ASIA LOW CARBON BUILDINGS TRANSITION
Life Cycle Assessment for Transitioning to a Low-Carbon Economy | PROJECT

ESCO Market Assessment and On-Bill Financing Readiness Study in Building Sector

Indonesia Country Report

In cooperation with :

GGGI EESL HEAT

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ASEAN Centre for Energy
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About ASEAN Centre for Energy

The ASEAN Centre for Energy ("ACE" or the "Centre") is an intergovernmental organisation driving multilateral energy cooperation and policy coordination among the ASEAN Member States. The Agreement on ASEAN Energy Cooperation in Manila, Philippines, on 22 May 1998, formally established ACE on 1 January 1999 in Jakarta, Indonesia. The formal establishment tasked ACE to serve as the regional energy think tank, catalyst, and knowledge hub to build coherent, coordinated, focused and robust energy policy agenda and strategy for ASEAN.

The three critical roles of ACE:

- To advance the ASEAN energy goals by unifying and strengthening the ASEAN energy cooperation and integration.
- To function as an energy data and knowledge hub by providing knowledge repository and services.
- To serve as an ASEAN energy think tank by assisting in research and practical solutions for the Member States.

Keeping the region's improvement, sustainable and harmless to the ecosystem is a fundamental concern of the ASEAN energy sector. Hosted by the Ministry of Energy and Mineral Resources of Indonesia, ACE's office is located in Jakarta, Indonesia. For more information on ACE website: aseanenergy.org

About the Asia Low-Carbon Buildings Transition (ALCBT) Project

The Asia Low-Carbon Buildings Transition (ALCBT) is a five-year initiative (August 2023 – August 2028) funded by the Government of Germany under its International Climate Initiative (IKI). The project aims to accelerate the nationwide transition toward low-carbon buildings in five Asian countries: Cambodia, India, Indonesia, Thailand, and Viet Nam. By adopting a lifecycle embedded carbon approach, ALCBT seeks to significantly reduce direct greenhouse gas (GHG) emissions from the building sector. This will be realised through the integration of innovative technical solutions, improved planning frameworks, strengthened institutional capacities, and the development of advanced analytical tools.

The ALCBT Project is implemented by a consortium partnership led by Global Green Growth Institute (GGGI) consisting of HEAT International, the ASEAN Centre for Energy (ACE), and Energy Efficiency Services Limited (EESL).

For more information: https://alcbt.gggi.org/

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Foreword

Energy efficiency is the cornerstone of a sustainable energy future, reducing pressure on Indonesia's energy supply, and achieving emission-reduction targets. Driven by the region's expanding economic activities, the need to strengthen energy management becomes increasingly urgent. Energy Service Companies (ESCOs) provide a crucial mechanism for delivering technically measurable energy savings, helping consumers lower energy usage, along with costs while supporting national conservation goals.

This ESCO market assessment is an important contribution to understanding the current landscape and future potential of ESCOs in Indonesia. The study offers a clear picture of market opportunities, implementation barriers, and the enabling conditions required to accelerate energy efficiency investment. The Directorate of Energy Conservation welcomes this assessment as a resource to guide policy refinement and improve coordination amongst government, industry, and financial institutions.

Indonesia has established a policy and regulatory foundation that encourages conservation, including mandatory consumption management for large energy users, energy audit requirements, minimum energy performance standards, and energy efficiency labelling. Within this framework, the ESCO model provides a performance-based approach that reduces the upfront financial burden for clients, while ensuring accountability through verified energy savings.

The Directorate has long supported ESCO development through regulatory guidance, technical standards, capacity-building programmes, and promotion of performance-based contracting. We also engage with financial institutions and market players to improve access to financing and encourage wider adoption of energy-efficiency projects. These efforts aim to expand the pipeline of bankable projects and strengthen confidence in the ESCO industry.

However, challenges remain. Awareness of ESCO mechanisms amongst building owners, industries, and local governments is still limited. Many financial institutions require clearer risk assessment tools and standardised project documentation. ESCOs themselves continue to face constraints related to scale, technical capacity, and initial project financing. This assessment provides valuable insights that will help identify solutions and guide future interventions.

A strong ESCO market is essential for achieving Indonesia's long-term energy-conservation objectives. As demand grows for efficient technologies, digital energy management systems, and performance-based retrofits, ESCOs are well positioned to deliver high-impact solutions across industrial, commercial, and public-sector facilities.

The Directorate of Energy Conservation reaffirms its commitment to supporting ESCO development through improved policies, stronger monitoring and verification frameworks, and enhanced collaboration with key stakeholders. We believe the insights from this assessment will help strengthen the ESCO ecosystem and accelerate Indonesia's transition toward a more efficient and sustainable energy future.

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Director of Energy Conservation
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Foreword

The ASEAN Centre for Energy (ACE) is pleased to launch the *Indonesia Country Report: ESCO Market Assessment and On-Bill Financing Readiness Study in the Building Sector*, an important contribution to advancing energy efficiency and conservation in Indonesia. As Southeast Asia's largest economy and energy consumer, Indonesia plays a central role in achieving the goals of the newly endorsed ASEAN Plan of Action for Energy Cooperation (APAEC) 2026–2030.

Energy efficiency—recognised as the "first fuel"—offers significant potential to curb rising energy demand across Indonesia and ASEAN. Buildings remain a major contributor to end-use consumption and associated emissions. Energy Service Companies (ESCOs) have emerged as a practical, ready-to-deploy solution to accelerate energy efficiency in this sector by helping address market barriers such as limited technical capacity, fragmented demand, and challenges in accessing financing.

Indonesia has made commendable progress by establishing regulatory frameworks, strengthening institutional support, and developing performance-based contracting mechanisms to encourage greater private-sector participation. The Ministry of Energy and Mineral Resources, through the Directorate of Energy Conservation, continues to champion ESCO models to scale up energy-efficient technologies. These efforts support ASEAN's collective aspiration to achieve 40% Energy Intensity Reduction in Total Primary Energy Supply (TPES) by 2030.

While key challenges persist, the potential for ESCO expansion in Indonesia remains strong. This study outlines current ESCO market conditions, identifies barriers and enablers, and presents actionable recommendations to strengthen the ecosystem. It also introduces On-Bill Financing as an alternative mechanism and assesses Indonesia's structural readiness to adopt it, informed by lessons from international experience.

For policymakers, the findings can guide refinements to national policies—such as accreditation schemes, monitoring and verification protocols, and incentive frameworks—to boost market confidence. For the private sector, the study highlights emerging opportunities in commercial and public buildings. For development partners, it presents strategic entry points to catalyse investment, build capacity, and accelerate implementation.

ACE extends its sincere appreciation to all stakeholders whose contributions enriched this study, including the Ministry of Energy and Mineral Resources, Ministry of Public Works, Indonesian Financial Services Authority, as well as building owners, managers, ESCOs, and financial institutions.

We look forward to continued collaboration with Indonesia and all ASEAN Member States to foster a vibrant ESCO ecosystem that supports APAEC implementation and advances the region's energy transition.

Dato' Ir. Ts. Razib Dawood
Executive Director
ASEAN Centre for Energy (ACE)

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Abbreviations and Acronyms

Acronym	Description
ACE	ASEAN Centre for Energy
AEDP	Alternative Energy Development Plan
AMS	ASEAN Member States
BEC	Building Energy Code
CPUC	California Public Utilities Commission
EE	Energy Efficiency
EEP	Energy Efficiency Plan
EERF	Energy Efficiency Revolving Fund
EESI	Environmental and Energy Study Institute
EGAT	Electricity Generating Authority of Thailand
EMS	Energy Monitoring System
ENCON	Energy Conservation Fund
EPPO	Energy Policy and Planning Office
ERC	Energy Regulatory Commission
ESCO	Energy Service Company
EVN	Viet Nam Electricity Group
GEM$	Green Energy Money $aver
GEMS	Green Energy Market Securitisation
HBPW	Holland Board of Public Works
HEB$	Hawaii Energy Bill $aver
HECO	Hawaii Electric Companies
HEF	Holland Energy Fund

Acronym	Description
HGIA	Hawaii Green Infrastructure Authority
HVAC	Heating, Ventilation, and Air Conditioning
IOU	Investor Owned Utilities
IoT	Internet of Things
IPPs	Independent Power Producers
JETP	Just Energy Transition Partnership
MEPS	Minimum Energy Performance Standards
M&V	Monitoring & Verification
NEEP	National Energy Efficiency Policy
NEP	National Energy Plan
NEPC	National Energy Policy Council
NZEB	Net Zero Energy Buildings
OBF	On-Bill Finance
OBF-AP	On-Bill Finance Alternate Pathway
OBL	On-Bill Loan
PDP	Power Development Plan
PEA	Provincial Electricity Authority
PG&E	Pacific Gas and Electric
PLN	*Perusahaan Listrik Negara*
PUC	Public Utilities Commission
SME	Small and Medium-Sized Enterprise
UNDP	United Nations Development Programme

Executive Summary

This report provides a consolidated assessment of Indonesia's energy-efficiency (EE) landscape, with a particular focus on the regulatory framework, the maturity of the Energy Service Company (ESCO) market, and the readiness of on-bill financing (OBF) as a viable financing mechanism. The assessment was undertaken as part of the Asia Low-Carbon Buildings Transition (ALCBT) programme.

According to the ASEAN Energy Outlook 8 (AEO8) energy consumption in the buildings sector accounted for 23% of total final energy use in ASEAN. Accelerating efficiency improvements in this sector is therefore critical to achieving national decarbonisation objectives.

Indonesia's regulatory environment for EE has evolved in recent years, anchored by Government Regulation No.33/2023 (PP33/2023), which mandates energy management for large energy consumers across sectors. Complementary derivative regulations, such as the Ministerial Regulations No.3/2025 and No.8/2025, outline responsibilities and financing mechanisms for government-led EE projects, including ESCO financing. However, implementation has been uneven due to fragmented inter-ministerial coordination, vague fiscal incentives, and limited non-fiscal support. Green building regulations (PP16/2023 and MPWHR21/2021) apply only to large buildings, leaving the residential sector – Indonesia's largest energy consumer – largely unaddressed.

While a new Ministerial Regulation focusing on ESCOs is in development, there are currently no active ESCO-specific policies. A credit guarantee mechanism supported by the Green Climate Fund exists but has seen limited uptake due to the lack of maturity of EE projects and ESCOs in the country, acknowledging that its focus is on the industrial sector.

The ESCO market in Indonesia remains nascent. Although 12 ESCOs are officially listed on the Ministry of Energy and Mineral Resources website, few possess the technical and financial capacity to deliver full-service energy performance contracts.

Scenario modelling indicates that ESCO deployment must grow by 20% to 25% annually for ESCOs to play a meaningful role in meeting Indonesia's building sector EE targets. This would require over 900 projects and more than 100 qualified ESCOs by 2050. This represents a substantial growth in ESCOs given their current nascent status.

Key barriers to ESCO growth include limited access to capital, lack of collateral, and low creditworthiness. Regulatory enforcement is limited, and coordination gaps between ministries further dilute policy impact.

Nevertheless, recent regulatory developments signal a growing commitment from the government. To unlock market potential, Indonesia must strengthen policy implementation and enforcement, improve access to financing through risk-sharing mechanisms and concessional loans, and invest in capacity building for both ESCOs and financial institutions. This would enable an ecosystem that will be self-sustaining in the long term.

To drive the growth of Indonesia's ESCO market, demand for EE services – particularly from customers – needs to be generated. Yet, the high upfront costs of retrofits often deter the majority of end users from adopting EE solutions.

This is where on-bill financing becomes an enabler. By giving utility customers, the chance to repay retrofit investments through their electricity bills, OBF can facilitate widespread adoption of EE measures, such as LED lighting and high-efficiency heating, ventilation and air conditioning systems (HVAC), often with cost neutrality or net savings.

Successful deployment will require regulatory preparation, stakeholder coordination, and programme design tailored to the regional context. Regulatory direction is especially key, noting that the state-owned utility *Perusahaan Listrik Negara* (PLN) is unlikely to implement EE programmes independently, since this would result in revenue reductions. Overestimated capacity growth alongside implementation has led to overcapacity in the power sector, requiring PLN to prioritise increasing electricity sales. The implementation of OBF is thereby unlikely to take off in the near to mid-term.

A sandbox pilot could be implemented in a municipality or residential area where PLN is not the electricity provider. Stakeholders suggested Cikarang as a pilot starting point, noting that electricity in the industrial estate is provided by *Cikarang Listrik Indo*, whose tariff rates are more reflective of the electricity generation costs. To enable such a pilot, early involvement of programme administrators, utilities, ESCOs, and consumers is essential to ensure feasibility, build trust, and refine implementation strategies. This groundwork should precede actual deployment, which is envisioned as a medium-term goal supported by fit-for-purpose regulations.

Based on the study, recommendations across five key themes have been identified to address critical gaps—ranging from regulatory frameworks and financing mechanisms to market awareness and capacity building. These actions aim to lay the foundation for a robust and sustainable EE business environment in Indonesia.

