SABAH ENERGY EFFICIENCY ACTION PLAN (SEEAP)

2026 - 2036

Towards a Sustainable Energy Future for Sabah

Sabah Energy Efficiency Action Plan (SEEAP) is a dynamic and living document and will be periodically reviewed every three years to reflect and incorporate latest data, progress and strategies, towards continuously ensuring optimal benefits to the State of Sabah

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Foreword

by the Chief Minister of Sabah

YAB Datuk Seri Panglima Haji Hajiji Haji Noor

As Sabah advances toward a future of greater prosperity, resilience, and sustainability, energy will remain a fundamental enabler of economic growth, industrial development, and social progress. Guided by the Sabah Energy Roadmap and Master Plan 2040 (SE-RAMP 2040), the State is committed to building an energy sector that is secure, affordable, sustainable, and capable of supporting the aspirations of future generations.

SE-RAMP 2040 sets the strategic direction for Sabah's energy transformation, charting a path toward a modern, resilient, and sustainable energy system. Achieving this vision requires a balanced approach by strengthening and expanding energy infrastructure while also promoting the efficient and responsible use of energy across all sectors of the economy.

In this regard, energy efficiency is one of the most effective and cost-efficient opportunities available. Often referred to as the 'first fuel', energy efficiency enables us to derive greater value from every unit of energy consumed. By reducing wastage and improving productivity, we can enhance energy security, manage future electricity demand more effectively, strengthen business competitiveness and support our broader environmental and sustainability goals.

The Sabah Energy Efficiency Action Plan (SEEAP) translates the aspirations of SE-RAMP 2040 into a practical and actionable roadmap for the coming decade. Through targeted initiatives, stronger governance, enhanced market participation and greater public awareness, SEEAP aims to unlock the full potential of energy efficiency as a strategic resource for Sabah's development.

The successful implementation of SEEAP will require the collective commitment of government agencies, industry players, businesses, educational institutions and the wider community. By working together, we can build a culture of energy efficiency, stimulate innovation and investment, create new economic opportunities and strengthen Sabah's position as a forward-looking and sustainable economy.

I commend the Energy Commission of Sabah (ECoS), its partners, and all stakeholders for their dedication and contributions in developing SEEAP. I am confident that this action plan will serve as an important pillar of Sabah's energy transition and contribute meaningfully to a more prosperous, sustainable, and energy-secure future for all Sabahans.

Foreword

by the Chairman of the Energy Commission of Sabah (ECoS)

Datuk Seri Panglima
Dr. Maximus Johnity Ongkili, JP

The Energy Commission of Sabah (ECoS) is entrusted with ensuring that Sabah's energy sector develops in a manner that is secure, sustainable and responsive to the needs of the State. As Sabah advances its energy transition agenda under the Sabah Energy Roadmap and Master Plan 2040 (SE-RAMP 2040), energy efficiency has emerged as a strategic priority that delivers enduring benefits to the economy, the environment and society.

The Sabah Energy Efficiency Action Plan (SEEAP) represents an important milestone in this journey. As a key implementation pathway under SE-RAMP 2040, SEEAP provides a structured roadmap to advance energy efficiency across the residential, commercial and industrial sectors. Supported by Sabah's evolving regulatory framework, including the Electricity Supply Enactment 2024 and the Efficient Management of Electrical Energy Regulations 2024, the Action Plan identifies practical measures to unlock meaningful and sustainable energy savings throughout the State.

Energy efficiency is more than reducing energy consumption. It strengthens energy security, enhances economic productivity, improves industrial competitiveness and supports responsible

environmental stewardship. The findings of this study demonstrate Sabah's significant potential to improve energy performance while creating value for businesses, consumers and the wider economy.

The successful implementation of energy efficiency initiatives requires effective governance, reliable data, strong institutions, supportive market mechanisms and sustained collaboration among stakeholders.

Accordingly, SEEAP outlines not only sector-specific measures but also the policy and institutional foundations necessary to establish a robust and enduring energy efficiency ecosystem for Sabah.

The development of SEEAP has benefited greatly from the contributions of government agencies, industry representatives, professional bodies, development partners and other stakeholders. On behalf of ECoS, I extend my sincere appreciation to all who have contributed to this important undertaking.

Through SEEAP, ECoS seeks to establish a strong foundation for continuous improvement in energy performance across Sabah. By aligning regulatory measures, market participation and stakeholder collaboration with the strategic direction of SE-RAMP 2040, we can realise the full value of energy efficiency as a driver of economic resilience, environmental sustainability and long-term energy security.

I am confident that, through our collective commitment and shared purpose, SEEAP will translate from strategy into action and deliver tangible benefits for the people of Sabah.

Foreword

by the Chief Executive Officer of the Energy Commission of Sabah (ECoS)

Datuk Ir. Abdul Nasser bin Abdul Wahid

The development of the Sabah Energy Efficiency Action Plan (SEEAP) reflects the Energy Commission of Sabah's (ECoS) commitment to advancing responsible energy use and supporting the State's long-term energy transition agenda.

As one of the key implementation instruments under the Sabah Energy Roadmap and Master Plan 2040 (SE-RAMP 2040), SEEAP translates strategic aspirations into practical actions that can be under-taken by government agencies, businesses, industries and consumers. It provides a clear roadmap to improve energy performance, optimise resource utilisation and foster a culture of energy efficiency across Sabah.

Energy efficiency represents one of the most cost-effective and impactful opportunities available to Sabah today. As electricity demand continues to grow alongside economic development, improving energy performance across buildings, industries and households can help manage future demand, reduce operational costs and strengthen the resilience of our energy system. At the same time, energy efficiency delivers tangible benefits to consumers and businesses through lower energy expenditure, enhanced productivity and improved competitiveness.

SEEAP has been developed through extensive technical assessments, benchmarking studies and stake-holder engagements involving representatives from government, industry, utilities, professional bodies and the wider energy efficiency community. The recommendations contained within this action plan are grounded in Sabah's unique circumstances and are designed to be practical, scalable, and achievable.

The action plan outlines a phased implementation approach from 2026 to 2036, focusing on strengthening governance, data systems and institutional capacity while progressively expanding energy efficiency initiatives across the residential, commercial and industrial sectors. Its successful implementation will depend on strong partnerships, sustained commitment and a shared determination to translate plans into measurable outcomes.

Beyond energy savings, SEEAP contributes to broader development objectives by supporting investment, strengthening local capabilities, encouraging innovation and creating new opportunities within Sabah's growing energy services sector. These outcomes will not only enhance energy performance but also contribute to the State's economic resilience and long-term prosperity.

I would like to express my sincere appreciation to all stakeholders who contributed their expertise, insights and valuable perspectives throughout the preparation of this action plan. Your collaboration and commitment have been instrumental in shaping a roadmap that is both ambitious and practical.

As we move into the implementation phase, ECoS remains committed to working closely with all partners to ensure that SEEAP delivers meaningful and lasting benefits for Sabah. Together, we can build a more energy-efficient, sustainable and resilient future that supports the aspirations of SE-RAMP 2040 and creates lasting value for all Sabahans.


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Executive Summary

Sabah Energy Efficiency Action Plan (SEEAP) has been developed to support the implementation of the Sabah Energy Roadmap and Master Plan 2040 (SE-RAMP 2040) by identifying practical, cost-effective, and scalable energy efficiency (EE) measures across the residential, commercial and industrial focus sectors. This study was done in the context of rapidly increasing electricity demand in Sabah, driven by economic growth and industrialisation. In the context of a growing electricity demand, energy efficiency represents a strategic resource capable of reducing system costs, improving energy security, supporting industrial competitiveness, and contributing to Sabah's decarbonisation objectives.

Sabah already benefits from several enabling foundations, including the Electricity Supply Enactment 2024, the Efficient Management of Electrical Energy Regulations 2024 (EMEER 2024), Minimum Energy Performance Standards (MEPS), and the related programs at federal level. But to fully capture the potential and unlock further benefits, the SEEAP has been developed to identify the realistic energy savings potential and the policy packages that will enable tapping into this potential.

The results demonstrate significant energy efficiency potential across all three sectors with total energy savings by 2036 estimated at around 8.5% compared to a business-as-usual scenario.

The implementation roadmap spans from 2026 to 2036 and prioritises early deployment of foundational measures with high implementation readiness and strong economic returns, particularly in the commercial and industrial sectors.


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1. Introduction

The energy sector is integral to Sabah's economic prosperity, creating skilled jobs, underpinning commercial and industrial growth, and improving the quality of life. The Sabah Energy Roadmap and Master Plan 2040 (SE-RAMP 2040) guide the state's transition towards sustainable energy development, with the Sabah Energy Efficiency Action Plan (SEEAP) as a key strategy to enhance energy sector contribution towards environmental sustainability.

This document presents SEEAP guiding principles and direction, including energy saving aspirations for three end-use sectors: commercial buildings, industry and residential.

2. SEEAP Guiding Principles

SEEAP guiding principles draw on two references: the strategic thrusts of SE-RAMP 2040, and stakeholders' articulation of the value of energy efficiency for Sabah.

1. Secure and sustainable development

Energy efficiency must support Sabah's economic growth and social development while safeguarding long-term energy security and environmental sustainability.

2. Productive and efficient use of energy

SEEAP aims to raise economic output and service quality per unit of energy consumed by encouraging adoption of efficient technologies, practices and management systems. It demonstrates that energy efficiency is a structural productivity lever for Sabah's commercial and industrial sectors.

3. Fair and inclusive transition

SEEAP seeks a fair, inclusive and cost-effective transition where the benefits of energy efficiency reach households, SMEs, and large consumers alike. Stakeholders emphasised the importance of addressing affordability, awareness and access barriers for smaller players, beyond early movers in the commercial and industrial segment.

4. Institutional strength and coordination

Clearly defined responsibilities and robust enforcement are key enablers of successful energy efficiency efforts. Stakeholders in Sabah highlighted opportunities to strengthen enforcement, improve data, and enhance coordination.

