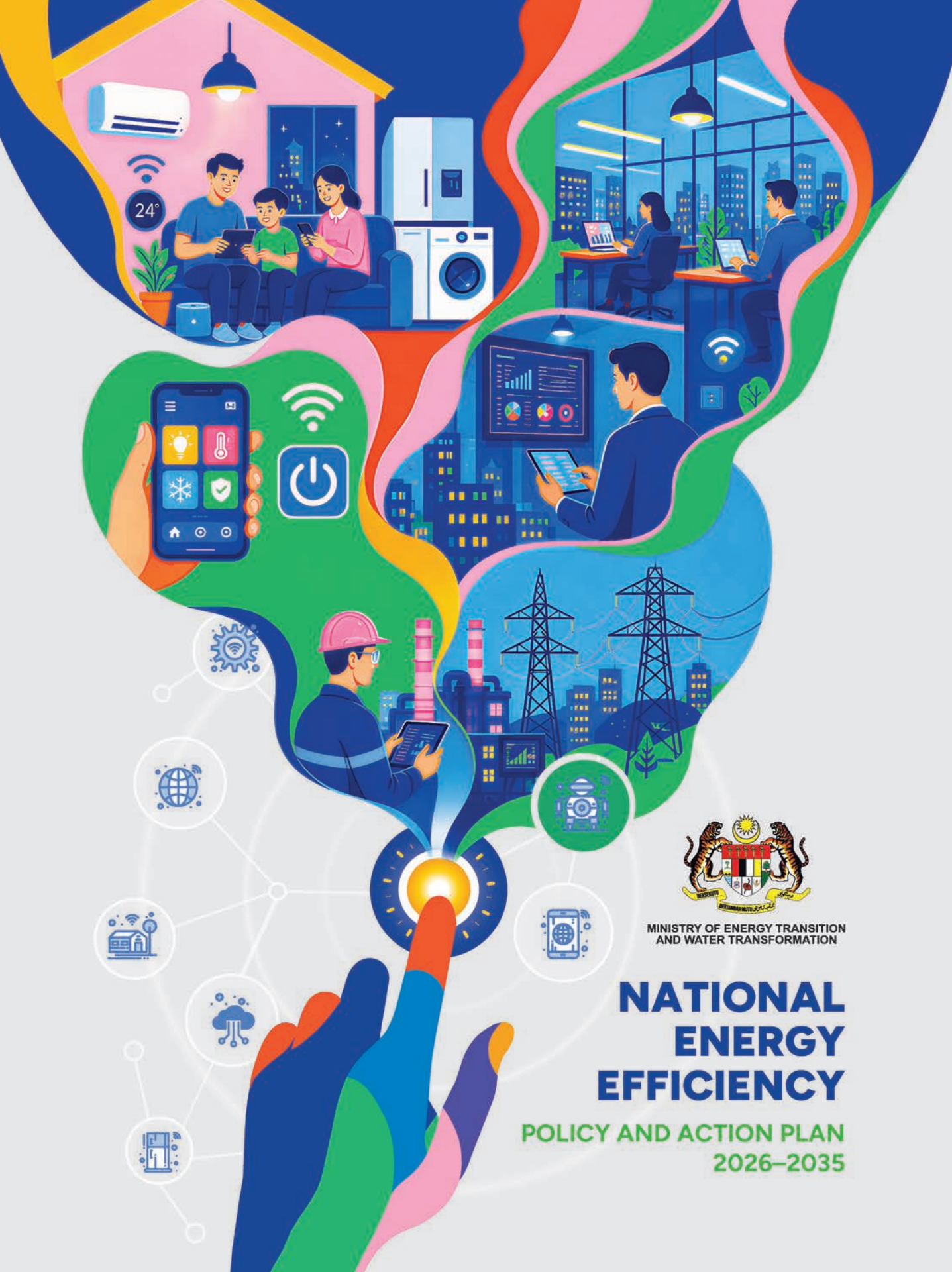

MINISTRY OF ENERGY TRANSITION
AND WATER TRANSFORMATION

NATIONAL ENERGY EFFICIENCY

POLICY AND ACTION PLAN 2026–2035

MINISTRY OF ENERGY TRANSITION
AND WATER TRANSFORMATION

National Energy Efficiency Policy and Action Plan 2026–2035 (NEEAP 2.0)

National Energy Efficiency Policy and Action Plan 2026–2035 (NEEAP 2.0)

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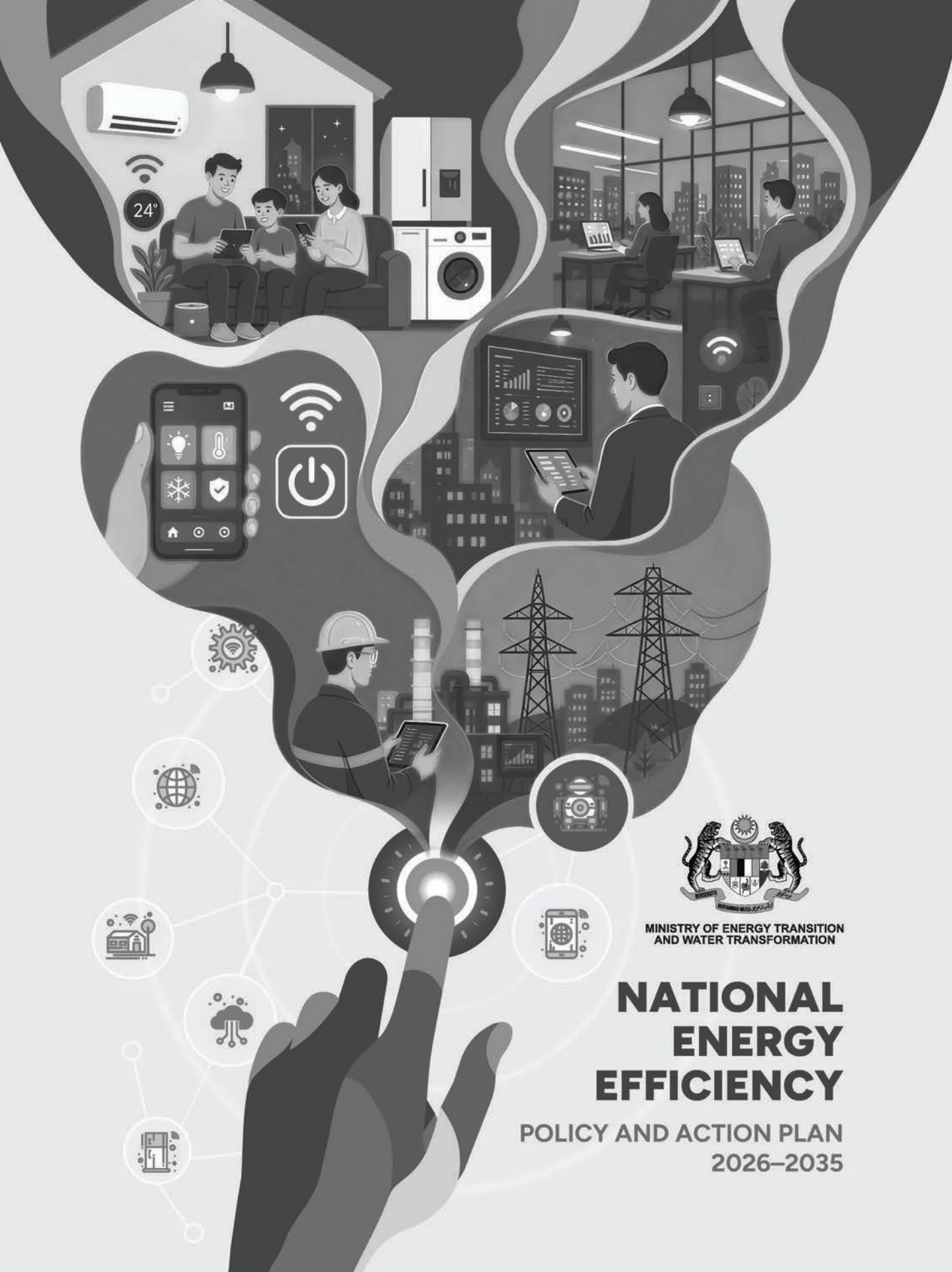

MINISTRY OF ENERGY TRANSITION
AND WATER TRANSFORMATION

NATIONAL ENERGY EFFICIENCY

POLICY AND ACTION PLAN 2026–2035

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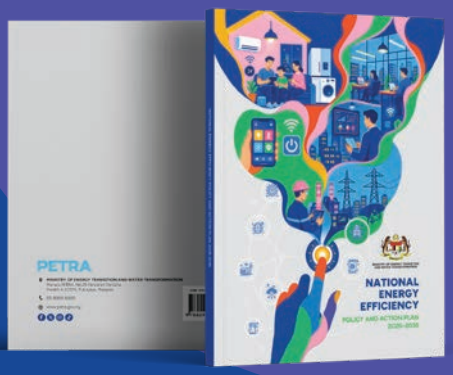

The cover depicts energy efficiency as an interconnected national ecosystem, uniting the domestic, commercial and industrial sectors in a single, flowing illustration. Smart technologies, energy-efficient appliances, digital monitoring, commercial workspaces, factories and grid infrastructure demonstrate how coordinated action supports responsible energy consumption across society.

At the centre, the illuminated touchpoint symbolises that energy efficiency starts with a touch of a button and activates meaningful change through research, strategic planning, implementation and behavioural change. Supporting icons and network lines communicate the integration of data, technology and operational efficiency, while the upward visual flow reflects Malaysia's progression towards a more efficient and resilient energy future.

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List of Abbreviations

AAIBE	Akaun Amanah Industri Bekalan Elektrik
ACMV	Air Conditioning and Mechanical Ventilation
AI	Artificial Intelligence
APAEC	ASEAN Plan of Action for Energy Cooperation
ASEAN	Association of Southeast Asian Nations
BAS	Building Automation System
BASAM	BAS Association of Malaysia
BAU	Business as Usual
BCR	Benefit-Cost Ratio
BEI	Building Energy Intensity
BSEEP	Building Sector Energy Efficiency Project
CEPA	Communication, Education and Public Awareness
CFL	Compact Fluorescent Lamp
CO_2	Carbon dioxide
COE	Certificate of Energy Efficiency
COP	Conference of the Parties
CRT	Cathode ray tube
CSPF	Cooling Seasonal Performance Factor
CxS	Commissioning Specialist
DCS	District Cooling System
DSM	Demand Side Management
EA	Energy Audit
EACG	Energy Audit Conditional Grant
EE	Energy Efficiency
EE&C	Energy Efficiency and Conservation
EECA	Energy Efficiency and Conservation Act
EEI	Energy Efficiency Indicator
EER	Energy Efficiency Ratio
EMEER	Efficient Management of Electrical Energy Regulations
EMIS	Energy Management Information System
ENCON	Energy Conservation Promotion
EnMS	Energy Management System
EPC	Energy Performance Contracting
EPU	Economic Planning Unit
ESG	Environmental, Social and Governance
ESM	Energy-Saving Measures
ETP	Economic Transformation Programme
F&B	Food and Beverage
GBI	Green Building Index
GEF	Global Environment Facility
GFA	Gross floor area
GHG	Greenhouse Gas
GITA	Green Investment Tax Allowance
GITE	Green Investment Tax Exemption
GJ	Gigajoule
GTFS	Green Technology Financing Scheme
GWh	Gigawatt-hour
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbons
HEM	High Efficiency Motors IE3
HFC	Hydrofluorocarbons
HFO	Hydrofluoroolefin
hp	Horsepower
HPMP	HCFC Phase-out Management Plan
HVAC	Heating, Ventilation and Air Conditioning
ICPT	Imbalance Cost Pass-Through

IEA	International Energy Agency
IEC	International Electrotechnical Commission
Ind4.0	Industry 4.0
IRR	Internal Rate of Return
JKR	Public Works Department
kWh	Kilowatt-hour
LCD	Liquid-crystal display
LCNA	Low Carbon Nation Aspiration
LED	Light-emitting diode
LPG	Liquefied petroleum gas
M&E	Mechanical and Electrical
M&V	Measurement and Verification
MAESCO	Malaysia Association of Energy Service Companies
MDL	Maximum Demand Limiting
MEPS	Minimum Energy Performance Standards
MIEEIP	Malaysian Industrial Energy Efficiency Improvement Project
MNKT	Majlis Negara bagi Kerajaan Tempatan
MSMEs	Micro, Small and Medium Enterprises
MTN	Majlis Tenaga Negara
MTPIN	Majlis Tindakan Perubahan Iklim Negara
MS 1525	Malaysian Standard 1525
NEEAP	National Energy Efficiency Action Plan 2016–2025
NEEAP 2.0	National Energy Efficiency Policy and Action Plan 2026–2035
NEEMP	National Energy Efficiency Master Plan
NEP	National Energy Policy
NETR	National Energy Transition Roadmap
NIMP 2030	New Industrial Master Plan 2030
NGO	Non-Governmental Organisation
NPV	Net Present Value
NUR@ PETRA	Nikmat Untuk Rakyat Programme
NZE 2050	Net Zero Emissions 2050
OTTV	Overall Thermal Transfer Value
PBT	Pihak Berkuasa Tempatan
PETRA	Ministry of Energy Transition and Water Transformation
PLC	Programmable Logic Controller
PUE	Power Usage Effectiveness
REA	Registered Energy Auditor
REM	Registered Energy Manager
ROI	Return on Investment
RT	Refrigeration Ton
RTI	Registered Training Institutions
RTTV	Roof Thermal Transfer Value
SAVE	Sustainability Achieved via Energy Efficiency
SEC	Specific Energy Consumption
SEDA Malaysia	Sustainable Energy Development Authority (SEDA) Malaysia
SI	System Integrator
ST	Suruhanjaya Tenaga (Energy Commission)
STC	Solar Thermal Cooling
TJ	Terajoule
TNB	Tenaga Nasional Berhad
TOR	Terms of Reference
UBBL	Uniform Building By-Laws
UNDP	United Nations Development Programme
UNFCCC	The United Nations Framework Convention on Climate Change

YAB Datuk Amar Haji Fadillah bin Haji Yusof

Foreword by Deputy Prime Minister and Minister of PETRA

As the nation advances economically, balancing our energy priorities becomes increasingly complex. Managing the energy trilemma—simultaneously achieving energy security, environmental sustainability and economic equity or affordability—is one of the defining challenges of our time. Energy efficiency stands out as the ultimate 'low-hanging fruit', offering an immediate, cost-effective avenue to harmonise these 3 competing dimensions by reducing carbon emissions while lowering operational overheads for businesses and households alike.

In achieving our low-carbon goals and energy priorities, the launch of the National Energy Efficiency Policy and Action Plan 2026–2035 (NEEAP 2.0) provides a timely, transformative blueprint for Malaysia's sustainable energy landscape for the next decade. Implemented alongside the landmark Energy Efficiency and Conservation Act (EECA) 2024, NEEAP 2.0 directly addresses critical historical gaps by providing a solid policy framework, resolving skill shortages and introducing sustainable funding mechanisms. Our mission is ambitious yet essential: to reduce national energy demand by 11.6% and achieve a cumulative energy saving of 815,382 TJ by 2035 against business-as-usual projections.

Built upon four distinct strategic thrusts, this plan focuses on our industrial, commercial and domestic sectors through rigorous energy management, building intensity standards and strict equipment performance benchmarks. By deploying innovative tools such as automation systems and Artificial Intelligence (AI), encouraging private sector Energy Performance Contracting (EPC) and upskilling our local workforce, the Ministry of Energy Transition and Water Transformation (PETRA) is leading a comprehensive, bottom-up transition. NEEAP 2.0 ensures that Malaysia not only adapts to the global clean energy transition, but thrives as a resilient, competitive green economy.

Preface by
Secretary General of PETRA

The Ministry of Energy Transition and Water Transformation (PETRA) is tasked with the profound responsibility of spearheading Malaysia's energy transition journey, translating the National Energy Transition Roadmap (NETR) into an actionable vision with measurable public value. The National Energy Efficiency Policy and Action Plan 2026–2035 (NEEAP 2.0) provides our public machinery with an operational blueprint to systematically address historical policy-action gaps and modernise Malaysia's energy landscape. From an institutional standpoint, executing a strategy of this scale demands a fundamental shift in how the government operates. Foremost among our priorities is breaking down the rigid bureaucratic silos that have historically fragmented national energy initiatives. By uniting all ministries, state governments and statutory agencies under the common goals established by NEEAP 2.0, we ascertain that economic, environmental and infrastructure policies can move in absolute lockstep.

Central to this administrative transformation is the 'Government Lead by Example' initiative. The public sector must serve as the vanguard of energy conservation before mandating compliance across the wider economy. Through the enforcement of the Energy Efficiency and Conservation Act (EECA) 2024, government facilities nationwide will spearhead the adoption of Building Energy Intensity (BEI) benchmarks, conduct comprehensive energy audits and integrate efficient facility management systems. By demonstrating the technical and financial viability of these measures within our own institutions, we build a trusted precedent for the private sector. Through strict regulatory execution, data-driven governance and cohesive cross-sectoral collaboration, the civil service is fully committed to optimising national resource utilisation and delivering a highly efficient, low-carbon public administration for all Malaysians.

YBhg. Dato' Sri Haji Mad Zaidi bin Mohd Karli

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Ministry of Economy

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Energy Commission (ST)

Sustainable Energy Development Authority (SEDA) Malaysia

Malaysia Investment Development Authority (MIDA)

Industry Associations & Players:

Federation of Malaysian Manufacturers (FMM)

The Electrical and Electronics Association of Malaysia (TEEAM)

Malaysia Association of Energy Service Companies (MAESCO)

Malaysian Iron and Steel Industry Federation (MISIF)

Cement & Concrete Association of Malaysia (C&CA)

Malaysian Rubber Products Manufacturers Association (MRPMA)

Malaysian Gas Association (MGA)

The Institution of Engineers, Malaysia (IEM)

Malaysian District Cooling Association (MDCA)

Malaysian Plastics Manufacturers Association (MPMA)

Malaysian Association of Registered

Electrical Energy Managers (MAREEM)

Malaysian Rubber Glove Manufacturers Association (MARGMA)

Malaysian Debt Ventures Berhad (MDV)

Tenaga Nasional Berhad (TNB)

Malaysia Green Technology & Climate Change Corporation (MGTC)

Credit Guarantee Corporation (CGC) Malaysia Berhad

ASHRAE Malaysia Chapter (MASHRAE)

Association of Consulting Engineers Malaysia (ACEM)

Association of Private Hospitals Malaysia (APHM)

Malaysia Budget & Business Hotel Association (MyBHA)

Malaysian Green Building Council (MGBC)

Malaysia Shopping Malls Association (MSMA)

Malaysian Association of Hotel Owners (MAHO)

National Association of Private Educational Institutions (NAPEI)

Pertubuhan Akitek Malaysia (PAM)

Malaysian Association of Hotels (MAH)

Malaysia Digital Economy Corporation Sdn. Bhd.

Federation of Malaysian Consumers Associations (FOMCA)

Malaysian Electrical Appliances Distributors Association (MEADA)

Real Estate and Housing Developers Association (REHDA)

Malaysian Air-Conditioning & Refrigeration Association (MACRA)

National House Buyers Association (HBA)

Malaysian Association of Local Authorities (MALA)

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Executive Summary

Energy efficiency is often deemed the 'first fuel' and a 'low-hanging fruit' in providing some of the quickest and most cost-effective carbon dioxide (CO_2) mitigation options for the clean energy transition, which also contribute towards strengthening energy security and reducing energy demand and energy intensity.

In 2023, nearly 200 governments, including Malaysia, agreed at the 28th Conference of the Parties (COP28) in Dubai to work together to collectively double the global average annual rate of energy efficiency improvements by 2030. However, global energy efficiency progress – measured by the rate of change in primary energy intensity – has fallen to 1.3% per year on average since 2019. On a regional level, under the ASEAN Plan of Action for Energy Cooperation (APAEC) Phase II (2021–2025), the goal is to reduce regional energy intensity by 30% by 2025, based on 2005 levels, and a target of 40% reduction by 2030 (APAEC 2026–2030) in key sectors such as transport, industry and buildings. On both accounts, Malaysia is still lacking efforts in achieving the goals and without serious intervention and actions, Malaysia will continue to be off track and left behind.