Short Term (Immediate to 2 years)	Medium Term (3 to 5 years)	Long Term (5+ years)
Theme 1: Create a more conducive policy and regulatory environment for EE in Indonesia		
Strengthen the enforcement of PP 33/2023 [Action by: EBTKE, ESDM] Develop a clear action plan to ensure Presidential and Ministerial Regulations are implemented [Action by: EBTKE, ESDM] Undertake a comprehensive study and pilot to explore potential regulatory pathways for OBF, with the aim of generating actionable insights to inform	Evaluate the effectiveness of Presidential and Ministerial Regulations [Action by: EBTKE, ESDM] Consider promulgating a regulation on OBF based on pilot insights [Action by: EBTKE, ESDM]	Continuous refinement of policies based on evaluation of market feedback and performance [Action by: EBTKE, ESDM]

Short Term (Immediate to 2 years)	Medium Term (3 to 5 years)	Long Term (5+ years)
policy development and implementation [Action by: EBTKE, ESDM]		
Theme 2: Increase finance mobilisation		
Explore the provision of financial incentives in coordination with the Ministry of Finance and the Ministry of Public Works [Action by: EBTKE, ESDM] Continue collaboration with PT PII to pilot a guarantee mechanism for EE projects in public buildings [Action by: EBTKE, ESDM] Work with development partners to pilot the implementation of de-risking mechanisms and to support schemes that can increase the mobilisation of EE finance [Action by: EBTKE, ESDM] Coordinate with OJK to develop guidelines for banks to explore EE projects with existing clients in their portfolio [Action by: EBTKE, ESDM]	Create financial sandboxes to facilitate increased flows of equity investment and project aggregation [Action by: EBTKE, ESDM and OJK] Establish risk-sharing mechanisms post-pilot [Action by: EBTKE, ESDM and OJK]	Consider the development of specific loan products for the EE project [Action by: EBTKE, ESDM, OJK and commercial and state-owned banks in Indonesia]
Theme 3: Increase individual and institutional EE capacity		
EBTKE, MASKEEI, and APKENINDO to jointly design and deliver training programmes that cover all aspects of the EE project development chain [Action by: EBTKE, MASKEEI, and APKENINDO] Curate training programmes for financiers and investors [Action by: EBTKE, OJK, IIF]	Evaluate the effectiveness of capacity building programmes, with a focus on capacity retention within institutions [Action by: EBTKE, Development Partners]	N/A

Short Term (Immediate to 2 years)	Medium Term (3 to 5 years)	Long Term (5+ years)
Promulgate Ministerial Regulations on ESCOs which include voluntary ESCO registration schemes [Action by: EBTKE, ESDM]		
Theme 4: Raise awareness on EE across the economy		
Conduct targeted outreach to commercial and industrial sectors [Action by: APKENINDO] Donor programmes should be designed with a longer-term tangible exit strategy beyond raising awareness [Action by: EBTKE, APKENINDO, Development Partners]	Showcase success stories to build trust [Action by: APKENINDO]	Foster long-term partnerships with large energy users [Action by: EBTKE, APKENINDO]
Theme 5: Advanced Market infrastructure and standards		
Initiate development of standardised contracts and M&V processes [Action by: EBTKE] Promote use of EMS, IoT, and digital tools for M&V [Action by: EBTKE, APKENINDO]	Strengthen the ESCO Association [Action by: EBTKE, APKENINDO, Development Partners] Support tech startups in EE [Action by: EBTKE]	Contribute to creating regional (ASEAN) frameworks [Action by: EBTKE, Green Building Council Indonesia] Integrate AI and advanced analytics into ESCO offerings [Action by: ESCOs, EE technology providers]

Indonesia has the potential to lead ASEAN's low-carbon building transformation if the country manages to reconcile policy ambitions, encourage market innovations, and promote financing accessibility, while ensuring that plans are implemented. A coordinated effort across government ministries, industry stakeholders, and financial institutions is essential to scale EE implementation. With the right regulatory support, investment mobilisation, and stakeholder engagement, Indonesia can establish a robust ESCO ecosystem.

Chapter 1
Introduction

1. Introduction

The ASEAN Centre for Energy (ACE), in collaboration with the Carbon Trust under the ALCBT project, undertook a comprehensive study to identify pathways for accelerating energy-efficiency (EE) adoption in buildings across the AMS. This integrated report consolidates three core workstreams—policy and regulatory framework review, an ESCO market assessment, and an evaluation of on-bill financing (OBF) readiness—to provide a holistic understanding of the enabling environment for EE measures.

The policy review examines the maturity and effectiveness of EE regulations across the AMS. This report focuses specifically on Indonesia, assessing the extent to which national policies align with EE objectives and identifying regulatory gaps that constrain ESCO market development.

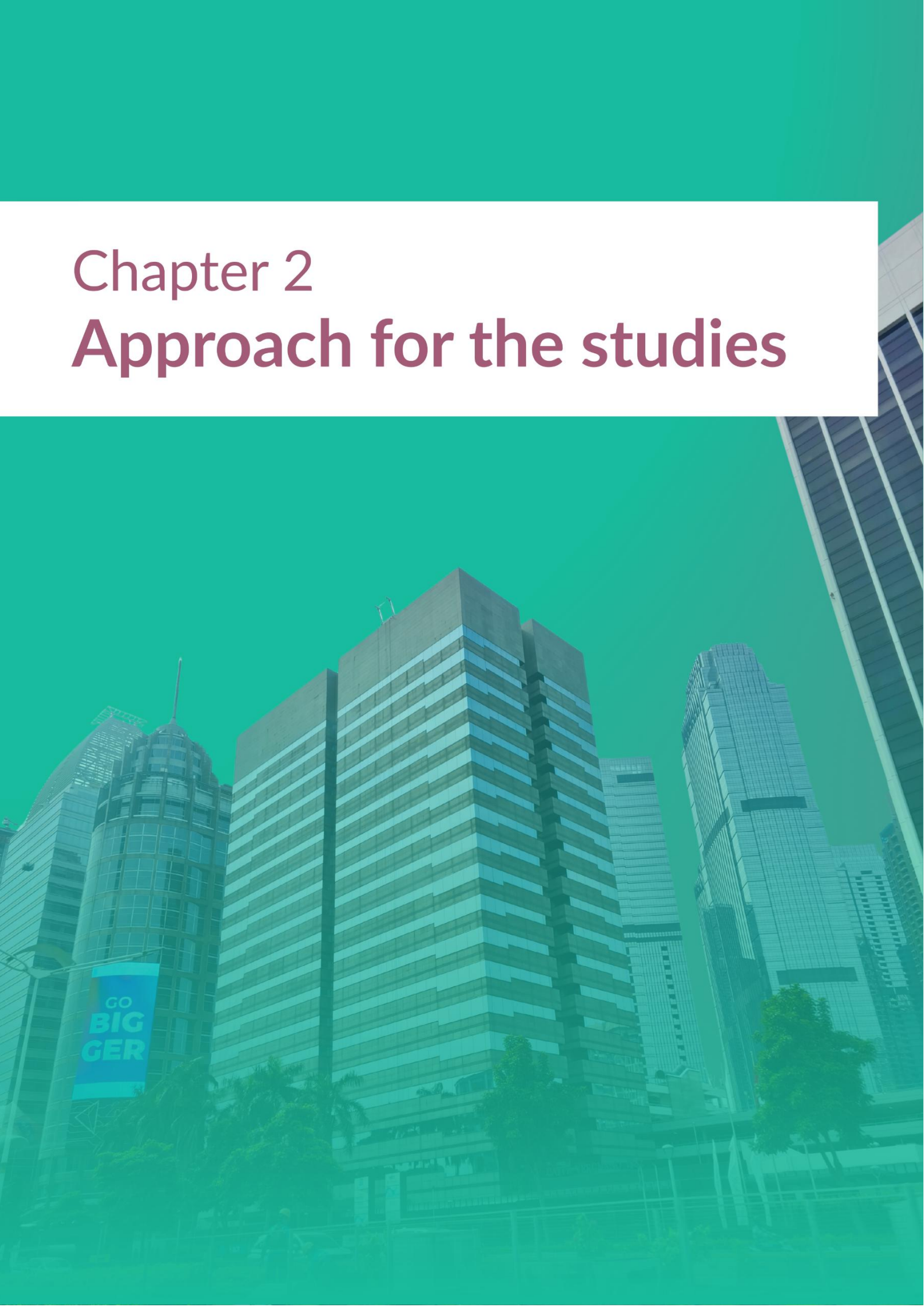
The ESCO market assessment presents an in-depth analysis of Indonesia's market readiness and capacity. It offers practical insights to support the growth of ESCOs and to strengthen their role in advancing energy-efficiency improvements nationwide.

OBF is a novel mechanism to overcome financial barriers to EE retrofits. It does this by embedding repayment into utility bills, thereby eliminating the need for upfront capital. OBF also serves as a potential way to open the residential building sector to ESCOs.

As the AMS strive to meet Net Zero targets amid rising energy demand and urbanisation, scaling EE solutions — particularly in the building sector, which accounts for about 23% of total final energy (TFEC) consumption across ASEAN—will be critical. This report aims to guide policymakers, investors, and industry stakeholders in creating an enabling environment for EE implementation through stronger policy frameworks, innovative financing models, and strategic market interventions.

This report defines ESCOs as companies that have the capability to manage a group of service providers, who can service the whole development value chain of EE projects, starting from Level 1 energy audits to Level 3 investment-grade energy audits, all the way to installation and commissioning, and monitoring and verification.

Chapter 2
Approach for the studies



2. Approach for the studies

2.1. Review approach for policy and regulatory framework

To obtain a comprehensive understanding of the ESCO market and OBF readiness in ASEAN, the study undertook a desk-based review of existing energy-efficiency regulations and policies, is undertaken.

The study includes an assessment of the regulatory landscape across the AMS, establishing the foundation required for ESCOs to operate effectively, as well as the policies and incentives that influence market behaviour and support an enabling environment for growth. The analysis was undertaken using an adapted version of the comprehensive framework developed by the IEA and ACE as part of the Roadmap for Energy Efficient Buildings and Construction in ASEAN, which was designed to evaluate the robustness of the regional policy landscape.

The Roadmap provides a framework intended to serve as a checklist for governments in creating a supportive regulatory and policy environment. It is structured around three main categories—Regulations, Information, and Incentives—representing the full range of policy mechanisms that can be considered when strengthening energy-efficiency governance.

This policy review applies the framework to provide an overview of existing policies in Indonesia and the gaps that have been identified, forming the basis for the detailed assessment that follows. The report examines regulations and policies relevant to ESCOs, highlighting those that directly influence market development, such as demand-side regulations that mandate ESCO services, and the availability of ESCO accreditation and training schemes.

In addition, it analyses the scope of these key regulations and identifies areas where gaps remain. The findings are informed by a desk-based literature review, supplemented by insights from the Carbon Trust's previous engagements and evaluation studies where available.

Aligned with the objectives of the ALCBT project, the review places particular emphasis on regulations and policies related to energy efficiency in buildings.

Framework for analysing EE policies

This section focuses on policies and incentives related to energy efficiency (EE) in buildings, as well as cross-sectoral enablers, in order to align with the objectives of the ALCBT project. The project prioritises technical, planning, and institutional tools to support the transition to low-carbon buildings in Cambodia, India, Indonesia, Thailand, and Viet Nam.

The policies reviewed concentrate on mechanisms that enable EE implementation, including EE financing, capacity-building for energy managers, and EE measures targeted at utilities.

To evaluate the strengths and identify gaps in current EE policy, this analysis draws on the policy categories and measures set out in the *Summary Policy Package towards Net Zero Carbon Buildings*, developed by the IEA in the report *Roadmap for Energy-Efficient*

Buildings and Construction in ASEAN.[1] The policy measures are grouped into three broad categories –Regulation, Information and Incentives.

- **'Regulation' policies** lay the foundational standards for EE, including building energy codes and standards, product standards such as MEPs, procurement regulations, regulations on materials, and framework regulations.
- **'Information' policies** refer to disclosure- and compliance-related measures, such as certification, labelling, disclosure, and benchmarking. It also encompasses capacity building initiatives like training programmes, accreditation for professionals, and awareness raising programmes for consumers.
- **'Incentives'** aim to enable EE through encouraging or discouraging market behaviours. These include financial incentives, non-financial incentives, and tariff policies.

Detailed descriptions of the policy measures in each category can be found in the IEA's *Roadmap for Energy-Efficient Buildings and Construction in ASEAN* report.[1]

Table 1. Framework for mapping energy efficiency and green building policies

Policy category	Policy measures	Description
Regulations	National EE Policy Framework or Regulation	National framework policy on EE (or energy if there is no EE-specific national framework) that is usually enacted by the Ministry of Energy in the respective countries, detailing the country's targets, objectives, priorities and policy mechanisms to achieve energy reductions.
	Minimum Energy Performance Standards (Product-related)	Mandatory minimum energy performance standards (MEPS) for all types of appliances and building systems with progressive and regular updates.
	Procurement regulations	Mandatory requirements for public procurement to use low-carbon materials and highly efficient equipment and appliances; use a life cycle approach to assess embodied carbon emissions in building materials.
	Building Energy Codes and Building Standards	Minimum energy and thermal performance requirements, renewable energy systems installation or utilisation, maximum allowed amount of embodied

[1] IEA (2022). *Roadmap for Energy-Efficient Buildings and Construction in ASEAN*. https://www.iea.org/reports/roadmap-for-energy-efficient-buildings-and-construction-in-the-association-of-southeast-asian-nations

Policy category	Policy measures	Description
		carbon emissions, structural and thermal resilience, covering all building types, new and existing buildings.
Information	Green Building Certification & Building Energy Labelling	Certification or rating labels for energy and carbon performance for new and existing buildings with requirements for materials efficiency, use of low-embodied-carbon materials.
	EE Labelling	Mandatory EE labelling regulations are designed to inform consumers about the energy performance of appliances, equipment, and buildings by displaying energy consumption metrics and efficiency ratings.
	Disclosure and Benchmarking	Mandatory disclosure and benchmarking schemes for energy and carbon performance for new construction and large renovation projects.
	Capability Development Programmes	Accreditation systems for professionals on energy management, audits, and other related curricula for all levels of education.
	Awareness Raising	Awareness raising programmes for consumers on multiple benefits of efficient and low-carbon buildings, energy-efficient renovation policies and incentives.
	Digital Tools and Data	Integrated design tools to assess energy performance and embodied carbon for building construction or renovation, building energy management systems (including accessibility of data by third parties/public).
Incentives	Financial Incentives	Grants, preferential loans, tax rebates, tied to energy and carbon performance levels of new or renovated buildings, building materials, systems and appliances.
	Non-financial Incentives	Expedited development review and approvals, fee reductions, density bonuses, and development allowances for energy-efficient low-carbon buildings.

