license, review of Uniform Building By-Laws) 	MITI
GM-LV4	<p>Accelerate electrification of light vehicles segment (E2W)</p> <ul style="list-style-type: none"> • Incentivise E2W purchase or leasing cost to expedite total cost of ownership parity with ICE 2W, targeting B40 household • Foster the expansion of E2W model availability through local manufacturing or support for foreign manufacturers' setup • Monitor E2W charging infrastructure development and establish battery charging standards for public and home charging 	MITI

Energy Transition Lever: Green Mobility (Land Transport – Heavy Vehicle)

Code	Initiatives	Champions
GM-HV1	<p>Enhance demand-side management with fuel economy</p> <ul style="list-style-type: none"> • Set common indicators and methodologies to measure fuel economy • Evaluate and utilise selected levers to meet estimated fuel efficiency target • Encourage vehicle replacement through targeted incentives 	MOT
GM-HV2	<p>Implement B30 biodiesel blending mandate</p> <ul style="list-style-type: none"> • Comprehensive review of biodiesel blending programme to ensure achievable blending rate • B30 to be mandated by 2030 when POGO spreads are projected to be economically viable 	KPK
GM-HV3	<p>Introduce future powertrains for heavy vehicles</p> <ul style="list-style-type: none"> • Track advancement in technology of future fuel powertrain • Explore the utilisation of hydrogen for long-haul trucks and battery electric vehicles (BEV) for short-to-medium-haul trucks 	MGTC

Energy Transition Lever: Green Mobility (Aviation)

Code	Initiatives	Champions
GM-AV1	<p>Establish overarching aviation decarbonisation roadmap</p> <ul style="list-style-type: none"> • Develop aviation decarbonisation roadmap collaboratively alongside key stakeholders with four main elements: (i) Foster industry-driven advancement through collaboration with private stakeholders, (ii) Address essential decarbonisation levers, (iii) Outline policy intervention tailored to each lever, and (iv) Establish milestones and monitor progress. 	MOT
GM-AV2	<p>Implement SAF blending mandate</p> <ul style="list-style-type: none"> • Establish an initial 1% SAF blending mandate to encourage demand • Incentivise investments in SAF production and infrastructure • Develop a comprehensive framework for progressive escalation of blending mandates in the long run 	KPK
GM-AV3	<p>Undertake palm oil-feedstock emissions study</p> <ul style="list-style-type: none"> • Re-evaluate emissions related to POME and ILUC to bolster adoption of SAF derived from palm oil • Ensure palm oil for SAF production is sourced in a sustainable manner 	KPK

Energy Transition Lever: Green Mobility (Marine Transport)

Code	Initiatives	Champions
GM-MA1	<p>Unlock market opportunities of biofuel in marine bunkering</p> <ul style="list-style-type: none"> • Research, conduct pilots, and drive technical and commercial viability of domestic biofuels usage in onboard equipment and marine bunkering fuel • Encourage early adoption of domestic biofuels in shipping industry to position biofuel for fuel exports 	MOT
GM-MA2	<p>Unlock market opportunities of future fuels in marine bunkering</p> <ul style="list-style-type: none"> • Keep track and selectively adopt pilot projects for alternative fuels and determine country strategy for these fuels as commercial viability is reached • Enhance the competitiveness of domestic ports in future fuel marine bunkering by providing incentives, lowering costs of fuel supply and enhancing refueling efficiency • Develop plan for domestic coastal ships to adopt future fuels in the medium- to long-term 	KPK

Energy Transition Lever: Carbon Capture, Utilisation and Storage (CCUS)

Code	Initiatives	Champions
CC1	<p>Develop CCUS-specific policies and regulations</p> <ul style="list-style-type: none"> • Develop policy and regulatory framework to facilitate the implementation of CCUS projects • Establish governance structure of CCUS by clearly defining roles of each ministry and agency • Amend existing regulations (e.g. Exclusive Economic Zone Act 1984 [Act 311] and National Land Code) to incorporate key enablers for CCUS development 	Ministry of Economy
CC2	<p>Strengthen CCUS adoption through provision of incentives across all relevant sectors and facilitate hub development</p> <ul style="list-style-type: none"> • Establish carbon pricing instrument to drive the adoption of carbon capture technology for stationary emitters • Enhance incentives to reduce cost, enable access to funding and encourage adoption of CCUS technologies (e.g., public catalytic funds, tax credits, contract for difference) 	MOF; Ministry of Economy
CC3	<p>CC3 - Facilitate CCUS Hub infrastructure development</p> <ul style="list-style-type: none"> • Explore collaboration with potential investors and financiers to fund and catalyse investments in CCUs infrastructure for hub development 	Ministry of Economy
CC4	<p>Establish transboundary CO2 agreement</p> <ul style="list-style-type: none"> • Negotiate and introduce transboundary CO2 regulatory agreement encompassing the provisions on transboundary movement and storage of carbon, liability and cost sharing 	Ministry of Economy
CC5	<p>Promote local utilisation of CO2 in industry</p> <ul style="list-style-type: none"> • Set specific mandates within use case (e.g. cured concrete and urea) 	MITI