According to the International Energy Agency (IEA) through its Energy Efficiency Report 2025, energy efficiency has been one of the key factors in lowering greenhouse gas (GHG) emissions, improving industry competitiveness and will continue to do so in the future. However, the growth of electricity demand, especially from the industrial sector, and slow progress in improving energy efficiency standards have been identified as key barriers hindering the progress of energy efficiency. In addition, skill and labour shortages, lack of sustainable funding mechanisms and policy-action gaps need to be addressed.

Malaysia's industrial, commercial and domestic sectors are highly dependent on electrical energy consumption to boost economic development. The industrial sector accounts for about 46% of overall demand, followed by the commercial and domestic sectors, which account for about 32% and 21%, respectively, with the transport and agriculture sectors holding a combined 1% share. Therefore, the need to take remediation actions is more pertinent than ever.

Prior to this document, a National Energy Efficiency Action Plan was established in 2016 that details a long-term strategy and goals specifically for energy efficiency. Consequently, a study was carried out on a national policy framework for energy efficiency and conservation (EE&C) to inform the development of the NEEAP 2026–2035 to provide a more comprehensive policy coverage for energy efficiency.

Findings from the study acknowledged that Malaysia is already on the right track by implementing several EE&C measures and programmes. However, at the time the report was written, the EECA 2024 was not yet in place. Therefore, the absence of a strong regulatory framework limited the overall impact and effectiveness of these efforts. Apart from that, the lack of a dedicated funding mechanism and financing schemes, insufficient R&D investment in energy-efficient technologies, limited capacity building and public awareness and data collection and analytics were some of the key gaps identified in Malaysia's EE&C landscape.

The enactment of the EECA 2024 and its enforcement on 1st January 2025 present a pivotal opportunity for Malaysia to accelerate energy efficiency (EE) efforts, ensuring that the country transitions to a more sustainable, resilient and energy-efficient future. Thus, the development of a National Policy on Energy Efficiency is essential in ensuring the sustainability and long-term success of energy efficiency initiatives and businesses in Malaysia.

This policy is designed to complement strategies and initiatives outlined in the NEEAP 2026–2035 and also developed in line with key roadmaps in Malaysia such as National Energy Policy 2022–2040, NETR, New Industrial Master Plan 2030 (NIMP 2030) and the Twelfth and Thirteenth Malaysia Plans (RMKe-12 & RMKe-13). It was also developed with input from multiple stakeholders, ministries, government agencies, industry associations, key industry players, experts and other related stakeholders.

The policy serves several key functions:

Regulatory Foundation:
Establish clear and enforceable regulations that mandate energy efficiency improvements across all sectors.

Funding Mechanisms and Incentives:
Explore the establishment of funding mechanisms that will provide financial support for both private-sector and public-sector initiatives. These could include energy efficiency funds, subsidies, grants, low-interest loans, blended financing, as well as the development of EPC to stimulate private investments. The policy will allow for the establishment of incentive structures to encourage industries and individuals to adopt energy-efficient practices. This could involve tax incentives, recognition programmes, or government-backed financial incentives for energy-efficient upgrades.

Integration across Sectors:
Ensure that energy efficiency practices are integrated across sectors, including alignment with national frameworks or roadmaps like the NETR.

Alignment with ESG Principles:
In line with Environmental, Social and Governance (ESG) principles, implementation of the policy targets reduction in GHG emissions and decarbonisation, promotes public awareness, capacity building and upskilling that create high-value jobs and establishes transparent corporate accountability and strong institutional oversight in energy management.

As the policy is centred on the strategies and initiatives outlined in NEEAP 2026–2035, it follows the policy house in Figure 2.1. The policy house represents a comprehensive framework for the implementation of NEEAP 2.0, designed to drive EE&C across the industrial, commercial and domestic sectors for the next decade. Guided by 4 strategic thrusts, the plan aims to achieve high energy reduction targets, sustainable energy use, economic growth, environmental sustainability and energy security.

Strategic Thrusts:

01

Implementation of Energy Efficiency Plan:
Develop and execute sector-specific energy efficiency targets and measures to reduce energy consumption, lower GHG emissions and improve energy performance.

02

Reskilling and Upskilling Workforce:
Build a skilled workforce capable of implementing and maintaining energy-efficient systems through targeted training programmes.

03

Sustainable Funding Mechanisms:
Secure reliable funding for energy efficiency projects to ensure their long-term sustainability and scalability.

04

Facilitate Private Sector EE Initiatives and Investments:
Encourage private sector participation through supportive policies, regulations and incentives to accelerate the deployment of energy-efficient solutions.

Key Initiatives by Sector:

Industrial Sector:
Establish specific energy consumption benchmarks through implementing 5 categories of energy-saving measures (ESMs), including energy management systems, efficient facilities, production processes, electrical energy efficiency equipment and thermal energy efficiency equipment;

Commercial and Domestic Sectors:
Ensure compliance with BEI labelling requirements, conduct energy audits and improve air conditioning and mechanical ventilation (ACMV) efficiency.

Equipment Efficiency:
Strengthen the regulatory requirement of Minimum Energy Performance Standards (MEPS) for appliances and energy-using products.

By adopting a bottom-up approach and engaging all stakeholders, including the public, NEEAP 2.0 aims to achieve significant and holistic energy reduction, contributing to national energy efficiency goals and aligning with broader environmental and economic objectives.

Chapter 1

Overview

Before reviewing energy efficiency policies and initiatives in Malaysia, a study was conducted to review and compare the energy efficiency policies and programmes of 4 selected countries, namely Denmark, Japan, Singapore and Thailand, recognised for their achievements in energy efficiency and their role in addressing climate change. The aim is to adopt best practices from these nations to help Malaysia accelerate its own energy efficiency efforts in light of the need to transform Malaysia's economy and livelihoods for a stronger and more resilient future.

Key Findings:

Stringent Regulatory Frameworks:

All 4 countries have implemented strong policies, supported by regulatory instruments that enforce energy efficiency measures. These frameworks are backed by substantial funding, ensuring the success of various energy efficiency programmes. As a result, these countries have consistently met and surpassed their energy efficiency targets, allowing for more ambitious mid-term goals.

Significant Progress and Ambition:

These countries, particularly Denmark and Japan, are pioneers in energy efficiency, with Denmark serving as a global model for building efficiency, and Japan excelling in appliance standards through its Top Runner Programme. Thailand is noted for its Energy Conservation Promotion (ENCON) Fund, which finances energy efficiency projects, while Singapore has made significant strides in transforming the building sector despite starting later than the others. These early movers also prioritise public awareness and education to drive demand for energy-efficient products and services.

Global Commitment to Climate Action:

Both Denmark and Japan have demonstrated a strong sense of responsibility for global climate change, with commitments to support developing countries in their energy transitions. This global perspective aligns with their domestic policies, where energy efficiency is viewed not only as essential for national progress but also as a tool for global climate action.

In conclusion, the following key elements were identified as playing a crucial role in the success of energy efficiency implementations:

Robust Policies and Regulatory Instruments: Strong policies like those seen in Thailand, Indonesia, Vietnam and Singapore, which mandate energy efficiency actions.

Well-funded Programmes: These nations have ensured significant funding for energy efficiency through state-backed funds or mandates.

Public Awareness and Education: Effective communication strategies to raise consumer awareness and demand for energy efficiency that becomes a culture.

The global shift towards renewable energy has overshadowed energy efficiency efforts in some regions, but energy efficiency remains crucial for achieving the United Nations Framework Convention on Climate Change (UNFCCC)'s 1.5°C temperature goal by 2030 and Net Zero by 2050. Policy support for energy efficiency often emerges in response to crises, such as the fuel crises of the 1970s, the Fukushima disaster in 2011 and the ongoing Russia-Ukraine war. These crises have demonstrated how quickly policies can adapt to prioritise energy conservation alongside the adoption of alternative energy sources. Amidst the current global energy crisis in the Middle East, the need to accelerate the adoption of energy efficiency measures is becoming more urgent than ever.

Overview of Energy Policies in Singapore, Thailand, Japan and Denmark

Two (2) regional neighbours, Thailand and Singapore, have successfully spearheaded energy efficiency in multiple economic sectors in their respective countries. There is a need to examine their policies to gain a better perspective on Malaysia's policy ambitions as well as to understand the ASEAN context for harmonising energy efficiency targets across the region.

At the same time, it is useful to compare with policy developments in the advanced economies which have been implementing energy efficiency since the 1970s. Japan is a leader in energy efficiency of appliances and buildings, while Denmark excels in building energy efficiency. These countries have demonstrated that in some cases, not only have targets been achieved early but that revising targets for higher ambition is attainable.

The policy comparison entails a stocktake of Malaysia's existing energy efficiency policies—its overarching goals, as well as regulatory and supporting mechanisms. The comparison of Malaysia's policy elements with those found in the selected countries' frameworks will serve as the basis for recommendations to accelerate Malaysia's energy efficiency aspirations.

There are complex drivers in each of the countries which contributed to their efficiency achievements, and these will be obvious in the section on Energy Efficiency Programme Implementation. An overview of the energy efficiency policies of these countries and Malaysia's National Energy Policy 2022–2040 is listed in Table 1.1.

Table 1.1: Overview and Comparison of Energy Policies in Malaysia, Singapore, Thailand, Japan and Denmark

	Strategic Plan	Principal Legal Framework	Subsidiary Regulations – Industrial & Commercial
Malaysia 	+ National Energy Policy 2022–2040 + NEEAP 1.0 (2016–2025) + National Energy Transition Roadmap 2023	+ Electricity Supply Act 1990 + Gas Supply Act 1993 + Renewable Energy Act 2011 + Energy Efficiency and Conservation Act 2024	+ Electricity Regulations 1994 + Gas Supply Regulations 1997 + Energy Efficiency and Conservation Regulations 2024
Singapore 	+ Singapore Green Plan 2030	+ Energy Conservation 2012 + Carbon Pricing Act 2018	+ Energy Management Practices Regulation 2013 + Registrable Corporations Order 2013
Thailand 	+ Long-Term Low Greenhouse Gas Emission Development Strategy (Nov 2022) + Energy Efficiency Plan (EEP 2018) + Bio-Circular Green Economic Model 2021–2026	+ Energy Conservation Promotion Act 1992	+ Persons Responsible for Energy 2009 + Energy Management in Designated Buildings and Factories 2009 + Energy Management Auditors 2012
Japan 	+ 6th Strategic Energy Plan 2021 for 2030 and 2050	+ Energy Efficiency Act 1979 + Energy Policy Act 2002	+ Rational Use of Energy Act 1997
Denmark 	+ Danish 2050 Energy Strategy + Denmark's Integrated National Energy and Climate Plan 2019 + Annual Climate Action Plans	+ Energy Efficiency Obligation Scheme + Climate Act 2014	+ Voluntary Agreement Scheme on Energy Efficiency

NEEAP 2016–2025 has concluded successfully despite the challenges it faced. Therefore, this benchmark study of policies and programmes from other countries that have successfully implemented their energy efficiency strategies and programmes is essential in leapfrogging Malaysia's achievements in the next phase of NEEAP. With these in mind, Malaysia planned its NEEAP 2026–2035 to reflect these externalities. It is critical that Malaysia rapidly develops and implements an ambitious and coordinated energy efficiency policy and action plan, with supporting mechanisms, to put it on equal footing with other economies in ASEAN as well as to attain the energy efficiency achievements of other advanced economies.

Malaysia's progress in energy efficiency has historically trailed behind several ASEAN peers. However, recent developments signal a positive shift in direction. The enactment of the EECA 2024 represents a key milestone in strengthening the national regulatory framework and aligning Malaysia more closely with international best practices. Despite this advancement, structural challenges persist, including continued reliance on energy subsidies that may weaken price signals for efficiency improvements, gaps in financing mechanisms and varying levels of socio-economic readiness across sectors. These factors have moderated the pace of adoption, although ongoing policy enhancements and institutional efforts are expected to drive greater momentum towards a more energy-efficient economy.

Energy Policy Landscape
in Malaysia

National Energy Policy (NEP) 2022–2040

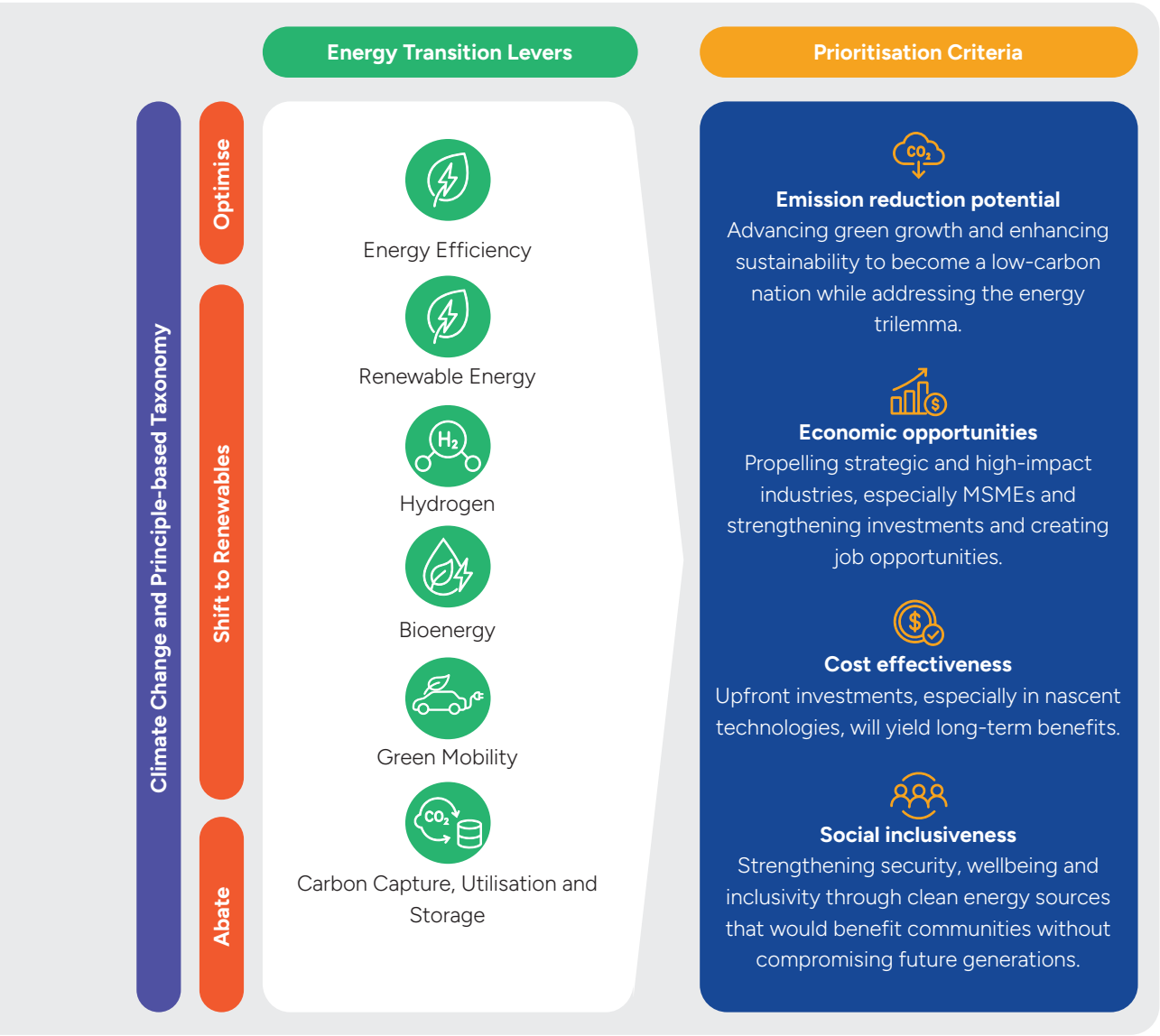
The NEP 2022–2040 was published in September 2022. In achieving the NEP vision of Low Carbon Nation Aspiration (LCNA) 2040, 4 strategic thrusts and 5 enablers have been identified to ensure effective implementation of the NEP. These strategic thrusts and enablers, as shown in Figure 1.1, are derived from a situational analysis of Malaysia's current position, its socio-economic aspirations and global energy transition megatrends. These strategic thrusts are supported by 12 strategies and 31 action plans. LCNA 2040 is outlined with nominal targets provided for 9 areas comprising 4 in the transport sector, 2 for energy efficiency and 3 in energy supply.

Figure 1.1: Policy House of NEP 2022–2040

National Energy Transition Roadmap (NETR)

The NETR was released in August 2023 and is a macro proposal for Malaysia's energy transition. It has identified 6 energy transition levers (Figure 1.2). These levers are supported by 5 enablers: financing and investment; policy and regulation; human capital and just transition; technology and infrastructure; and governance and implementation.

Figure 1.2: Energy Transition Levers – Malaysia's National Energy Transition Roadmap 2023



Energy Policy Governance

To oversee national efforts on climate action, Malaysia has created ***Majlis Tindakan Perubahan Iklim Negara*** **(MTPIN)** or National Climate Change Action Council, chaired by the Prime Minister and consisting of Federal Ministers, Chief Ministers and the Chief Secretary to the Government, along with experts on climate change. The council is the highest platform attended by Federal and State Governments responsible for determining policy direction and matters related to climate change.

Majlis Tenaga Negara **(MTN)** or National Energy Council, which is also chaired by the Prime Minister, acts as the highest council in determining the nation's energy sector's planning and trajectory, and also monitors initiatives under Malaysia's energy transition plans to achieve net zero carbon by 2050. Members in this council include Cabinet Ministers and representatives from ministries related to the energy sector such as the Ministry of Energy Transition and Water Transformation and the Ministry of Economy.

Majlis Negara bagi Kerajaan Tempatan **(MNKT)** acts as a platform in formulating and harmonising national policies to promote, advance and manage the administration of local governments throughout Malaysia.

Energy Efficiency Policies in Malaysia

Historically hampered by fossil fuel interests and political short-termism, the global transition towards energy efficiency has gained significant momentum as the visible impacts of climate change drive more ambitious national pledges. Early movers such as Denmark, Japan and Thailand serve as global benchmarks, demonstrating that long-term success relies on a combination of strategic funding, progressively strict standards and robust public awareness programmes. By establishing these strong policy foundations early, these nations, along with rapid adopters like Singapore, are now positioned to set even more aggressive targets while championing a sustainable green economy through international aid and a commitment to collective climate responsibility.

Figure 1.3 shows that Malaysia is not short of efforts in promoting and implementing energy efficiency programmes and initiatives. Since the turn of the century, when the 7th Malaysia Plan (1996–2000) initiated EE promotions, it set the stage for more actions in subsequent plans. Many programmes and initiatives have since been implemented primarily by the public sector, with some from the private sector, that have indeed marked a significant shift in Malaysia's approach to energy efficiency, with a focus on improving energy use in industrial, commercial and domestic sectors.

Figure 1.3: Summary of Energy Efficiency Initiatives by Public and Private Sectors in Malaysia

1996–2000

EE Promotions Integrated into the 7th Malaysia Plan.

2001

MS 1525: Development of the MS 1525 Code of Practice on EE.

2006

- Industrial Guidelines: Development of EE guidelines (electrical & thermal) for Malaysian Industries.
- Green Building Index (GBI): Launch/ Development of the GBI.

2009–2011

- SAVE 1.0 Programme: Sustainability Achieved via Energy Efficiency (SAVE) 1.0 programme implemented by SEDA Malaysia.
- Government Lead by Example Programme implemented by ST.

2014

Consumption Monitoring: Monitoring of government building electricity consumption.

1999–2007

Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP).

- Initially focused on 8 energy-intensive industries: wood, rubber, food, ceramics, glass, pulp & paper, iron & steel and cement.
- 3 additional sub-sectors were added during implementation: plastics, textiles and oleochemicals.

2002

- Government Energy Audits: Energy audits conducted on government buildings.
- Capacity Building: Capacity building initiatives in ST & related key institutions on EE & Demand Side Management (DSM).

2008

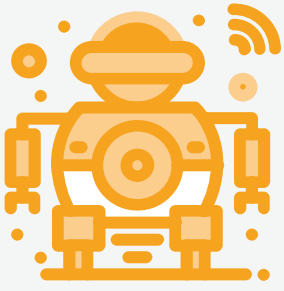
Regulations: Efficient Management of Electrical Energy Regulations 2008.