5. Market-based and innovation-friendly approach

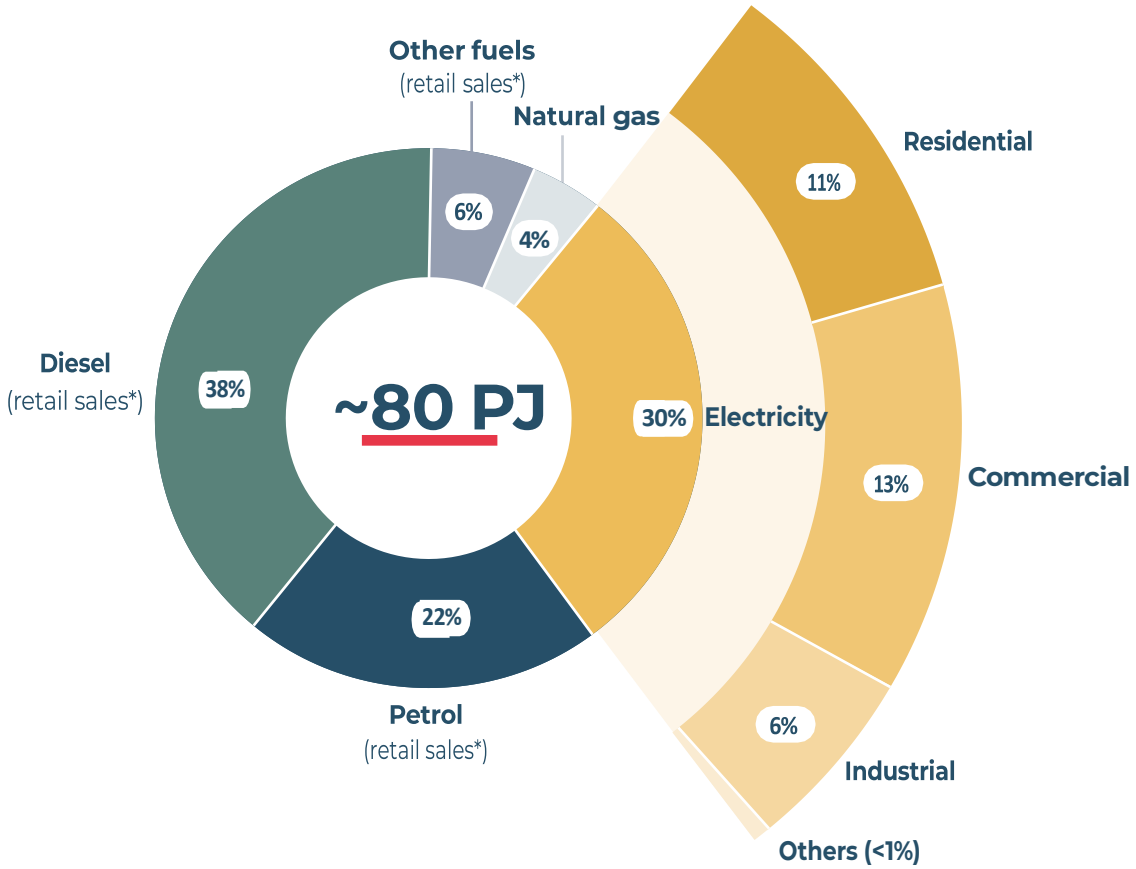
International experience shows that a mix of regulation, pricing signals and market mechanisms is needed to unlock sustained energy efficiency investment and innovation. For Sabah, stakeholders also highlighted the need for tailored financing and new business models to overcome upfront cost barriers and support the development of a local energy efficiency ecosystem.

3. Sabah's Energy Context

Effectively improving energy efficiency in Sabah requires a preliminary analysis of the state's current energy consumption.

Sabah's current energy consumption is dominated by retail fuel sales (66%) and electricity (30%)

Figure 1 – Final energy consumption in Sabah by fuel type

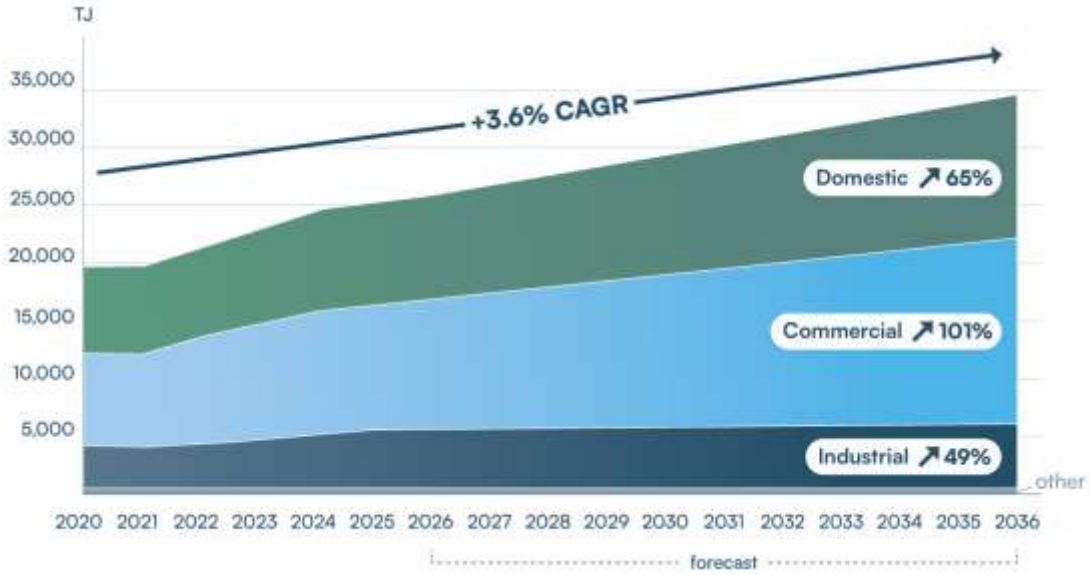


**2021 retail fuel sales data from National Energy Balance 2022.*

Note: Excludes non-energy natural gas use. Electricity consumption includes F.T. Labuan's electricity network which is integrated with the Sabah grid, and accounts for approximately 6% of electricity demand on the Sabah grid. Natural gas consumption excludes F.T. Labuan since the territory is not governed by Sabah energy regulations.

Sabah's electricity consumption is forecasted to increase by 76% from 2020 to 2036, driven by growth in commercial sector consumption

Figure 2 – Historical (2020-2024) and forecasted (2026-2036) electricity consumption by sector for Sabah and F.T. Labuan



Note: Includes F.T. Labuan electricity consumption. 'Other' includes public lighting

Based on Sabah Grid Demand Forecast Committee (SGDFC) No. 1/2026 electricity demand forecast, electricity consumption in Sabah and F.T. Labuan (that is connected to the same grid) is expected to increase by 34% in the next decade, exceeding 33 PJ per annum by 2036 (+3.6% CAGR between 2020 and 2036).

Sabah's commercial sector is driving growth in electricity demand and will account for over half of total electricity consumption by 2036.

76% total electricity consumption increase

forecasted between 2020 and 2036

Current Energy Efficiency Initiatives in Sabah

Sabah's energy efficiency framework, led or facilitated by ECoS, integrates state-level actions with national policies to drive sustainable energy practices. These initiatives form the regulatory and strategic foundation for SEEAP, combining foundational and mandatory compliance measures with supportive programmes that encourage broad stakeholder participation.

Foundational Initiatives

1. **Sabah Energy Roadmap & Master Plan 2040 (SE-RAMP 2040)** – Outlines a long-term strategic vision for Sabah's energy sector, setting ambitious targets for energy efficiency improvements aligned with SEEAP objectives.

2. **Electricity Supply Enactment 2024** – Establishes the legal authority for ECoS to enforce regulations that promote efficient electricity usage across Sabah, ensuring compliance through monitoring and penalties.

3. **Efficient Management of Electrical Energy Regulations (EMEER 2024)** – Obligates large energy-consuming facilities (over 3 million kWh for 6 consecutive months) to designate Registered Energy Managers responsible for implementing energy-saving measures and submitting regular energy consumption reports to ECoS.

4. **Minimum Energy Performance Standards (MEPS) & Star Rating Labels** – Prohibits the sale and import of appliances that do not meet minimum efficiency criteria, while mandating clear labelling to help consumers identify energy-efficient products.

5. **Malaysia Standards 1525 (MS 1525) Codes of Practice** – Provides technical guidelines and best practices for designing buildings and appliances that optimise energy efficiency, supporting sustainable development goals.

Supporting Initiatives

1. **LED Streetlight Upgrades** – Encourages municipalities to replace conventional street lighting with energy-saving LED technology, reducing public energy consumption and maintenance costs.

2. **Public Awareness Campaigns** – Conducts educational workshops and distributes guidelines aimed at increasing awareness of energy-saving practices among businesses, institutions, and the public.

3. **Energy Audit Conditional Grant (EACG)** – Provides financial support to organisations undertaking energy audits and implementing verified energy efficiency projects, lowering the barrier to investment.

4. **NUR@PETRA, NUR: MSME, NUR: CHILLER Rebates** – Offers rebates and incentives for adopting efficient cooling technologies and appliances, helping reduce energy consumption in commercial and industrial sectors.

5. **Voluntary Low Carbon Building Assessment** – Facilitates centralised submission of building energy data for Green Building Index certification and BEI benchmarking, encouraging voluntary participation in sustainability initiatives.

6. **Government Green Procurement (GGP) & MyHIJAU Certification** – Promotes the purchase of certified energy-efficient products by federal agencies, setting an example and stimulating market demand.

4. SEEAP Target

SEEAP target for energy savings uses realistic uptake assumptions for a list of identified energy efficiency measures.

SEEAP can deliver 8.5% energy savings by 2036

Figure 3 — Energy consumption evolution in a 10-year period until 2036 under BAU and SEEAP scenarios (TJ)

Uptake assumptions

Behavioural measures

60%

Behavioural measures tend to be low to no cost and will see high uptake.

Thermal and electrical measures

30%

Measures directly targeting thermal and electrical efficiency tend to see slower uptake, due to cost and implementation complexity e.g., chillers retrofits, boiler optimisations, etc.

Prioritising Energy Efficiency Measures Merit Order

The merit order of energy efficiency measures is a ranking framework that compares interventions based on two key criteria:

1. **Cost of saved energy (RM/MWh)** – the economic efficiency of each measure, calculated as the cost per unit of electricity avoided.

2. **Technical savings potential (MWh or TWh/year)** – the total amount of electricity that could be saved if the measure were widely implemented.

By plotting the cost of saved energy (RM/MWh) against technical savings potential (MWh/TWh per year), it is found that measures delivering the largest savings at the lowest cost rank highest. Low-cost, high-impact interventions such as HVAC temperature adjustments emerge as priority actions, while capital intensive retrofits fall lower in the merit order. This framework offers policymakers, businesses, and households a clear, data driven roadmap to prioritise energy efficiency measures across all sectors.