Appendix 2: NETR Flagship Catalyst Projects and Initiatives

Energy Transition Lever	Flagship	Modalities	Champion
Energy Efficiency (EE)	Efficient Switch	Energy Efficiency and Conservation Act (EECA) The Energy Efficiency and Conservation Bill to regulate energy-intensive users, buildings and products will be tabled in Parliament in the fourth quarter of 2023.	NRECC
		Energy Audit For Rail Sector Railway operators to perform energy audit exercise under the Energy Audit Conditional Grant (EACG 2.0) aimed at establishing the current energy consumption baseline, identifying potential energy savings in their premises and lowering utility costs.	MOT
Renewable Energy (RE)	Renewable Energy Zone (RE Zone)	Integrated RE Zone A large-scale, integrated sustainable development spanning the entire energy supply chain, from generation and energy storage to efficient demand management and consumption, will be created. A pilot RE Zone will be established encompassing an industrial park, zero-carbon city, residential development and data centre.	Khazanah Nasional Berhad
		Solar Park Centralised large-scale solar (LSS) parks co-developed by TNB, in partnership with SMEs, cooperatives, and state economic development corporations. These parks will consist of 100 MW deployment per site across 5 sites in several states.	TNB

Energy Transition Lever	Flagship	Modalities	Champion
Renewable Energy (RE) (cont.)	Renewable Energy Zone (RE Zone) (cont.)	<p>Hybrid Hydro-Floating Solar PV (HHFS) Development of 2500 MW HHFS potential at TNB hydro dam reservoirs will increase RE generation close to 24-hour availability. The hydro plant acts as energy storage by conserving the water in the reservoir during peak hours and discharging it during non-peak, while providing quick response to the duck curve. Reduce investment by utilising existing hydro infrastructure as compared to BESS + solar PV. Potential scaling up for future green hydrogen feedstock in collaboration with other hydrogen producers such as Gentari as the green electron offtaker.</p> <p>Residential Solar The construction of 4.5 MW solar capacity across 450 homes in City of Elmina and Bandar Bukit Raja. Up to 10 kW solar capacity per house through rooftop leasing with offtake within the township by high-demand users from the commercial or industrial sector.</p>	TNB Sime Darby Properties
	Energy Storage	<p>Energy Storage System (ESS) Development of utility-scale ESS to enable higher penetration of variable RE in Malaysia.</p>	NRECC; Energy Commission
	Energy Secure	<p>Sabah Energy Security Initiative An integrated initiative is underway to secure the long-term energy supply and support the socioeconomic development of the state. This includes: the development of large-scale solar (LSS) and small hydropower plants; the formulation of policy and regulatory framework on biowaste to ensure a consistent supply of feedstock; and the feasibility of geothermal for power generation.</p>	Energy Commission of Sabah

Energy Transition Lever	Flagship	Modalities	Champion
Hydrogen	Green Hydrogen	<p>Sarawak Hydrogen Hub Implementation of three integrated projects to produce green hydrogen will propel Sarawak as a regional green hydrogen hub. These projects involve the development of a green hydrogen production plant in Kuching by 2025 for domestic use, and two plants in Bintulu by 2027, mainly for export purposes. Sarawak State Government through SEDC Energy is collaborating with strategic partners to develop the state into a green hydrogen hub.</p>	SEDC Energy
	Hydrogen for Power	<p>Co-Firing of Hydrogen and Ammonia Green hydrogen and ammonia co-firing in collaboration with PETRONAS to decarbonise TNB generation plants.</p>	TNB
Bioenergy	Biomass Demand Creation	<p>Biomass Clustering Development of potential biomass clusters with a centralised plant using aggregated feedstock from multiple neighbouring mills. Biomass clustering is expected to improve economies of scale as well as securing larger and more reliable feedstock.</p>	KPK; NRECC; SEDA
		<p>Biomass Co-firing Co-firing initiative at the existing 2100MW Tanjung Bin Power Plant by burning biomass along with coal. Biomass sources include Empty Fruit Bunch (EFB) pellets, wood chips, wood pellets, bamboo pellets, coconut husk and rice husk. A pilot phase of co-firing will commence in 2024 with a view to scale up to a minimum of 15% biomass co-firing capacity by 2027.</p>	KPK; Malakoff