2013

- MEPS: Introduction of Minimum Energy Performance Standards (MEPS).
- LED Efficiency: Retrofit and re-lamping of LED lighting in selected ministries.

2016

- NEEAP 1.0: National Energy Efficiency Action Plan (NEEAP) 1.0, 2016–2025.
- 11th Malaysia Plan: Implementation of EE projects under the 11th Malaysia Plan (2016–2025).



2016–2017

BSEEP: Building Sector Energy Efficiency Project (BSEEP), funded by GEF and United Nations Development Programme (UNDP), implemented by Public Works Department (JKR).

2017

+ EPC Fund: Energy Performance Contracting (EPC) Fund.
+ DSM Study: DSM Preliminary Study by EPU, funded by UNDP.

2018

Legislative Drafting: Drafting of the Energy Efficiency and Conservation Act (EECA).

2019

Public Sector EPC: Energy Performance Contracting (EPC) in Government Buildings.

2021

+ SAVE 2.0 Programme implemented by SEDA Malaysia.
+ EACG 2.0: Energy Audit Conditional Grant (EACG) 2.0.

2022

SAVE 3.0 Programme implemented by SEDA Malaysia.

2023

+ NETR 2023: Launch of the National Energy Transition Roadmap (NETR) 2023.
+ NEEAP 2.0 Study: Commenced in May 2023.
+ EECA 2024: Listed alongside 2023 roadmap milestones.

2023–2024

+ SAVE 4.0 Programme implemented by SEDA Malaysia.
+ Enactment of EECA 2024.

2025

+ Enforcement of EECA 2024
+ *Nikmat Untuk Rakyat* (NUR@PETRA) Programme was introduced and implemented by SEDA Malaysia.

In parallel with the development of regulatory and policy initiatives, Malaysia also explored DSM as a strategic approach to optimise energy consumption. DSM refers to programmes and measures that encourage consumers to improve energy efficiency, shift or reduce energy demand during peak periods and promote more efficient utilisation of the energy system.

National Energy Efficiency Action Plan (NEEAP), 2016–2025

On 6 January 2016, the Cabinet approved NEEAP 2016–2025 for the implementation of energy efficiency initiatives and programmes for electricity in the industrial, commercial and domestic sectors over a 10-year period. The objectives of NEEAP 2016–2025 are as follows:

- **Reduction of Operating Costs**: By using energy more efficiently, industrial, commercial and domestic sectors are able to reduce energy bills, thereby freeing up capital for investment, innovation or other expenditures;
- **Enhanced Competitiveness:** Energy-efficient companies benefit from lower production costs, making their products and services more competitive in both domestic and international markets;
- **Long-Term Economic Stability**: Energy efficiency reduces Malaysia's dependence on the consumption and importation of fossil fuels. This helps enhance national energy security and reduces economic exposure to global energy price volatility;
- **Development of New Industrial Technologies:** Energy efficiency efforts promote innovation in green technologies, create new job opportunities such as energy auditors and energy efficiency solution providers and expand the energy services industry; and
- **Achievement of Sustainability Goals:** Energy efficiency is a key measure in reducing Malaysia's carbon emissions, in line with global climate commitments and Malaysia's net-zero carbon target by 2050.

Various programmes and initiatives have been implemented under NEEAP 1.0 across relevant sectors. Figure 1.4 provides a summary of these programmes and initiatives.

Figure 1.4: Energy Efficiency Programmes and Initiatives

Energy Audit Conditional Grant (EACG) Programme

EACG 2.0
Energy Audit Conditional Grant

Rebate programmes for purchasing energy-efficient electrical appliances, namely the Sustainability Achieved via Energy Efficiency (SAVE) Programme 1.0 to 4.0 and the *Nikmat Untuk Rakyat* Programme (NUR@PETRA) Year 2025

nur
Nikmat Untuk Rakyat

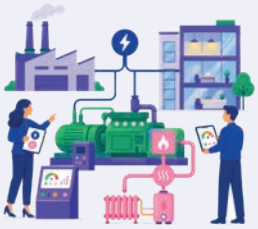
Energy Audit and Retrofit Programme for Government Buildings

Promotion of Energy Efficient Electrical Appliances

Enforcement of Minimum Energy Performance Standards (MEPS)

Energy-efficient building labelling (BEI Labelling)

Promotion of co-generation in industrial and commercial buildings



Encouragement of energy efficiency practices through promotional activities, engagement sessions and capacity building

Sectors:

Domestic Commercial Industrial Public

In driving the implementation of these initiatives, fiscal incentives and financial assistance such as Green Investment Tax Allowance (GITA), Green Investment Tax Exemption (GITE) and Green Technology Financing Scheme (GTFS) were offered to assist with the implementation of energy efficiency programmes.

> **As a result, NEEAP has successfully saved 60,886 gigawatt-hours (GWh) of electricity over a 10-year period, exceeding the initial target of 52,233 GWh. This amount is equivalent to the reduction of 35.6 million tons of carbon dioxide ($mtCO_2eq$), with an estimated savings of RM16.1 billion.**

In many countries, energy efficiency frameworks encompass both electrical and thermal energy use, recognising the significant role of thermal energy in overall energy consumption across industrial, commercial and domestic sectors. However, the implementation of the NEEAP 2016–2025 primarily targets energy efficiency in electricity consumption, without extending to thermal energy use. This is because the plan is anchored by the Electricity Supply Act 1990 and the Efficient Management of Electrical Energy Regulations (EMEER) 2008, which focus specifically on the management and efficient use of electrical energy, thereby limiting its scope to electricity-related efficiency measures.

Energy Efficiency Regulatory Framework

The EECA 2024 [Act 861] came into force on 1 January 2025. EECA 2024 establishes a comprehensive legal framework for energy efficiency to regulate, enforce, coordinate and implement holistic energy efficiency initiatives across both electrical and thermal energy consumption.

The Act directly strengthens the role of ST as the implementing agency by providing statutory authority to impose mandatory requirements on energy consumers, commercial buildings and energy-using products. It enables ST to obtain energy-related data, conduct monitoring activities and enforce compliance with energy efficiency measures in a more systematic manner.

To support the implementation of EECA 2024, ST has developed the enhanced version of the Energy Management Information System (EMIS), an online platform for regulated energy consumers to submit their compliance progress in the form of energy efficiency and conservation reports, a core element of the energy management system and energy audit reports. EMIS facilitates energy data reporting, compliance monitoring and performance assessment to support effective implementation of the Act.

The enforcement of EECA 2024 is not only intended to ensure mandatory compliance, but also serves as an enabler for the implementation of a new energy efficiency action plan with more ambitious and comprehensive targets. This is to be achieved through structured energy efficiency initiatives, supported by appropriate incentive mechanisms and financial assistance.

Energy Efficiency and Conservation Act (EECA) 2024

The primary objective of EECA 2024 is to strengthen national efforts in reducing energy consumption and carbon emissions, in line with Malaysia's commitment to reduce GHG emissions and achieve carbon neutrality by 2050. The enforcement of EECA 2024 introduces a structured and mandatory compliance framework covering 4 key regulated areas:

Energy Consumers (Industrial and Commercial Sectors)

Large energy consumers exceeding a threshold of 21,600 GJ annually are required to:

- Appoint a Registered Energy Manager (REM);
- Develop and implement an Energy Management System (EnMS);
- Submit annual EE&C reports; and
- Conduct periodic energy audits by Registered Energy Auditors (REA).

Approximately 2,500 energy consumers are expected to be regulated under this framework.

Buildings (Commercial – Office Buildings)

The Act introduces mandatory requirements for designated buildings, particularly office buildings with a gross floor area (GFA) of 8,000 m² and above, including:

- Annual application and display of BEI labels;
- Compliance with minimum energy performance standards; and
- Mandatory energy audits and improvement plans for non-compliant buildings.

Energy-Using Products (EUP)

Manufacturers and importers are required to:

- Obtain a Certificate of Energy Efficiency (COE) for energy-using products intended to be sold in Malaysia;
- Ensure compliance with minimum energy performance requirements; and
- Affix energy efficiency rating labels on products.

This framework expands the scope of energy efficiency regulation across domestic, commercial and industrial equipment.

Energy Efficiency Professionals and Institutions

The Act establishes a regulated ecosystem by requiring:

- Registration of Energy Managers;
- Registration of Energy Auditors; and
- Accreditation of Registered Training Institutions (RTI) to ensure competency and capacity building in the energy efficiency sector.

Other Regulatory Instruments and Standards

Uniform Building By-Laws (UBBL) and MS 1525: Energy Efficiency and Use of Renewable Energy for Non-Residential Buildings – Code of Practice

The implementation of energy efficiency in Malaysia's building sector is driven by a strategic synergy between the UBBL and the MS 1525 code of practice. While the UBBL provides the necessary legal teeth, MS 1525 serves as the technical backbone, with the latest version of MS 1525 including the introduction of the BEI benchmark to ensure that non-residential buildings are designed to minimise energy waste. This regulatory framework primarily targets the 'cooling load', which is the largest consumer of electricity in tropical climates. By mandating that new large-scale developments adhere to these standards, the government ensures that energy efficiency is baked into the building's DNA from the design phase, rather than being treated as an afterthought.

Central to this implementation are the concepts of Overall Thermal Transfer Value (OTTV) and Roof Thermal Transfer Value (RTTV) defined in MS 1525. These metrics limit the amount of heat that can penetrate a building's envelope, directly reducing the energy required for air conditioning. For instance, By-Law 38A of the UBBL mandates that buildings over 4,000 m^2 must not exceed an OTTV of 50 W/m^2. This forces architects to utilise high-performance glazing, strategic shading and better insulation. By integrating these passive design strategies with active system requirements such as efficient lighting and Heating, Ventilation and Air Conditioning (HVAC), Malaysia is successfully transitioning towards a more sustainable built environment that aligns with its 2050 net-zero carbon goals.

The adoption of the UBBL across Malaysia is a nuanced process, as building regulations fall under the jurisdiction of individual state governments rather than the federal authority. For the energy efficiency mandates specifically, for By-Law 38A to become legally enforceable, each state must formally gazette the amendments into their local legislation. While the federal government provides the framework, the actual implementation at the ground level depends on the readiness and policy priorities of the various State Authorities and their respective Local Authorities (Pihak Berkuasa Tempatan, PBT).

Historically, states like Selangor, Terengganu and Penang have been the pioneers, integrating energy efficiency requirements into the building plan approval process early on. In these regions, developers are strictly required to submit OTTV and RTTV calculations to demonstrate compliance with MS 1525 before construction can commence. Other states have followed at varying speeds, often influenced by the technical capacity of their local councils to verify complex energy engineering data or concerns regarding the initial increase in construction costs for developers.

Chapter 2

National Policy on Energy Efficiency

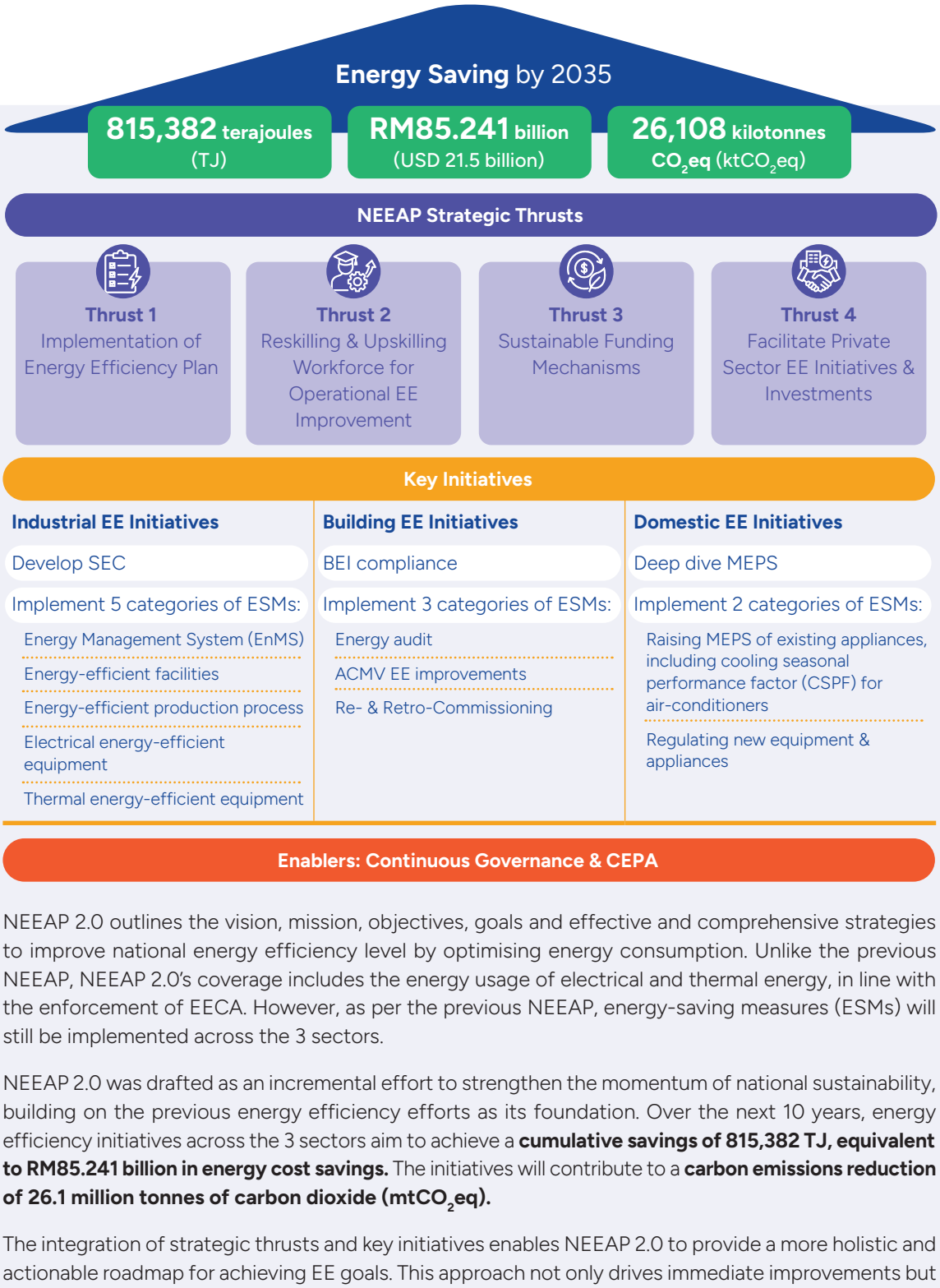
Countries with successful EE achievements all have implemented strong policies and regulatory instruments effectively in enforcing EE&C measures. These frameworks are backed by substantial funding to ensure the success of various EE programmes. Consequently, these countries have consistently met and surpassed their EE targets, allowing for more ambitious mid-term goals.

Adopting robust, long-term and consistent energy efficiency policies and regulatory instruments is crucial for spurring business investments in implementing ESM projects. To follow up on the implementation of the EECA, formulating a long-term and consistent national policy framework on energy efficiency is a prudent way forward. This will accelerate Malaysia's efforts in achieving higher EE targets in line with the NETR.

In consideration of the above, the objective of establishing a national policy and action plan for energy efficiency is to accelerate the country's efforts to meet ambitious sustainability goals at the national, regional and global levels. This will help promote a balanced and resilient energy ecosystem that aligns with environmental and economic goals, optimise electrical and thermal energy use to reduce waste and advance the competitiveness of industries and businesses to boost national energy performance.

Figure 2.1 shows an overview of the NEEAP 2.0 Policy House that summarises its Strategic Thrusts and Key Initiatives.

Figure 2.1: NEEAP 2.0 Policy House



NEEAP 2.0 outlines the vision, mission, objectives, goals and effective and comprehensive strategies to improve national energy efficiency level by optimising energy consumption. Unlike the previous NEEAP, NEEAP 2.0's coverage includes the energy usage of electrical and thermal energy, in line with the enforcement of EECA. However, as per the previous NEEAP, energy-saving measures (ESMs) will still be implemented across the 3 sectors.

NEEAP 2.0 was drafted as an incremental effort to strengthen the momentum of national sustainability, building on the previous energy efficiency efforts as its foundation. Over the next 10 years, energy efficiency initiatives across the 3 sectors aim to achieve a **cumulative savings of 815,382 TJ, equivalent to RM85.241 billion in energy cost savings.** The initiatives will contribute to a **carbon emissions reduction of 26.1 million tonnes of carbon dioxide ($mtCO_2eq$).**

The integration of strategic thrusts and key initiatives enables NEEAP 2.0 to provide a more holistic and actionable roadmap for achieving EE goals. This approach not only drives immediate improvements but also ensures sustained progress, contributing to a greener, more resilient and economically vibrant future.

Vision, Mission and Goals

Vision

To drive Malaysia's energy transition through a culture of efficiency and conservation, towards achieving net zero goals by 2050.

Mission

To contribute towards reducing national energy intensity by implementing regulatory and non-regulatory energy efficiency initiatives, towards intensive energy consumers and commercial buildings, promotion of energy-saving measures across all sectors through a skilled workforce, with a sustainable financing mechanism.

Goals

Cumulative energy saving of
815,382 TJ
by 2035

Overall energy demand reduction of
11.6%
by 2035 against the Business as Usual (BAU)

Table 2.1: Objectives and Outcomes of NEEAP 2.0

Category	Objectives	Outcome
Implementation of EE Plan	To establish and execute a comprehensive energy efficiency plan for industrial, commercial and domestic sectors.	Reduced energy consumption and energy-use intensities, lower GHG emissions and improved energy performance and security.
Reskilling and Upskilling Workforce for Operational EE Improvement	To build a skilled workforce capable of designing, implementing, commissioning and maintaining energy-efficient systems for both new and retrofitting work.	Enhanced and upskilled capacity to adopt and sustain EE practices, leading to long-term operational improvements.
Sustainable Funding Mechanisms	To secure reliable funding for sustainable implementation of EE projects and initiatives.	Increased availability of financial resources to scale up EE&C activities and ensure their sustainability.
Facilitate Private Sector EE Initiatives and Investments	To encourage and empower the private sector to actively participate in energy efficiency efforts and ownership.	Accelerated deployment of EE solutions that will spur economic activities resulting in improved energy performance and cost-effective and sustainable operations.

Strategic Thrusts for Driving Energy Efficiency and Conservation

The NETR provides guiding principles that recognise EE as the most important lever in promoting resource optimisation and accelerating the energy transition while improving climate resilience. With the enforcement of the long-awaited EECA, a legally binding framework is finally in place to regulate energy management in industrial, commercial and domestic sectors.

NEEAP 2.0 is a comprehensive plan designed to drive EE&C across key sectors of the economy. Built on 4 strategic thrusts, NEEAP formulates targeted initiatives for the industrial, commercial and domestic sectors. This integrated approach ensures that energy efficiency improvements are not only implemented effectively but also sustained holistically over the long term, fostering economic growth, environmental sustainability and energy security.

NEEAP 2.0 employs 4 strategic thrusts to operationalise and implement energy efficiency improvements effectively:

Implementation of EE&C Plan through policy, regulation and national plan:

Establishing a robust framework and executing national plans and standards to guide energy efficiency practices for industrial, commercial and domestic sectors.

Key action:	Outcome:
Develop sector-specific EE targets and a programme of ESMs and initiatives.	Reduced energy consumption and energy-use intensities, lower GHG emissions and improved energy performance and security.

Capacity building for reskilling and upskilling of workforce:

Empowering stakeholders to build a skilled workforce capable of designing, implementing, commissioning and maintaining energy-efficient systems through education, training and awareness campaigns to elevate the skill levels and adoption of best practices for operational EE improvement.

Key action:	Outcome:
Provide electrical and thermal training programmes for professionals, technicians and supervisors in energy management and EE technologies.	Enhance and upskill capacity to adopt and sustain EE practices, leading to long-term operational improvements.

Sustainable funding mechanisms:

Establishing sustainable funding mechanisms is critical to the successful implementation of EE initiatives and programmes under NEEAP 2.0.

Key action:	Outcome:
Establish dedicated EE funds or financing schemes for the comprehensive implementation of the EE action plan.	Increased availability of financial resources to scale up EE&C activities and ensure their sustainability.