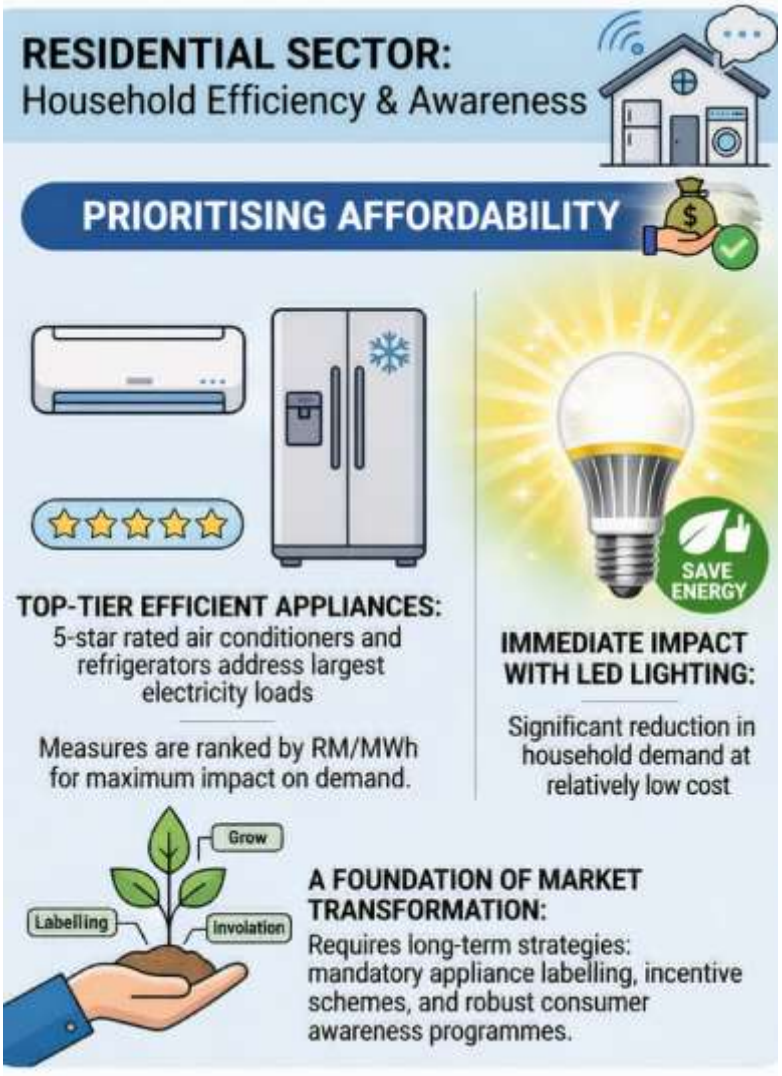
In short, the merit order provides a practical roadmap: begin with “quick wins” that deliver low cost, high return savings, then advance toward deeper structural changes that unlock the full technical potential of energy efficiency in residential, commercial, and industrial applications.

Residential Energy Efficiency Measure

Sabah's residential merit order highlights quick win measures that deliver high savings at low cost.

Top priorities: 5 Star Air-Conditioners, 5 Star Refrigerators, and LED Lighting.

These interventions cut household electricity demand immediately and affordably. Sustained progress depends on appliance labelling, incentives, and consumer awareness to drive long term market transformation.

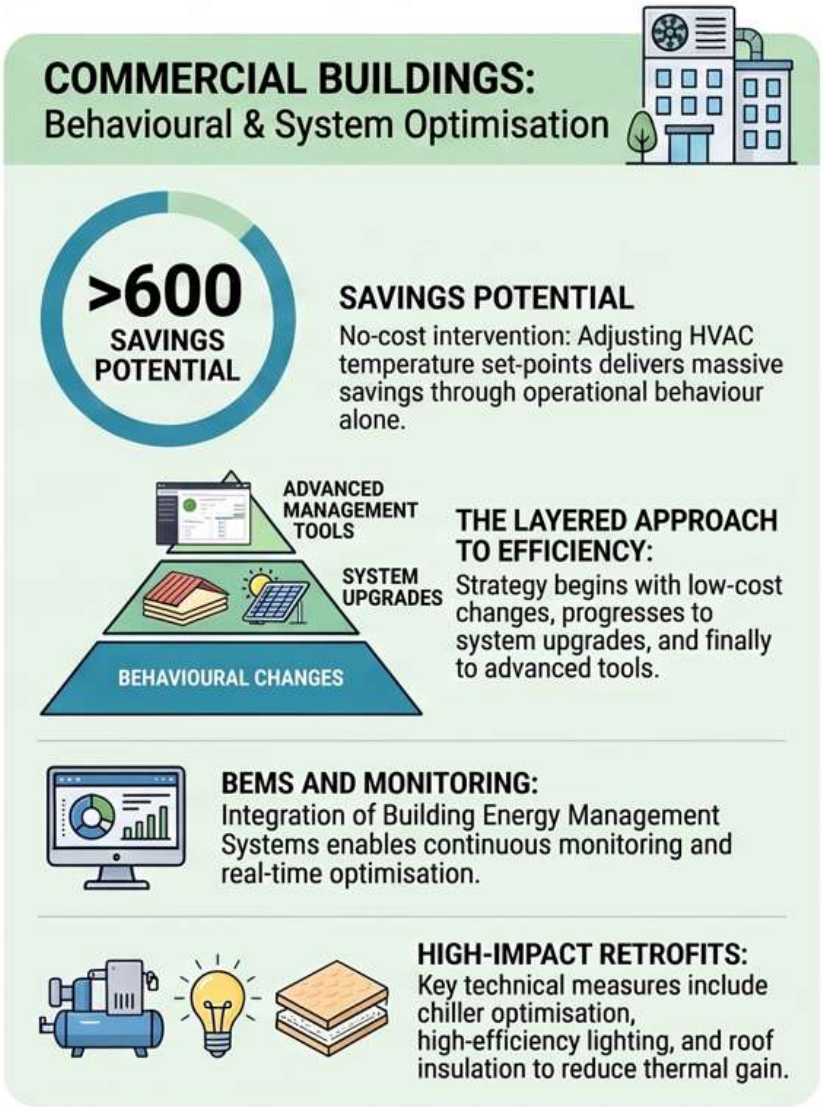


Commercial Buildings Energy Efficiency Measure

The commercial merit order shows that HVAC temperature setpoint adjustment offers the largest savings with minimal cost over 600 TWh/year potential.

Next steps: roof insulation, efficient lighting, chiller optimisation, and Building Energy Management Systems (BEMS) for continuous monitoring.

Start with low-cost behavioural changes, then advance to system upgrades for lasting efficiency

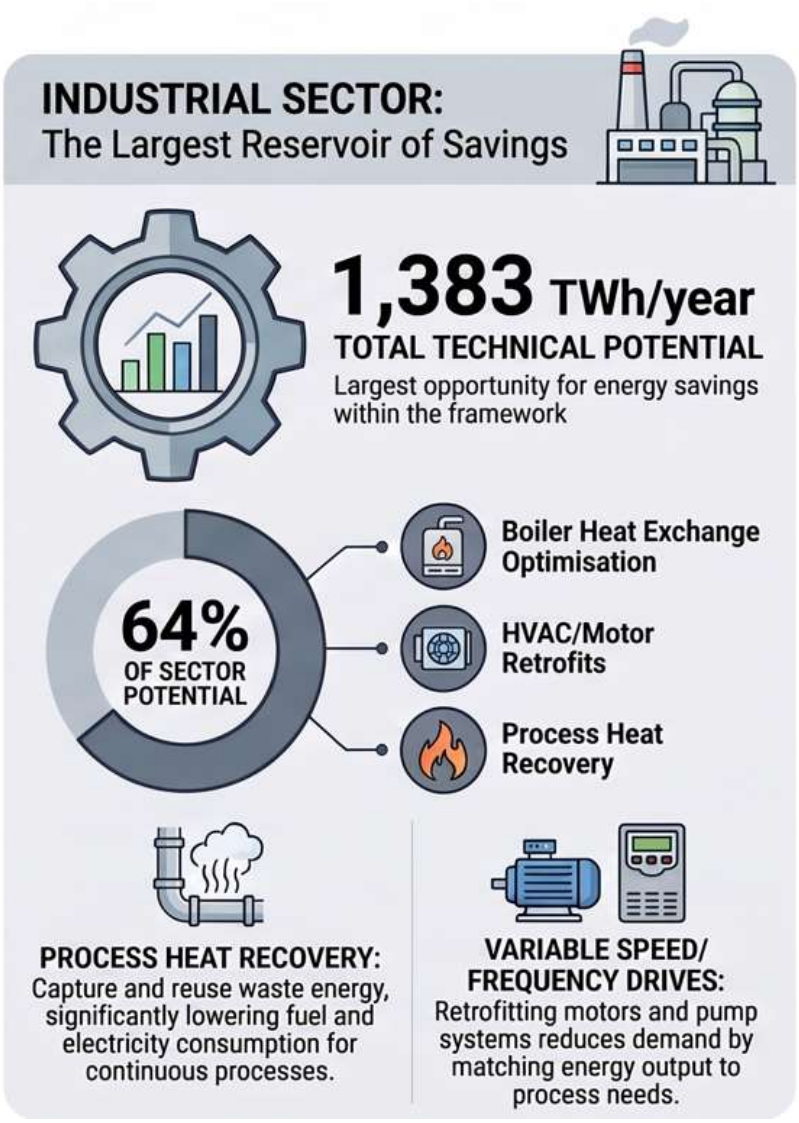


Industrial Energy Efficiency Measure

Industrial measures provide the highest overall savings potential about 1,383 TWh/year.

Key actions: boiler optimisation, motor retrofits, and process heat recovery, delivering high-volume savings at competitive cost.

These upgrades combine cost effectiveness with technical feasibility, positioning industrial efficiency as a cornerstone of Sabah's sustainable energy transition.



5. SEEAP benefits

5.1 Economic benefits

The Cost-Benefit Analysis (CBA) evaluates the net system-level impact of energy efficiency investments across Sabah. By focusing specifically on the power system, encompassing generation, transmission, and distribution – the analysis excludes direct impacts on individual consumers. Furthermore, this assessment does not account for broader macro-economic benefits, such as enhanced asset values, economic growth, energy security, or public health improvements.