Energy Transition Lever	Flagship	Modalities	Champion
Green mobility	Future Mobility	E Charging Stations Installation of 10,000 EV charging stations by 2025 along highways and at selected commercial buildings in collaboration with strategic partners, among others, TNB, Plus Malaysia Berhad (PLUS), Permodalan Nasional Berhad (PNB), Gentari and Sunway Group.	MITI
		Mobile Hydrogen Refuelling Station Introduction of the first mobile hydrogen refuelling station for transportation in Peninsular Malaysia, in collaboration with NanoMalaysia Berhad, PETRONAS, United Motor Works (UMW) and the MGTC.	MOSTI
		Public Transport Electrification This project involves electrification of first and last mile public transport and upgrading infrastructure and electrical lines at bus depots for charging, with maintenance, repair and overhaul (MRO) opportunities for local SMEs.	MOT; Prasarana
		Solar Photovoltaic (PV) Installation for Rail Operations The Rail Sector Energy Management and Renewable Energy (EMRE) Action Plan entails the installation of Solar Photovoltaic (PV) systems for non-traction electricity usage in rail operations such as stations and depots.	MOT
	Future Fuel	Biofuels Hub A bio-refinery will be developed in Pengerang, Johor, to serve as a catalyst for creating hubs to produce a range of bio-based products, including sustainable aviation fuel (SAF), hydrotreated vegetable oil (HVO), advanced sustainable fuel (ASF) and biochemicals.	PETRONAS
Carbon Capture, Utilisation and Storage (CCUS)	Carbon Capture and Storage (CCS) for Industry	Regulatory Framework Development of policy and regulatory framework to facilitate the implementation of CCUS projects, including transboundary carbon movement.	Ministry of Economy
		Kasawari and Lang Lebah CCS Implementation of carbon capture and storage (CCS) catalyst projects for Kasawari and Lang Lebah high-CO2 gas fields, which are expected to be in operation by 2026 and 2028 respectively. CCS technology will be used to capture CO2 from the gas production field and store it in the depleted fields.	PETRONAS

Appendix 3: Cross-cutting enablers and initiatives

Enabler 1: Financing and Investment

Code	Initiatives	Champions
EN1	<p>Launch a National Energy Transition Facility (NETF)</p> <ul style="list-style-type: none"> • Launch initial seed fund amounting to RM2 billion • Explore the catalytic blended finance platform, aimed at expediting the mobilisation and deployment of capital to enhance the accessibility of funds, streamline investment processes, and ensure a seamless flow of financial resources towards energy transition projects 	Ministry of Economy
EN2	<p>Mobilise and attract private capital for energy transition sectors</p> <ul style="list-style-type: none"> • Attract private capital from the green foreign direct investments (FDI), international and domestic capital markets, venture capital (VC), and private equity (PE) • Accelerate adoption of innovative sustainable finance instruments, e.g. sustainability-linked/green/SDG financing, bonds and sukuk, blended finance structures • Develop capacity building programme to upskill FIs and fund managers in collaborations with Joint Committee on Climate Change (JC3) and financial industry training institutes • Scale-up sustainable finance literacy, awareness programmes and technical capacity building targeting SMEs by JC3 including through pilot programmes such as Greening the Value Chain • Expedite VC investments in high-risk, early-stage energy ventures in suitable areas 	MITI; BNM; SC
EN3	<p>Roll out carbon pricing mechanism</p> <ul style="list-style-type: none"> • Implement a phased and meticulously calibrated carbon pricing mechanism that sends clear market signals on decarbonisation while simultaneously creating an additional capital pool for investments in energy transition • Roll out communication strategy to seek buy-in from the businesses and rakyat 	MOF; NRECC

Enabler 2: Policy and Regulations

Code	Initiatives	Champions
EN4	Rationalise energy subsidies <ul style="list-style-type: none"> Develop a targeted subsidy mechanism based on needs Ensure transparency and effective communication on subsidy removal Leverage Pangkalan Data Utama (PADU) to facilitate targeted subsidies 	MOF; Ministry of Economy; KPDN; NRECC
EN5	Launch the Natural Gas Roadmap (NGR) <ul style="list-style-type: none"> Optimise country value-add of indigenous natural gas resources Enhance competitiveness of upstream oil and gas to meet domestic demand and energy transition needs (sustainability and security) Plan and execute timely, and cost-effective build-out of gas infrastructure 	Ministry of Economy