Policy category	Policy measures	Description
	Tariff Policies	Energy tariff levels and presence of fossil fuel subsidies.

2.2. Review approach for ESCO Market Assessment

Given the market is at a nascent stage of development, the assessment is anchored on a central question: What would constitute a meaningful ESCO contribution to achieving Indonesia's commercial building TFEC reduction target?

To assess ESCO market conditions and OBF readiness across ASEAN, with a particular focus on Indonesia, a combination of desk-based and quantitative assessments was used, building on primary and secondary data. A summary of these steps is provided in the following sections.

Desk-based assessment

The initial step was to conduct a comprehensive literature review of published studies, white papers, and sector reports on commercial buildings, ESCO models and appliance efficiency.

The literature review was complemented by stakeholder engagement through semi-structured interviews and online surveys amongst four groups: (1) ESCOs and technology suppliers; (2) policymakers; (3) building owners; and (4) financiers. Interviewee outreach was supported by the ACE and the Carbon Trust's networks including ESCO expert Alexander Ablaza. Surveys were also disseminated via APKENINDO, Indonesia's ESCO association.

In total, 24 stakeholders participated (12 interviews, 12 surveys), comprised predominantly ESCOs and financiers. Government inputs included representatives from the Ministry of Energy and Mineral Resources, and the Financial Services Authority (*Otoritas Jasa Keuangan*). Table 2 summarises the distribution by country and stakeholder category.

Table 2. Total number of stakeholder engagements by category

Stakeholder category	Interviews completed	Surveys completed	Total no. of engagements
Indonesia	12	12	24
Building owners	2	-	2
Development organisations	1	-	1
ESCO/ESCO Associations/Technology suppliers	5	5	10
Financiers	2	6	8
Government	2	1	3

Quantitative assessment

To estimate the market size of ESCO growth in Indonesia, a quantitative approach was applied across three building types (public, commercial, and residential), which have been tested using multiple scenarios to derive the following insights: the number of ESCO projects required, the indicative number of ESCOs the market would need, and the volume of finance to be mobilised. The purpose of this assessment is to demonstrate that the present market is materially insufficient, and to set out the case for strengthening regulations, programmes and incentives.

The underlying data for the assessment were obtained from the 7th and 8th ASEAN Energy Outlooks; sources, assumptions and calculation steps are provided in Appendix 1.

2.3. Review approach for on-bill financing readiness

As efforts to accelerate EE adoption gain momentum—particularly within national and regional strategies to achieve Net Zero targets—a persistent challenge lies in securing affordable financing and developing innovative, and often unconventional, financial structures. On-bill financing (OBF) has emerged as a viable pathway, as it addresses both issues simultaneously. By embedding repayments directly into utility bills, OBF removes the need for large upfront investment, making energy-efficiency upgrades more accessible to building owners, homeowners, and tenants. This model not only simplifies the financing process, but also aligns repayment with realised energy savings.

A critical success factor for OBF programmes is the integrated ecosystem of stakeholders involved, including utilities, programme administrators, ESCOs, and end-users. This multi-actor collaboration enhances transparency, credibility, and trust in project delivery, positioning OBF as a strategic enabler for accelerating decarbonisation across the AMS.

Section 6 on OBF draws primarily on desk-based research, with extensive reference to case studies from the United States, where OBF programmes are comparatively more mature. These examples provided valuable insights and strategic considerations relevant to Indonesia's potential rollout of OBF, and helped shape recommendations tailored to its local context.

Chapter 3

Overview of energy service companies

3. Overview of energy service companies

Definition of ESCOs

An ESCO is a specialised firm equipped to deliver or coordinate comprehensive EE solutions across the entire development value chain of an EE project. This includes initiating the process with a Level 1 or walkthrough energy audit, progressing to a more detailed Level 3 or investment-grade audit, and then structuring the project to attract and secure financing.

ESCOs also oversee the installation and commissioning of energy-saving measures, and are responsible for conducting measurement and verification of energy savings to ensure that the projected energy savings are realised. Their integrated approach allows clients to benefit from a seamless, performance-driven model that reduces energy consumption and operational costs, while minimising risk.

3.1. Business models

ESCOs play a critical role in delivering EE solutions, serving as a one-stop shop for a facility owner's EE needs. There are various contractual business models that an ESCO could enter with a facility owner when implementing EE measures. One approach is through Energy Service Performance Contracts (ESPC, or an Energy Performance Contract, EPC).

ESPCs are contracts that guide the roles of an ESCO and facility owner in an EE project, the approach taken to measuring energy savings post-implementation of EE measures, and the payment to an ESCO. The remuneration to the ESCO is most often based on the amount of savings from reduced energy consumption from the energy-efficient systems/equipment installed. There are two types of ESPC business models: shared savings and guaranteed savings.

Shared savings model

In a shared savings model, the ESCO provides financing for the total upfront capital expenditure of the EE project on top of the project development and implementation costs. The energy (cost) savings are split between the ESCO and facility owner over the contract period according to a pre-arranged percentage split. The split depends on considerations, such as the cost of the project, the length of the contract, and the risks taken by the ESCO and the business owner (i.e., the client). This percentage split is typically large enough for the ESCO to repay its debt service to the lender, cover monitoring and verification costs, and receive compensation for performing its services.

Under this model, the facility owner has no contractual obligation to repay the lender. Instead, the loan is taken on by the ESCO, which means that the ESCO assumes both project performance and end-user credit risks. This approach typically requires an equity investment, as banks would typically only provide loans of up to 80% of the project value, causing the overall risk assumed by the ESCO to be higher than in a guaranteed savings structure.

The shared savings model works well as an introductory model for developing markets where facility owners are new to EE. It allows facility owners to avoid upfront capital investment and financial risk, making it easier to adopt energy-saving measures. Payments

to the ESCO would be ongoing based on savings obtained and therefore be off balance sheet. However, the success of this model is contingent on the ESCO being creditworthy and bankable. It should also be noted that this structure could potentially limit the long-term market growth for ESCOs, as they are required to raise substantial amounts of equity for their pipeline of EE projects to grow.

Guaranteed savings model

In a guaranteed-savings model, the ESCO commits to achieving a pre-determined level of energy savings over an agreed period (for example, monthly, quarterly, or annually). If the installed EE project fails to deliver the savings specified in the ESPC, the ESCO must compensate the facility owner for the shortfall. Conversely, if the realised savings exceed the guaranteed level, the facility owner pays the ESCO an agreed proportion of the additional savings.

This performance guarantee mitigates the facility owner's concern that the projected savings may not materialise, thereby reducing uncertainty around payback and supporting investment confidence in EE projects.

In this model, the upfront capital expenditure for the project is provided by the facility owner. This could either be from its balance sheet, or a loan from a bank. The bank loan will 5likely have to be combined with the facility owner's own equity, as banks normally provide loans of 75% to 80% of the project value. Business models differ country to country in ASEAN. The Philippines and Malaysia make greater use of the shared savings model, whereas countries such as Thailand rely more on the guaranteed savings model.[2] [3] [4] [5] By contrast, both shared and guaranteed savings models appear to be common in Singapore.[6] [7]

[2] Energy Transition Partnership. (2024). Philippines ESCO market research. https://www.energytransitionpartnership.org/wp-content/uploads/2024/04/Philippines-ESCO-Market-Research.docx-1.pdf

[3] Asian Development Bank Institute. (2021). *Energy service companies in Asia: A review of ESCO models and financing mechanisms* (ADBI Working Paper Series No. 1183). https://www.adb.org/sites/default/files/publication/636646/adbi-wp1183.pdf

[4] Asia-Pacific Economic Cooperation. (2017). *Sector study on environmental services: Energy efficiency businesses*. 217_PSU_Environmental-Services_Energy-Efficiency-Businesses.pdf

[5] International Energy Agency. (2018). *Energy service companies (ESCOs): ESCO contracts*. https://www.iea.org/reports/energy-service-companies-escos-2/esco-contracts

[6] Asian Development Bank Institute. (2021). *Energy service companies in Asia: A review of ESCO models and financing mechanisms* (ADBI Working Paper Series No. 1183). Https://www.adb.org/sites/default/files/publication/636646/adbi-wp1183.pdf

[7] National Environment Agency. (n.d.). *Energy efficiency in the public sector*. https://www.nea.gov.sg/our-services/climate-change-energy-efficiency/energy-efficiency/public-sector

The choice of model depends on various factors, such as the presence of enabling market conditions and the ESCO's ability to raise capital independently, either through debt or equity. **Servitisation model**

In the servitisation, or 'as-a-service', model, clients pay ESCOs based on performance metrics—such as energy saved or cooling delivered—rather than purchasing equipment outright. Unlike shared-savings or guaranteed-savings models, the ESCO retains ownership of the installed systems (for example, cooling, lighting, or HVAC) and delivers energy-efficiency outcomes as a service. This approach aligns with performance-based contracting, in which the ESCO assumes both the technical and financial risks and is compensated through the verified savings achieved.

Servitisation helps overcome common barriers to EE adoption, such as high upfront costs and perceived technology risks. It incentivises ESCOs to deploy efficient, reliable systems and optimally maintain them, since their revenue depends on sustained performance. This model is especially effective in public sector procurement and emerging markets, where budget constraints and sustainability goals drive demand for innovative financing and delivery mechanisms.[8]

OBF as a business model for ESCOs

OBF presents a compelling business model for ESCOs, particularly in markets like Indonesia, where access to upfront capital remains one of the barriers to EE adoption. On-bill financing is an EE mechanism where utility companies cover upfront costs for energy-saving upgrades, and customers repay through a charge on their utility bill. This approach simplifies access to EE improvements by eliminating the need for separate loans and tying repayment to energy savings.

Given OBF's multi-stakeholder structure – typically involving utilities, programme administrators, and end-users [more in Section 6.1.1] – ESCOs are well positioned to serve as the technical delivery arm of an OBF programme.

Under a typical OBF scheme, ESCOs are engaged as pre-qualified or accredited service providers, listed on an approved vendor registry maintained by the programme manager. Their core responsibilities include conducting energy audits, designing EE interventions, and implementing the installation of EE technologies. This model offers several advantages for ESCOs:

- **Steady project pipeline** – as the programme scales, ESCOs benefit from a high volume of relatively standardised projects; and
- **Reduced customer acquisition burden** – with financing mechanisms embedded in utility bills and programme-level marketing, ESCOs benefit from increased customer trust (through the programme) and access to a large market through the utility.

[8] World Economic Forum. (2020, November 20). *What is servitisation, and how can it help save the planet?* World Economic Forum. https://www.weforum.org/stories/2020/11/what-is-servitization-and-how-can-it-help-save-the-planet/

However, this model also comes with operational considerations. In residential or small commercial segments, the project size may be modest, with high volume and repetition. ESCOs must optimise and streamline execution. OBF shifts what may be perceived as bespoke deliveries toward a more programmatic, volume-driven delivery model. For ESCOs, this presents an opportunity to scale impact while contributing to EE goals.

3.2. Best available practices and case studies

Globally, the availability of detailed case studies remains limited. This is largely due to the confidentiality clauses embedded within ESPCs, which often restrict ESCOs from disclosing project outcomes and other related data to external audiences.

A country's ESCO market can be established in numerous ways. In countries where there is substantial demand for EE solutions, service providers often establish a market presence organically. However, governments frequently play a catalytic role in the early stages of market development, by creating enabling conditions. Italy offers a notable example. Its regulatory support mechanisms, particularly the White Certificates scheme, were amongst the key drivers of EE implementation. When White Certificates became accessible to ESCOs, they provided a financial incentive by allowing these companies to earn and sell certificates to obligated energy distributors, thereby monetising verified energy-saving projects.[9]

The case studies provide a balance of both the guaranteed and the shared savings models. Both models are widely used in ESCO contracts. The guaranteed savings model is often preferred by clients who prioritise predictability and control — typically in public sector projects — since it ensures a minimum level of energy savings. By contrast, the shared savings model is better suited for performance-based partnerships, where the ESCO and client jointly benefit from the actual savings achieved.

Case Study 1: The Athenee Hotel, Bangkok (Thailand)

The Athenee Hotel, owned by Asset World Corporation, is a newly restored luxury hotel located in Thailand's central business district and operated in partnership with Marriott International. The ESCO services provided are through a collaboration between Azbil (Thailand), focusing on technical and operations, and Fuyo General Lease (Thailand), which will own and manage the installed EE equipment. Both organisations originate from Japan, and this collaboration aims to bring together the strengths of each to deliver an integrated solution for The Athenee Hotel [see Figure 1].

The project was agreed upon, and construction began in January 2022, under which the ESCOs undertook a **shared savings agreement** with The Athenee Hotel's owner, Asset

[9] Sciences Po. (2023, September 13). *The ESCO market in Italy and Germany: Overview and areas of improvement*. Chair for Sustainable Development. *The ESCO Market in Italy and Germany; Overview and Areas of Improvement – European Chair for Sustainable Development and Climate Transition*

World Corporation (AWC).[10] The contract size of this project has not been publicly disclosed.

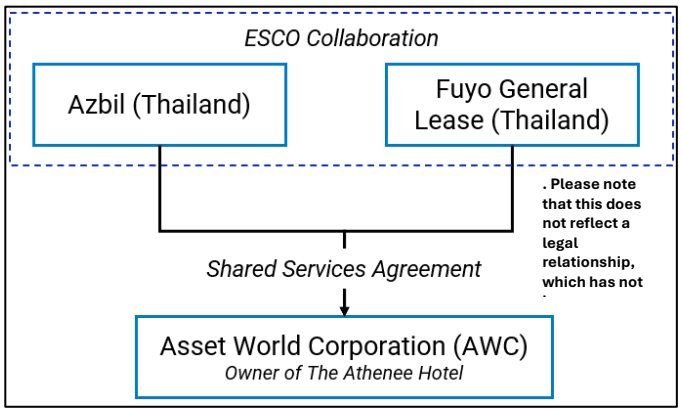


Figure 1: Relationship between ESCO, equipment owner and The Athenee Hotel

Prior to the project's initiation, the hotel faced challenges in accurately assessing its energy consumption, which hindered efforts to implement an efficient and sustainable energy strategy. The cost of deploying a centralised monitoring system to visualise energy usage further complicated the approach.[11] However, through a shared savings agreement with an ESCO, the hotel was able to leverage specialised expertise, while keeping upfront investment to a minimum.