Energy efficiency costs and benefits at system-level

Benefits

- Energy-related costs avoided by the utility
- Capacity-related costs avoided by the utility, including generation, transmission, and distribution
- Environmental values (e.g., emissions reduction)
- For thermal measures specifically: Natural gas savings

Costs

RM Total equipment and installation costs

By 2036, energy efficiency measures could realise RM502 million in discounted benefits[1] from avoided power generation and storage, with HVAC improvements serving as a major contributor. Simultaneously, thermal efficiency upgrades are set to save RM15 million through decreased natural gas demand.

1. Benefits and costs in the CBA calculations are discounted, with a 3.56% discount rate based on the average Malaysia Base Rate from Jan 2015 to Jan 2021.

Cost-benefit ratios of ~4.8

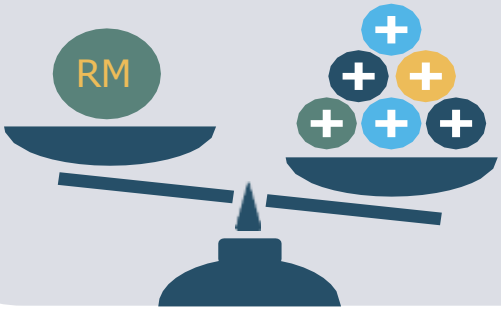
for industrial sector[2]

and ~2.84

for commercial sector[2]

These results demonstrate the strong economic value of energy efficiency for Sabah's commercial and industrial sectors.

2. The cost-benefit ratio is estimated excluding emissions prices.



5.2 Social Benefits

Energy efficiency can create material social benefits for Sabah by turning energy savings into a local services market. Unlike large generation projects, which tend to be capital intensive and concentrated around a smaller number of specialised contractors, many energy efficiency measures require distributed, labour-intensive work across buildings, facilities, households and industrial sites.

Energy efficiency investment creates jobs through three channels:

Direct jobs

in audits, installation, controls, engineering, project management and verification.

Indirect jobs

through local equipment suppliers, distributors, training providers, testing bodies and professional services.

Induced jobs

when bill savings from energy efficiency are redirected to household and business spending.

1,300

to 5,000 jobs

supported over the SEEAP period

SEEAP would require a **total gross investment of around RM1.3 billion in equipment and implementation costs** by 2036, which could support between **1,300 and 5,000 jobs** over the SEEAP period using a conservative estimate of 1 to 3.8 jobs per RM1 million invested (IEA, IEA jobs 2025 and IEA energy efficiency 2020). This is equivalent to an average of around **130 to 500 jobs per year between 2026 and 2036.**

5.3 GHG Benefits

Energy efficiency can also contribute to Sabah's and Malaysia's decarbonisation goals via reduced electricity and natural gas use.

The SEEAP target is estimated to yield 1.9 MtCO2e in cumulative emission savings. This represents a significant contribution to Malaysia's climate goals, accounting for **13% of the 15 MtCO2e reduction floor** set in the nation's third NDC target for 2035[3].

3. Using Sabah's electricity grid emission factor and projections

~1.9 $MtCO_2e$

Estimated cumulative carbon emission savings

6. SEEAP Timeline

6.1 Strategic Priorities and Policy Pathways

The roadmap follows the SE-RAMP 2040 design of medium-term implementation from 2026 to 2030 and long-term continuation from 2031 onward, while keeping SEEAP to a 10-year horizon from 2026 to 2036. Actions that have high priority but long development times, such as the building energy code, begin early but reach mandatory implementation later.

Phase 1: Building foundations and early delivery

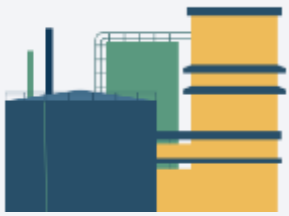
2026 | 2027 | 2028 | 2029 | 2030

- Operationalise and strengthen EMEER 2024 as Sabah's energy management framework
- Establish a scheduled review and tightening cycle for regulatory foundations
- Build Sabah's energy efficiency capability and service-provider ecosystem
- Gazette energy efficiency requirements into the Sabah
- Activate retailers, schools and consumer channels with bill-saving messages
- Tighten MEPS requirements for priority appliances and lighting schemes
- Potential future rebates and support

Residential policy package

- Launch public-sector building benchmarking, procurement and retrofit programme
- Develop commercial buildings energy efficiency guidelines
- Reform grant into an audit-to-implementation pathway

Industrial policy package



- Publish technical guidance, benchmarks, and M&V templates,
- Establish thermal pathways, audits and rules

Policy recommendations combine four inputs

1. The review of Sabah's existing energy efficiency initiatives.
2. Stakeholders' views gathered through engagement, which highlighted the need for stronger enforcement, better financing support, improved capability, clearer information on the value of energy efficiency, and more practical support for implementation.
3. International best-practices.
4. SEEAP target and energy efficiency measures uptake assumptions.

Phase 2: scaling implementation and tightening

2031 2032 2033 2034 2035 2036

Uniform Building By-Laws

Pillar package: Governance and data foundations

Publish reduction guidance and integrate energy efficiency into public and affordable housing

Pilot targeted residential envelope retrofits

Create commercial retrofit financing, EESCO delivery mechanisms and tariff-linked incentives for verified savings

Commercial policy package

supported by risk-sharing and financing options

Screen co-generation and deeper thermal opportunities in heat-intensive industries

Launch industrial electrical systems retrofit programme and integrate eligible measures into energy audit incentives and financing pathways

6.2 Policy packages

Figure 4 — High-level overview of the policy packages and the targeted measures

Pillar package: Governance and Data Foundations

- Operationalise and strengthen EMEER 2024 as Sabah's energy management framework
- Build Sabah's energy efficiency capability and service-provider ecosystem
- Establish a scheduled review and tightening cycle for EMEER 2024 and MEPS requirements and building energy rules
- Develop a Sabah building energy efficiency code for new large non-residential buildings and major refurbishments
- Establish Sabah's energy data collection channels, including utility data, regular surveys, appliance sales data, audit data and programme records

Sector packages are made possible only by setting strong governance and data foundations

Residential package

Helps households save energy where they use it most, through efficient appliances, better cooling and improved home comfort.

5.4% Potential sector energy savings vs. BAU

Commercial package

Unlocks the largest sectoral opportunity by systematically retrofitting commercial buildings for lower cooling, lighting and HVAC energy use.

12.3% Potential sector energy savings vs. BAU

Industrial package

Tackles industry's efficiency wins by cutting both heat and power intensity, with a strong economic case

6.2% Potential sector energy savings vs. BAU

The previous figure shows the high-level overview of the three sectoral policy packages that include the targeted measures as well as the potential savings that can be unlocked. These three packages are supported by a pillar package to set up governance and data foundations. These policy recommendation packages are detailed in the following section.

Pillar Package: Governance and Data Foundations

Measure coverage

Non-direct: supports all residential, commercial and industrial measure groups through governance, data access, reporting, capacity building, and review cycles.

Description

- Establishes SEEAP's institutional and evidence base
- Operationalises EMEER 2024 and strengthens large-user compliance
- Builds professional and service-provider capability
- Sets scheduled review cycles for EMEER 2024, MEPS and building energy rules
- Develops Sabah building energy code

Intended outcomes

- Clear compliance baseline for large users
- Stronger enforcement credibility
- Predictable implementation pathway for users, providers and financiers
- Better data to monitor savings and guide future tightening

Residential Appliance Efficiency and Cooling-Load Reduction Package

Measure coverage

- Residential efficient appliances and lighting
- Residential building envelope improvements
- Residential water heating upgrades

Description

- Shifts household purchases towards efficient cooling, refrigeration and lighting
- Combines MEPS tightening, appliance rebates, point-of-sale financing, retailer engagement and school campaigns
- Supports replacement and recycling of old inefficient appliances
- Provides residential cooling-load guidance
- Integrates envelope efficiency into selected public and affordable housing
- Pilots targeted envelope retrofits

Intended outcomes

- Higher penetration of efficient air-conditioners, refrigerators and LED lighting
- Reduced exposure to uncertified and inefficient products
- Lower growth in household cooling demand
- Improved household comfort
- Stronger contractor capability for residential envelope

Commercial Building Performance and Retrofit Package

Measure coverage

- Commercial operational and control optimisation
- Commercial building fabric and lighting retrofits
- Commercial HVAC retrofit package
- Commercial hot water efficiency

Description

- Converts benchmarking, audits, procurement, financing and EESCO delivery into practical retrofit guidelines
- Covers public sector leadership and building-type retrofit guidelines
- Reforms incentives into an audit-to-implementation pathway
- Supports commercial retrofit financing and EESCO mechanisms
- Uses tariff-linked incentives for verified savings where appropriate

Intended outcomes

- Repeatable commercial retrofit pipeline
- Early public sector case studies
- Stronger building owner confidence
- More mature EESCO delivery channels
- Verified reductions in cooling, lighting and HVAC electricity use

Industrial Electrical and Thermal Efficiency Package

Measure coverage

- Industrial operational optimisation and controls
- Industrial thermal and steam efficiency
- Industrial HVAC and utility system retrofits
- Industrial motor-driven systems and compressed air
- Industrial lighting and sector specific process optimisation

Description

- Combines industrial thermal and electrical workstreams into one package
- Covers thermal energy management, audits and implementation support
- Provides thermal guidance, benchmarks, M&V templates, financing and risk-sharing options
- Screens co-generation and deeper thermal opportunities
- Launches industrial electrical retrofit programmes
- Integrates eligible measures into energy audit incentive and financing pathways
- Supports SCADA, EMS, controls and sector specific optimisation packages

Intended outcomes

- Lower industrial fuel and electricity intensity
- Stronger industrial energy management
- Pipeline of thermal and electrical projects
- Wider uptake of efficient boilers, steam systems, HVAC, chillers, motors, VSDs, compressed air systems, SCADA and EMS
- Stronger leadership engagement on industrial energy efficiency

Appendix

Stakeholders engaged in discussion during breakout sessions

1. Stakeholder engagement

1.1. Workshops

ECoS convened two stakeholder engagement work-shops. The first workshop was a knowledge-building session to raise awareness and gather stakeholder views on energy efficiency priorities in Sabah. The second workshop presented first insights and measures identified and gathered the expectations of the

stakeholders around what ECoS and the regulators could put in place to help each industry implement the measures.