Facilitate private sector initiatives and investments:

Encouraging and empowering the private sector to mobilise financial resources and incentivise investments in energy efficiency projects will ensure widespread and long-term impact to achieve energy reduction targets.

Key action:	Outcome:
Create an enabling and participative environment through supportive policies, regulations, streamlined procedures and assistance and incentives.	Accelerated deployment of EE solutions that will spur economic activities resulting in improved energy performance and cost-effective and sustainable operations.

The framework is supported by enablers that are required to drive the 4 strategic thrusts and successfully execute key initiatives across the industrial, building and domestic sectors:

Governance: Ensuring that policy design translates into mandatory, standardised actions and provides the legal and institutional framework necessary to manage, monitor and enforce national energy efficiency goals.

Communication, Education and Public Awareness (CEPA): CEPA educates, builds capacity and assists in behavioural changes necessary to facilitate the implementation of energy efficiency policy and action plans.

Sector-Specific **Initiatives**

NEEAP 2.0 tailors its initiatives to address the unique energy challenges and opportunities within 3 key sectors:

Industrial Sector: Enhancing energy efficiency in manufacturing and production processes to reduce costs and emissions.

Commercial Sector: Promoting energy-saving practices in businesses, offices and public institutions to improve operational efficiency.

Domestic Sector: Encouraging households to adopt energy-efficient technologies and behaviours to lower energy consumption, cost and environmental footprints.

The NEEAP 2.0 key initiatives are designed to promote and implement energy efficiency across the 3 sectors. These initiatives are practical and actionable, and are aligned with NETR to achieve significant energy reduction targets. By focusing on the actionable measures and initiatives listed below, the NEEAP 2.0 key initiatives adopt a bottom-up approach that will engage all stakeholders, including partnering programmes through ST to tap the expertise available in private sector organisations and professional bodies, in order to scale higher achievements in national energy efficiency goals.

Industrial Energy Efficiency Initiatives

+ **Develop specific energy consumption (SEC) benchmarks for all sub-sectors:**
  - Establish energy intensity benchmarks for industrial production.
  - Encourage industries to monitor and reduce their energy intensity.

+ **Implement 5 categories of ESMs:**
  - Energy Management System (EnMS);
  - Energy-efficient facilities;
  - Energy-efficient production process;
  - Electrical energy-efficient equipment; and
  - Thermal energy-efficient equipment.

Building Energy Efficiency Initiatives

+ **BEI compliance**

+ **Implement 3 categories of ESMs:**
  - Energy audit;
  - ACMV energy efficiency improvement; and
  - Re- or Retro-Commissioning.

Domestic Energy Efficiency Initiatives

+ **Deep dive MEPS to set and enforce minimum energy performance standards:**
  - Raising MEPS of existing appliances including the cooling seasonal performance factor (CSPF) of air-conditioners; and
  - Regulating new equipment & appliances.

Chapter 3

National Energy Efficiency Action Plan 2026–2035

Overall Target and Sectoral Target

The NEEAP 2026–2035 faces a different energy efficiency landscape from that which existed for the initial NEEAP 2016–2025. Several enabling levers that were addressed for NEEAP 2016–2025 have been institutionalised now, and these critical levers can help to accelerate the implementation of future EE initiatives. The most critical of these enablers is the enactment of the EECA.

The EECA has covered the desired needs of legislative provisions to permit effective regulation and enforcement of the Act (except for any provision of the necessary funding mechanisms, as was incorporated in the RE Act). With the legal foundation laid out, future implementation of EE initiatives will become simpler since the implementing agency, ST, will have legal powers to acquire data and other relevant information and enforce implementation mechanisms by the consumers affected under the EECA, something that had not been possible previously.

This is a paradigm shift in the national efforts to be more effective and ambitious in pursuing effective implementation of EE initiatives to aim for a low-carbon economic environment as an option towards achieving the national Net Zero Emissions by 2050 (NZE 2050) aspirations.

The NEEAP 2026–2035 addresses all energy consumers, including those who are not affected under the EECA. This means that the multitude of ESMs identified and incorporated under the NEEAP 2026–2035 will also be available to influence other consumers, who may be termed 'free riders', to join the bandwagon and to adopt the ESM concerned. These 'free riders' would also be able to take advantage of financial, fiscal and other incentives that are created or enhanced through the implementation of the NEEAP 2026–2035 during its 10-year implementation period.

Based on the ESM initiatives described in the following section, the overall and sectoral energy demand reduction targets have been estimated and summarised together with yearly breakdown targets for the respective sectors, in Table 3.1 below:

i. The total energy demand (BAU) for the 3 sectors in 2035 is 1,465,879 TJ

ii. The total energy reduction for the 3 sectors in 2035 is 169,528 TJ

Overall target of energy demand reduction at 2035 is 11.6% as derived from:

i. Industrial sector target at 2035 of 11.9%

ii. Commercial sector target at 2035 of 13.2%

iii. Domestic sector target at 2035 of 8.7%

Table 3.1: Energy Demand in Overall Sector, Industrial, Commercial and Domestic Sectors (2026–2035)

Overall Sector						
Year	BAU (TJ)	Energy saving				Saving over BAU (%)
		Industrial	Commercial	Domestic	Total (TJ)	
2026	1,237,990	2,745	2,547	460	5,752	0.5
2027	1,260,852	6,681	5,249	1,061	12,991	1.0
2028	1,284,536	12,068	8,108	1,860	22,035	1.7
2029	1,308,848	21,847	12,953	3,064	37,864	2.9
2030	1,333,776	39,032	18,074	5,457	62,563	4.7
2031	1,359,256	61,239	20,539	7,966	89,744	6.6
2032	1,385,241	83,265	23,141	10,626	117,031	8.4
2033	1,411,692	101,785	25,869	13,576	141,231	10.0
2034	1,438,580	113,036	26,657	16,949	156,642	10.9
2035	1,465,879	121,607	27,451	20,471	169,528	11.6
Total	13,486,650	563,304	170,588	81,490	815,382	

Industrial Sector					
Year	Energy demand	EE&C programme	Thermal	Electrical	Reduction rate
Unit	TJ	TJ	TJ	TJ	%
2026	870,563	2,745	1,654	1,091	0.3%
2027	886,429	6,681	3,924	2,757	0.8%
2028	902,690	12,068	7,727	4,341	1.3%
2029	919,246	21,847	15,279	6,567	2.4%
2030	936,061	39,032	27,835	11,197	4.2%
2031	953,091	61,239	43,050	18,189	6.4%
2032	970,303	83,265	57,297	25,968	8.6%
2033	987,670	101,785	69,178	32,608	10.3%
2034	1,005,170	113,036	76,209	36,827	11.2%
2035	1,022,789	121,607	78,400	43,206	11.9%

Commercial Sector					
Year	Energy demand	EE&C programme	Thermal	Electrical	Reduction rate
Unit	TJ	TJ	TJ	TJ	%
2026	170,537	2,548	0	2,548	1.5%
2027	173,458	5,248	0	5,248	3.0%
2028	176,773	8,109	0	8,109	4.6%
2029	180,428	12,950	0	12,950	7.2%
2030	184,413	18,075	0	18,075	9.8%
2031	188,710	20,541	0	20,541	10.9%
2032	193,304	23,140	0	23,140	12.0%
2033	198,182	25,875	0	25,875	13.1%
2034	203,335	26,652	0	26,652	13.1%
2035	208,754	27,451	0	27,451	13.1%

Domestic Sector					
Year	Energy demand	EE&C programme	Thermal	Electrical	Reduction rate
Unit	TJ	TJ	TJ	TJ	%
2026	196,890	460	0	460	0.2%
2027	200,966	1,061	0	1,061	0.5%
2028	205,073	1,860	0	1,860	0.9%
2029	209,174	3,064	0	3,064	1.5%
2030	213,301	5,457	36	5,422	2.6%
2031	217,454	7,966	72	7,894	3.7%
2032	221,634	10,626	109	10,517	4.8%
2033	225,841	13,576	147	13,430	6.0%
2034	230,075	16,949	185	16,764	7.4%
2035	234,337	20,471	225	20,246	8.7%

Figure 3.1 provides a graphical presentation of total energy demand savings from the 3 sectors with respect to BAU energy demand from 2026 to 2035. Figure 3.2 shows the sectoral energy demand savings with respect to BAU energy demand from 2026 to 2035. The largest share of energy demand savings is expected to come from the industrial sector at approximately 69%, while the shares of contributions to energy demand savings from the commercial and domestic sectors are approximately 21% and 10%, respectively.

Figure 3.1: Final Energy Demand Savings vs BAU (2026–2035)

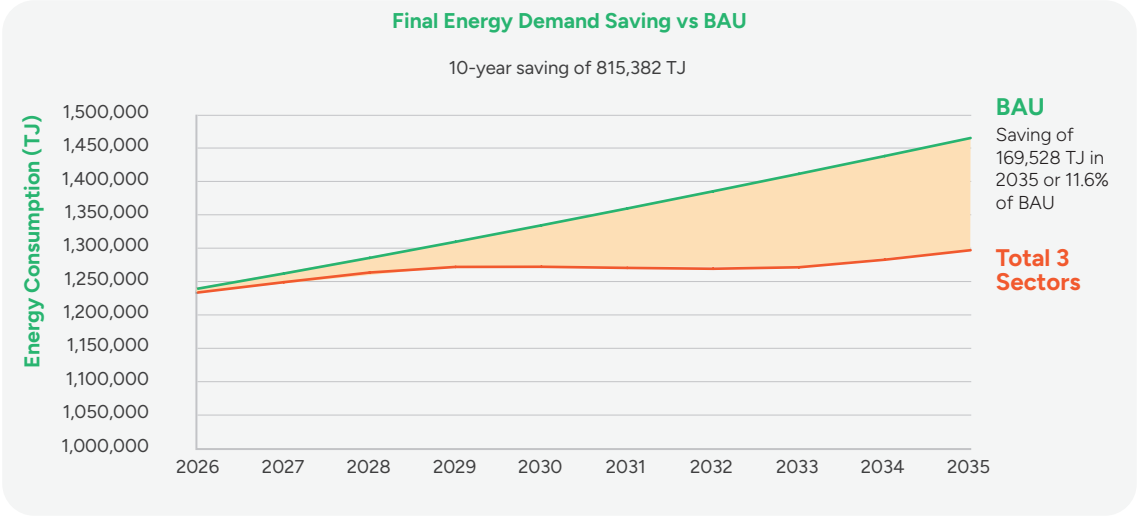
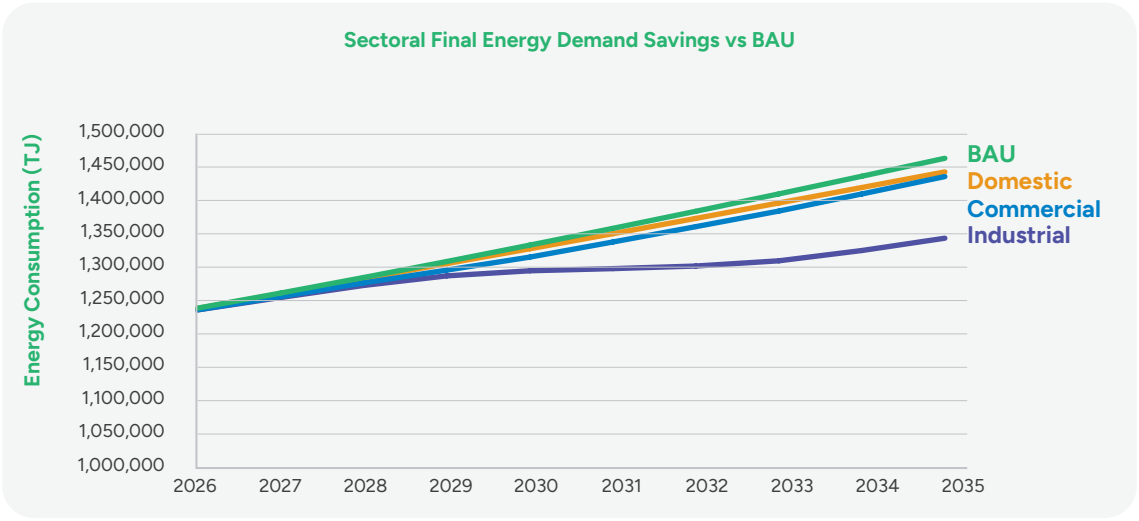


Figure 3.2: Sectoral Final Energy Demand Savings vs BAU (2026–2035)



Key Initiatives

Industrial Sector

A total of 10 industrial energy-saving initiatives, or commonly known as energy-saving measures (ESMs), have been identified for the implementation of NEEAP 2.0, and they can be classified into 5 categories for convenient reference as follows:

i. Energy Management System (EnMS): comprises procedural EnMS, and re/retro-commissioning & maintenance.

ii. Energy-efficient facilities: comprises compressed air, hot water, cooling water, steam and thermal comfort cooling, etc.

iii. Energy-efficient production process: comprises digitalisation of production process (Industry 4.0, real-time process monitoring & control, energy-efficient production line, insulation, rationalisation of energy use (fuel change, e.g. heat pumps, thermal oil heaters).

iv. Electrical EE equipment: comprises High Efficiency Motors (HEM), energy-efficient fans and pumps and lighting.

v. Thermal EE equipment: comprises heat recovery equipment, heat exchangers, solar thermal preheating, etc.

Details of the 10 industrial sector ESMs are elaborated below:

ESM #1: Lighting

Private Investment

RM299 million

Lighting has been recognised as a 'low-hanging fruit' EE measure and has been widely accepted in the industry. Therefore, it is expected that, on average, at least 50% of remaining industries classified as large consumers under EECA will install energy-efficient lighting. This ESM is expected to be implemented immediately and completed over a 2-year period from 2026. This ESM includes the installation of energy-efficient light fixtures, timer controls, motion and photoelectric sensors and lighting control systems. This ESM accounts for 2% of the total industrial sector ESM savings.

ESM #2: Insulation

Private Investment

RM291 million

An effective method to prevent heating and cooling energy losses is the use of thermal insulation. Insulation is a low-cost measure and is expected to be implemented immediately over a 5-year period from 2026 in all industrial sub-sectors. A wide range of insulation materials is available for industrial applications, and no incentive is recommended to kick-start this ESM. The overall impact on the total industrial sector ESM savings is 2%.

ESM #3: Energy Management System

Private Investment

RM300 million

This ESM constitutes a procedural EnMS, which is a requirement under the EECA that requires large energy consumers to adopt a systematic energy management practice. Examples of this procedural system are the ISO 50001 Energy Management System, AEMAS Energy Management Gold Standard or other systematic energy management method. Implementation of this ESM is expected to commence in 2026 and continue throughout the 10-year NEEAP 2.0 duration. With company management's commitment and systematic approach through the Plan-Do-Check-Act (P-D-C-A) method, the industrial sector can derive both electrical and thermal energy savings from housekeeping, energy conservation measures, productivity improvements and other measures deemed appropriate by the in-house energy management committee. The anticipated total industrial sector ESM savings is 8%.

ESM #4: Recommissioning & Retro-Commissioning

Public Investment

RM30 million

Private Investment

RM952 million

Recommissioning (ReCx) and Retro-Commissioning (RetroCx) will identify shortcomings and provide opportunities to re-assess and re-adjust in order to optimise operational performance. This ESM includes the implementation of regular preventive maintenance, which will help maintain optimum plant operating conditions.

While Commissioning (Cx) focuses on new plant facilities, ReCx maintains plant performance efficiency over time. ReCx will provide opportunities to re-adjust plant operational settings for optimum performance in accordance with design intent and operation and maintenance (O&M) recommendations, as settings could have been altered after years of operation. The initial commissioning could be superseded by operational changes.

RetroCx is necessary after the completion of repairs and/or retrofitting work. It will ensure optimum operation is achieved after a process of fine-tuning, testing, measurement and verification. Both ReCx and RetroCx processes are crucial for ensuring that plants operate smoothly, efficiently and safely. This ESM will provide significant savings in electrical and thermal energy. The overall impact on total industrial sector ESM savings is 8%.

ESM #5: Rationalisation of Energy Sources

Public Investment	Private Investment
RM50.32 million	RM62.4 million

Changing from conventional fuel-fired facilities to more efficient energy sources such as electricity or technologies such as heat pumps will save on thermal energy. Another example is a thermal oil heater that can perform process heating or drying efficiently in the operating temperature range of 150°C to 400°C, instead of a steam system or direct firing. A thermal oil heater for this temperature range application is cost-effective because it requires less ancillary equipment compared with a steam system; the thermal fluid system does not need to be pressurised; and the thermal oil heating system is safer and easier to operate. Implementation is expected to be completed within a 3-year period from 2028 for all sub-sectors except transportation, machinery and wood products. The overall impact on the total industrial sector ESM savings is 2%.

ESM #6: Energy-Efficient Utilities

Private Investment
RM1,682 million

Energy-efficient utilities such as compressed air, steam, hot water, etc. will provide energy savings from energy-efficient equipment and distribution systems, including minimising or eliminating leakages. Implementation is expected to be completed over a 5-year period from 2028. Energy savings are estimated to be 3% in electrical and thermal energy, respectively. The overall impact on the total industrial sector ESM savings is a significant 12%.

ESM #7: Digitalised Production Process

Public Investment	Private Investment
RM30 million	RM1,215 million

Digitalised production is the process of using computerised control systems to support and improve manufacturing operations. Digitalised production comes in a variety of forms, including 3D printing, computer-aided design/manufacturing, Industry 4.0 (Ind4.0), industrial internet of things (IoT) for real-time monitoring and optimisation, robotics and artificial intelligence (AI), all of which will provide energy-saving opportunities in planning new or upgrading existing production facilities for all sub-sectors. Incorporating measurement and verification (M&V) for real-time energy-efficient operation, excluding transportation and machinery sub-sectors, will provide continuous energy savings without having to wait for energy audits to be conducted. As a result, energy savings can be realised with immediate effect. Implementation of this ESM in the industrial sector is expected to be completed over a 5-year period from 2029. Digitalised production processes can improve energy efficiency and also productivity.

Digitalised production processes incorporating energy management functions, including data analytics and control functions, will allow continuous process monitoring and optimisation. They can also be programmed to provide useful data on energy use intensity or SEC for setting benchmark improvement targets and, hence, greater energy savings. The overall impact on the total industrial sector ESM savings is 4%.

ESM #8: High Efficiency Motors

Public Investment	Private Investment
RM29 million	RM1,620 million

The implementation of High Efficiency Motor (HEM) IE3 motors, classified as 'premium efficiency' motors in accordance with IEC/EN 60034-30-1 for the power range of 0.12 to 1,000 kW, over a 4-year period from 2029, will generate electrical energy savings. IE3 motors will minimise energy losses and are ideal for continuous operation in manufacturing processes. The overall impact on the total industrial sector ESM savings is 4%.