A critical step in the scope of work involved Azbil installing its proprietary Building Energy Management System (BEMS). This component, alongside other upgrades, was meant to improve the operations of HVAC systems, promote efficiency, and introduce energy-conservation controls. Azbil collected operational data, evaluated the energy-saving effectiveness, and reported upwards to AWC every month. Fuyo Lease acts as the owner and manager of the facilities, leveraging the BEMS.

The four-year ESCO contract period began in October 2022, and uses the hotel's total energy consumption (in kWh) from 2017 to 2019 as a baseline. From that baseline, it sets an approximate 8% reduction of energy consumption (electrical bill) for the entire building and 12% for the energy consumption of the air conditioning system.

It is projected that Azbil's BEMS will play a major role in achieving more than a 50% reduction in energy consumption.[12] Since the project's inception, successful outcomes in installation and energy conservation have been reported. Both Azbil and Fuyo Lease are

[10] Hotel Management Network. (2023, October 27). *Azbil, Fuyo General Lease to offer ESCO services at The Athenee Hotel*. https://www.hotelmanagement-network.com/news/azbil-fuyo-general-esco-services/

[11] Azbil (n.d.) The Athenee Hotel Flyer. https://www.azbil.com/case/pdf/flyer_EN_azbil_2024_TheAtheneeHotel.pdf

[12] Azbil Corporation. (n.d.). The Athenee Hotel, a Luxury Collection Hotel, Bangkok: Delivery case of building solutions. https://www.azbil.com/case/bsc/app_051/index.html

now in support of other energy-saving hotel projects across Thailand.[13] In this study, we see how two ESCOs – one specialising in building energy management systems and the other in asset management – collaborated to unlock contracts that potentially neither company could have secured independently.

Case Study 2: Adi Husada Undaan Hospital, Surabaya (Indonesia)

Adi Husada Undaan Hospital (AHUH) is a prominent private general hospital located in Surabaya. It offers a range of general and speciality medical services for the surrounding community. The hospital operates under the management of the Adi Husada Foundation. In this case study, Synergy Efficiency Solutions (SES) partnered with AHUH to execute an EE retrofit. SES acted as the project lead, overseeing the full life cycle, ranging from initial energy audits to engineering design and implementation of an optimised system across lighting, cooling, steam, and power quality.[14] The initiative was financed through a five-year **shared savings contract**, in which SES invested its own capital. This contract structure was key, as it was reported that AHUH would have otherwise not upgraded due to the high upfront investment.[15] Both SES and AHUH will share in the resulting energy cost savings during the contract period. Upon completion, all upgraded assets will be transferred to the hospital, which would benefit from 100% of the ongoing savings for the remaining equipment lifespan, estimated at 15 years.

Before implementing upgrades, SES undertook data collection and baseline analysis, followed by the development of a tailored solution. Only after this process were investments approved and installations carried out. Key upgrades included:

Steam system	• Replaced a diesel boiler with a right-sized electric boiler
Domestic hot water	• Installed solar thermal hot water system for water heating during the day
Cooling system	• Retrofitted refrigerants with high efficiency hydrocarbon refrigerant
Lighting system	• Upgraded all lights to LEDs • Installed motion and photosensors across the hospital
Building envelope	• Installed Low E window film on windows with higher exposure to the sun, reducing the entering heat load
Remote energy monitoring	• Installed monitoring devices to monitor energy savings in real time, providing data to optimise future savings

Source: Adi Husada Case Study

[13] Azbil (n.d.) *Azbil launches ESCO services for The Athenee Hotel in Bangkok*. https://www.azbil.com/press/231026.html

[14] Synergy Energy Solutions. (n.d.). Adi Husada Case Study. https://drive.google.com/file/d/1FLmE3X7IHUAlhNXKZvkGNk9RaVAtev1E/view

[15] Freischlad, N. (2015, August 20). *This Indonesian company designed the most energy efficient building in Southeast Asia*. Tech in Asia. https://www.techinasia.com/ses-designed-most-energy-efficient-building-southeast-asia

The SES project with AHUH has since concluded and enabled a 38% cost savings on its energy bill, and a 39% energy savings (kWh) over the five-year contract. AHUH achieved an immediate return on investment, as it did not provide any upfront capital. AHUH energy baseline was modelled on a multiple-variable regression-based bed occupancy rate, electricity use, and diesel consumption. This model adjusts monthly energy expectations according to patient load, allowing a more accurate measurement of stated savings.

3.2.1. Emerging insights

Trust and transactions

ESCO engagements require more than just technical solutions – they demand a deeper transactional relationship, beyond simply buying/selling a service. The case studies have shown that a level of trust, transparency and accountability must be present before projects are kicked off.

Experts with aligned incentives

ESCOs are recognised as specialists in energy management, distinguished by extensive on-the-ground experience over time. Their performance is typically measurable and outcome-driven, making them ideal partners for organisations that want to improve EE, reduce costs, and support decarbonisation goals. In the case of AHUH, the initial plan to self-manage energy upgrades was reconsidered after evaluating the complexity and upfront investment required. Partnering with SES under the shared savings model not only made commercial sense, but also considerably de-risked implementation by entrusting the project to a specialist with a vested interest in its success. It underscores the value of letting ESCOs do what they do best.

ESCO services are generally sector agnostic

The case studies demonstrate that ESCOs have successfully delivered value across a diverse range of sectors, including public-owned residential development, luxury hospitality, and healthcare facilities. These examples highlight the broad applicability of ESCO solutions, particularly where energy upgrades focus on more generic systems such as HVAC, lighting, and ventilation. Contractual models like shared savings and guaranteed savings have proven effective in aligning stakeholder interests and creating mutually beneficial outcomes.

However, certain markets and sectors may demonstrate challenges that limit ESCO engagement.

In some markets, public sector engagement with ESCOs is hindered by restrictive procurement frameworks. Government contracting rules often prohibit hybrid arrangements that do not fit into 'pure goods' or 'pure services' categories, such as ESPCs. Additional barriers include limitations on multi-year contracts and budgetary policies that prevent public agencies from using accrued energy savings to finance EE measures or compensate ESCOs.

Highly specialised or tightly regulated industries, such as data centres, defence facilities or transportation networks, often exhibit unique energy consumption profiles and compliance requirements, making solution offerings more challenging, thereby guaranteeing savings is a riskier claim.

Fragmented ownership structures can hinder project implementation. For instance, mixed-use developments like Berjaya Times Square, a well-known shopping mall in Malaysia, comprise retail spaces, residential units, offices and hotels, each owned by separate entities.[16] In such cases, ESCOs may struggle to deploy building-wide energy solutions due to the complexity of coordination. Performance-based contracts are particularly risky when consensus is difficult to achieve, and accountability is spread thin.

[16] Berjaya Properties. (n.d.). *Berjaya Times Square Sdn Bhd introduces Times Square 2 Kuala Lumpur*: Your key to city living. https://www.berjayaproperties.com/news/iproperty/berjaya-times-square-sdn-bhd-introduces-times-square-2-kuala-lumpur-your-key-to-city-living

Chapter 4

Deep dive into EE policies and regulations

4. Deep dive into EE policies and regulations

4.1. Regulations

The government's efforts on EE are guided by the national EE regulation, first promulgated in 2009 and subsequently revised and strengthened in 2023. This regulation functions as an overarching framework that covers multiple aspects of EE, although it remains high level in scope. More detailed provisions are set out in derivative regulations, which address specific components, such as ESCO development and incentives for implementing EE measures. Additional regulations also exist, including those governing minimum energy performance standards (MEPS) for appliances.

However, MEPS is an area in which Indonesia lags behind other countries. Only a limited number of appliances are currently regulated, and where standards do exist, the qualifying thresholds are often regarded as too low, particularly when compared with international benchmarks.

National *EE Regulation – Government Regulation No. 33/2023 on EE (or Peraturan Pemerintah Republik Indonesia Nomor 33 Tahun 2023 tentang Konservasi Energi (PP 33/2023)*

Indonesia promulgated PP 33/2023, which is an umbrella regulation on energy conservation, mandating energy management in Indonesia for the following parties:[17]

- Energy supplier who consumes energy sources and/or energy of more than or equal to 6,000 tonnes of oil equivalent (toe) per year.
- Entities in the transport and industry sectors that consume energy sources and/or energy of more than or equal to 4,000 toe per year.
- Entities in the commercial sector that consume energy sources and/or energy of more than or equal to 500 toe per year.

PP 33/2023 mandates entities that meet the above criteria to appoint a certified energy manager, undertake EE programme planning, periodic energy audits, and implement the recommendations from the energy audits.

The regulation further states that measurement and verification of EE projects must be performed by verifiers with the appropriate competency certificates.

PP 33/2023 acknowledges the importance of fiscal and non-fiscal incentives and disincentives in facilitating the implementation of energy conservation. Additionally, it goes further and mandates regional governments to implement energy conservation in their respective jurisdictions, with the appropriate budgets set aside under the local state budgets.

PP 33/2023 replaces *Peraturan Pemerintah Republik Indonesia Nomor 70 Tahun 2009 tentang Konservasi Energi* (PP 70/2009), which was Indonesia's first energy conservation

[17] *Peraturan Pemerintah Nomor 33 Tahun 2023 Tentang Konservasi Energi*. (2023). https://faolex.fao.org/docs/pdf/ins221477.pdf

regulation, laying the early foundation for energy management in Indonesia. Under PP 70/2009, entities are only subjected to the regulation if their consumption exceeded 6,000 toe per year, regardless of economic sector. PP33/2023 is a significant improvement over PP70/2009, as it includes qualifying criteria that are more relevant to the different economic sectors, and reduces the qualifying threshold for the transport, industry, and commercial sectors, thereby requiring more entities to take action on EE.[18]

PP 70/2009 mentioned incentives that could be made available to entities subjected to the regulation, such as tax facilities for energy-efficient equipment, reducing tax burdens and low-interest loans for EE projects. However, it has been reported that none of these incentives were implemented.

4.1.1. Derivative regulation

Indonesia's MEMR enacted two derivative regulations following on from PP 33/2023 in January 2025. These are:

- ***Ministerial Regulation No. 3/2025 on EE in National and Local Governments,***[19] providing details on the responsibilities linked to EE that government entities need to enact. This includes appointing an energy manager, preparing an EE programme, undertaking regular energy audits and implementing the outcomes of these audits, accounting for EE in government procurement, awareness raising, capability development and cooperation on EE.
    - This regulation additionally includes ESCO financing for government projects as an approved source of finance for implementing EE.
    - It further includes sections on reporting, monitoring, evaluating and applying the economic value of carbon.

- ***Ministerial Regulation No. 8/2025 on Energy Management***[20] provides further detail on the obligations of companies subject to PP 33/2023, including the procedures they must follow and the financing options available for EE projects—amongst them ESCO financing. It also emphasises the importance of pairing Energy Savings Performance Contracts (ESPCs) with monitoring and verification conducted by certified experts. In addition, the regulation outlines incentives and disincentives available to eligible entities.
    - Both fiscal and non-fiscal incentives are mentioned; however, there is a lack of detail on fiscal incentives, with the related clause merely stating that it will

[18] Peraturan Pemerintah Republik Indonesia Nomor 70 Tahun 2009 Tentang Konservasi Energi. (2009). https://peraturan.bpk.go.id/Details/4996

[19] Peraturan Menteri Energi dan Sumber Daya Mineral, Republik Indonesia, Nomor 3 Tahun 2025 Tentang Konservasi Energi Oleh Pemerintah dan Pemerintah Daerah. (2025). https://jdih.esdm.go.id/dokumen/download?id=2025pmesdm3.pdf

[20] *Peraturan Menteri Energi dan Sumber Daya Mineral, Republik Indonesia, Nomor 8 Tahun 2025 Tentang Manajemen Energi*. (2025). https://jdih.esdm.go.id/dokumen/download?id=2025pmesdm8.pdf

be guided by Indonesia's state finance regulations. A suite of non-fiscal incentives is also listed, but it is unclear if these are sufficient to motivate action.

- Disincentives include written reminders, announcements of non-compliance in mass media, and recommendations for ministers, governors or mayors to revoke incentives.

4.1.2. Specific regulations

Green Building Regulation

Indonesia promulgated Government Regulation No. 16/2021 *'Peraturan Pemerintah Republik Indonesia Nomor 16 Tahun 2021 tentang Peraturan Pelaksanaan Undang-Undang Nomor 28 Tahun 2002 tentang Bangunan Gedung'*. PP 16/2021 regulates and codifies green buildings at the national level for the first time, and outlines the types of buildings mandated to follow green building guidelines.[21]

Additionally, Regulation of the Minister of Public Works and Public Housing No. 21/2021 (MPWHR 21/2021) on Green Building Performance Assessment[22] was enacted shortly after PP 16/2021. It specifies the types of buildings that are required to comply with PP 16/2021, and includes provisions on energy performance assessment, as well as measurement, reporting and certification related to green buildings and outlines the parameters, which include energy and water use efficiency, for obtaining green building certification (*Utama, Madya* or *Pratama*). It further specifies the incentives that owners and/or managers of green buildings can obtain from provincial and local governments.[23]

Subnational regulations on green buildings in Indonesia exist, and many of them predate PP 16/2021 and MPWHR 21/2021. These regulations are:

- Mayoral Regulation of Semarang No. 24/2019 on Green Buildings;
- Mayoral Regulation of Bandung No. 1023/2016 on Green Buildings;
- Mayoral Regulation of Pariaman, West Sumatera No. 33/2018 on Green Buildings; and
- Gubernatorial Regulation of Jakarta 60/2022 on Green Buildings – This regulation has since been revoked in 2023, to align with the national regulations on green buildings, PP 16/2021, and MPWHR 21/2021;

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[21] *Peraturan Pemerintah Republik Indonesia Nomor 16 Tahun 2021 Tentang Peraturan Pelaksanaan Undang-Undang Nomor 28 Tahun 2002 Tentang Bangunan Gedung*. (2021). https://jdih.pu.go.id/detail-dokumen/PP-nomor-16-Tahun-2021-tahun-2021-Peraturan-Pelaksanaan-Undang-Undang-Nomor-28-Tahun-2002-Tentang-Bangunan-Gedung.