The workshops brought together close to 50 local stakeholders from State and Federal government agencies, as well as relevant residential, industrial, and commercial sectors, to share insights, feedback, and sector-specific perspectives to ensure the SEEAP reflects on-the-ground realities and opportunities.

Examples of participants included:

- Sabah State Ministry of Works and Utilities
- Sabah State Ministry of Local Government and Housing
- Sabah Electricity
- SIRIM Berhad
- Malaysia Debt Ventures
- Malaysia Green Building Council
- Registered ECoS Energy Service Company
- Sabah Energy Managers Association

ECoS, the consultant, and Sabah energy stakeholders during the first SEEAP workshop

In the first workshop's opening statement, Ir. Magdalene Chu Wai Quan, ECoS Deputy CEO (Planning and Economic Regulations), emphasised the importance of energy efficiency in strengthening Sabah's competitiveness and positioning its industries to meet evolving sustainability requirements and market expectations. Ir. Magdalene Chu Wai Quan further stressed that SEEAP is not about regulatory compliance alone, but about long-term transformation to reduce consumption while enhancing productivity and economic value.

Presentation topics included an introduction to energy efficiency, the relevance of energy efficiency to Sabah, Sabah's current state of energy efficiency, examples of energy efficiency implementation in Sabah, and the structural and technical barriers to energy efficiency uptake in the state.

Stakeholders were then invited to discuss four main themes in structured breakout sessions: value and opportunities of energy efficiency in Sabah, drivers that enable energy efficiency uptake in Sabah, barriers hindering energy efficiency uptake in Sabah, and expectations for SEEAP to accelerate energy efficiency implementation.

SEDA presentation during SEEAP second workshop

In the second workshop, SEDA presented energy efficiency opportunities, the MS 1525 code, and the technical measures available for buildings and industry, illustrated with real, successful case studies. The workshop set out the main

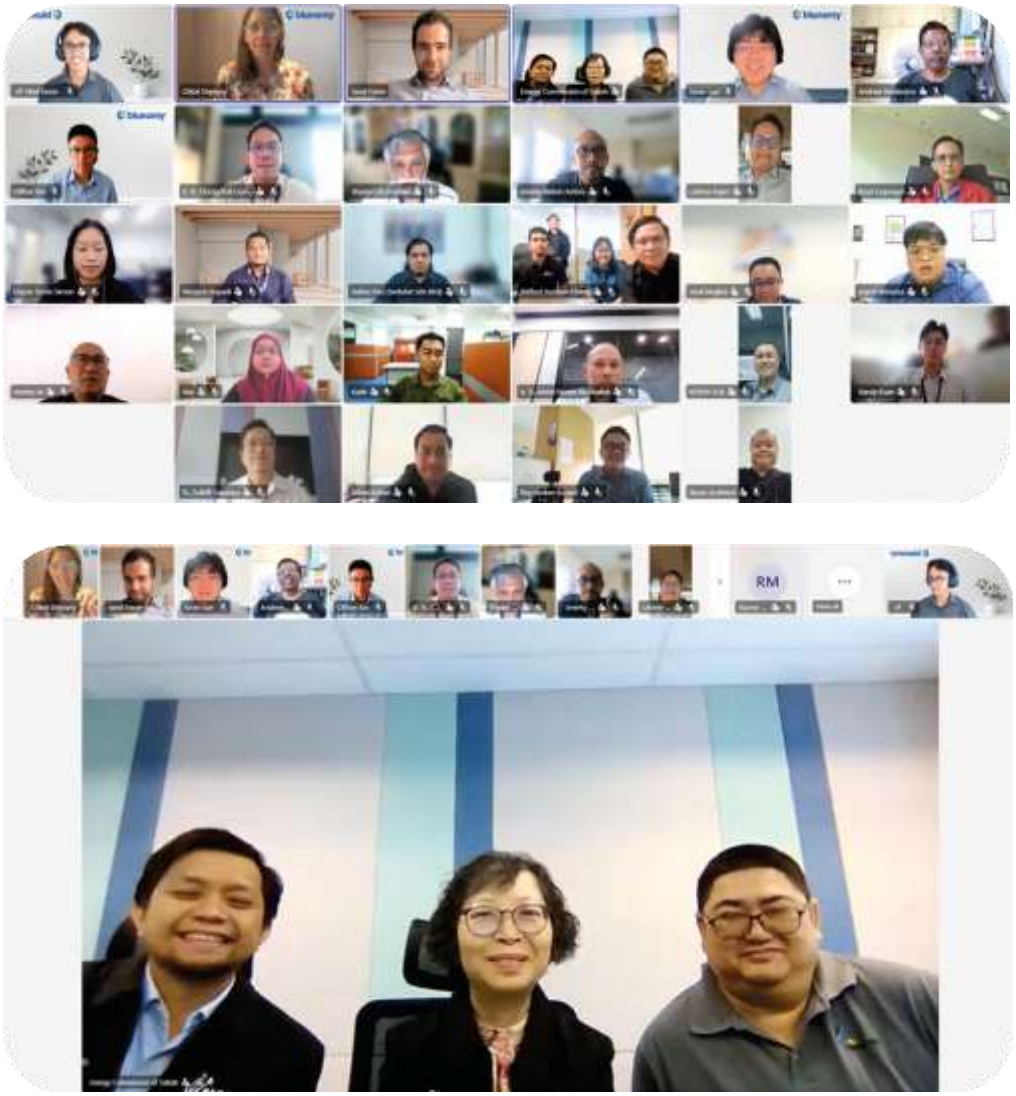
directions of the SEEAP to stakeholders, who then discussed the challenges, the risks, and the key initiatives that would mitigate implementation risks and maximise the uptake of energy efficiency measures. These discussions and their conclusions helped fine tune the SEEAP directions and the policy packages designed to address the identified challenges.

The two workshops highlighted that stakeholders expect SEEAP to strengthen regulatory frameworks and enforcement, stimulate market and financing mechanisms, and build local institutional and eco-system capacity. Some specific suggestions included:

- Improvements to stakeholder outreach and communication through technical publications and local centres of excellence.
- Information campaigns highlighting the financial benefits of energy efficiency.
- Efforts to onboard senior leadership through sectoral, business-linked certifications and codes (e.g., MSPO, MS, etc.).
- Enforcement of mandatory energy audits and energy data monitoring for selected C&I consumers, with penalties for non-compliance.
- Development of frameworks for private sector energy efficiency financing.
- Acceleration of local training and accreditations for targeted professionals, including energy managers, auditors, and trainers.
- Rationalisation of electricity subsidies, with attached discounts for efficiency improvements.
- State-wide energy awards to recognise strong energy efficiency performers.
- Support for local energy efficiency technology manufacturing.

1.2. SEEAP presentation webinar

The stakeholders were invited for a final webinar to present the final SEEAP directions and have the opportunity to raise any concerns or questions. The Energy Commission of Sabah thanked the participants for their valuable inputs and involvement in SEEAP development.



From left: Ir. Ts. Mohammad Nizamuddin Zainal Abidin, Assistant Director, Energy Management & New Technology Unit, Sustainable Energy Department, ECoS; Ir. Magdalene Chu Wai Quan, Deputy CEO, Planning & Economic Regulation, ECoS and Ts. Frederick Wong Tsun Kiong, Director, Sustainable Energy Department, ECoS; and—joined by the consultant and Sabah energy stakeholders during the SEEAP presentation webinar.

2. Cost-benefit analysis approach

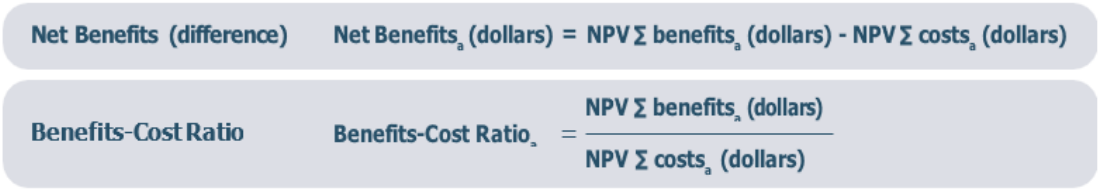
2.1. Cost-benefit method for energy efficiency

The CBA assesses the cost-effectiveness of each measure on the existing list of energy efficiency policies identified previously in the report through the calculation of total benefits and total costs from a certain vantage point to determine whether the overall benefits exceed the costs.

A CBA is positive if the benefit-to-cost ratio is greater than one, and negative if it is less than one.

The results can be reported either in net present value (NPV) or as a ratio (benefits/costs) (Figure 5). By determining the annual benefits and costs, SEEAP's annual cash flow can be derived.

Figure 5 — Equations for net benefit and benefit-cost ratio



2.2. Assumptions and data

Table 1 — Assumptions and data used in CBA

Data input	Usage in CBA	Sources and assumptions
Annual system cost of generation (current and forecast)	To act as the counterfactual to calculate the avoided energy-related costs as a result of improved energy efficiency	Single Buyer Sabah
Annual cost of transmission and distribution network augmentation (current and forecast)	To act as the counter-actual to calculate the avoided capacity-related costs as a result of improved energy efficiency	Sabah Electricity
Distribution and transmission losses (current and forecast)	To calculate the true cost of avoided energy generation as a result of improved energy efficiency	Sabah Electricity
Grid emission factor of Sabah (current and forecast)	To calculate the avoided emissions from power generations as a result of improved energy efficiency	Suruhanjaya Tenaga (2022 to 2024 figures). ECoS (2026 to 2036 figures)

Data input	Usage in CBA	Sources and assumptions
Emission pricing estimates (current and forecast)	To calculate the value of avoided emissions from power generation as a result of improved energy efficiency	Referenced from https://asiafoundation.org/wp-content/uploads/2024/08/Malaysia_Carbon-Pricing-and-the-Business-Case-for-Emissions-Reductions-and-Nature-Conservation-in-Malaysia_EN.pdf Moderate scenario
Annual measure savings (2026 to 2036)	To calculate avoided costs from energy savings	SEEAP study
Annualised cost of measure implementation	To calculate the net cost of measures	Various sources

3. Transport Energy Efficiency Opportunities in Sabah

This section shares a few high-level insights on what the transport sector could achieve if the right policies and incentives are put in place. The figures are indicative: they are meant to show the scale of the opportunity, not to prescribe a single path.