ESM #9: Heat Recovery

Public Investment	Private Investment
RM0.2 million	RM361.4 million

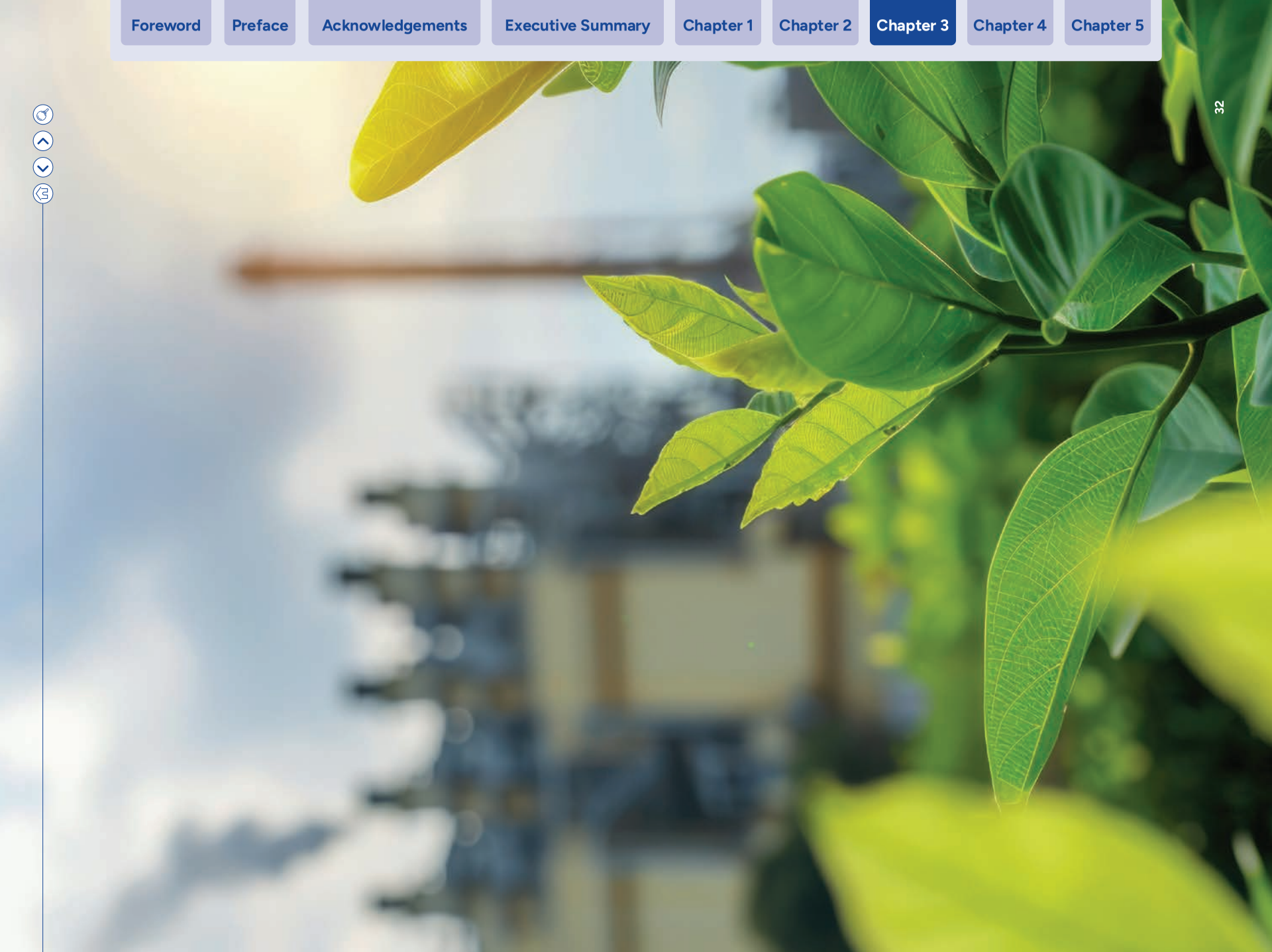
Fossil fuel combustion, which generates the majority of onsite industrial heat energy for production processes, tends to transfer heat to the environment as waste heat. Heat recovery using equipment, such as economisers, heat exchangers and recuperators, is an established technology that can be deployed to recover waste heat to improve energy utilisation, generate cost savings, reduce environmental impact and enhance workflow and productivity for all processes in industries. Many industrial facilities can be upgraded and retrofitted with waste heat recovery equipment to improve their SEC. This ESM is expected to be implemented over a 5-year period from 2030, but it should be promoted as early as practicable, as its overall impact on the total industrial sector ESM savings is significant at 6%.

ESM #10: Solar Thermal Preheating

Public Investment	Private Investment
RM0.2 million	RM341 million

Solar thermal preheating provides an integration strategy for harnessing solar heat energy through solar thermal collectors in conventional fuel-based industrial heating processes to supplement or replace the process preheating or heating requirements, although it is subject to temperature requirements. Heating demands for industrial processes below 250°C can easily be met by solar thermal energy.

This ESM will provide substantial thermal energy savings. Implementation of this ESM is expected to take place over a 5-year period from 2029 for the chemical, food and beverage (F&B), pulp and paper and textile sub-sectors. The overall impact on the total industrial sector ESM savings is significant at 5%.



Commercial Sector

Target energy savings for the commercial sector have been computed on an overall average reduction of various building categories' BEIs over 2 phases to achieve their respective ultimate BEIs, which are significantly lower than their current average BEI levels. In conjunction with this goal, 11 commercial ESMs were identified. These are grouped into 3 main categories as listed:

Energy Audit
Consists of energy audit (ESM1), lighting replacement & improvement (ESM2) and insulation (ESM3).

ACMV EE improvements
Consist of energy-efficient (EE) chillers & accessories replacement (ESM4), waterside & airside replacement (ESM5), heat pumps for hot water generation (ESM6), heat recovery wheels (ESM7), solar thermal cooling – air conditioning (ESM8) and district cooling (ESM11).

Recommissioning & Retro-Commissioning
Consists of building automation system (BAS) including maximum demand limiting (MDL) (ESM9) and recommissioning or retro-commissioning (ESM10).

List of 11 specific ESMs planned for the commercial sector:

- Energy audit
- Lighting replacement & improvement
- Insulation
- Energy-efficient chillers and accessories replacement
- Waterside & airside improvement
- Heat pumps for hot water generation – hotels & hospitals
- Heat recovery wheels
- Solar thermal cooling – air conditioning
- Building automation system including maximum demand limiting
- Recommissioning or retro-commissioning
- District cooling system

The 11 ESMs identified for the Commercial Sector are elaborated hereunder:

ESM #1: Energy Audit

Public Investment	Private Investment
RM58 million	RM137 million

It is proposed that the government provide an Energy Audit (EA) grant of RM40,000 per approved building. EA cost for a large building, defined as >8,000 m^2 GFA, is estimated at RM80,000, and that for a small building of 4,000 to 8,000 m^2 GFA is RM60,000. As such, the EA grant will only cover part of the EA cost. The partial EA grant is intended to extend coverage to more buildings, and it should be noted that the benefits of carrying out EA through Conditional Grants for EAs during NEEAP 2016–2025 are well publicised and acknowledged in the industry.

The total government investment of RM58 million under the proposed EA grant will consist of RM29 million for a direct EA grant and RM29 million for an extensive campaign for all 11 ESMs, including administrative verification costs for relevant ESMs and extensive EE training workshops in collaboration with non-governmental organisations (NGOs).

The direct EA grant of RM29 million will cover 25% of private buildings from a total of 2,749 buildings exceeding 4,000 m^2 GFA, and is targeted to be utilised within the first 4 years of NEEAP 2.0. This sector will comprise office buildings, hotels, retail and hospitals but excludes data centres.

Meanwhile, private investment for EA is anticipated to cover another 25% of the affected buildings, resulting in half of the 2,749 private buildings (>4,000 m^2 GFA) to have undergone EA. The total private investment for EA is estimated at RM137 million. The overall contribution to total commercial sector ESM savings is 10%.

ESM #2: Lighting

Private Investment

RM137 million

EA Reports are expected to recommend re-lamping to LED lighting as the fastest initiative to realise an immediate ESM with attractive returns to boot. With the ever-improving LED technology and very competitive pricing, there is no need for public funding for this ESM. All that is needed to accelerate market adoption are awareness campaigns, and this will be spearheaded by the ESM on EA.

Re-lamping to LED can cost up to RM100,000 per large building. The total private investment for this ESM is estimated at RM137 million. The re-lamping exercise is expected to be actively pursued following the EA report within the first 4 years of NEEAP 2.0. The anticipated ESM savings are 10%.

ESM #3: Insulation

Private Investment

RM27 million

EA reports will inevitably identify air-conditioning as the largest energy consumer, and preventing energy loss due to deteriorating or defective thermal insulation of air-conditioning systems will constitute a low-cost action. The cost of this activity is estimated at around RM20,000 per building with a total private investment of RM27 million. ESM savings are 1.5%.

Similar to the ESM for lighting, awareness campaigns and the like, coupled with the EA report, will suffice to result in the appropriate rectification and/or re-insulation action.

ESM #4: Energy-Efficient Chillers

Public Investment	Private Investment
RM30 million	**RM450 million**

In 2011, the SAVE 1.0 rollout included the Energy-Efficient (EE) Chiller Replacement Programme, which was successfully implemented to replace ageing, inefficient chillers with new high-efficiency chillers. However, the SAVE 2.0 to 4.0 programmes have excluded the EE Chiller Replacement Programme.

Since the SAVE 1.0 programme, chiller technology has advanced significantly, with the emergence of magnetic chillers, variable speed chillers and more. Ageing HCFC chillers also need to be phased out to meet Malaysia's HCFC Phase-out Management Plan (HPMP) commitment under the Kigali Amendment. Hydrofluoroolefin (HFO) chillers are also now in the market to replace high-global-warming-potential (GWP) hydrofluorocarbons (HFC) chillers. It is further recommended that the replacement of HCFC-22 chillers be given priority to aid DOE Malaysia in achieving the HCFC phase-out timeline by 2030.

Replacement with EE chillers will entail replacement of associated equipment such as pumps and cooling towers, and is hence a high capital expenditure investment. The EE Chiller replacement is now included in the SAVE 5.0 programme launched around January 2025. Implementation of this programme remains with SEDA Malaysia, since the logistics framework, including the team of verifiers, is well established.

The public grant of RM250 per Refrigeration Ton (RT) may be maintained to achieve a wider reach but should preferably be increased to RM300 per RT to take into account chiller cost increases since 2011. A direct grant of RM30 million is proposed, with other associated costs involving verifiers taken up under the campaign allocation of ESM #1. The rollout is targeted from Year 2 to 6 following the EA reports to optimise benefits, or may now be accelerated given the earlier launch of SAVE 5.0.

The prevailing cost of EE chillers is around RM4,000 per RT, so private investment will amount to RM450 million over the same period. Although the replacement cost is high, building owners will find the returns attractive, apart from their need to achieve the mandatory Building Energy Labelling under EECA and comply with the national HPMP timeline. ESM savings are 30%.

ESM #5: Waterside & Airside Improvements

Private Investment

RM450 million

There is no need for public funding for this ESM, as energy savings from ESM #4 will provide the necessary awareness and impetus for building owners to adopt this ESM. The SAVE 1.0 EE Chiller Replacement Programme has provided ample case studies on the need to improve waterside and airside plants to optimise energy savings for the air-conditioning system, following the replacement of chillers with new configurations suited to a building's actual cooling load profile, which in the majority of cases tend to be oversized. Nonetheless, continuous training workshops should be conducted to build such awareness, including training of in-house and external personnel to carry out these improvements.

A total private investment of RM450 million is deemed conservative. Implementation will run from Year 1 to 9, with ESM savings of 21%.

ESM #6: Heat Pumps

Private Investment

RM107 million

No public funding is recommended for this ESM, which would result in substantial energy savings to the buildings concerned.

In Malaysia, heat pump technology will be applicable for hot water generation, unlike in temperate climates, where applications also include space heating. As such, this ESM will benefit hotels and hospitals that are still using hot water boilers or other fuel-derived heating sources. The preferred technology will be either water-to-water or air-to-water heat pumps. The former may enhance complementary energy efficiency operation by connecting into the cooling tower condenser water circuit, and the latter by diverting the cool air discharge for secondary space cooling. The use of natural refrigerants (hydrocarbons) should also be considered instead of relying on high-GWP synthetic refrigerants.

Private investment in the range of RM200,000 per building is envisaged and targeted for 50% of the total 1,068 hotels and hospitals. Implementation will run from Year 1 to 6 following the EA reports. Estimated ESM savings are 3%.

ESM #7: Heat Recovery Wheels

Private Investment

RM29 million

Similar to heat pumps, no public funding is recommended. This ESM is applicable to all commercial building types with central riser exhausts or spaces with high ventilation rates, such as high-rise hotel or office toilet exhaust stacks, hospital settings and exhibition halls. The potential energy savings from the resultant reduced cooling loads will provide for attractive returns.

A total private investment of RM100,000 per building targeted for 10% of the total buildings is estimated, with implementation from Year 2 to 5. ESM savings are 1%.

ESM #8: Solar Thermal Cooling

Public Investment	Private Investment
RM20 million	**RM40 million**

Solar Thermal Cooling (STC) is more efficient than Solar Photovoltaic in terms of harvesting solar heat, since solar electricity is limited to specific spectrums of sunlight. Unfortunately, this technology has not advanced in Malaysia, where solar energy is available throughout office hours compared to temperate climate countries. Although STC is better suited for factories and warehouses due to their excellent roof-to-floor ratio, its application in the commercial sector should also be encouraged. To date, there are fewer than a handful of STC installations nationwide due to a lack of further R&D and high initial cost.

Public funding of RM20 million is proposed to offset the cost of implementing 3 example cases and is slated for Years 5 to 7. Private investment of RM40 million will be required to cover the full cost of these projects. ESM savings will be 1.5% for this promotional stage.

ESM #9: Building Automation System including Maximum Demand Limiting

Private Investment

RM29 million

No public funding is proposed for this ESM as the main component of the cost will be captured under ESM #10.

Building Automation System (BAS) is an integrated building control system comprising hardware and software that enables the monitoring, control and optimisation of building services, including air-conditioning, ventilation, lighting and other electrical systems. The EnMS forms part of the BAS to support energy monitoring, control and optimisation. It is to be noted that By-Law 38A of the UBBL 1984 (amended 2012 and 2021) mandates EnMS (aka BAS) provision for a building with air-conditioned areas exceeding 4,000 m^2. The absence of BAS is detrimental to the successful automated operation and performance of an EE building, and even more so to realising an automated MDL programme for the building. MDL programming was first introduced for green buildings in Malaysia, ahead of its subsequent adoption globally. Unfortunately, its wide-scale implementation has been very slow in Malaysia due to a lack of technical expertise in software programming. This setback is now being addressed by a 3-day course with an examination to certify BAS System Integrators (SIs), developed by the BAS Association of Malaysia (BASAM). Apart from MDL, a comprehensively operating BAS is crucial to achieving a high-performing EE building, as elaborated further under ESM #10.

To install, reinstate or replace deficient BAS, a private investment totalling RM29 million is estimated, for implementation from Year 3 to 10, catering to 20% of existing buildings. This implementation would be in conjunction with ESM #10, which should be carried out after implementation of the other ESMs. ESM savings are 5%.

ESM #10: Recommissioning or Retro-Commissioning

Public Investment	Private Investment
RM61 million	**RM122 million**

While Cx focuses on new buildings, Recommissioning (ReCx) maintains building performance efficiency over time, and Retro-Commissioning (RetroCx) breathes new life into older buildings. These processes are crucial for ensuring that buildings operate smoothly, efficiently and safely.

Before the introduction of the Commissioning Specialist (CxS) under the GBI rating tool, few new buildings were fully commissioned in Malaysia. One of the main reasons is that full and proper Cx can only be carried out when the building is sufficiently occupied to generate sufficient load to operate all its Mechanical and Electrical (M&E) systems. GBI requires buildings to be at least 50% occupied before they can be properly commissioned. The provision of a fully commissioned BAS is a critical and integral component of a building to ensure continued high-performing operation thereafter.

Hence, to realise truly high-performing EE buildings, it is imperative that Cx be fully implemented, and for that reason, where Cx is lacking in new buildings, ReCx or RetroCx need to be incentivised through the public funding of RM61 million, aimed at assisting up to 30% of existing buildings.

Private investment is estimated to double that, at RM122 million. Implementation needs to be scheduled after all EE improvement works are completed, commencing from Year 3 to 9 and beyond.

The success and sustainability of this ESM will necessitate continuous and intensive training to increase external expertise and in-house supporting technical personnel. This will include working with the currently industry-driven 3-day CxS course (with examination and certificate) conducted by MASHRAE. ESM savings are 15%.

ESM #11: District Cooling System

Private Investment

RM500 million

The modular configuration of chillers of a District Cooling System (DCS) plant ensures optimal energy-efficient operation across varying plant cooling loads at all times. Hence, the viability of DCS is beyond debate, and there are ready investors both globally and locally for DCS investment projects, so there is no need for any public funding. However, the viability of DCS locally has in the past been hampered by poor end-user experiences relating specifically to issues such as perpetual fixed demand charges and lopsided contractual terms, which in turn tend to give rise to other problems.

There is thus an urgent need for the government to properly regulate this industry to secure a sustainable, long-term, mutually beneficial arrangement between providers and end users. The regulation should examine and adapt prevailing global regulations to suit our local context. Allowing time for development of said regulations, implementation is targeted from Year 7 onwards, with a projection for 4 DCS plants, each with a capacity of 10,000 RT, totalling RM500 million in private investment. ESM savings are 2%.

Domestic Sector

The domestic or residential sector will target the use of energy-efficient equipment and appliances as summarised below.

1. Raising the MEPS of 10 existing appliances.
2. Substantially raising the CSPF of air-conditioners.
3. Two (2) new appliances to be regulated with MEPS.

A total of 12 ESMs have been identified, of which 10 are initiatives to raise the MEPS of existing 2-star regulated appliances. The remaining 2 ESMs are proposed new appliances to be regulated under MEPS for this sector. The 12 ESMs are elaborated hereunder.

ESM #1: Refrigerators

The refrigerator is a basic electrical appliance in all residential homes, and the implementation and enforcement of MEPS for refrigerators has started since 2013. As refrigerators use electricity 24/7, the impact of MEPS and the 3-star to 5-star rated refrigerators inevitably reduces electricity consumption significantly. Essentially, the total energy consumption of a refrigerator makes up 18 to 20% of the average home's total energy consumption annually. Therefore, raising the MEPS of refrigerators helps to further reduce the electricity consumption in the domestic sector.

This proposal includes the enforcement of revised MEPS, whereby in the first revision, the existing 3-star efficiency level will be adopted as the new 2-star minimum requirement, and in the second revision, the existing 4-star efficiency level will be adopted as the new 2-star minimum requirement. By raising the MEPS to a higher efficiency value in this way, high energy efficiency is achieved. As shown in Table 3.2 and for illustration purposes, the existing 2-star index value [(-25%) ≤ Star Index < (-10%)] will be increased to the revised 2-star index value [(-10%) ≤ Star Index < (+10%)] in the first revision. For the second revision, the 2-star index value will be [(+10%) ≤ Star Index < (+25%)].

Table 3.2: MEPS of Refrigerators

Star Rating	Refrigerator Star Index Value		
	Existing	Proposed (1st Revision)	Proposed (2nd Revision)
5	Star Index ≥ +25%	Star Index ≥ +30%	Star Index ≥ +35%
4	(+10%) ≤ Star Index < (+25%)	(+25%) ≤ Star Index < (+30%)	(+30%) ≤ Star Index < (+35%)
3	(-10%) ≤ Star Index < (+10%)	(+10%) ≤ Star Index < (+25%)	(+25%) ≤ Star Index < (+30%)
2	(-25%) ≤ Star Index < (-10%)	(-10%) ≤ Star Index < (+10%)	(+10%) ≤ Star Index < (+25%)
1	(-35%) ≤ Star Index < (-25%)	(-25%) ≤ Star Index < (-10%)	(-10%) ≤ Star Index < (+10%)

The annual market volume is estimated at approximately 340,000 units per year, based on average sales data from 2018 to 2023 under NEEAP 2016–2025 monitoring, with an assumed average refrigerator lifetime of 15 years. Additionally, the annual energy savings for a refrigerator are calculated based on the revised star rating structure, whereby the former 3-star performance level is reclassified as the new 2-star rating in the first revision, and the former 4-star performance level is reclassified as the new 2-star rating in the second revision.

Thus, the calculation of savings is based on the difference in average annual energy consumption between the 3-star and 2-star models for the year 2023, which is 92 kWh/year for the first revision. For the second revision, the calculation is based on the average difference in energy consumption of both the 4-star and 3-star models relative to the 2-star model, resulting in savings of 99 kWh/year.

The penetration rate over the 10-year period is tabulated in Table 3.3 as below:

Table 3.3: Penetration Rate of Refrigerators

Title	Refrigerators
Description	Revised MEPS 2-star
Annual Market Increase	2%
Lifetime Savings (years)	15
2026	0%
2027	4%
2028	4%
2029	4%
2030	4%
2031	4%
2032	32%
2033	32%
2034	32%
2035	32%

For the first year of implementation, the annual savings are computed to be 4.7 TJ, assuming a penetration rate of 4% each year in the first phase and 32% each year in the second phase, with a market increase of 2% per year.

Cumulative Energy Savings (GWh) for 10 years = 173 GWh (equivalent to 624.2 TJ) as per Table 3.4 below.