[22] *Peraturan Menteri Pekerjaan Umum Dan Perumahan Rakyat, Republik Indonesia, Nomor 21 Tahun 2021, Tentang Penilaian Kinerja Bangunan Gedung Hijau*. (2021). https://greenbuilding.ft.ugm.ac.id/wp-content/uploads/sites/978/2024/11/Permen-PUPR-No-21-Tahun-2021.pdf

[23] Cities Climate Finance Leadership Alliance. (March 2024). *Financing Green Buildings in Indonesian Cities, An analysis of key Instruments for Climate Impact*. https://www.climatepolicyinitiative.org/wp-content/uploads/2024/03/Financing-Green-Buildings-in-Indonesia.pdf

- Gubernatorial Regulation of Bali 45/2019 on Bali Clean Energy (including Article 22 on Green Buildings); and
- Regal Regulation of Gorontalo Regency No. 53/2017 on Green Buildings.[23]

These regulations represent a positive step towards advancing energy efficiency in Indonesia's building sector. However, their scope remains limited, as they apply only to very large buildings with a floor area greater than 5,000 m^2. The residential sector—responsible for 83% of energy demand from buildings—is not required to comply with these regulations.[23] Enforcing compliance with green building standards remains a significant challenge.

Since the subnational regulations on green buildings predate the national regulations, efforts should be undertaken to ensure that they are aligned and not in conflict with the broader scopes of PP 16/2021 and MPWHR 21/2021.

Appliance minimum energy performance standards

On 22 June 2021, the government of Indonesia promulgated and enacted the *Regulation of the Minister of Energy and Mineral Resources No. 14/2021 on Application of Minimum Energy Performance Standards to Energy Consuming Equipment*. The Regulation sets out the fundamental principles for MEPS and EE labelling schemes for energy-consuming equipment. The Regulation does not stipulate specific target products or standard values. Such detailed rules are scheduled to be enacted by the relevant Directorate Generals within the Ministry of Energy and Mineral Resources.

Appliance-specific regulations include:

1. Decree of the Minister of Energy and Mineral Resources No. 103.K/EK.07/DJE/2021 on Minimum Energy Performance Standards and Energy Savings Labels for Energy-Consuming Air-Conditioners (or *Kepmen ESDM No.103.K/EK.07/DJE/2021*).[24]
2. Decree of the Minister of Energy and Mineral Resources No. 20.K/EK.07/DJE/2024 on Minimum Energy Performance Standards and Energy Savings Labels for Energy-Consuming Equipment – Light Emitting Diodes (or *Kepmen ESDM No. 20.K/EK.07/DJE/2024)*. This regulation specifies the energy savings value (in lumens/watt) for each star level (1 to 5), and the testing and certification processes.
3. Decree of the Minister of Energy and Mineral Resources No. 8.K/EK.07/DJE/2024 on Minimum Energy Performance Standards and Energy Savings Labels for Refrigerators (or *Kepmen ESDM No.8.K/EK.07/DJE/2024*).

[24]Decree of the Minister of Energy and Mineral Resources No. 103.K/EK.07/DJE/2021 on Minimum Energy Performance Standards and Energy Savings Labels for Energy-Consuming Air-Conditioners. (2021). https://simebtke.esdm.go.id/sinergi/assets/content/20210924123008_103KEK07DJE2021_STANDAR_KINERJA_MINIMUM_DAN_LABEL_TANDA_HEMAT_ENERGI_UNTUK_PERALATAN_PEMANFAATAN_ENERGI_PENGONDISI_UDARA.pdf

4. Decree of the Minister of Energy and Mineral Resources No. 114.K/EK.07/DJE/2021 on Minimum Energy Performance Standards and Energy Savings Labels for Fans (or *Kepmen ESDM No.114.K/EK.07/DJE/2021*).
5. Decree of the Minister of Energy and Mineral Resources No. 115.K/EK.07/DJE/2024 on Minimum Energy Performance Standards and Energy Savings Labels for Rice Cookers (or *Kepmen ESDM No.114.K/EK.07/DJE/2024*).
6. Decree of the Minister of Energy and Mineral Resources No. 8.K/EK.07/DJE/2024 on Minimum Energy Performance Standards and Energy Savings Labels for Refrigerators (or *Kepmen ESDM No.8.K/EK.07/DJE/2024*).
7. Decree of the Minister of Energy and Mineral Resources No. 126.K/EK.06/DJE/2023 on Minimum Energy Performance Standards and Energy Savings Labels for Refrigerated Display Case (or *Kepmen ESDM No. 126.K/EK.06/DJE/2023*).
8. Decree of the Minister of Energy and Mineral Resources No. 162.K/EK.06/DJE/2023 on Minimum Energy Performance Standards and Energy Savings Labels for Televisions (or *Kepmen ESDM No.162.K/EK.06/DJE/2023*).
9. Decree of the Minister of Energy and Mineral Resources No. 87.K/EK.01/MEM.E/2025 on Minimum Energy Performance Standards and Energy Savings Labels for Drinking Water Dispenser (or *Kepmen ESDM No. 87.K/EK.01/MEM.E/2025*).

4.2. Information-oriented policies

Referencing the policy framework for Net Zero carbon buildings in Table 1, it is evident that EE policies in Indonesia fall predominantly within the regulation category. Indonesia's EE efforts are strongly guided by existing regulatory instruments, most notably the national PP 33/2023 and the subsequent Ministerial Regulations derived from it. This indicates that regulation is the primary policy lever used by the Ministry of Energy and Mineral Resources (MEMR) to drive EE implementation.

Accreditation and human resource development

The Green Building Certificate is currently the only certification policy in Indonesia that relates to EE. However, it applies only to new buildings with a gross floor area greater than 5,000 m^2, limiting its coverage and impact.

Human capability development programmes for EE are being implemented, yet there does not appear to be a clear long-term strategy guiding them. Many of these training initiatives are delivered through development-partner programmes and are therefore constrained by programme duration. To sustain progress, training should be continuous and designed to support both the upskilling and renewal of existing talent, as well as the development of new talent entering the workforce.

4.3. Incentive-oriented policies

Fiscal incentives are referenced in PP 33/2023 and its derivative regulations. However, the provisions are vague, stating only that any incentives offered would be aligned with Indonesia's state finance regulations. It remains unclear if, or how, such incentives will be

developed, given the need for coordination across multiple ministries. Experience under the previous national regulation, PP 70/2009, indicates that this process is challenging and may ultimately not be implemented.

Non-fiscal incentives are also included in PP 33/2023, such as the provision of training, the issuance of energy-savings certificates, the delivery of energy audits, and support for the development of energy-management systems. However, it is uncertain how many buildings are able to benefit from these incentives, or whether they are sufficiently attractive to building owners. Current understanding suggests that energy audits are supported primarily through development-partner programmes and through MEMR's Human Capability Development Unit (*Pusat Pengembangan Sumber Daya Manusia*). Resources are limited, meaning that only a small number of audits can be delivered each year.

4.4. ESCO market policy and regulatory environment in Indonesia

Policy landscape

No clear policies for ESCOs were identified in Indonesia. Nonetheless, existing regulations on green buildings and energy management for large energy consumers both require the implementation of EE measures identified in an energy audit. This implicitly suggests that there is a role for ESCOs to play in supporting the implementation of EE in Indonesia.

A Ministerial Regulation on ESCOs is understood to be in draft stages. It is hoped that this regulation will include additional policy programmes to support its operationalisation.

Only one incentive mechanism that could benefit ESCOs was identified in Indonesia. This is the EE credit guarantee mechanism managed by the Korean Development Bank, with funding from the Green Climate Fund. Through this mechanism, ESCOs could receive a credit guarantee that covers up to 95% of the loans they receive from a participating financial institution.[25] A credit guarantee can help to allay some of the perceived risks that financial institutions have in ESCOs, EE projects and the related business models, thereby enabling ESCOs to access loans, reducing the need for them to invest a large part of their own equity in projects. With less equity locked in projects, ESCOs will have the ability to develop more EE projects, thereby enabling them to grow further as a business.

The Carbon Trust has worked on piloting a credit guarantee mechanism in Indonesia. At the time of writing this report, however, no ESCO has yet received a credit guarantee under this programme. This can largely be attributed to the lack of creditworthiness of most ESCOs in Indonesia and the absence of an environment that is conducive to the further development of ESCOs.

Regulatory environment

PP 33/2023 requires entities with energy consumption at or exceeding the qualifying threshold to implement mandatory energy management, including undertaking periodic energy audits and implementing the outcomes from these audits. While PP 33/2023 does

[25] Green Climate Fund. (2022). FP196 *Supporting Innovative Mechanisms for Industrial Energy Efficiency Financing in Indonesia with Lessons for Replication in other ASEAN Member States,* https://www.greenclimate.fund/project/fp196

not specifically mention ESCOs, this requirement alludes to their relevance, as they are entities that can deliver both energy audits and the implementation of EE measures.

Furthermore, it is known that the MEMR are currently drafting a Ministerial Regulation on ESCOs as a follow-up to PP 33/2023. When released, this regulation is expected to provide a regulatory basis for the development of ESCO businesses and the associated business models in Indonesia, thereby facilitating the growth of the Indonesian ESCO market.

Previously, Ministerial Regulation No. 14/2016 on the establishment of ESCOs was issued as a derivative regulation of PP 70/2009. It provided additional detail on ESCO business models, registration requirements, reporting obligations, and capability-development programmes supported by MEMR. However, the regulation was revoked in 2018 as part of wider efforts to streamline regulations in line with presidential directives to promote investment by reducing licensing requirements and regulatory complexity.

Energy efficiency is also a core assessment criterion in the Regulation of the Minister of Public Works and Public Housing No. 21/2021 on Green Building Performance Assessment. Performance is evaluated through parameters such as building envelopes, ventilation, air-conditioning, and lighting systems. Although ESCOs are not explicitly referenced in this regulation, the need to identify, implement, and verify energy-saving measures in order to qualify for green-building certification indicates a critical role for ESCOs in supporting compliance and driving performance improvements across Indonesia.

Chapter 5

ESCO market potential in Indonesia

5. ESCO market potential in Indonesia

Overview of the ESCO market in Indonesia

The regulatory environment for EE in Indonesia continues to grow in maturity, and it is evident that regulations are the main policy tools used by MEMR to encourage EE uptake. The promulgation of **Government Regulation No. 33/2023 on Energy Conservation** marks the most substantial policy intervention in Indonesia's EE landscape since the original regulation was enacted over a decade ago, replacing **PP No. 70/2009,** and significantly expanding the scope, obligations, and mechanisms for energy conservation across sectors.

There remains a lack of policies and incentives to promote awareness and uptake, especially in the private sector. The effectiveness of current policies in overcoming existing barriers, such as a lack of awareness of EE measures, ESCO business models, and encouraging private sector financing is therefore limited.

5.1. Status of ESCOs in Indonesia

The ESCO market remains quite nascent, as minimal ESCO projects have been implemented. There are 12 ESCOs listed on the government's website, while stakeholder engagements suggested that only ten are active in developing projects.[26] Many ESCOs in Indonesia are small engineering firms that can provide energy audits, typically up to Level 2. However, engagements with these ESCOs revealed that most lack the ability and capacity to undertake Investment Grade Audits (IGAs), structure finance, enter ESPCs, and implement projects. This suggests that there are service providers who refer to themselves as ESCOs, but who are unable to deliver the full suite of services of a true ESCO.

Stakeholder engagements further revealed that shared savings and energy-as-a-service projects have been implemented, though their success remains limited due to the inability to address some of the risks related to EE (economic, financial, and regulatory risks). Guaranteed savings projects have not yet been implemented, though there are ESCOs that have guaranteed performance based on parameters such as pressure of compressed air and cooling load over a limited timeframe for EE projects developed in the industrial sector.

Numerous energy audits have been undertaken in Indonesia. Most of these indicate opportunities to carry out integrated system renovations (as opposed to single technology) within the industry sector.[27] The most common opportunity within the building sector involves HVAC systems (about 70% to 80% of all energy audits undertaken), according to ESCO and energy service providers surveyed. Other opportunities in the building sector

[26] Direktorat Jenderal EBTKE. (n.d.). *Daftar perusahaan jasa konservasi energi*. https://simebtke.esdm.go.id/sinergi/page/perusahaan_jasa_konservasi_energi

[27] Camarasa, C., Lütken, S., & Yargattimath, T. (2025). Global ESCO market report 2025. UNEP Copenhagen Climate Centre. https://c2e2.unepccc.org/wp-content/uploads/sites/3/2025/05/global-esco-market-report-2025.pdf

include building management systems, window film tinting, lighting, and variable speed drives and motors.

Although few ESCO projects have been delivered in Indonesia to date, those that have been implemented have demonstrated annual energy consumption savings of over 20%, particularly where there were upgrades to HVAC systems.[28] [29]

Ticket sizes of projects are typically within IDR1 billion to IDR3 billion (approximately USD60,000 to USD200,000), based on survey responses from Indonesian ESCOs. Payback periods for these projects are typically achieved within three years. For some ESCOs surveyed, the payback period could be under two years, depending on the technologies involved.[30] In contrast, international ESCOs operating in Indonesia cited larger ticket sizes of at least SGD0.5 million (approximately USD390,000), achieving annual cost and energy savings of approximately SGD80,000, and 10%$ to 40% respectively, with average payback periods of 3-5 years.