3.1. Sabah's transport sector at a glance

10,400
new light vehicles registered in Sabah each year on average (based on 2015-2025 evolution)

70%
of new vehicles ran on diesel 2025

7.2
litres/100km average fuel consumption in Sabah today vs 4.1 litres/100km the National 2030 fuel economy target

3.2. The opportunity

Malaysia's Low Carbon Mobility Blueprint sets a national goal of improving average fuel economy to 4.1 litres per 100 km by 2030, a major step up from Sabah's current estimate of around 7.2 litres per 100 km. If Sabah's new vehicles move towards this level of efficiency, the potential fuel and energy saving is substantial:

- More than 40% maximum energy saving potential by 2036 (assuming a full transition to new high-efficiency vehicles) compared to a BAU scenario (no fuel-economy improvement)
- Lower fuel costs for households and businesses
- Lighter subsidy burden on public finances
- Cleaner air and fewer emissions.

3.3. The levers that matter most

- Set the baseline with fuel-economy standards. Clear efficiency targets for new vehicles are the foundation to build on.
- Electrify the vehicles that work hardest. Buses, delivery fleets and motorcycles offer the biggest immediate gains, and those gains grow as Sabah's electricity supply becomes cleaner.
- Give people good alternatives to driving. Reliable public transport delivers large long-term benefits for the whole system.
- Tighten efficiency standards on imported vehicles. Gradually tightening efficiency standards for imports keeps the least efficient models off Sabah's roads.
- Encourage behavioural shifts. Measures such as working from home and carpooling can help, but only make a real difference if taken up widely.

3.4. What it will take to achieve transport efficiency opportunities

Turning these opportunities into results can be supported through three key approaches:

- Promoting efficient vehicle adoption, for example, through measures such as rebates for energy efficient vehicles, and assistance for drivers transitioning from older models.
- Government efforts to align policies for efficiency, so that initiatives complement one another and strengthen overall outcomes.
- Enhancing data availability and use, to ensure that measures are well-targeted and relevant to the areas where they can deliver the greatest impact.

4. List of existing financing schemes

Energy users in Sabah are eligible for a number of energy efficiency financing schemes administered by the Malaysian federal government (Table below).

Table 1 — List of existing financing schemes.

S/N	Funder	Scheme	Details
1	Malaysia Debt Ventures (MDV)	Energy efficiency financing	Total fund allocation of RM200 million. Tailored financing to suit individual project requirements.
2	Bank Pembangunan Malaysia	National Energy Transition Facility	RM5 million to RM30 million per project of convertible preference shares or convertible debt, including energy efficiency improvements
3	Hong Leong Bank	Sustainable finance framework	Sustainable Finance Funding, including for investments in energy efficient technologies or equipment, and energy efficiency services.

S/N	Funder	Scheme	Details
4	NUR@PETRA, NUR:MSME, NUR:CHILLER	Rebates	NUR@PETRA supports the commercial uptake of efficient cooling technologies through targeted rebates. For MSMEs, the programme offers RM200 per unit, up to RM4,000 per premises. For larger C&I buildings, NUR:CHILLER provides rebates for replacing older, inefficient chillers used for comfort cooling .
5	SEDA	Energy audit incentives	Provides financial assistance to buildings and installations to perform energy audits and implement energy savings.
6	Malaysia Green Technology and Climate Change Corporation (MGTC)	Green Technology Financing Scheme 4.0 (GTFS 4.0)	60% to 80% government guarantee for energy efficiency-related loans.

S/N	Funder	Scheme	Details
7	Local commercial banks	Low Carbon Transition Facility (LCTF)	Financing facility (up to RM10 million per company with 10-year tenure) to encourage and support SMEs to adopt sustainable practices for business resilience.
8	Malaysia Investment Development Authority (MIDA)	Green Investment Tax Allowance (GITA)	60% tax allowance on qualifying CAPEX in energy efficiency equipment or systems. Allowance can be used to offset up to 70% of a company's statutory income.
9	MIDA	Domestic Investment Accelerator Fund (DIAF) Matching Grant	Matching grant to support Malaysian-owned Small and Medium Enterprises (SMEs) and Mid-Tier Companies (MTCs) in the manufacturing and selected services sectors in their transition towards ESG practices, including carbon emissions tracking and data collection.

Bibliography

Abu Dhabi City Municipality. (2025). Abu Dhabi City Municipality Promotes Sustainable Green Building Concept and Projects. Retrieved 10 10, 2025, from https://www.dmt.gov.ae/en/adm/Media-Centre/News/08Jan2025

ACEEE. (n.d.). Energy Efficiency and Economic Opportunity. Retrieved from https://www.aceee.org/files/pdf/fact-sheet/ee-economic-opportunity.pdf

ADEME. (n.d.). 5ème période CEE (2022-2025) - Bilan année 2024. Retrieved 22 10, 2025, from https://www.ecologie.gouv.fr/sites/default/files/documents/Bilan%20annuel%20CEE%20P5%20-%202024%20 v2clean.pdf

Advanced Energy. (2025). Electrification of Steam Crackers in the Petrochemical Industry. Retrieved from https://www.advancedenergy.com/getmedia/b7dcca76-2f79-4190-9e72-ab8b0c2b6cd1/ENG-Steam-Crackers-Case-Study-295-01.pdf

Agence nationale de l'habitat. (n.d.). Les chiffres clés 2023. Retrieved 10 10, 2025, from https://www.anah.gouv.fr/ anatheque/les-chiffires-cles-2023

Alamin, E., Kamaruzaman, N., & Mohamad Kamar, H. (2023). A pragmatic retrofitting approach to enhancing the thermal, energy and economic performance of an educational building: a case study in Malaysia. Clean Energy.

ALLICE. (n.d.). Introduction to French White Certificates for Industry. Retrieved 10 10, 2025, from https://www.alliance-allice.com/data/medias/1154/style/default/ALLICE_CEE_Report_November2023_BD.pdf

American Council for an Energy-Efficient Economy. (2016). New and improved methods for evaluating CHP cost-effectiveness.

American Council for an Energy-Efficient Economy. (2018). Cost-effectiveness tests: Overview of state approaches to energy efficiency.

American Council for an Energy-Efficient Economy. (2021). The Cost of Saving Electricity for the Largest US Utilities. Retrieved 22 10, 2025, from https://www.aceee.org/sites/default/files/pdfs/cost_of_saving_electricity_ final_6-22-21.pdf

American Council for an Energy-Efficient Economy. (n.d.). Energy Efficiency in California: A Historical Analysis. Retrieved 10 10, 2025, from https://www.aceee.org/sites/default/files/pdfs/E951.pdf

AOS Bath. (n.d.). Solar Water Heaters.

ASEAN. (2021). ASEAN Fuel Economy Roadmap.

ASEAN Center for Energy (ACE). (2023). Best Practices in Energy Efficiency and Conservation: ASEAN Energy Awards 2023.

Asia Foundation. (2023). Research Summary and Policy Recommendations. Retrieved from https://asiafoundation.org/wp-content/uploads/2024/08/Malaysia_Carbon-Pricing-and-the-Business-Case-for-Emissions-Reductions-and-Nature-Conservation-in-Malaysia_EN.pdf

Asia-Pacific Economic Cooperation. (2013). APEC Building Codes, Regulations, and Standards.

Asia-Pacific Economic Cooperation. (2023). APEC Workshop on District Cooling and/or Heating Systems. Australian Government. (2025). GEMS 2024-25 year in review. Retrieved 10 10, 2025, from https://www.energyrating.gov.au/news-and-stories/gems-2024-25-year-review

Australian Government. (n.d.). Commercial Building Disclosure. Retrieved 10 10, 2025, from https://www.cbd.gov.au/

Australian Government. (n.d.). Minimum Energy Performance Standards. Retrieved 10 10, 2025, from https://www.energyrating.gov.au/industry-information/understand-requirements/_minimum-energy-performance-standards

Australian Government. (n.d.). New Vehicle Efficiency Standard. Retrieved 10 10, 2025, from https://www.infrastructure.gov.au/infrastructure-transport-vehicles/vehicles/new-vehicle-efficiency-standard

Australian National Audit Office. (2025). Administration of the Equipment Energy Efficiency Program (GEMS). Retrieved 10 10, 2025, from https://www.anao.gov.au/work/performance-audit/ administration-of-the-equipment-energy-efficiency-program-gems

Australian Building Codes Board. (n.d.). National Construction Code. Retrieved 10 10, 2025, from https://ncc.abcb.gov.au/

Betz, R. (2012). A Review of Energy Efficiency Obligation. Retrieved 10 10, 2025, from https://www.ceem.unsw.edu.au/sites/default/files/documents/r_betz%20IAEE%202012%20Venice.pdf

Blunomy and Metrix. (2024). Market research on energy efficiency, self-consumption generation (rooftop solar PV) and electric vehicles for Sabah and F.T. Labuan.

Borneo Post. (9 8, 2025). Engineering bodies, ECoS unite to boost electrical safety and efficiency in Sabah. Retrieved 10 10, 2025, from https://www.theborneopost.com/2025/08/09/ engineering-bodies-ecos-unite-to-boost-electrical-safety-and-efficiency-in-sabah/

California Air Resources Board. (n.d.). Advanced Clean Cars. Retrieved 10 10, 2025, from https://ww2.arb.ca.gov/ our-work/programs/advanced-clean-cars-program/advanced-clean-cars

California Energy Commission. (n.d.). Achieving Energy Efficiency. Retrieved 10 10, 2025, from https://www.energy.ca.gov/about/core-responsibility-fact-sheets/achieving-energy-efficiency

California Energy Commission. (n.d.). Building Energy Benchmarking Program Frequently Asked Questions. Retrieved 10 10, 2025, from https://www.energy.ca.gov/programs-and-topics/programs/ building-energy-benchmarking-program/building-energy-benchmarking

California Energy Commission. (n.d.). Clean Energy and Pollution Reduction Act - SB 350. Retrieved 10 10, 2025, from https://www.energy.ca.gov/rules-and-regulations/energy-suppliers-reporting/clean-energy-and-pollution-reduction-act-sb-350

California Energy Commission. (n.d.). Electric Generation Capacity and Energy. Retrieved 10 10, 2025, from https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/ electric-generation-capacity-and-energy

California Green Innovation Index. (2024). Energy Efficiency. Retrieved 10 10, 2025, from https://greeninnovationindex.org/2024-edition/energy-efficiency/

California Public Utilities Commission. (n.d.). 2022 Annual Report. Retrieved 10 10, 2025, from https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-and-enforcement-division/reports/annual-reports/2022-cpuc-annual-report.pdf

Clarke, R., & Holt, S. (2008). How the Enforcement of MEPS in Australia has Led to a Paradigm Shift in Suppliers Attitudes. Retrieved 10 10, 2025, from https://www.aceee.org/files/proceedings/2008/data/papers/9_311.pdf

Clasp. (2021). Air Conditioner Labeling in Thailand: Key Findings and Recommendations. Retrieved 10 10, 2025, from https://www.clasp.ngo/wp-content/uploads/2021/06/Air-Conditioner-Labeling-in-Thailand-Policy-Brief.pdf

Clean Energy Regulator. (2025). 2023–24 safeguard data highlights. Retrieved 10 10, 2025, from https://cer.gov.au/markets/reports-and-data/safeguard-data/2023-24-safeguard-data-highlights

Clean Energy Regulator. (n.d.). National Greenhouse and Energy Reporting Scheme. Retrieved 10 10, 2025, from https://cer.gov.au/schemes/national-greenhouse-and-energy-reporting-scheme

Climate Change Laws. (n.d.). Energy Conservation Promotion Act B.E. 2535 and B.E. 2550. Retrieved 10 10, 2025, from https://climate-laws.org/document/energy-conservation-promotion-act-b-e-2535-and-b-e-2550_fd81

Climate Policy Initiative. (2024). Financing Green Buildings in Indonesian Cities.