Enabler 3: Human Capital and Just Transition

Code	Initiatives	Champions
EN6	Establish green skills taxonomy and ensure strategic workforce planning <ul style="list-style-type: none"> Develop green skills taxonomy that defines the essential skills needed for a just transition towards a sustainable workforce Facilitate a strategic alignment between workforce demand and supply based on the green skills taxonomy and competency standards of present and future industry requirements Establish a task force to develop strategic plans for the future of the energy sector's workforce 	Sector-specific agencies
EN7	Develop and roll out targeted green skilling programmes <ul style="list-style-type: none"> Implement reskill and upskill programmes for affected workforce Establish strategic partnerships with local universities and industry partners to enhance green skills Enhance TVET and tertiary programmes for new green sectors 	Sector-specific agencies
EN8	Develop and implement community support programmes <ul style="list-style-type: none"> Develop a clear mitigation and communication plan for affected community and region Implement targeted community support programmes 	Sector-specific agencies
EN9	Enhance energy literacy and energy efficiency awareness among students, SMEs and consumers <ul style="list-style-type: none"> Strengthen the Malaysia Energy Literacy Program (MELP) to catalyse a significant change in public perception and behaviour towards energy utilisation Encourage SMEs to incorporate EE practices in their business Implement energy literacy and awareness programmes at educational Institutions 	Sector-specific agencies; TNB

Enabler 4: Technology and Infrastructure

Code	Initiatives	Champions
EN10	Accelerate development of domestic industries for green manufacturing and adoption of green technologies <ul style="list-style-type: none">• Develop programmes tailored to support SMEs involvement in the green value chain in the form of technical expertise and financial support	MITI
EN11	Develop a National Energy Knowledge Hub for public access <ul style="list-style-type: none">• Establish a one-stop centre for energy transition data, information and programmes under the purview of MTN	Ministry of Economy

Enabler 5: Governance and Implementation

Code	Initiatives	Champions
EN12	Establish National Committee on Energy Transition under the National Energy Council <ul style="list-style-type: none">• Introduce the National Committee on Energy Transition (NCET) spearheaded by the Minister of Economy to monitor the implementation of NETR projects	Ministry of Economy

Abbreviation

<i>Term</i>	Definition
<i>BEV</i>	Battery Electric Vehicles
<i>CCS</i>	Carbon Capture and Storage
<i>CCUS</i>	Carbon Capture, Utilisation and Storage
<i>DTN</i>	National Energy Policy 2022-2040
<i>EE</i>	Energy Efficiency
<i>EECA</i>	Energy Efficiency and Conservation Act
<i>ESS</i>	Energy Storage System
<i>FIT</i>	Feed-in-Tariff
<i>GLCs</i>	Government-linked Corporations
<i>HHFS</i>	Hybrid Hydro-Floating Solar PV
<i>ICE</i>	Internal Combustion Engine
<i>ILUC</i>	Indirect Land Use Change
<i>LCOH</i>	Levelized Cost of Hydrogen
<i>LSS</i>	Large-scale-solar
<i>Mtpa</i>	Million Tonnes Per Annum
<i>NETR</i>	National Energy Transition Roadmap
<i>NOVA</i>	Net Offset Virtual Aggregation
<i>POGO</i>	Palm Oil Gas Oil
<i>POME</i>	Palm Oil Mill Effluent
<i>RE</i>	Renewable Energy
<i>SAF</i>	Sustainable Aviation Fuel
<i>TPA</i>	Third-Party Access
<i>UCO</i>	Used Cooking Oil
<i>WtE</i>	Waste-to-energy

<i>Champion</i>	Definition
<i>BNM</i>	Bank Negara Malaysia
<i>ECoS</i>	Energy Commission of Sabah
<i>JKR</i>	Public Works Department
<i>KKR</i>	Ministry of Works
<i>KPK</i>	Ministry of Plantation and Commodities
<i>MEESTy</i>	Ministry of Energy and Environmental Sustainability, Sarawak
<i>MGTC</i>	Malaysian Green Technology and Climate Change Corporation
<i>MITI</i>	Ministry of Investment, Trade and Industry
<i>MOF</i>	Ministry of Finance
<i>MOSTI</i>	Ministry of Science, Technology and Innovation
<i>MOT</i>	Ministry of Transport
<i>NCET</i>	The National Committee on Energy Transition
<i>NRECC</i>	Ministry of Natural Resources, Environment and Climate Change
<i>PETRONAS</i>	Petroleum Nasional Berhad
<i>SC</i>	Securities Commission
<i>SEB</i>	Sarawak Energy Berhad
<i>SEDA</i>	Sustainable Energy Development Authority
<i>SEDC</i>	Sarawak Economic Development Corporation
<i>SESB</i>	Sabah Electricity Sdn Bhd
<i>ST</i>	Energy Commission
<i>TNB</i>	Tenaga Nasional Berhad



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