Table 3.4: Cumulative Energy Savings – Refrigerators

Annual Cumulative Savings (GWh)	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Total
Refrigerators	-	1	3	4	5	7	19	32	45	58	173

ESM #2: Lamps

Another basic electrical energy-consuming appliance in homes is lighting. In the domestic sector, lighting accounts for about 22% of the total electrical energy used. Thus, improving lighting energy efficiency can result in substantial savings. This initiative is aimed at promoting more energy-efficient lighting by raising the luminous efficacy of all 4 categories of lamps: T5 & T8 Fluorescent lamps (non-LED), Compact Fluorescent Lamp (CFL) self-ballasted, CFL (non-integrated) and all LED lamps.

For this proposal, it is assumed that every household has at least 5 units of lamps, which account for 38,640,000 of the total market. An average lifetime of 10 years is assumed per lamp; therefore, the annual market is equal to 3,864,000 per year. The proposed revised MEPS for lamps is as shown in Table 3.5 below.

Table 3.5: Proposed Luminous Efficacy of Lamps

Type of Lamp	Tubular Fluorescent								LED Lamp	
	T8				T5					
	18–30 W		≥ 31 W		14 W		≥ 15 W			
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
MEPS (lm/W)	70	75 / 85*	80	85 / 90*	75	80 / 85*	80	85 / 90*	50	70 / 100*

Type of Lamp	CFL (Self-Ballasted)							
	< 9 W		9–14 W		15–24 W		≥ 25 W	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
MEPS (lm/W)	46	60 / 70*	52	60 / 70*	55	60 / 70*	62	65 / 70*

Type of Lamp	CFL (Non-Integrated Lamps)							
	< 10 W		10–18 W		19–26 W		≥ 27 W	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
MEPS (lm/W)	46	60 / 70*	55	60 / 70*	59	65 / 70*	70	75/ 80*

** 1st & 2nd revision proposal*

The penetration rate over the 10-year period and cumulative energy savings are tabulated in Table 3.6 and Table 3.7 as follows:

Table 3.6: Penetration Rate of Lamps

Title	Lamps
Description	Revised MEPS 2-star
Annual Market Increase	2%
Lifetime Savings (years)	10
2026	0%
2027	0%
2028	44%
2029	44%
2030	44%
2031	44%
2032	44%
2033	70%
2034	70%
2035	70%

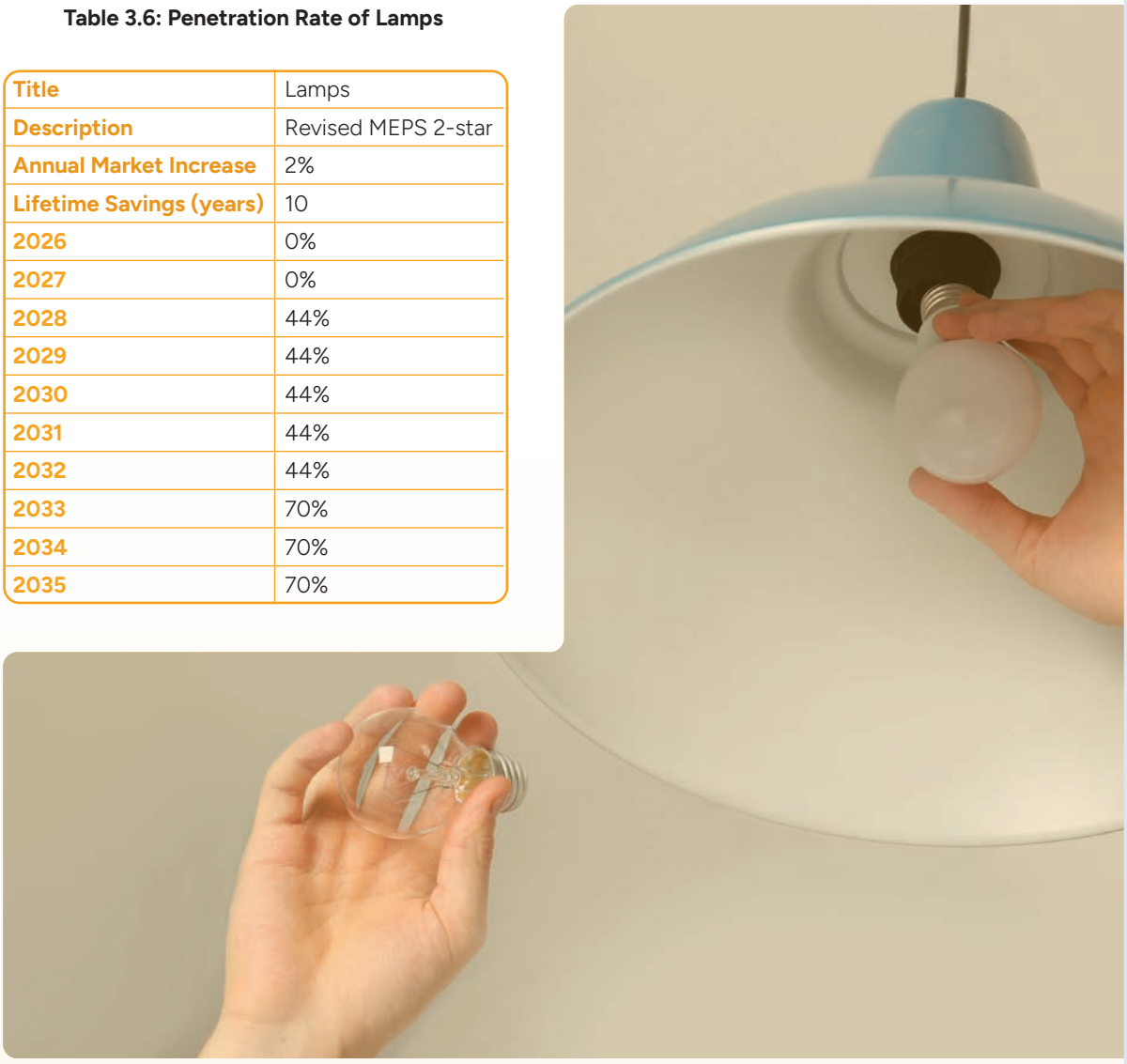


Table 3.7: Cumulative Energy Savings – Lamps

Title	Annual Cumulative Savings (TJ)										Total
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
Lamps	0.0	0.0	32.5	65.6	99.4	133.9	169.0	226.1	284.2	343.6	1,354.2

For the first year of implementation, in 2028, the annual saving is estimated at around 9 GWh or 32.5 TJ, assuming a penetration rate of 44% and a market increase of 2%. The cumulative savings over 10 years are 1,354 TJ.

ESM #3: Air Conditioners

The widespread use of air-conditioning for indoor comfort cooling of residential homes and buildings has inevitably resulted in increased electricity consumption. The scope of MEPS since 2013 is inclusive of single-phase non-ducted single split wall-mounted type vapour compression air conditioners with cooling capacity up to 7.1 kW. NEEAP 2026–2035 proposed to expand the cooling capacity from more than 7.1 kW and up to 14.1 kW, as air conditioners of 3 to 5 horsepower (hp) are being increasingly used in some large houses and in commercial buildings. The other proposed inclusion is the ceiling-hung or cassette air conditioners. Multi-split air conditioners within the expanded cooling capacity are excluded from being regulated by MEPS until such time as testing standards for multi-split air conditioners are formally established and adopted.

Air conditioners consume most of the energy in commercial buildings and the same applies to residential homes. On this basis, and taking into consideration the ASEAN Regional Policy Roadmap on MEPS and targets of the international community, the following CSPF of 6.09 as MEPS, with the timelines as shown in Table 3.8, is proposed.

Table 3.8: Recommended CSPF and Timelines

Category A:

Star Rating	Capacity < 4.5 kW	Recommendation	
	Existing	Phase 1	Phase 2
		Year: 2026–2029	Year: 2030–2035
5	≥5.30	≥6.09	≥7.5
4	4.60 ≤ CSPF < 5.30	5.40 ≤ CSPF < 6.09	7.00 ≤ CSPF < 7.50
3	3.30 ≤ CSPF < 4.60	4.80 ≤ CSPF < 5.40	6.50 ≤ CSPF < 7.00
2	3.10 ≤ CSPF < 3.30	4.10 ≤ CSPF < 4.80	6.09 ≤ CSPF < 6.50

Category B:

Star Rating	Capacity ≥ 4.5 kW ≤ 7.1 kW	Recommendation	
	Existing	Phase 1	Phase 2
		Year: 2026–2029	Year: 2030–2035
5	≥5.10	≥5.60	≥7.0
4	4.00 ≤ CSPF < 5.10	5.00 ≤ CSPF < 5.60	6.50 ≤ CSPF < 7.00
3	3.10 ≤ CSPF < 4.00	4.40 ≤ CSPF < 5.00	6.09 ≤ CSPF < 6.50
2	2.90 ≤ CSPF < 3.10	4.00 ≤ CSPF < 4.40	5.60 ≤ CSPF < 6.09

Category C*:

Star Rating	Capacity > 7.1 kW ≤ 14.1 kW	Recommendation	
	New Category	Phase 1	Phase 2
		Year: 2026–2029	Year: 2030–2035
5	N/A	≥5.40	≥6.60
4	N/A	4.80 ≤ CSPF < 5.40	6.20 ≤ CSPF < 6.60
3	N/A	4.30 ≤ CSPF < 4.80	5.80 ≤ CSPF < 6.20
2	N/A	3.80 ≤ CSPF < 4.30	5.40 ≤ CSPF < 5.80

*Note: *Have yet to be regulated*

For the first revision, the calculation is based on the average midpoint CSPF value of the existing 2-star rating and the proposed new 2-star rating (current 3-star rating). Based on the average CSPF for the 2-star air conditioner, the annual energy consumption is 1,650 kilowatt-hours (kWh). For the current 3-star air conditioner, the annual energy consumption is 1,314 kWh. Therefore, the estimated annual energy savings amount to 336 kWh.

For the second revision, the calculation is based on the average midpoint CSPF value of the existing 2-star rating (after the first revision) and the proposed new 2-star rating (current 5-star rating). Based on the average CSPF for the 2-star air conditioner (after the first revision), the annual energy consumption is 1,599 kWh. For the current 5-star air conditioner, the annual energy consumption is 1,152 kWh. Therefore, the estimated annual energy savings amount to 447 kWh.

For the period 2026–2029, a market penetration rate of 26% is assumed, based on the current 2-star market share prior to the revision. For the period of 2030–2035, the penetration rate is assumed to be 100%, based on the combined pre-revision market share of 2-star, 3-star, 4-star and 5-star air conditioners (data derived from NEEAP 2016–2025 monitoring). However, to avoid double counting of energy savings under the SAVE/NUR programme, the effective penetration rate is gradually reduced from 97% in 2030 to 60% in 2035.

Table 3.9: Penetration Rate of Air Conditioners

Title	Air Conditioners
Description	Revised MEPS 2-star
Annual Market Increase	2%
Lifetime Savings (years)	10
2026	26%
2027	26%
2028	26%
2029	26%
2030	97%
2031	90%
2032	85%
2033	80%
2034	70%
2035	60%

Table 3.10: Cumulative Energy Savings of Air Conditioners from Revised 2-star CSPF Value

Title	Annual Cumulative Savings (TJ)										Total
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
Air Conditioners	352.9	712.8	1,079.9	1,454.4	3,350.1	5,144.2	6,872.5	8,531.7	10,012.5	11,307.2	48,818.1

The annual cumulative savings across the 10 years is 48,818.1 TJ, which is the same as the lifetime savings, as the life span of an air conditioner is typically 10 years.

ESM #4: Fans

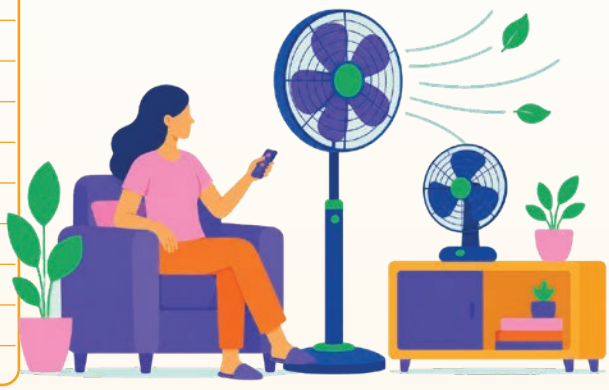
A must-have appliance in any Malaysian household is none other than a fan, as it is one of the most cost-friendly and effective ways to improve ventilation and circulation at home. For MEPS, the scope of coverage includes ceiling fans, pedestal fans, wall fans and desk fans.

For the first revision, the proposed 2-star COP threshold will be raised to the previous 5-star COP level. For example, the existing 2-star COP range of 2.58–2.65 will be revised to a new 2-star minimum COP value of 4.00. For the second revision, the proposed 2-star COP threshold will be further increased to 6.00.

In the computation of energy saving, for the first revision, the proposed COP for a 2-star rating is 4.0. The savings calculation is based on an average air volume of 162 m^3/min. The estimated annual energy savings for the first revision are 37 kWh per unit. For the second revision, the proposed COP for a 2-star rating is 6.0. The savings calculation is similarly based on an average air volume of 162 m^3/min. The estimated annual energy savings for the second revision are 34 kWh per unit.

Table 3.11: Penetration Rate of Fans

Title	Domestic Fans
Description	Revised MEPS 2-star
Annual Market Increase	2%
Lifetime Savings (years)	20
2026	0%
2027	0%
2028	0%
2029	32%
2030	32%
2031	32%
2032	32%
2033	32%
2034	60%
2035	60%



This energy saving is computed yearly at an annual market increase of 2% and the corresponding cumulative energy saving from this ESM is tabulated in Table 3.12.

Table 3.12: Cumulative Energy Savings of Fans

Annual Cumulative Savings (GWh)	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Total
Domestic Fans	-	-	-	38	78	118	158	200	273	348	1,213

Cumulative Savings (GWh) for 10 years = 1,213 GWh (equivalent to 4,368.2 TJ).

ESM #5: Televisions

Similar to all other appliances, the MEPS value for the 2-star rating of a television is raised by adopting the existing 3-star star-index rating as the revised 2-star MEPS, as shown in Table 3.13 below. The scope of MEPS regulations remains unchanged, and covers the following types of television with size up to or equal to 177.8 cm (70 inches):

a. plasma;
b. liquid-crystal display (LCD);
c. light-emitting diode (LED);
d. cathode ray tube (CRT); and
e. any other display type with similar function.

The enforcement of television MEPS can be achieved by increasing the existing star index value. The minimum requirement for MEPS appliances is 2-star, for the first revision, the proposed new 2-star index value is raised to the 3-star index value of the previous star rating.

Table 3.13: Proposed New MEPS of Televisions

Star Rating	Star Index Value		
	Existing	Proposed (1st Revision)	Proposed (2nd Revision)
5	Star Index ≥ +70%	Star Index ≥ +85%	Star Index ≥ +105%
4	(+25%) ≤ Star Index < (+70%)	(+70%) ≤ Star Index < (+85%)	(+85%) ≤ Star Index < (+105%)
3	(-22%) ≤ Star Index < (+25%)	(+25%) ≤ Star Index < (+70%)	(+70%) ≤ Star Index < (+85%)
2	(-55%) ≤ Star Index < (-22%)	(-22%) ≤ Star Index < (+25%)	(+25%) ≤ Star Index < (+70%)
1	Star Index < -55%	(-55%) ≤ Star Index < (-22%)	(-22%) ≤ Star Index < (+25%)

For the first revision, the savings calculation is based on the difference in average annual energy consumption between the 3-star and 2-star models for the year 2021, amounting to 81 kWh per year. For the second revision, the savings are calculated based on the average difference between the current 4-star models and the combined average of the current 2-star and 3-star models, resulting in 96 kWh per year. All calculations are based on 2021 energy consumption and sales data.

The penetration rate and cumulative energy saving are tabulated in Table 3.14 and Table 3.15, respectively.

Table 3.14: Penetration Rate of Televisions

Title	Televisions
Description	Revised MEPS 2-star
Annual Market Increase	2%
Lifetime Savings (years)	10
2026	0%
2027	0%
2028	0%
2029	40%
2030	40%
2031	40%
2032	40%
2033	40%
2034	80%
2035	80%

Table 3.15: Cumulative Energy Savings of Televisions

Annual Cumulative Savings (GWh)	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Total
Televisions	-	-	-	33	67	102	137	173	261	350	1,123

The annual cumulative savings over 10 years is 4,044.2 TJ or 1,123 GWh.

ESM #6: Washing Machines

Washing machines are essential household appliances, widely used due to the increasing emphasis on convenience and time-saving in daily chores. On average, Malaysians have a minimum of 1 washing machine per household. Malaysians tend to prefer automatic washing machines, particularly top-load models, for their ease of use and affordability, though front-load machines are gaining popularity due to their energy and water efficiency.

The MEPS guideline regulates washing machines up to a 16 kg load with or without heating devices, utilising cold and/or hot water supply. There are 2 types of washing machines included in the scope, and they are the top-loading and front-loading types.

Similar to certain other appliances, for the first revision, the MEPS values for the 2-star rating of both the top-loading and front-loading washing machines are raised by adopting the existing 3-star rating of energy efficiency ratio (EER) as the revised 2-star MEPS, as shown in Table 3.16 below. For the second revision, the proposed new 2-star EER is to be increased to the 4-star EER of the current star rating.

Table 3.16: Proposed New MEPS of Washing Machines

Star Rating	Energy Efficiency Ratio (Wh/kg)			
	Top Loading Capacity ≤16 kg		Front Loading Capacity ≤16 kg	
	Existing	Proposed	Existing	Proposed
5	< 6.0	< 4.0	< 70.0	< 50.0
4	6.0 ≤ EER ≤ 10.0	4.0 ≤ EER < 6.0	70.0 ≤ EER < 90.0	50.0 ≤ EER < 70.0
3	10.0 ≤ EER < 17.0	6.0 ≤ EER < 10.0	90.0 ≤ EER < 140.0	70.0 ≤ EER < 90.0
2	17.0 ≤ EER < 22.5	10.0 ≤ EER < 17.0	140.0 ≤ EER < 220.0	90.0 ≤ EER < 140.0
1	≥ 22.5	17.0 ≤ EER < 22.5	≥ 220.0	140.0 ≤ EER < 220.0

For the first revision, the energy savings calculation is based on the difference in average annual energy consumption between the 3-star and 2-star models for the year 2021, amounting to 25 kWh per year. For the second revision, the savings are calculated based on the average difference between the current 4-star models and the combined average of the current 2-star and 3-star models for the year 2021, resulting in 13 kWh per year. All calculations are based on 2021 energy consumption and sales data.

The penetration rate over the 10-year period is as shown in Table 3.17 and the cumulative energy saving is tabulated in Table 3.18 as follows:

Table 3.17: Penetration Rate of Washing Machines

Title	Washing Machines
Description	Revised MEPS 2-star
Annual Market Increase	2%
Lifetime Savings (years)	10
2026	0%
2027	0%
2028	0%
2029	0%
2030	11%
2031	11%
2032	11%
2033	11%
2034	11%
2035	62%

Table 3.18: Cumulative Energy Savings of Washing Machines

Annual Cumulative Savings (GWh)	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Total
Washing Machines	-	-	-	-	1	2	4	5	6	10	28

The annual cumulative savings over 10 years is 99 TJ or 28 GWh.

ESM #7: Microwave Ovens

This ESM applies the same approach of raising the existing 2-star efficiency by adopting the existing 3-star efficiency percentage. Effectively, the MEPS of a microwave oven is raised by 1 notch of the existing star hierarchy. The revised star rating and the corresponding MEPS value at 2 stars are as shown in Table 3.19. A microwave oven is generally considered an energy-efficient appliance when compared with conventional cooking methods. A microwave oven is seen as a faster option for reheating and defrosting food.

The scope of coverage for this appliance remains unchanged, and regulates microwave ovens of any size up to or equal to 32 litres (L). Energy saving is computed from the difference between the midpoint value of the existing 2-star MEPS efficiency and that of the new revised 2-star MEPS.