Climate Technology Centre & Network. (n.d.). Enforcement Guidelines of BEC. Retrieved 10 10, 2025, from https://www.ctc-n.org/system/files/dossier/3b/CTCN%20Project_Handbook-1%20Regulation_Rev.02_2021.12.30%20Eng%20New.pdf

Climatescope. (n.d.). Thailand. Retrieved 22 10, 2025, from https://www.global-climatescope.org/markets/thailand

Department of Alternative Energy Development & Efficiency. (2023). Thailand's Economy Update. Retrieved 10 10, 2025, from https://www.apec.org/docs/default-source/Satellite/EGEEC/Files/60/Economy_Updates_-_Thailand.pdf

Department of Alternative Energy Development & Efficiency. (n.d.). Country Report: Thailand's Energy Efficiency Situation. Retrieved 10 10, 2025, from https://apec.sitefinity.cloud/docs/default-source/satellite/EGEEC/Files/Thailand.pdf

Department of Climate Change, Energy, the Environment, and Water. (2023). Australian energy statistics. Retrieved 10 10, 2025, from https://www.energy.gov.au/publications/ australian-energy-statistics-table-o-electricity-generation-fuel-type-2022-23-and-2023

Department of Energy Abu Dhabi. (n.d.). Abu Dhabi Energy & Water Efficiency Strategy 2030. Retrieved 10 10, 2025, from https://www.doe.gov.ae/-/media/Project/DOE/Department-Of-Energy/Media-Center-Publications/DSM-strategy---English.pdf

Department of Statistics Malaysia. (2022). Household Expenditure Survey Report - Sabah.

Department of Statistics Malaysia. (2022). Key Findings on Population and Housing Census of Malaysia 2020. Retrieved 22 10, 2025, from https://www.dosm.gov.my/portal-main/release-content/ launching-of-report-on-the-key-findings-population-and-housing-census-of-malaysia-2020-

Department of Statistics Malaysia. (2023). Gross Domestic Product (GDP) by State. Retrieved 22 10, 2025, from https://www.dosm.gov.my/portal-main/release-content/gross-domestic-product-gdp-by-state-

Department of Statistics Malaysia. (2024). Sabah Statistics Yearbook 2024.
Department of Statistics Malaysia. (2025). New Vehicle Registrations.

Depco Power Systems. (n.d.). How efficient are diesel generators and what influences fuel consumption?

Dubai Electricity & Water Authority. (2024). DEWA's projects promote emiratisation of the energy sector, creating pioneering job opportunities. Retrieved 10 10, 2025, from https://www.dewa.gov.ae/en/about-us/ media-publications/latest-news/2024/06/dewas-projects-promote-emiratisation-of-the-energy-sector

Dubai Supreme Council of Energy. (n.d.). Annual Report 2022. Retrieved 10 10, 2025, from https://dubaisce.gov.ae/wp-content/uploads/2023/06/Taqati-Annual-Report-2022_Hor_En-small.pdf

Dubai Supreme Council of Energy. (n.d.). Demand Side Management Annual Report 2016. Retrieved 22 10, 2025, from https://dubaisce.gov.ae/wp-content/uploads/2021/08/DSM-AR-2016-Published-Eng.pdf

Econoler. (n.d.). Super EESCOs.

EDF. (n.d.). Le dispositif CEE : les clés pour tout comprendre. Retrieved 10 10, 2025, from https://www.edf.fr/entreprises/le-mag/le-mag-entreprises/decryptage-du-marche-de-l-energie/ comprendre-le-dispositif-cee-en-3-points-cles

Electricity Generating Authority of Thailand. (n.d.). 30 years of Energy-saving Label No.5 to drive Thailand toward a green and sustainable future. Retrieved 10 10, 2025, from https://www.egat.co.th/home/en/20250924e/

Energy Commission. (2019). National Energy Balance. Retrieved 10 10, 2025, from https://meih.st.gov.my/ documents/10620/19759/National+Energy+Balance+2019

Energy Commission. (2019). Sabah Electricity Supply Industry Outlook.

Energy Commission. (2023). National Energy Balance 2022.

Energy Commission. (2024). Energy Efficiency and Conservation Act (EECA) 2024.

Energy Commission. (2024). Guidelines on Energy-Using Product [GP/ST/No.50/2024]. Energy Commission. (2024). Presentation - Energy Efficiency Initiatives in Malaysia.

Energy Commission. (2025). Malaysia Energy Statistics Handbook 2023.

Energy Commission. (n.d.). Efficient Management of Electrical Energy Regulation (EMEER) 2008.

Energy Commission. (n.d.). List of installations involved under the Efficient Management of Electrical Energy Regulations 2008.

Energy Commission of Sabah. (2023). Sabah Energy Roadmap and Master Plan 2040.

Energy Commission of Sabah. (2024). EFFICIENT MANAGEMENT OF ELECTRICAL ENERGY REGULATIONS 2024.

Energy Commission of Sabah. (2024). Energy Efficiency Infographic.

Energy Commission of Sabah. (2024). LIST OF REGULATED ELECTRICAL EQUIPMENT TO BE TESTED ACCORDING TO THE MINIMUM ENERGY PERFORMANCE.

Energy Commission of Sabah. (2024). LIST OF REGULATED ELECTRICAL EQUIPMENT TO BE TESTED ACCORDING TO THE MINIMUM ENERGY PERFORMANCE STANDARDS (MEPS).

Energy Commission of Sabah. (n.d.). Top 100 electricity consumers. Energy Commission. (n.d.). Transition from EMEER 2008 to EECA 2024.

Energy Futures Group. (2017). National Standard Practice Manual for Benefit-Cost Analysis of Utility Customer-Funded Energy Efficiency Resources.

Energy Generating Authority of Thailand. (2014). Power Utility's Demand Side Management Programme. Retrieved 22 10, 2025, from https://www.thai-german-cooperation.info/download/20140327_03_EGAT_experiences.pdf

Energy Policy and Planning Office. (n.d.). Energy Statistic. Retrieved from https://www.eppo.go.th/index.php/en/ en-energystatistics/electricity-statistic

ERIA. (2021). Technical Guidelines for Energy Efficiency and Conservation in Commercial Buildings.

Essential Services Commission. (2023). Victorian Energy Upgrades performance reports. Retrieved 10 10, 2025, from https://www.esc.vic.gov.au/victorian-energy-upgrades-program/veu-updates-reports-reviews-and-data/

veu-performance-reports

Eurostat. (2025). Electricity price statistics.

Finder. (2024). What is the average (kWh) cost of electricity in Australia? Retrieved 10 10, 2025, from https://www.finder.com.au/energy/electricity/average-cost-of-electricity

GHG Protocol. (n.d.). Conversion factors. Retrieved from https://ghgprotocol.org/sites/default/files/Emission_ Factors_from_Cross_Sector_Tools_March_2017.xlsx

Global Efficiency Intelligence. (2021). Electrification of Boilers in U.S. Manufacturing. Retrieved from https://static1.squarespace.com/static/5877e86f9de4bb8bce72105c/t/62fb89dfb827c92c3340 eed9/1660652049933/Boiler+Electrification-final+Rev2.pdf

IEA. (2014). Capturing the Multiple Benefits of Energy Efficiency. Retrieved from https://www.oecd.org/ content/dam/oecd/en/publications/reports/2014/09/capturing-the-multiple-benefits-of-energy-efficiency_ g1g476b1/9789264220720-en.pdf

IEA. (2020). Energy Efficiency. Retrieved from https://www.iea.org/reports/energy-efficiency-2020/ energy-efficiency-jobs-and-the-recovery

IEA. (2020). Sustainable Recovery. Retrieved from https://www.iea.org/reports/sustainable-recovery/buildings

IEA. (2025). Jobs. Retrieved from https://www.iea.org/reports/jobs

Independent Pricing and Regulatory Tribunal. (2025). 2023–24 Energy Security Safeguard Report to Minister. Retrieved 10 10, 2025, from https://www.energysustainabilityschemes.nsw.gov.au/sites/default/files/cm9_ documents/2023-24-Energy-Security-Safeguard-Report-to-the-Minister.PDF

Ir. Dr. Goh Hui Hwang, D. C. (23 3, 2019). Energy Performance Contract (EPC) in Malaysia and Other Countries. Retrieved 10 10, 2025, from https://ipm.my/wp-content/uploads/2020/02/Energy-Performance-Contract-EPC-in-Malaysia-and-Other-Countries.pdf

Kementerian Tenaga Teknologi Hijau dan Air. (2015). National Energy Efficiency Action Plan. Retrieved 10 10, 2025, from https://faolex.fao.org/docs/pdf/mal220626E.pdf

Kusumastuti, D., Lubis, M., Ciosconara, F., & Loeksmanto, I. (2026). Evaluating District Cooling as Energy Efficiency Technology for Government Buildings' Retrofit Strategy. 5th ASEAN International Conference on Energy and Environment (AICEE).

Kyriaki, E., Giama, E., Papadopoulou, A., Drosou, V., & Papadopoulos, A. (2017). Energy and Environmental Performance of Solar Thermal Systems in Hotel Buildings. Procedia Environmental Sciences.