5.2. Barriers to growth for ESCOs in Indonesia

Although Indonesia has introduced several national and derivative regulations, one of the most significant challenges remains the limited follow-through on implementation across multiple aspects of the promulgated policies. For example, it is understood that none of the tax incentives referenced in PP 70/2009 were implemented, due largely to insufficient coordination between the Ministry of Energy and Mineral Resources, which is responsible for energy efficiency, and the Ministry of Finance, which oversees tax and other financial incentives. Furthermore, there is little clarity on how fiscal incentives will be delivered in practice, beyond the general statement that they will be governed by state finance regulations.[31]

The weak inter-Ministry coordination has also resulted in weak enforcement, as many entities do not comply with PP 70/2009's reporting and other requirements despite mandates.[32] Building occupancy permits are regulated by the Ministry of Public Works, and building owners are required to renew these permits every five years. This presents an opportunity for EE to be enforced as part of the permit renewal process. However, the lack of coordination between MEMR and MPW does not enable stronger enforcement mechanisms to be implemented.

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[28] Synergy Energy Solutions. (n.d.). Adi Husada Case Study. https://drive.google.com/file/d/1FLmE3X7IHUAlhNXKZvkGNk9RaVAtev1E/view

[29] Based on responses to a survey shared with ESCOs as part of this project.

[30] Camarasa, C., Lütken, S., & Yargattimath, T. (2025). *Global ESCO market report 2025*. UNEP Copenhagen Climate Centre. https://c2e2.unepccc.org/wp-content/uploads/sites/3/2025/05/global-esco-market-report-2025.pdf

[31] Energy Transition Partnership. (2024, April). *Diagnostic analyses report of energy efficiency development in Indonesia*. https://www.energytransitionpartnership.org/wp-content/uploads/2024/04/Diagnostic-Analyses-Report-of-Energy-Efficiency-Development-in-Indonesia.pdf

[32] As above.

PP 33/2023 states the types of disincentive mechanisms that might be implemented in the event of non-compliance. While these are intended to serve as a 'stick' to companies, many entities see these as only a 'slap on the wrist' and not sufficiently consequential to their operations. Thus, enforcement of the green building regulations has not been as successful.

Indonesia does not have programmes to operationalise the regulations that the government enacts. The absence of a plan could explain the relatively low uptake of EE across the economy. While there are several programmes run by development partners – such as UK PACT, Indonesia-Danish Energy Partnership Programme, GIZ Sustainable Energy Transition Initiative – these are often time-bound and limited in implementation capacity.

The government should make a more concerted effort to develop clear plans for operationalising activities listed in its various EE regulations. This will help clarify the activities that are needed, thereby demonstrating a clear policy direction for all actors across the economic sectors.

One of the biggest challenges is the lack of access to finance, coupled with the lack of expertise from financial institutions to evaluate ESCO projects. This is a result of several factors, as banks are unsure about the energy savings and have high-risk perceptions of the projects.

The financiers surveyed noted the lack of creditworthiness and fixed asset collateral as key impediments to financing ESCOs. This is especially true for small ESCOs that are unable to meet the high collateral requirements of banks, and energy savings cash flows are not acknowledged as collateral. As such, the perceived higher risk of EE also result in higher loan pricing.

Banks see ESCO revenues as too small to meet the debt service coverage ratio requirements. The relatively small loan/ticket sizes of EE projects, especially compared to RE projects, are a deterrent.[33] The SME financing arm of banks is also not a viable option. *Kredit Usaha Mikro* is a government scheme for SME financing, but it is not related to the energy sector. Banks are hesitant to finance small-scale/SME energy projects because they are unfamiliar with the sector, and there are no government programmes to support it. As a result, banks continue to focus on more traditional sectors, such as textiles, and food and beverage.

Some of the financiers surveyed did not have a pipeline of EE projects, partly due to a limited understanding of ESCO business models, such as the measurement and verification requirements, project evaluation, and technical risks. To overcome this, banks could rely on external EE consultants for project evaluation and monitoring. However, this would only increase transaction costs for both the bank and its clients/ESCOs.

[33] OECD-CEFIM & CASE for Southeast Asia. (2024, May). *Energy savings insurance (ESI) and ESCO business model to support energy efficiency* [Report]. https://caseforsea.org/wp-content/uploads/2024/05/240506_OECD-CEFIM_ESI-and-ESCO-business-model-to-support-EE.pdf

As banks typically require high minimum levels of energy-savings performance, some ESCOs do not regard them as viable sources of finance, and instead seek to engage with non-bank financial institutions. These financial institutions (FIs), such as multi-finance companies, can offer greater flexibility and may support smaller ticket sizes that are better suited to EE projects. While multi-finance institutions have expressed interest in developing EE financing as a new product line, they are generally less familiar with EE financing structures. Moreover, loans from multi-finance institutions often carry higher interest rates than those offered by banks, which may limit their suitability for ESCO business models or end-users of the technologies.

Some technology suppliers and ESCOs surveyed faced barriers in following through to the Investment Grade Audit (IGA) stages of an ESCO project. Their clients often perceive the IGAs and ESCO costs to be high, and many adopt the EE recommendations suggested by the ESCOs themselves with their own CAPEX.

A key barrier that hinders the growth of the ESCO market is the **lack of technical capacity of ESCOs to perform as true ESCOs** in undertaking the business models. Many of the ESCOs in Indonesia function as technology or energy suppliers, and only a minority have the more advanced capabilities of an ESCO. Few ESCOs can deliver investment-grade audits, nor do they have the expertise to structure a financing scheme, raise financing, or implement EE measures.

Based on stakeholder consultations, some barriers to growth include the **general lack of awareness and demand for EE.** For example, it has been suggested that there is a local culture of trusting one's own existing building engineers and facility management team, and a general lack of trust in outsourcing to new technologies and ESCOs. The building's C-suite and management may sometimes be receptive to EE projects, as these make commercial and financial sense, but could face hesitancy from the engineers and facility team on ESCO services and concerns about disruptions to current building operations.

Another challenge shared by a stakeholder is the lack of demand from building owners for EE owing **to the low electricity tariffs,** which then fail to incentivise energy conservation through efficiency measures.[34] Indonesia has some of the lowest electricity tariffs in Southeast Asia, and they are kept low through government subsidies. This is intended to stimulate Indonesia's business climate and attract investors, particularly for industries that rely on large electricity consumption. In 2022, the tariff for medium-voltage big business customers in Indonesia was IDR1,115/kWh, which is also the cheapest in the region compared to Malaysia (IDR1,227), Thailand (IDR1,370), the Philippines (IDR1,603), Viet Nam (IDR1,787), and Singapore (IDR2,063).[35]

Public-sector buildings present significant potential as demonstration projects for ESCO-led EE upgrades, while also offering an opportunity for ESCOs to strengthen their financial position. However, this remains challenging in Indonesia. Public agencies are currently

[34] As above.

[35] The Indonesia. (2022, April 6). *Indonesia's electricity price lowest in ASEAN: Ministry*. https://www.theindonesia.co/news/2022/04/06/133000/indonesias-electricity-price-lowest-in-asean-ministry

unable to retain utility-cost savings for payment to ESCOs and are also unable to enter multi-year contracts. In addition, government procurement stipulates that ESCOs must submit outcomes from costly investment-grade audits, after which the contract is awarded to the lowest-cost provider. ESCOs are unlikely to deliver such audits without a clear prospect of a longer-term agreement.

Public–private partnership (PPP) schemes have been proposed as a potential mechanism to enable ESCO projects in public buildings. However, the process is lengthy and complex, and there are no successful case studies to date.

5.3. ESCO market potential in Indonesia

A quantitative analysis was undertaken to estimate the potential size of the ESCO market in Indonesia. The analysis draws on Total Final Energy Consumption (TFEC) projections from the Baseline Scenario (BAS) and ASEAN Target Scenario (ATS) presented in the eighth edition of the ASEAN Energy Outlook. With only five active ESCO projects currently in operation, the Global ESCO Market Report 2025 estimates the market size in Indonesia at approximately USD175,000.

Against this backdrop, the central question guiding the analysis is: what would constitute a meaningful ESCO contribution toward achieving energy-reduction targets in the buildings sector? This section explores this question by assessing several scenarios, estimating the number of ESCO projects required, the corresponding number of ESCOs needed to deliver them, and the volume of finance that would need to be mobilised.

This analysis is structured based on commercial, public, and residential buildings.

5.3.1. Commercial buildings

Three scenarios were developed to analyse the ESCO market potential for the commercial building sector. The scenarios are:

1. Scenario 1: ESCO delivers projects at the current rate (i.e. three projects in commercial buildings per year);[36]
2. Scenario 2: ESCOs contribute to 10% of the TFEC reduction target in existing commercial buildings; and
3. Scenario 3: ESCOs contribute to 25% of the TFEC reduction target in existing commercial buildings.

In addition to entering into ESCO business models, EE projects can be self-financed, implemented through an Engineering, Procurement and Construction (EPC) scheme, or through instalments directly with a technology supplier. ESCO business models are better suited to projects in existing buildings, as they apply a baseline energy consumption benchmark against which payments are made. Hence, Scenarios 2 and 3 have been defined to give a view of what a 10% and 25% contribution would look like in relation to the

[36] According to the Global ESCO Market 2025 Report, there were 3 new ESCO projects in Indonesia. Therefore, for the purposes of this modelling, it will be assumed that three new active projects are launched annually.

TFEC for existing buildings, respectively. This excludes the impact of new buildings on the overall commercial building sector's TFEC.

Figure 2 depicts the split between reductions in TFEC due to more efficient new buildings, and the retrofit of existing buildings. The construction of more efficient new buildings is expected to contribute to approximately 75% of the reduction in TFEC in the commercial building sector, with retrofits in existing buildings accounting for the remaining 25%.

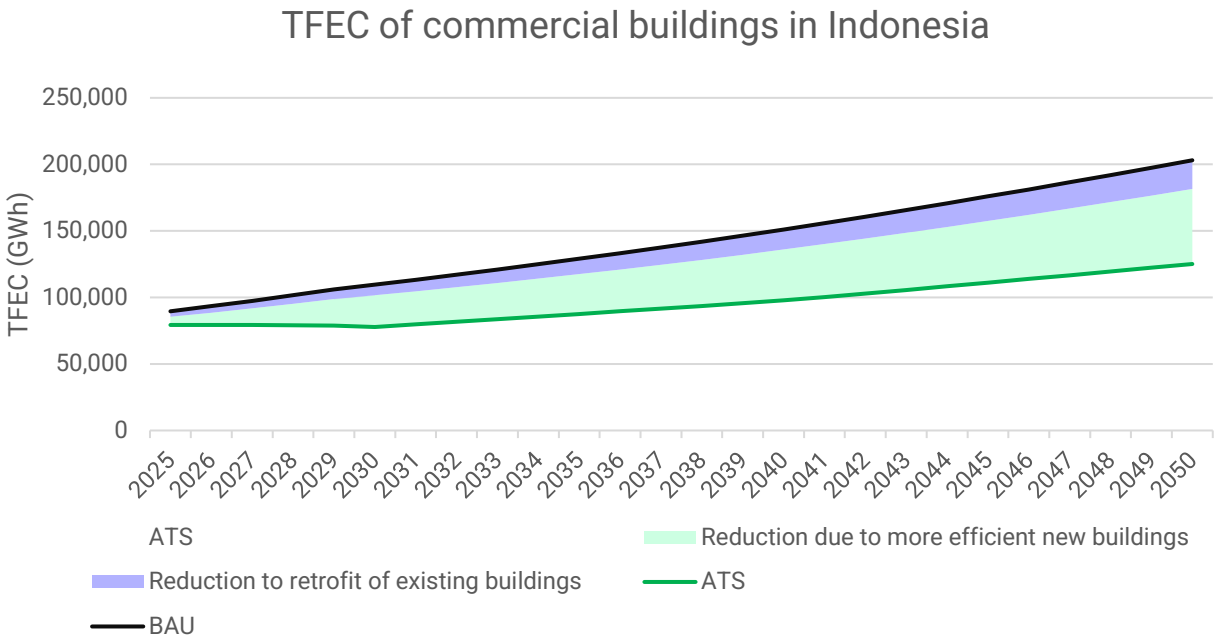

Figure 2. TFEC of commercial buildings in Indonesia, and the split of savings between new and existing buildings expected between the BAS and ATS scenarios.

In Scenario 1, ESCOs deliver three projects per year, totalling 78 projects over the 2025-2050 period. By 2050, ESCOs will contribute to approximately 0.3% of the TFEC reductions, due to retrofits in existing buildings.

ESCO projects must grow by 20% to 25% annually to contribute to a 10% to 25% reduction in TFE, due to retrofits in existing buildings, as observed in Scenarios 2 and 3, respectively. In Scenario 2, the number of ESCO projects grows from three in 2025, to 326 in 2050. Similarly, the number of ESCO projects grows from three in 2025, to 947 in 2050 in Scenario 3. Figure 3 and Figure 4 display the contribution of ESCOs to the reductions in TFEC due to retrofits in existing buildings between 2025 and 2050, with a snapshot of 2050.