Table 3.19: Proposed New MEPS of Microwave Ovens

Star Rating	Efficiency, η	
	Existing	Proposed
5	η ≥ 65%	η ≥ 70%
4	58% ≤ η < 65%	65% ≤ η < 70%
3	53% ≤ η < 58%	58% ≤ η < 65%
2	45% ≤ η < 53%	53% ≤ η < 58%
1	η < 45%	45% ≤ η < 53%

The penetration for a 10-year period is as shown in Table 3.20, and the cumulative energy saving is tabulated in Table 3.21 as follows:

Table 3.20: Penetration Rate of Microwave Ovens

Title	Microwave Ovens
Description	Revised MEPS 2-star
Annual Market Increase	2%
Lifetime Savings (years)	8
2026	0%
2027	0%
2028	0%
2029	0%
2030	0%
2031	11%
2032	11%
2033	11%
2034	11%
2035	11%

Table 3.21: Cumulative Energy Savings of Microwave Ovens

Annual Cumulative Savings (GWh)	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Total
Microwave Ovens	-	-	-	-	-	2	4	6	8	10	30

The annual cumulative savings over 10 years are 107.9 TJ or 30 GWh.

ESM #8: Electric Rice Cookers

This ESM applies the same approach of raising the 4 power categories of existing 2-star efficiency of electric rice cookers by adopting the existing 3-star efficiency percentage. Effectively, the MEPS of this appliance is raised by 1 notch of the existing star rating hierarchy. The revised star rating and the corresponding MEPS value at 2 stars are as shown in Table 3.22.

Table 3.22: Proposed New MEPS of Rice Cookers

Star Rating	Efficiency, η (%)									
	P ≤ 400 W		400 W < P ≤ 600 W		600 W < P ≤ 800 W		800 W < P ≤ 1,000 W		1,000 W < P ≤ 2,000 W	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
5	≥ 85	≥ 90	≥ 87	≥ 91	≥ 89	≥ 92	≥ 91	≥ 93	≥ 93	≥ 95
4	≥ 80	≥ 85	≥ 81	≥ 87	≥ 82	≥ 89	≥ 83	≥ 90	≥ 84	≥ 93
3	≥ 75	≥ 80	≥ 76	≥ 81	≥ 77	≥ 82	≥ 78	≥ 83	≥ 79	≥ 84
2	≥ 70	≥ 75	≥ 71	≥ 76	≥ 72	≥ 77	≥ 73	≥ 78	≥ 74	≥ 79
1	≥ 65	≥ 70	≥ 66	≥ 71	≥ 67	≥ 72	≥ 68	≥ 73	≥ 69	≥ 74

Energy saving is computed from the difference between the efficiency value of the existing 2-star MEPS of 70% and that of the new revised 2-star MEPS of 75% for rice cookers with power less than or equal to 400 W.

The penetration rate over the 10-year period is as shown in Table 3.23, and the cumulative energy saving is tabulated in Table 3.24 as follows:

Table 3.23: Penetration Rate of Rice Cookers

Title	Electric Rice Cookers
Description	Revised MEPS 2-star
Annual Market Increase	2%
Lifetime Savings (years)	10
2026	0%
2027	0%
2028	0%
2029	0%
2030	0%
2031	36%
2032	36%
2033	36%
2034	36%
2035	36%

Table 3.24: Cumulative Energy Savings of Rice Cookers

Title	Annual Cumulative Savings (TJ)										Total
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
Electric Rice Cookers	0.0	0.0	0.0	0.0	0.0	17.9	36.2	54.8	73.8	93.1	275.8

The annual cumulative savings for 10 years is 275.8 TJ.

ESM #9: Freezers

For the first revision, this ESM applies the same approach of raising the star index values of the existing 2-star efficiency of freezers by adopting the existing 3-star efficiency metric. The revised star rating and the corresponding MEPS value at 2 stars are as shown in Table 3.25.

Table 3.25: Proposed New MEPS of Freezers

Star Rating	Freezer Star Index Value		
	Existing	Proposed (1st Revision)	Proposed (2nd Revision)
5	Star Index ≥ +35%	Star Index ≥ +55%	Star Index ≥ +75%
4	(+15%) ≤ Star Index < (+35%)	(+35%) ≤ Star Index < (+55%)	(+55%) ≤ Star Index < (+75%)
3	(-20%) ≤ Star Index < (+15%)	(+15%) ≤ Star Index < (+35%)	(+35%) ≤ Star Index < (+55%)
2	(-37%) ≤ Star Index < (-20%)	(-20%) ≤ Star Index < (+15%)	(+15%) ≤ Star Index < (+35%)
1	Star Index < -37%	(-37%) ≤ Star Index < (-20%)	(-20%) ≤ Star Index < (+15%)

Energy saving is computed from the difference between the midpoint efficiency metric of the existing 2-star MEPS of (-37%) ≤ Star Index < (-20%) and that of the new revised 2-star MEPS of (-20%) ≤ Star Index < (+15%).

The penetration rate over the 10 years is as shown in Table 3.26, and the cumulative energy saving is tabulated in Table 3.27 as follows:

Table 3.26: Penetration Rate of Freezers

Title	Freezers
Description	Revised MEPS 2-star
Annual Market Increase	2%
Lifetime Savings (years)	15
2026	0%
2027	0%
2028	6%
2029	6%
2030	6%
2031	6%
2032	6%
2033	45%
2034	45%
2035	45%

Table 3.27: Cumulative Energy Savings of Freezers

Title	Annual Cumulative Savings (TJ)										Total
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
Freezers	0.0	0.0	22.2	44.8	67.9	91.5	115.5	318.9	526.5	738.2	1,925.5

The annual cumulative savings for 10 years are 1,925.5 TJ.

ESM #10: Electric Ovens

The electric oven is the tenth appliance being regulated by ST, enforced from 1 November 2024. With this appliance now regulated, the non-star-rated and 1-star-rated electric ovens are being phased out from the market and eliminated from Malaysian homes. The MEPS and star rating hierarchy are tabulated in Table 3.28.

Table 3.28: MEPS of Electric Ovens

Star Rating	EEI (%)	
	Built-in Oven	Portable Electric Oven
5	EEI < 82	EEI < 85
4	82 ≤ EEI < 92	85 ≤ EEI < 95
3	92 ≤ EEI < 115	95 ≤ EEI < 110
2	115 ≤ EEI < 140	110 ≤ EEI < 120
1	140 ≤ EEI	120 ≤ EEI

The annual saving calculation is based on the average midpoint energy-efficiency indicator (EEI) values of both the existing 1-star and 2-star ratings, and the cavity volume is assumed to be 70 L for each type of electric oven. The penetration rate across the 10-year period is as shown in Table 3.29, and the cumulative energy saving is tabulated in Table 3.30 as follows:

Table 3.29: Penetration Rate of Electric Ovens

Title	Electric Ovens
Description	Revised MEPS 2-star
Annual Market Increase	2%
Lifetime Savings (years)	13
2026	0%
2027	0%
2028	0%
2029	0%
2030	0%
2031	0%
2032	20%
2033	20%
2034	20%
2035	20%

Table 3.30: Cumulative Energy Savings of Electric Ovens

Title	Annual Cumulative Savings (TJ)										Total
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
Electric Ovens	0.0	0.0	0.0	0.0	0.0	0.0	54.6	110.3	167.1	225.0	556.9

The annual cumulative savings for 10 years is 556.9 TJ.

ESM #11: Liquefied Petroleum Gas Cooking Stoves

This ESM on MEPS for liquefied petroleum gas (LPG) cooking stoves is a new addition to the list of current 10 appliances under the regulation and enforcement of ST. This initiative is a natural development as LPG cooking stoves have been a popular kitchen equipment for cooking due to ease of use, affordability and high heat content. However, LPG cooking stoves do have low thermal efficiency and high emissions due to heat loss and incomplete combustion.

Regulating the efficient use of LPG cooking stoves through MEPS helps to reduce thermal energy consumption in the domestic sector. Since Malaysia has yet to implement MEPS for this household appliance, the proposed star rating efficiency metric as shown in Table 3.31 adopts that of India, along with its testing standards of IS 4246:2002. The MEPS guideline is set for all types of LPG cooking stoves designed for domestic use only. Similar to the MEPS regime of ST, the 2-star value will be the MEPS and any appliance with a lower efficiency value than that of MEPS shall be banned from being imported or manufactured.

Table 3.31: Proposed MEPS for LPG Stoves

Star Rating	Thermal efficiency, η
	Proposed
5	$\eta \geq 85\%$
4	$81\% \leq \eta < 85\%$
3	$78\% \leq \eta < 81\%$
2	$75\% \leq \eta < 78\%$
1	$72\% \leq \eta < 75\%$

The savings calculation is based on the average midpoint efficiency values of the 2-star rating against that of the 1-star stove. It is assumed that current LPG stoves in use are either non-star rated or, at best, 1-star rated. Thus, the midpoint efficiency value of a 1-star stove is 70.0%, while that of a 2-star stove is 73.5%.

The penetration for a 10-year period is as shown in Table 3.32, and the cumulative energy saving is tabulated in Table 3.33 as follows:

Table 3.32: Penetration Rate of LPG Cooking Stoves

Title	LPG Cooking Stoves
Description	MEPS New Appliances
Annual Market Increase	2%
Lifetime Savings (years)	15
2026	0%
2027	0%
2028	0%
2029	0%
2030	20%
2031	20%
2032	20%
2033	20%
2034	20%
2035	20%

Table 3.33: Cumulative Energy Savings of LPG Cooking Stoves

Title	Annual Cumulative Savings (TJ)										Total
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
LPG Cooking Stoves	0.0	0.0	0.0	0.0	35.6	71.9	109.0	146.8	185.3	224.7	773.3

The annual cumulative savings for 10 years is 773.3 TJ.

ESM #12: Water Dispensers

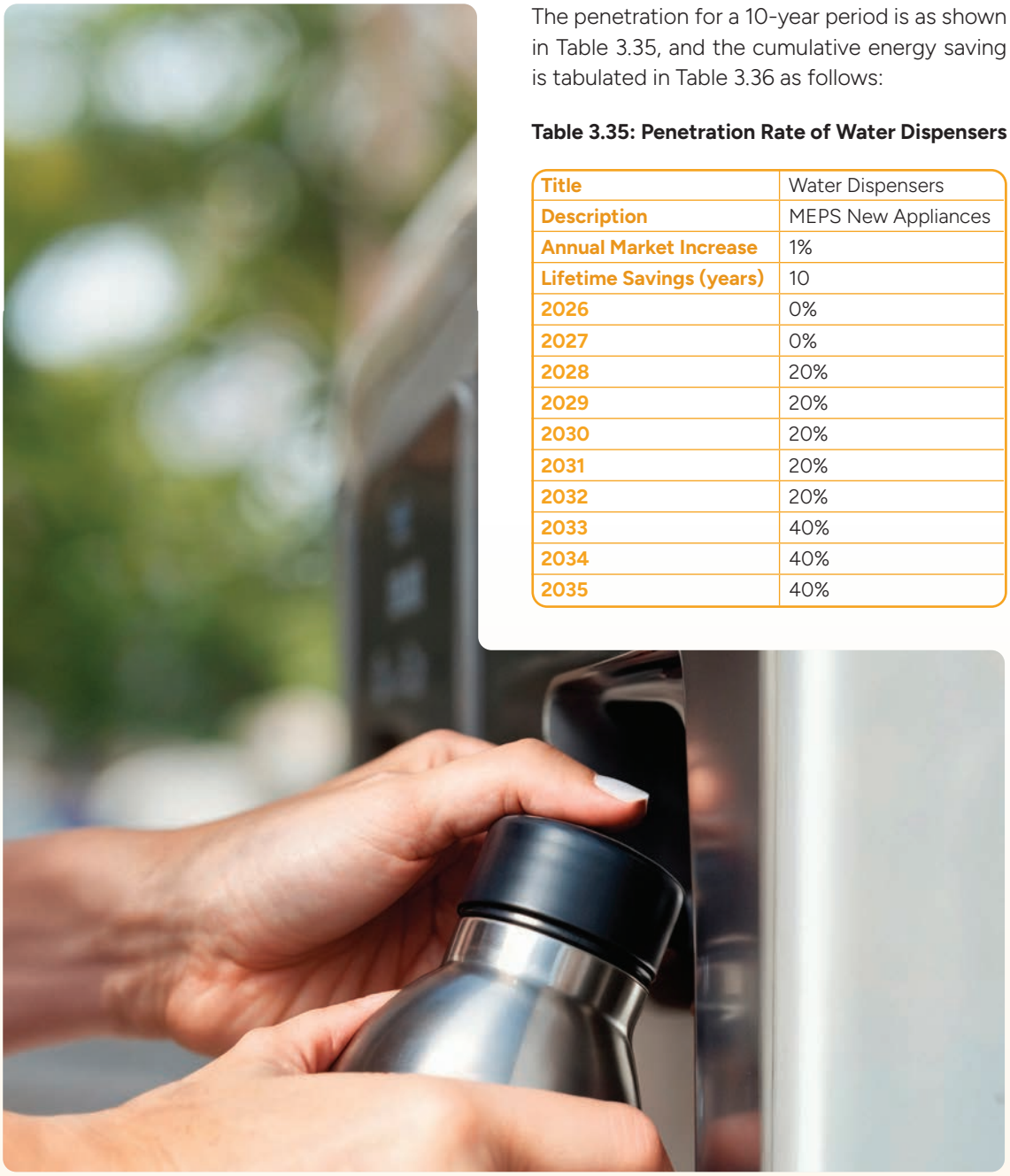
This ESM on MEPS for electric water dispensers is the second new addition to the list of current 10 appliances under the regulation and enforcement of ST. Electric water dispensers are becoming essential home appliances due to their readiness to dispense hot water as compared with a conventional kettle, which boils water only when in use. Most Malaysian households have a water dispenser, especially households with young children and older people. The water storage tank is equipped with an internal heating element and is well insulated externally. When switched on, it directly heats up the water stored inside the tank and maintains the temperature.

Since Malaysia has yet to implement MEPS for this household appliance, the proposed star rating efficiency metric as shown in Table 3.34 adopts that of Korea, and its testing standards are IEC 60335-2-21 and IEC 60335-2-35. The MEPS guideline is set for all types of domestic water dispensers with storage that comply with safety and testing standards. Similar to the MEPS regime of ST, the 2-star value will be the MEPS and any appliance with a lower efficiency value than the MEPS shall be banned from being imported or manufactured. A revision of the star rating table is anticipated around 2031, whereby the EEI threshold for the 2-star rating will be tightened. For example, the current range of 1.4 < EEI ≤ 1.8 may be revised to 1.1 < EEI ≤ 1.4.

Table 3.34: Proposed MEPS of Water Dispensers

Star Rating	EEI
5	EEI ≤ 0.8
4	0.8 < EEI ≤ 1.1
3	1.1 < EEI ≤ 1.4
2	1.4 < EEI ≤ 1.8
1	1.8 < EEI ≤ 2.5

The introduction of MEPS will lead to energy savings due to the transition from the lowest 1-star rating to the 2-star rating (MEPS requirement). The saving calculation is based on the average midpoint efficiency value of the proposed 1-star and proposed 2-star ratings. From the table, the midpoint efficiency value of the proposed 1-star EEI is 2.15 while the midpoint EEI of the proposed 2-star is 1.6.



The penetration for a 10-year period is as shown in Table 3.35, and the cumulative energy saving is tabulated in Table 3.36 as follows:

Table 3.35: Penetration Rate of Water Dispensers

Title	Water Dispensers
Description	MEPS New Appliances
Annual Market Increase	1%
Lifetime Savings (years)	10
2026	0%
2027	0%
2028	20%
2029	20%
2030	20%
2031	20%
2032	20%
2033	40%
2034	40%
2035	40%

Table 3.36: Cumulative Energy Savings of Water Dispensers

Title	Annual Cumulative Savings (TJ)										Total
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
Water Dispensers	0.0	0.0	11.7	23.6	35.5	47.6	74.9	102.5	130.4	158.6	585.0

The annual cumulative savings for 10 years is 585 TJ.

Chapter 4

Socio-Economic Impact Analysis

A comprehensive socio-economic analysis of the impact of the 10-year implementation programme for NEEAP 2.0 was conducted. This section presents the results of the financial flow analysis based on the potential energy savings, public and private investments, cost benefits, internal rate of return, net present value, payback period and balance of payments. In addition, detailed analyses are also provided on energy avoidance, energy intensity reduction, GHG emissions avoidance and potential job creation.

Financial Flow Analysis
for the 10-Year Plan Implementation

Based on the BAU forecast, this section analyses the impact of implementing ESMs and other initiatives in the NEEAP 2.0 on the Malaysian economy from 2026 to 2035, with a particular focus on the impact on government expenditures and the balance of payments.

The ESMs that reduce overall energy consumption primarily come from electricity and fossil fuels, which comprise coal, natural gas and petroleum products. The constituent fuels of petroleum products are diesel, fuel oil and LPG. In the case of electricity, the reduction is focused on coal- and natural gas-fired generation sources. In addition, the energy losses in electricity generation are included in the energy reductions, as losses in electricity generation (energy conversion efficiency) occur within the conversion sector.

In Malaysia, natural gas for power generation and other key energy sources such as diesel, fuel oil and LPG are subsidised, putting pressure on government coffers. Reducing final energy consumption in the 3 targeted sectors through various ESMs of the EE&C measures will reduce fuel subsidies provided by the government. On the other hand, reductions in final energy consumption in the 3 target sectors simultaneously reduce coal, natural gas (LNG) and petroleum products (or crude oil) imports, thus improving the balance of payments and reducing the production cost for the private sector.

In implementing NEEAP 2.0, the government and the private sector will invest a total of RM36.602 billion, comprising RM560 million in public expenditure and RM36.04 billion in private investment, as shown in Figure 4.1. However, the total benefits for the government are derived from the net fuel reduction plus the total energy reduction (both electricity and thermal energy) from ESMs of the 3 sectors over the same period, which amount to RM85.241 billion. It is to be noted that the net fuel reduction is derived from the savings of all fuel types at the point of electricity generation less the rebate or surcharge rates of the Imbalance Cost Pass-Through (ICPT) component. In this forecast, the ICPT rates of the first half year of 2025 are assumed to be applied for the next 10 years.