Lawrence Berkeley National Laboratory. (2017). Better Buildings Energy Efficiency Cost-Effectiveness Tool (v2.0): FAQs.

Liu, Z.-A., Li, Y., Hou, J., Tien, L., Wang, S., Hu, W., & Zhang, L. (2025). Impact of exterior envelope thermal performance on energy demand and optimization strategies for university teaching-office buildings. Scientific Reports.

Long, A. (2025). Zero Energy and Low Carbon (ZEALC) Building as a Carbon Neutrality Solution for Micro, Small, and Medium Enterprises (MSMEs).

Long, A., & Shafie, M. (2026). Bridging Energy Audits and Energy Performance Contracting (EPC). 5th ASEAN International Conference on Energy and Environment (5th AICEE).

Malaysia Automotive Robotics and IoT Institute. (n.d.). Labelling for Energy Efficient Vehicle. Retrieved 10 10, 2025, from https://eev.marii.my/SuppDoc/EEV_Labels_Brochure_Compiled_Final.pdf

Malaysia Government. (2016). Electricity Supply Act 1990.

Malaysia Green Technology Corporation. (2020). Low Carbon Mobility Blueprint 2021-2030.

Ministry of Ecological Transition. (2024). Diagnostic de performance énergétique - DPE. Retrieved 10 10, 2025, from https://www.ecologie.gouv.fr/politiques-publiques/diagnostic-performance-energetique-dpe

Ministry of Ecological Transition. (2024). Vers l'efficacité énergétique: le parc tertiaire français accélère le pas. Retrieved 10 10, 2025, from https://www.ademe.fr/presse/communique-national/ vers-lefficacite-energetique-le-parc-tertiaire-francais-accelere-le-pas

Ministry of Ecological Transition. (2025). Location et gel des loyers des passoires énergétiques. Retrieved 10 10, 2025, from https://www.ecologie.gouv.fr/politiques-publiques/location-gel-loyers-passoires-energetiques

Ministry of Economy. (2023). National Energy Transition Roadmap.

Ministry of Environment and Water. (2021). Low Carbon Mobility Blueprint 2021-2030.

Ministry of Environment, Energy, and the Sea. (2016). ENERGY TRANSITION FOR GREEN GROWTH ACT. Retrieved 10 10, 2025, from

https://www.ecologie.gouv.fr/sites/default/files/documents/Energy%20Transition%20 for%20Green%20Growth%20Act%20in%20action%20-%20Regions,%20citizens,%20business%20(%2032%20 pages%20-%20juillet%202016%20-%20Versions%20anglaise).pdf

Ministry of Science, Energy, Telecommunications and Transport. (2024). National Energy Balance 2023.

Ministry of Transport | ASEAN - German Technical Cooperation. (2016). Malaysia Stocktaking Report on Sustainable Transport and Climate Change.

NABERS. (2024). Building momentum for a sustainable future: key takeaways from the 2024 NABERS + CBD Conference. Retrieved 10 10, 2025, from https://www.nabers.gov.au/news/ building-momentum-sustainable-future-key-takeaways-2024-nabers-cbd-conference

NABERS. (2024). NABERS Annual Report 2023/24. Retrieved 10 10, 2025, from https://nabers.info/ annual-report/2023-2024/welcome/

NABERS. (n.d.). What is NABERS. Retrieved 10 10, 2025, from https://www.nabers.gov.au/about/what-nabers

National Climate Finance Institutions Support Programme. (2012). Case Study: The Thai Energy Efficiency Revolving Fund. Retrieved 10 10, 2025, from https://unfccc.int/files/cooperation_and_support/financial_mechanism/standing_committee/application/pdf/fs-unep_thai_eerf_final_2012.pdf

National Energy Screening Project. (2017). National Standard Practice Manual for Energy Efficiency Cost-Effectiveness.

National Energy Screening Project. (2020). Database of screening practices: State approaches to benefit-cost analysis.

National Environmental Agency Singapore. (n.d.). Energy Efficiency. National Property Information Centre. (2015-2025). Property Stock Report. National Property Information Centre. (n.d.). Property Stock Report.

NSW Department of Climate Change, Energy, the Environment, and Water. (2025). Final statutory review NSW Energy Savings Scheme. Retrieved 22 10, 2025, from https://www.energy.nsw.gov.au/sites/default/files/2025-06/ NSW-ESS-Final-Statutory-Review-Report.pdf

Odoi-Yorke, F., Akpahou, R., Opoku, R., & Mensah, L. (2023). Technical, financial, and emissions analyses of solar water heating systems for supplying sustainable energy for hotels in Ghana. Solar Compass.

RTE. (2023). Annual electricity review. Sabah Electricity. (n.d.). Tariff Rider.

Seeley, C., & Dhakal, S. (2021). Energy Efficiency Retrofits in Commercial Buildings: An Environmental, Financial, and Technical Analysis of Case Studies in Thailand. Energies.

Singapore Building and Construction Authority. (2024). Building Energy Benchmarking. Statistics Canada. (n.d.). Appendix A: Conversion factors.

Synapse Energy Economics. (2012). Energy efficiency cost-effectiveness screening: How to properly account for 'other program impacts' and environmental compliance costs.

T. S. Jalal, P. B. (2009). National Energy Policies and the electricity sector in Malaysia. 3rd International Conference on Energy and Environment (ICEE), Malacca, Malaysia, 385-392.

TNB. (2024). Energy Transition and Greater Customer Empowerment. Retrieved 10 10, 2025, from https://www.tnb.com.my/sustainability/energy-transition-and-greater-customer-empowerment

U.S. Department of Energy. (n.d.). Estimating the Costs and Energy Efficiency of a Solar Water Heater. Retrieved from U.S. Department of Energy.

U.S. Environmental Protection Agency. (2008). Understanding cost-effectiveness of energy efficiency programs: Best practices, technical methods, and emerging issues for policy-makers.

UAE Ministry of Energy & Infrastructure. (2023). Statistical Book.

UK Green Building Council. (2024). Retrofitting Office Buildings: Building the Case for Net Zero. Umar, Z. (n.d.). Energy Commission Demand Side Management Unit.

UNDP. (n.d.). Malaysia. Retrieved from https://climatepromise.undp.org/what-we-do/where-we-work/malaysia

US Bureau of Economic Analysis. (n.d.). GDP by State. Retrieved 10 10, 2025, from https://www.bea.gov/data/gdp/ gdp-state

US Census Bureau. (2024). State Population Totals and Components of Change: 2020-2024. Retrieved 10 10, 2025, from https://www.census.gov/data/tables/time-series/demo/popest/2020s-state-total.html

US Energy Information Administration. (n.d.). California State Energy Profile. Retrieved 10 10, 2025, from https://www.eia.gov/state/print.php?sid=CA

Victoria State Government. (2024). New home energy efficiency standards explained. Retrieved 10 10, 2025, from https://www.energy.vic.gov.au/

data/assets/pdf_file/0016/670300/7-star-new-homes-standards-factsheets-building-practitioners.pdf

Wang, F., Kusnadar, Lin, H., & Tsai, M. (2021). Energy Efficient Approaches by Retrofitting Heat Pumps Water Heating System for a University Dormitory. Buildings.

World Bank. (2013). Thailand - Energy efficiency revolving fund: case study. Retrieved 10 10, 2025, from https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/647241468304446784/ thailand-energy-efficiency-revolving-fund-case-study

World Bank Data platform for Australia. (2025). https://data.worldbank.org/ World Bank Data platform for France. (2025). https://data.worldbank.org/ World Bank Data platform for Thailand. (2025). https://data.worldbank.org/

World Bank Data platform for United Arab Emirates. (2025). https://data.worldbank.org/

World Bank; ESMAP. (n.d.). Regulatory Indicators for Sustainable Energy methodology. Retrieved 10 10, 2025, from https://rise.esmap.org/methodology

World Economic Forum. (2024). The hidden fuel: energy efficiency lessons from the UAE. Retrieved 10 10, 2025, from https://www.weforum.org/stories/2024/11/energy-efficiency-uae/

Wurfel, L. (2024). The History of NABERS. Retrieved 10 10, 2025, from https://buenoanalytics.com/news/ the-history-of-nabers/

Yusof, Y. D. (19 8, 2025). International Green Build Conference (IGBC) 2025 Ministerial Keynote. Retrieved 10 10,2025, from https://www.petra.gov.my/uploads/content-downloads/file_20250819160533.pdf

Zailan, R., & Che Kar, M. (2018). Energy Audit: A Case Study in FTK Building Universiti Malaysia Pahang. International Journal of Engineering Technology and Sciences.

Glossary

Key terms and acronyms used throughout the document, listed alphabetically.

BAU	Business-As-Usual scenario
BCR	Benefit-Cost Ratio
C&I	Commercial and Industrial
CAGR	Compound Annual Growth Rate
CBA	Cost-Benefit Analysis
CO_2e / $MtCO_2e$	Carbon Dioxide equivalent / Million tonnes of CO_2 equivalent
CPO	Crude Palm Oil
EACG	Energy Audit Conditional Grant
ECoS	Energy Commission of Sabah
EE	Energy Efficiency
EESCO	ECoS Energy Service Company
EMEER 2024	Efficient Management of Electrical Energy Regulations 2024
EMS	Energy Management System
F.T. Labuan	Federal Territory of Labuan
GHG	Greenhouse Gas
GITA	Green Investment Tax Allowance
HVAC	Heating, Ventilation and Air Conditioning
IPP	Independent Power Producer
LNG	Liquefied Natural Gas

LSS	Large Scale Solar
M&V	Measurement and Verification
MEPS	Minimum Energy Performance Standards
MGTC	Malaysia Green Technology and Climate Change Corporation
MIDA	Malaysia Investment Development Authority
MW / MWh	Megawatt / Megawatt-hour
NDC	Nationally Determined Contribution
NPV	Net Present Value
PJ / TJ	Petajoule / Terajoule
RE	Renewable Energy
RM	Ringgit Malaysia
SCADA	Supervisory Control and Data Acquisition
SE	Sabah Electricity Sdn Bhd
SE-RAMP 2040	Sabah Energy Roadmap and Master Plan 2040
SEDA	Sustainable Energy Development Authority
SEEAP	Sabah Energy Efficiency Action Plan
SGDFC	Sabah Grid Demand Forecast Committee
SME	Small and Medium Enterprise
VSD	Variable Speed Drive

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