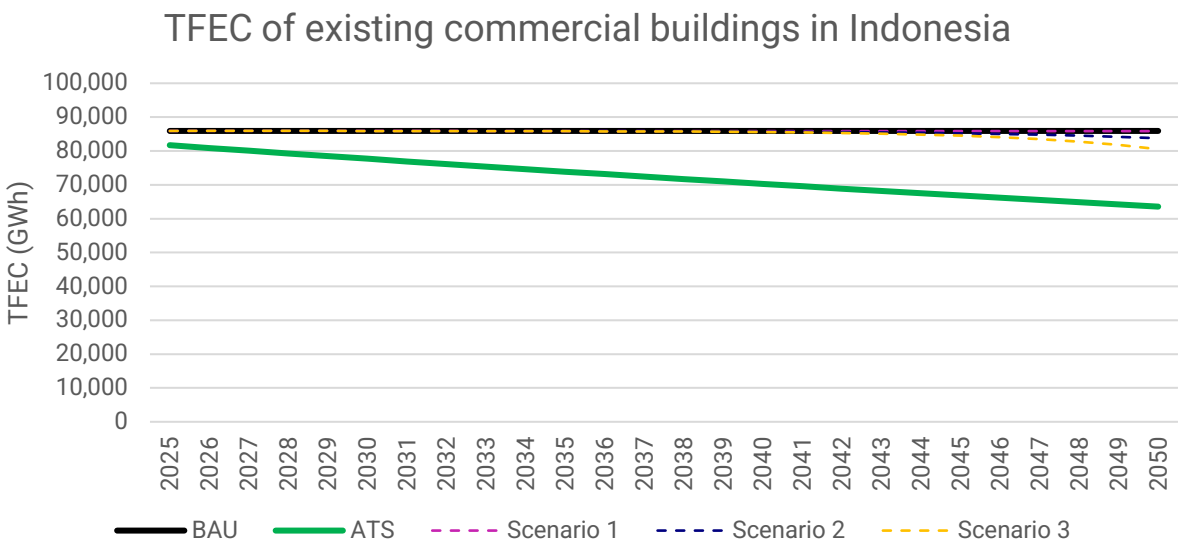

Figure 3. Contribution of ESCOs in reducing the TFEC of existing commercial buildings in Indonesia from 2025 to 2050 across the three scenarios.

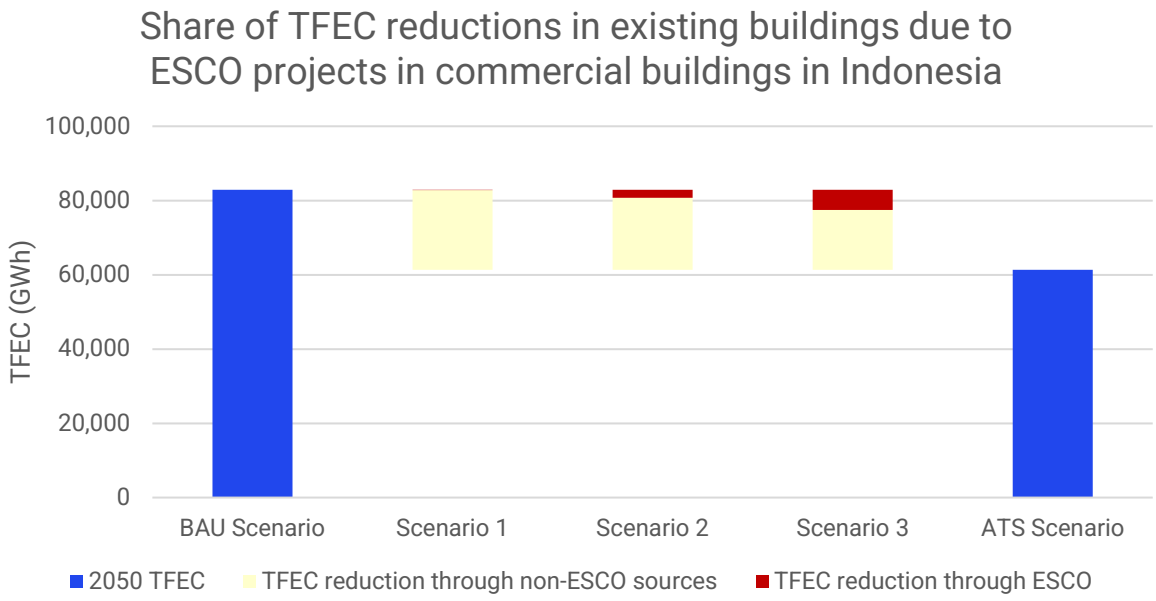

Figure 4. Contribution of ESCOs in reducing the TFEC of existing commercial buildings in Indonesia in 2050 across the three scenarios.

ESCO market size and mobilisation of finance

It is clear from Scenario 1 in the previous figures that business-as-usual or minimal growth in ESCO projects is insufficient for Indonesia to meet its commercial building sector TFEC reduction targets. Scenarios 2 and 3 present more promising results, especially when taken with the longer-term view of 2050. In Scenario 2, ESCOs contribute approximately 10% of the total reduction in TFEC of existing commercial buildings by 2050, while in Scenario 3, they contribute to 25% of the total reduction. Table 3 shows the number of ESCO projects that will need to be delivered in existing commercial buildings each year for Scenarios 2 and 3.

A similar assumption to that in Cambodia is applied here, and it is assumed that technically and financially competent ESCOs can deliver 5 to10 ESCO projects per year. This is subject to resourcing constraints. Based on this estimation and on Scenario 2's parameters, the demand for ESCOs will significantly rise as we head into 2050. However, ESCOs vary in size and capabilities, and with any business in positive market conditions, they can potentially scale. Therefore, it is expected that some ESCOs will be able to fulfil more projects than others.

Based on a review of several energy audit reports, a conservative estimate of an EE project in a commercial building is USD100,000 to USD150,000.[37] In Scenario 2, a cumulative total of approximately USD190 million to US290 million needs to be mobilised to retrofit existing commercial buildings by 2050. In Scenario 3, a cumulative total of approximately USD460 million to USD690 million is needed to retrofit existing commercial buildings by 2050. Table 3 provides a snapshot view of the number of ESCO projects, the corresponding range in the number of ESCOs, and the range of finance to be mobilised in 2025, 2030, 2035, 2040, 2045, and 2050 across Scenarios 2 and 3.

Table 3. Number of ESCO projects across existing commercial buildings in Indonesia to be delivered in Scenarios 1, 2 and 3 in various years

Year	2025	2030	2035	2040	2045	2050
No. of ESCO projects in existing commercial buildings – Scenario 1	3	3	3	3	3	3
No. of ESCO projects in existing commercial buildings – Scenario 2	3	8	20	50	128	326
No. of ESCO projects in existing commercial buildings – Scenario 3	3	9	30	95	300	947
Estimated No. of qualified ESCOs needed (commercial buildings) – Scenario 1	1	1	1	1	1	1
Estimated No. of qualified ESCOs needed (commercial buildings) – Scenario 2	**1**	**1**	**2-4**	**5-10**	**12-25**	**32-65**
Estimated No. of qualified ESCOs needed (commercial buildings) – Scenario 3	**1**	**1-2**	**3-6**	**10-20**	**30-60**	**>100**
Investment required per year (USD in millions) – Scenario 1	0.3-0.5	0.3-0.5	0.3-0.5	0.3-0.5	0.3-0.5	0.3-0.5
Investment required per year (USD in millions) – Scenario 2	0.3-0.5	0.8-1.2	2-3	5-7.5	12.5-20	32.6-50
Investment required per year (USD in millions) – Scenario 3	0.3-0.5	0.8-1.35	3-4.5	9.5-14.3	30-45	95-142

[37] These reports were shared confidentially as part of the project. It includes energy audit outcomes in large commercial buildings and several small- to mid-size public buildings.

5.3.2. Public buildings

The existing regulations in Indonesia do not facilitate the development of EE projects in public buildings by private sector ESCOs, as they do not allow government agencies to enter multi-year paid-from-savings contracts. While there are existing efforts to enable this through the public-private partnership (PPP) scheme, these projects take a long time to reach a financial close. There is no case study of the successful implementation of EE projects in public buildings through the PPP scheme beyond public street lighting programmes. Significant changes in regulations will be needed for ESCOs to be able to deliver EE projects in public buildings. This section estimates the number of public building EE that ESCOs will need to implement across two scenarios:

- Scenario 1: ESCOs contribute to 10% of the TFEC reduction target from upgrades to existing public buildings; and
- Scenario 2: ESCOs contribute to 25% of the TFEC reduction target from upgrades to existing public buildings.

For ESCOs to contribute to 10% of the TFEC reduction target in commercial buildings (Scenario 1), the annual number of ESCO projects delivered needs to grow by 21%, increasing from three in 2025, to 323 in 2050, totalling over 1,800 projects from 2025 to 2050. In Scenario 3, the number of ESCO projects delivered annually needs to grow by 30%, increasing from three in 2025, to 950 in 2050, totalling over 4,500 projects over the same period. The high number of ESCO projects needed to deliver 10% and 25% of the TFEC reduction targets reflects a clear need for amending existing government procurement regulations.

Between 50 and 100 ESCOs would be needed to deliver on the estimated number of ESCO projects in 2050 across Scenarios 1 and 2, respectively. Scenario 1 would also require the mobilisation of approximately USD93 million to USD110 million, while Scenario 2 would require more than double that amount, in the range of USD230 million to USD275 million.

5.3.3. Residential buildings

Engagements with ESCOs indicate that residential buildings are currently not a target market segment. This is primarily due to the nature of energy consumption in residential properties, which is driven largely by domestic appliances such as air conditioners, refrigerators, water heaters, televisions, and lighting. Energy-efficiency gains in this sector are typically achieved through appliance upgrades, which generally do not require the specialist expertise that ESCOs provide.

Although ESCOs have traditionally not served the residential sector, innovative mechanisms such as on-bill financing (OBF) may create opportunities for involvement. In this context, the role of an ESCO would be comparatively straightforward: conducting simple energy audits to assess appliance efficiency, rather than undertaking complex building-level audits.

A high-level assessment suggests that upgrading approximately 25,000 residential units per year with more efficient refrigerators, room air conditioners, and lighting would contribute to 10% of the sector's TFEC reduction target by 2050. To contribute 25% of the sector target, annual upgrades in around 60,000 units would be required. The scale of

these figures underscores the need to accelerate energy-efficiency efforts within the residential sector.

Overall, as demonstrated in Sections 5.3.1, 5.3.2, and 5.3.3, the ESCO market in Indonesia must expand substantially to contribute meaningfully to the building-sector reduction targets. The current annual number of ESCO projects will need to increase significantly, requiring a corresponding rise in the number of technically and financially capable ESCOs by 2050. Financiers, investors, and asset owners will also need to mobilise up to USD1 billion to enable ESCO activity at the scale required to achieve approximately 25% of the building-sector reduction target. Supportive regulations—including those enabling the implementation of OBF—will be essential to unlock this growth.

5.4. Drivers of growth for ESCOs in Indonesia

Indonesia's regulatory environment for EE and ESCOs continues to grow in maturity. It covers a broad range of levers that are meant to support growth in the market. For instance, Indonesia promulgated PP 33/2023, which is an umbrella regulation on energy conservation that mandates energy management in Indonesia for the largest energy consumers across the industrial, commercial buildings, transport, and power generation sectors. It acknowledges fiscal and non-fiscal incentives (e.g., training, delivery of audits and support to developing energy management systems) and disincentives in the regulation as means to spur activities.

Green building regulations under Government Regulation No. 16/2021 codify green-building requirements at the national level for the first time, and define the categories of buildings mandated to comply with green-building guidelines. In addition, the Regulation of the Minister of Public Works and Public Housing No. 21/2021 (MPWHR 21/2021) on Green Building Performance Assessment was issued shortly after PP 16/2021. This regulation specifies the building types required to comply with PP 16/2021, and includes provisions on energy-performance assessment, as well as the measurement, reporting, and certification processes associated with green buildings. It also outlines the parameters used for assessment.

In January 2025, two important new Ministerial Regulations were issued, recognising the responsibilities of national and local governments in advancing EE. These responsibilities include preparing EE programmes, incorporating EE considerations into government procurement, and supporting capacity development and awareness raising. The regulations also acknowledge ESCO financing as an approved mechanism for implementing EE measures.

It remains to be seen what impact these regulations will have on EE and ESCO activities in practice.

EBTKE has prepared a draft version of the Ministerial Regulation related to ESCOs and has organised a public consultation. If enacted in its current form, this regulation will encourage qualified entities to register as ESCOs with the government based on the scope of services that they are able to provide. Entities that register with the government will benefit from technical support and training, and certification opportunities.

While these recently or soon-to-be promulgated regulations are useful building blocks that strengthen the foundation for increased efforts on EE, and greater professionalism amongst ESCOs in Indonesia, they will require some time for them to have an impact. Nonetheless, a clear implementation plan must accompany the regulations to maximise their impact and enable ESCOs to contribute to achieving the efficiency targets, as demonstrated in Section 5.3.

Lessons must be drawn from previous regulations that delivered limited impact, and the challenges outlined in Section 5.2 must be addressed to strengthen the maturity of Indonesia's nascent ESCO market.

Chapter 6

On-bill financing readiness assessment

6. On-bill financing readiness assessment

While there remain minor deviations to the definition of OBF, it is a mechanism that allows the upfront cost of EE improvements to be covered by an electric utility or a third-party financier. EE improvements could include HVAC upgrades and the insulation or installation of EE appliances, like LED lighting. The cost for improvement is repaid over time through additional charges on the customer's utility bill, deriving the reference of 'on-bill'. This system takes away barriers to investing in energy-saving upgrades without the large upfront expenses.[38,39]

In some cases, OBF has become an umbrella term for any financing mechanism that incorporates charges into a utility bill. For the purposes of this report, OBF refers specifically to the financing of EE upgrades in which the utility bill serves as the repayment channel.

While OBF has yet to gain traction in Southeast Asia, it has been piloted and operated in the United States since the 1990s. In the European Union, the Energy Performance of Buildings Directive (EPBD) has been effective in mandating energy-performance requirements; however, the mechanisms it supports focus primarily on market signalling and regulatory compliance, rather than OBF-style financial delivery.