Figure 4.1: Public and Private Investment

Industry

Total Public Funding

RM140.72 mil

Total Private Investment

RM7,112.31 mil

Commercial

Total Public Funding

RM169.00 mil

Total Private Investment

RM2,029.47 mil

Domestic

Total Public Funding

RM250.40 mil

Total Private Investment

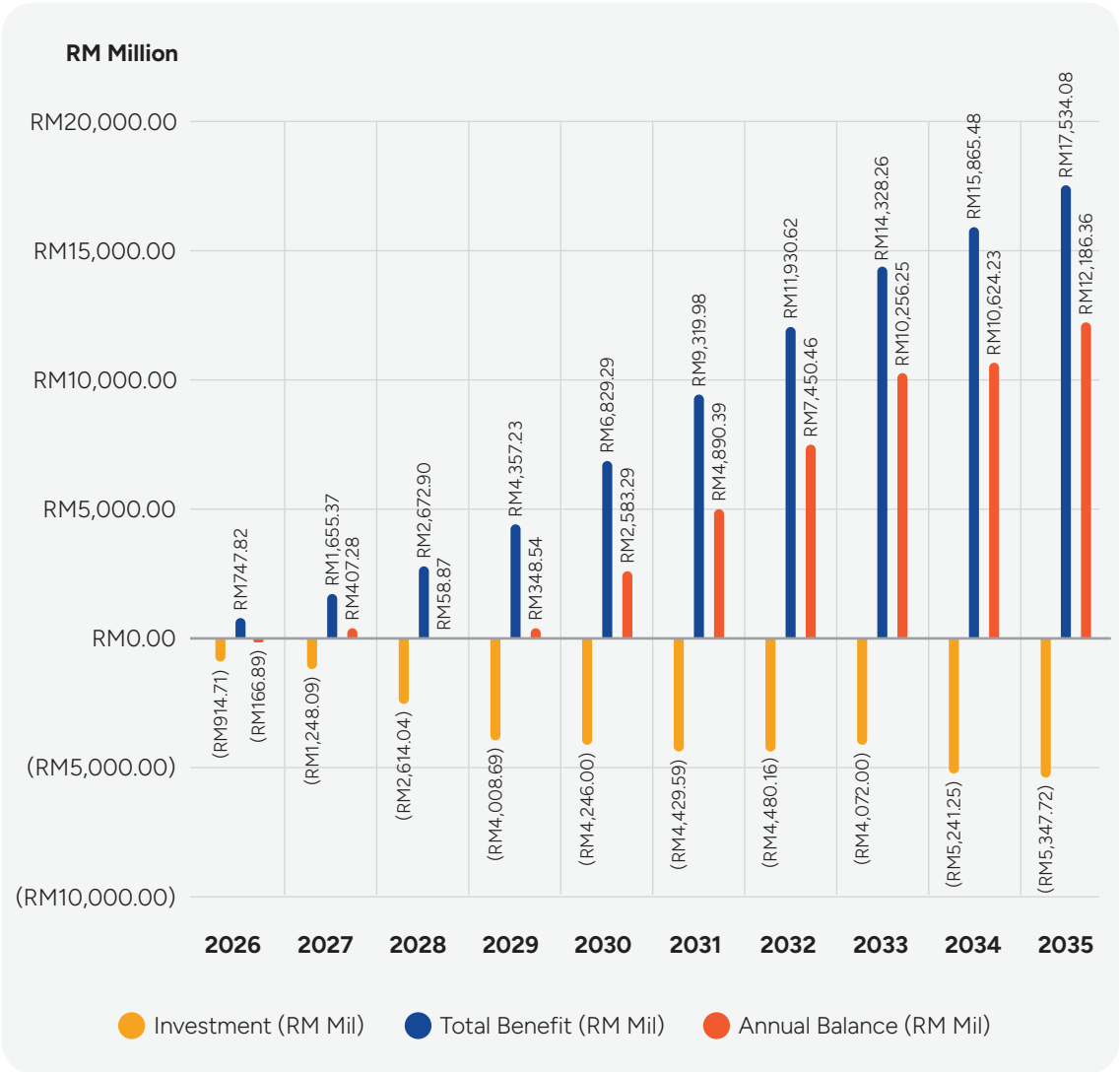
RM26,900.34 mil

Total Public Funding	Total Private Investment
RM560.12 mil	**RM36,042.12 mil**

Table 4.1: Financial Flow (2026–2035)

Financial Flow	Total Benefit (RM Mil)	Discounted Benefit Value (RM Mil)	Investment (RM Mil)	Discounted Investment Value (RM Mil)	Annual Balance (RM Mil)
2026	RM747.82	RM747.82	-RM914.71	-RM914.71	-RM166.89
2027	RM1,655.37	RM1,576.54	-RM1,248.09	-RM1,188.66	RM407.28
2028	RM2,672.90	RM2,424.40	-RM2,614.04	-RM2,371.01	RM58.87
2029	RM4,357.23	RM3,763.94	-RM4,008.69	-RM3,462.86	RM348.54
2030	RM6,829.29	RM5,618.47	-RM4,246.00	-RM3,493.19	RM2,583.29
2031	RM9,319.98	RM7,302.45	-RM4,429.59	-RM3,470.70	RM4,890.39
2032	RM11,930.62	RM8,902.81	-RM4,480.16	-RM3,343.16	RM7,450.46
2033	RM14,328.26	RM10,182.82	-RM4,072.00	-RM2,893.90	RM10,256.25
2034	RM15,865.48	RM10,738.38	-RM5,241.25	-RM3,547.48	RM10,624.23
2035	RM17,534.08	RM11,302.62	-RM5,347.72	-RM3,447.19	RM12,186.36
Total	RM85,241.01	RM62,560.25	-RM36,602.24	-RM28,132.85	RM48,638.77

Figure 4.2: Financial Flow (2026–2035)



The analysis of financial flows over the 10-year implementation plan is shown in Table 4.1 and Figure 4.2. The analysis reveals that with the exception of 2026, which shows a negative cash flow of RM166.89 million, the remaining 9 years will yield a positive balance of financial positions ranging from RM407.28 million in 2027 to RM12.186 billion in 2035. The net financial flow for NEEAP 2.0 will be RM48.639 billion over the 10-year implementation period.

Potential Investment
Value

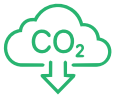
This analysis shows that several aspects of the implementation plan arising from the ESMs and other initiatives can be beneficial. Each aspect is presented below:

Balance of Payments

The estimated energy savings from all 3 sectors were elaborated in Chapter 3. In the commercial sector, only electricity consumption will be reduced. In contrast, in the domestic sector, electricity is the primary source of energy savings, but there is a slight reduction in LPG consumption. In the industrial sector, however, reductions are estimated for natural gas, diesel, fuel oil, coal and electricity use. Reductions in energy imports significantly improve the country's balance of payments but are not recorded as a direct benefit of EE&C measures.

Energy Reduction (Benefits from Private Investment)

The private sector invests in ESMs to save operating expenditures. After the successful implementation of NEEAP 1.0, there is hardly any hanging fruit to pluck for electricity consumption savings. Consumers from both the commercial and industrial sectors have to implement middle- to high-cost ESMs for meaningful savings, which may provide an attractive return on investment (ROI). The direct benefit of private investment is a reduction in energy consumption, resulting in lower production costs. For private companies, it is expected to contribute significantly to the reduction of production costs as well as to the improvement of production efficiency.



CO_2 Reduction

As of the writing of this document, the CO_2 emissions trading market in Malaysia has yet to be legislated. The environmental tax and the formation of a CO_2 emissions trading market, as implemented in many developed countries, give a market value to CO_2 emissions. This added value of CO_2 emissions is not included in this analysis, but it is anticipated as a future benefit.

Cost-Benefit Analysis

Figure 4.3 shows the impact of the ESMs and other initiatives and policy instruments on government finances in the BAU case. As described in the previous chapter and the corresponding figure below, the annual investment balance resulting from the implementation plans becomes positive after 2027 and increases yearly up to 2035; the total investment amount from 2026 to 2035 requires RM36.602 billion, and the benefits reach RM85.241 billion.

Figure 4.3: Impact of ESMs on Government Finances (2026–2035)

Benefit-Cost Ratio

The benefit-cost ratio (BCR) is an indicator used to assess the economic benefits of a project or investment. It is calculated by comparing a project's total benefits with its total costs.

The formula for calculating BCR is as follows:

BCR = Total benefit (RM) / Total investment (RM)

Where:

Total benefit	=	**Electricity Saving (RM) + Thermal Energy Saving (RM)**
Total Investment	=	**Total Public Funding (RM) + Private Investment (RM)**

BCR is computed as:

BCR	=	**RM85.241 billion / RM36.602 billion**
BCR	=	**2.33**

If the BCR is greater than 1.0, the project's total revenues exceed its total costs, which means that the project is likely to be economically viable. Since the overall NEEAP 2.0 will generate a BCR of 2.33, the benefits of the implementation plan far outweigh the investment by the government and the private sector, at 2.33 times the cost.

Net Present Value

The formula for calculating Net Present Value (NPV) is as follows:

NPV	=	**cash flow expected after t years ÷ (1 + discount rate) - initial investment**

The NPV is calculated based on a discount rate of 5% and is RM34.43 billion. The Internal Rate of Return (IRR) is generally evaluated for validity by comparing it with the discount rate. For example, if the discount rate is 5%, an IRR of above 5% is worth investing in.

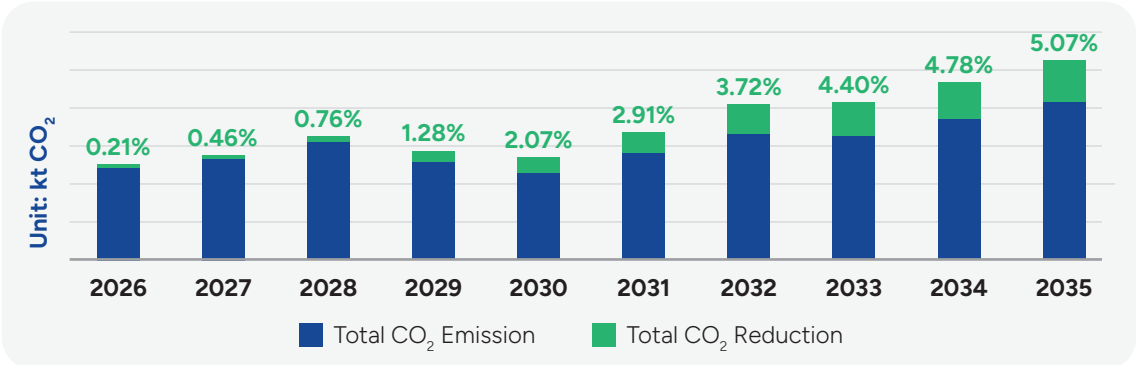
Analyses on
GHG Emission Avoidance

Total CO_2 emissions from the 3 analysed sectors are expected to rise by an average of 1.1% per year, from 97.34 Mt-CO_2 in 2026 to 105.7 Mt-CO_2 in 2035. In terms of individual years, reductions start at 0.21% in 2026 and increase yearly to 5.07% (5.36 Mt-CO_2) per year in 2035. From Table 4.2, reductions in electricity demand make the most significant contribution, accounting for 53% (13.92 Mt-CO_2), and reductions from fuels (thermal) make up 47% (12.19 Mt-CO_2) of the total cuts. Cumulative CO_2 emissions over the 10-year implementation period are 1,001.61 Mt-CO_2, with cumulative CO_2 emission reductions over the same period of 26.11 Mt-CO_2, an overall decrease of 2.6% as shown in Table 4.2 below.

Table 4.2: CO_2 Emission Reduction in Final Energy Demand (Total 3 Sectors) (2026–2035)

Unit: kt CO_2	Total Final Energy Demand CO_2 Emission	Thermal CO_2 Reduction	Electricity CO_2 Reduction	Total CO_2 Reduction	Percentage Reduction (%)
2026	97,340.72	58.27	144.39	202.66	0.21%
2027	98,359.87	136.59	315.59	452.18	0.46%
2028	100,453.08	268.69	497.56	766.25	0.76%
2029	97,996.18	507.18	749.55	1,256.73	1.28%
2030	96,431.37	891.04	1,109.20	2,000.23	2.07%
2031	99,002.41	1,385.85	1,498.39	2,884.24	2.91%
2032	101,667.87	1,855.58	1,855.58	3,782.88	3.72%
2033	101,193.82	2,185.22	2,266.81	4,452.03	4.40%
2034	103,444.09	2,412.56	2,534.10	4,946.66	4.78%
2035	105,720.17	2,487.88	2,876.40	5,364.28	5.07%
Total 10 Years	1,001,609.58	12,188.85	13,919.28	26,108.14	2.6%

Figure 4.4: CO_2 Emission Reduction in Final Energy Demand (Total 3 Sectors) (2026–2035)



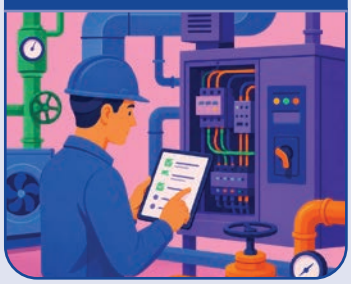
Analysis on
Potential Job Creation

As a result of the drive to optimise EE and achieve energy savings, the implementation of ESMs will require private-sector investments, which will also lead to the creation of new jobs. Some of this job creation is expected to include upskilled professional jobs, which will require capacity building. The estimation of job creation includes trainers and specialist personnel as listed below:

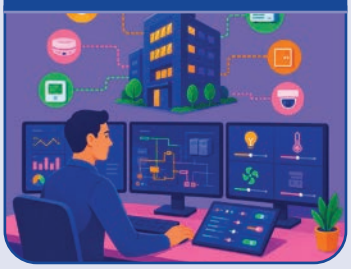
Designer/Consultant

Energy Manager

CxS



BAS/Control Specialist



Operational and Maintenance Personnel

SEC and EE Trainers

Energy Auditor Support Staff

Trainers

Operators

Total Job Creation

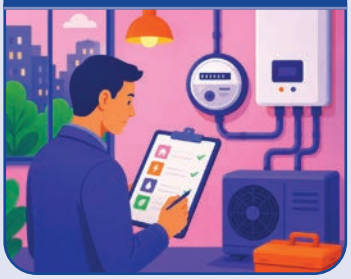
Primarily, both sectors seem to generate similar jobs, but to a large extent, the nature and scope of work are different, as the ESMs to be implemented are designed specifically for each sector. The total number of jobs created increases yearly and reaches its maximum of 29,110 by 2035, as shown in Table 4.3 below.

Table 4.3: Total Job Creation from Industrial and Commercial Sectors

Year	Sector		Total
	Industrial	Commercial	
2026	170	1,000	**1,170**
2027	160	1,045	**1,205**
2028	1,140	1,105	**2,245**
2029	2,770	1,150	**3,920**
2030	2,870	1,215	**4,085**
2031	2,260	1,290	**3,550**
2032	2,400	1,370	**3,770**
2033	1,780	1,445	**3,225**
2034	1,480	1,525	**3,005**
2035	1,340	1,595	**2,935**
Total	16,370	12,740	**29,110**

Skilled Installer/ Supervisor

Energy Auditor



Admins, Designers, Installers and Supervisors

Chapter 5

Conclusion

A Paradigm Shift in **Malaysia's Energy Landscape**

NEEAP 2.0 represents a definitive and transformative blueprint for Malaysia's sustainable development over the next decade. While its predecessor, NEEAP 1.0 (2016–2025), successfully established initial momentum and exceeded its primary electricity savings targets, it was historically constrained by the lack of thermal energy coverage and the absence of a comprehensive mandatory regulatory framework.

The formulation of NEEAP 2.0 marks a significant paradigm shift. Anchored by the landmark enforcement of the **EECA 2024** on 1 January 2025, PETRA now possesses the statutory authority to bridge historical policy-action gaps. By expanding governance to regulate both electrical and thermal energy consumption across the industrial, commercial and domestic sectors, Malaysia is moving past fragmented, voluntary approaches towards an integrated, legally binding ecosystem. This comprehensive strategy directly aligns with the NETR, the NIMP 2030 and the ultimate goal of achieving Net Zero Emissions by 2050.

Realising Strategic and Sectoral Targets

Through a rigorous bottom-up framework and the deployment of distinct strategic thrusts—policy execution, workforce upskilling, sustainable funding and private sector mobilisation—NEEAP 2.0 establishes concrete, data-driven milestones for the 2026–2035 period:

National Energy Demand Reduction:
An overall reduction target of

11.6%

against BAU projections by 2035.

Cumulative Energy Savings:
Achieving a total target of

815,382 TJ

over the 10-year implementation timeline.

Industrial Sector Target:

An

11.9%

reduction rate by 2035, driven by SEC benchmarks and targeted ESMs, spanning energy management systems, high-efficiency motors (IE3), digitalised production processes and thermal recovery.

Commercial Sector Target:

A

13.2%

reduction rate by 2035, underpinned by mandatory BEI labelling compliance, extensive energy audits and HVAC/ACMV efficiency improvements.

Domestic Sector Target:

An

8.7%

reduction rate by 2035, propelled by deep-dive expansions to MEPS, and the regulation of new domestic appliances.

Socio-Economic
Dividends and Capital Mobilisation

The socio-economic impact analysis demonstrates that energy efficiency serves as Malaysia's primary and most cost-effective 'first fuel'. Far from being merely an environmental mandate, NEEAP 2.0 stands out as a robust driver of national wealth, industrial competitiveness and high-skilled job creation.

The economic viability of the 10-year plan is proven by key financial metrics:

Investment Architecture

A total joint investment of

RM36.602
billion,

balancing a strategic RM560 million public funding framework with RM36.042 billion in private-sector capital investments.

Monetary Return and Viability

The total accrued benefit reaches

RM85.241
billion,

resulting in an impressive BCR of 2.33 and an NPV of RM34.43 billion (evaluated at a 5% discount rate).

Fiscal Resilience

By mitigating utility costs and directly reducing the consumption of subsidised natural gas, diesel and LPG, the plan relieves pressure on government finances and yields a net financial flow of

RM48.639
billion.

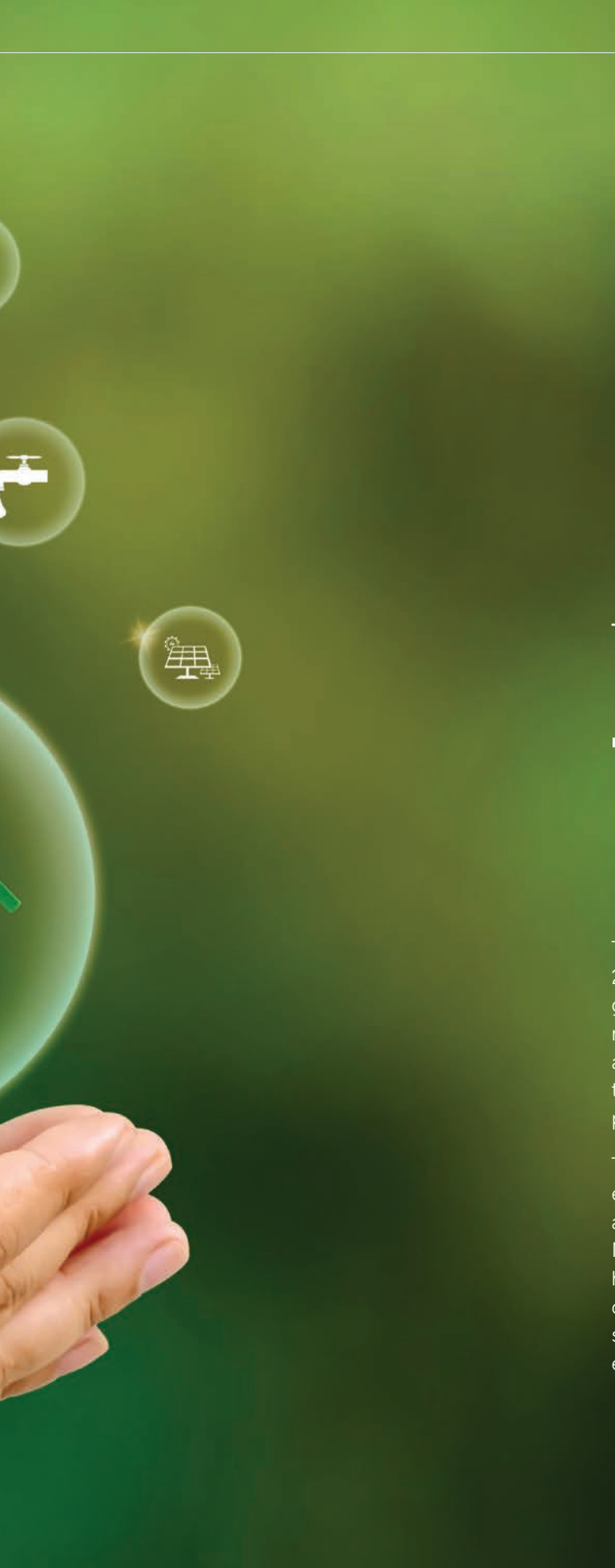
Green Job Creation

The execution of sector-specific energy-saving projects will stimulate manufacturing, engineering and digital tech ecosystems, scaling up to create more than

29,000
high-value jobs
by 2035.

Fulfilling Environmental Stewardship and Global Commitments

By aggressively addressing energy waste at its source, NEEAP 2.0 ensures that Malaysia steps up to its international responsibilities. The plan directly supports the global pledge made at COP28 to work towards doubling the global average annual rate of energy efficiency improvement by 2030, while positioning the nation to meet the regional ASEAN target of a 40% reduction in energy intensity. Over the 10-year period, the collective strategies outlined in this document will deliver a cumulative GHG emission avoidance of **26.11 Mt-CO_2eq**, representing a vital step forward in mitigating the structural impacts of climate change and protecting the livelihoods of future generations.



Energy Efficiency: **The Way Forward**

The successful implementation of NEEAP 2.0 requires alignment across all branches of governance. With cooperation from federal ministries, state governments, statutory bodies and local authorities (PBT), Malaysia can ensure that infrastructure, economic and environmental policies move in perfect harmony.

Through strict regulatory enforcement, data-driven energy governance, sustainable blended financing and active public awareness campaigns, or CEPA, Malaysia is not merely transitioning away from heavy carbon dependence. We are confidently constructing a resilient, highly competitive and sustainable low-carbon economy that perfectly encapsulates the vision of Malaysia MADANI.

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