As of 2014, more than USD2 billion had been mobilised for OBF programmes in the United States. A study by the Lawrence Berkeley National Laboratory reported that approximately USD180 million of on-bill lending occurred in 2014 alone. Of this amount, around 60% originated from utilities, ~30% from the private sector, and the remainder from public-sector funds—either as direct lending or catalytic financing to attract greater private-sector participation.[40]

A key differentiating feature of OBF is its seamless integration with utility billing systems. Traditionally, EE upgrades are undertaken through more direct financing options, such as balance sheets or debt financing. These methods present higher upfront costs, which often act as a barrier for many consumers. By embedding repayment into the utility bill, OBF simplifies the process and enhances accessibility. OBF also leverages the existing relationship between the customer and the utility, fostering greater buy-in. The recovery of EE costs through the utility bill is partially secured by the customer's ongoing payments for utility services. This structure helps lower the barriers to entry that might otherwise exist with a standalone or newly introduced programme.

6.1.1. Stakeholders in an OBF programme

Implementing an OBF mechanism requires coordinated action across multiple stakeholders. These stakeholders form the foundation of a working OBF model and

[38] Zhang, S. (2013). *On-bill financing: Encouraging energy efficiency*. Center for Climate and Energy Solutions. https://www.c2es.org/document/on-bill-financing-encouraging-energy-efficiency/

[39] Southeast Energy Efficiency Alliance. On-Bill Finance. https://www.seealliance.org/initiatives/low-income-financing/

[40] American Council for an Energy-Efficient Economy. (2017, February 16). *On-bill energy efficiency*. https://www.aceee.org/toolkit/2017/02/bill-energy-efficiency

influence its eventual success and outcomes. Six primary actors are outlined in this section. Based on the complexity of programmes, however, more or fewer actors may be required. Below are the main actors and the relationships:

- **Government:** The OBF programme is expected to be initiated via a decision at the governmental level. Regulations specific to OBF must be crafted to create an environment that will allow OBF to be operationalised by various subsequent actors, mainly driven by a programme manager who should be selected by an appropriate decision-maker, i.e., government body.

- **Programme manager:** Oversees the design, marketing, implementation, and administration of OBF. This could be a government entity or subcontracted to a private organisation for the day-to-day operations, e.g., Michigan Saves (non-profit entity), utility company.
    - The programme manager **ensures ESCOs are credible**, and in some cases, manages them from a pre-approved list. They **market OBF to customers, answer queries, and gather feedback**.
- **Financiers**: Provide upfront capital for EE upgrades, e.g., Conventional lenders: Local Government, Commercial banks, Development Agency, or Super-ESCO.
    - Financiers depend on utility companies to **facilitate repayment** through billing systems, and if applicable, to **check all consumer credit risks** based on an agreed level of due diligence. Financiers bear the risk of non-repayment. However, they can collaborate with the utility to enforce repayment, e.g., through electricity disconnection.
- **ESCO**: Audits, designs, develops, and implements EE solutions, e.g., Synergy Efficiency Solutions (Indonesia).
    - ESCOs work with utilities/programme developers to **deliver energy audits and execute equipment retrofits.**
    - **Utility company**: Delivers services and acts as billing intermediary, e.g., *Perusahaan Listrik Negara* (Indonesia).
    - The utility company provides the **mechanism to enable customer participation**, **facilitate fund flows,** and the ESCO inputs for **financing amount to the consumer**.
- **End-customer**: Residential, commercial, or institutional user.
    - The end-customer partners with a relevant utility company to participate in an on-bill financing scheme, and through the scheme, engages an ESCO to implement EE upgrades.

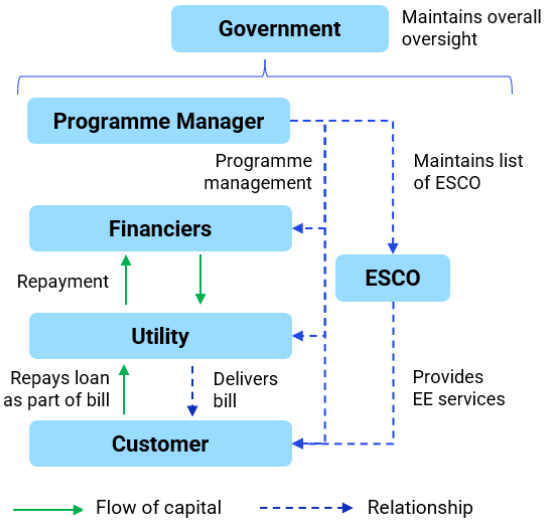

Figure 5. Interactions between key stakeholders in an OBF mechanism

Other stakeholders would include, but are not limited to regulators, relevant government agencies, OBF programme administrators, and technology providers. They play a crucial role in supporting and ensuring the operability of the overall OBF ecosystem.

The structure in Figure 5 is illustrative. In practice, interactions may vary depending on the legal and compliance requirements of each jurisdiction.

6.1.2. Benefits and challenges of OBF

OBF eliminates the need for large upfront investments. It streamlines repayment and offers predictable monthly costs for households or building owners – often offset by the energy savings achieved. To those who find it challenging to secure loans, the decision to upgrade becomes much more accessible and manageable.

Beyond simplification, OBF could also open the door to financiers if done correctly. An EE project undertaken in a single school, residential unit, or industrial building may not have a ticket size large enough to warrant a dedicated loan, but when bundled together, a case is built for its bankability and materiality for impact. For governments with national energy goals, this could serve as another instrument to achieve their EE and emission reduction targets.

An OBF programme extends beyond the simple act of providing credit to customers. It serves as a mechanism to drive outcomes in EE and, more broadly, to catalyse market transformation. This transformation occurs when the programme demonstrates to government and conventional lenders the viability and benefits of supporting EE financing.[41] Strong performance, as evidenced by consistent repayment rates and increased adoption of EE measures, can build lender confidence and attract a broader pool of capital providers. It can also pave the way for lower technology costs over time by aggregating demand.

[41] Henderson, P. (2013, July). *On-bill financing: Overview and key considerations for program design* (Issue Brief No. IB:12-08-a). Natural Resources Defense Council. https://www.nrdc.org/sites/default/files/on-bill-financing-IB.pdf

As with any emerging loan class, lenders and investors require access to long-term, seasoned loan performance data to establish appropriate lending parameters that ensure predictable and stable returns. Therefore, the potential market transformation effect of OBF programmes in the longer term should be considered during the programme design phase.

Table 4. Summary of the operational benefits and challenges of an OBF

Benefits	Challenges
Implementation (ESCO and utility company)	
Mechanisms like OBF can build economies of scale for projects, creating a more favourable environment for financiers and consequently supporting broader ESCO-service adoption.	Requires coordination between utilities, ESCOs and financiers, which can be resource-intensive.
Utility customer retention through the value-added service of OBF.	Increased administrative complexity, where utilities must manage billing and other roles, often outside of their core expertise. Additionally, the right incentives must be in place for utilities to implement EE programmes for their customers.
ESCOs are well-equipped to implement efficiently and cost-effectively.	Post-installation challenges for EE upgrades include delays in service resolution, technology integration issues, warranty and maintenance complexities, limited spare parts due to obsolescence, and aesthetic or customisation concerns. Even with EE improvements, faults — whether product- or usage-related — may require difficult replacements, especially for residential consumers.
Consumers	
No high upfront cost lowers the barrier for participation across income ranges.	Possible unexpected increase in bills, even temporarily, can erode trust in the programme.
If designed well, energy savings can offset financing costs, making upgrades cost-neutral for consumers (i.e., pay the same or pay less compared to the original bill pre-OBF).	Energy savings ultimately depend on technology, user behaviour, weather and building conditions, amongst other conditions.
Financiers	
Typical strong repayment rates due to the essential nature of utility service.	Uncertainty around the repayment enforcement and penalty mechanism for default.
Debt/bill item can stay with the meter (where the upgrade took place), not with the individual.	Traditional credit checks are typically not required (e.g., credit report/score), making it easier for consumers to access credit.

6.1.3. Risk and barriers to adoption

Beyond the operational and financial considerations, broader systemic challenges could hinder the scale and speed of OBF adoption. At its core, OBF is not just a financing mechanism; it functions as a **collaborative model** that aligns multiple stakeholders within the energy ecosystem. Its success hinges on the coordinated participation of utilities, regulators and financiers, ESCOs, and consumers. This interdependence raises the bar for implementation. As seen in Hawaii's HEB$ example, even well-intended pilots can stall without stakeholder alignment, or in the absence of administrators.

A key regulatory risk lies in the **ambiguity around whether current credit rating systems are fit for purpose**. Traditional credit scores may not accurately reflect a consumer's ability or willingness to repay utility-tied loans. This creates a dilemma for lenders: should they rely on utility payment history, which is more inclusive but potentially less predictive, or stick with traditional underwriting models, which may offer greater accuracy but require effort that may not be economically justified? Moreover, financiers remain cautious, uncertain about their ability to participate operationally in such programmes without clear regulatory guidance. Their involvement is likely to remain limited unless formal frameworks or legislative acts are established to define roles, risks, and compliance requirements.

On **the consumer front, inertia is a formidable barrier**. Many households are comfortable with the status quo and may view new financing models with scepticism. Others may want to finance upgrades independently for greater decision independence, or fear that the on-bill item is priced higher than expected. Overcoming resistance requires trust – trust that savings will materialise, that the programme is fair, and that all parties, from utilities to ESCOs, are aligned in their interests and committed to the shared goal of accelerating EE at scale. In certain markets and regions, customers may find it challenging to trust utilities or utility-owned ESCOs in genuinely wanting to support EE.

6.1.4. Global case studies

Globally, OBF initiatives are at different stages of maturity. OBF is well-established across the US, where over 100 utilities offer such programmes according to the Environmental and Energy Study Institute (EESI).[42] These programmes range from rural electric cooperatives and public utilities, to investor-owned utilities. Given the maturity of OBF programmes in the US, it is worthwhile to draw from both their successes and challenges to inform context-specific adaptation in ASEAN markets.

6.1.4.1. Case study #1: Holland, Michigan – Targeting residential retrofits through on-bill loans

Summary

The City of Holland launched an On-bill Loan (OBL) programme in 2016, to improve EE across approximately 7,400 single-family homes, many of which were older and less energy efficient than the state average. The programme sought to remove upfront cost

[42] Environmental and Energy Study Institute. *Interactive map of utilities with on-bill financing programs*. https://www.eesi.org/obf/map

barriers by enabling customers to finance upgrades and repay via their utility bills. Participation was voluntary and targeted individual homeowners citywide, rather than being implemented through a government-led bundled housing project or settlement complex. Key innovations included transferable loans tied to the property, inclusive underwriting criteria, and homeowner advisory support. While the programme demonstrated strong repayment performance and high-value upgrades (upgrades were generally tailored to individual homes), upgrades amongst lower-income households remained limited.

Context

Holland's housing stock presented a clear opportunity for EE improvements, with many single-family homes built before modern energy codes, creating a major improvement opportunity.[43] Traditional financing often excluded moderate- and lower-income households due to their credit requirements or a lack of upfront capital. The city's public utility, Holland Board of Public Works (HBPW), launched the OBL programme in partnership with Holland Energy Fund (HEF) to overcome these barriers, targeting broader residential participation, while supporting deeper retrofits. [See Table 5 for a detailed overview of the key actors involved, and Figure 6 for their relationships and interactions.]

Both the HBPW and Michigan Saves followed a structured process to develop their OBF models—starting with research and expert engagement, followed by goal-setting, programme design, pilot development, and culminating in a formal launch.[43] Experts in this case included: the Environmental and Energy Study Institute, a non-profit policy institute; Harcourt Brown & Carey, a clean energy finance and policy development consultant; and Mott Foundation, the grant provider to Michigan Saves, as well as Michigan Saves, a nonpartisan public policy research and consulting firm that served as the programme administrator for case study #1.[43]

Table 5. Key stakeholders in the implementation of Holland's OBL programme

Partners	Roles
Homeowner/Customer	• Selects an authorised contractor for improvements and applies for a loan
City of Holland Holland MICHIGAN	• Develop, market and administer the programme and coordinate marketing efforts with stakeholders • Co-provide loan capital to HEF[44]

[43] Saliers, A., & Templeton, M. (2018). *On-bill programs in Michigan* [Presentation]. Michigan Public Service Commission. https://www.michigan.gov/mpsc/-/media/Project/Websites/mpsc/workgroups/EWR_Collaborative/2018/Holland_BPW_On-bill__loan.pdf

[44] The Holland Sentinel. (2016, November 2). *Holland Energy Fund launches new program*. https://www.hollandsentinel.com/story/news/local/2016/11/02/holland-energy-fund-launches-new/24632529007/

Holland Board of Public Works (HBPW)	• Local not-for-profit utility provider that promotes a loan programme with customers, bills customers, and collects loan payments • Promotes the Holland OBL programme to customers and provides support (e.g., customer service and contractor outreach)[43] • Co-provide loan capital to HEF[44]
Holland Energy Fund (HEF)	• Holds loan capital and loan agreements with customers
Michigan Saves	• Programme administrator • Manages the loan centre operations • Oversees contractor registration and training, maintains support systems and databases, and monitors overall programme performance
Contractor/Energy Auditor (authorised by Michigan Saves)	• Offers financing solutions to customers and delivers assessments of home energy systems • Installs energy-saving or renewable energy improvements
Loan Originator and Servicer (appointed and under contract with Programme Administrator)[43, 45]	• Handles loan applications, assesses eligibility, and manages loan documentation and registration • Prepares loan closing documents and closes the loan with the customer
Loan Servicer[43]	• Processes loan payments • Tracks principal and interest paid on the loan • Monitors delinquencies and payoffs

[45] Michigan Saves. (2016, July). *Request for proposal for origination and servicing for residential on-bill financing program*. https://michigansaves.org/wp-content/uploads/2016/07/On-bill-origination-and-servicing-RFP.pdf

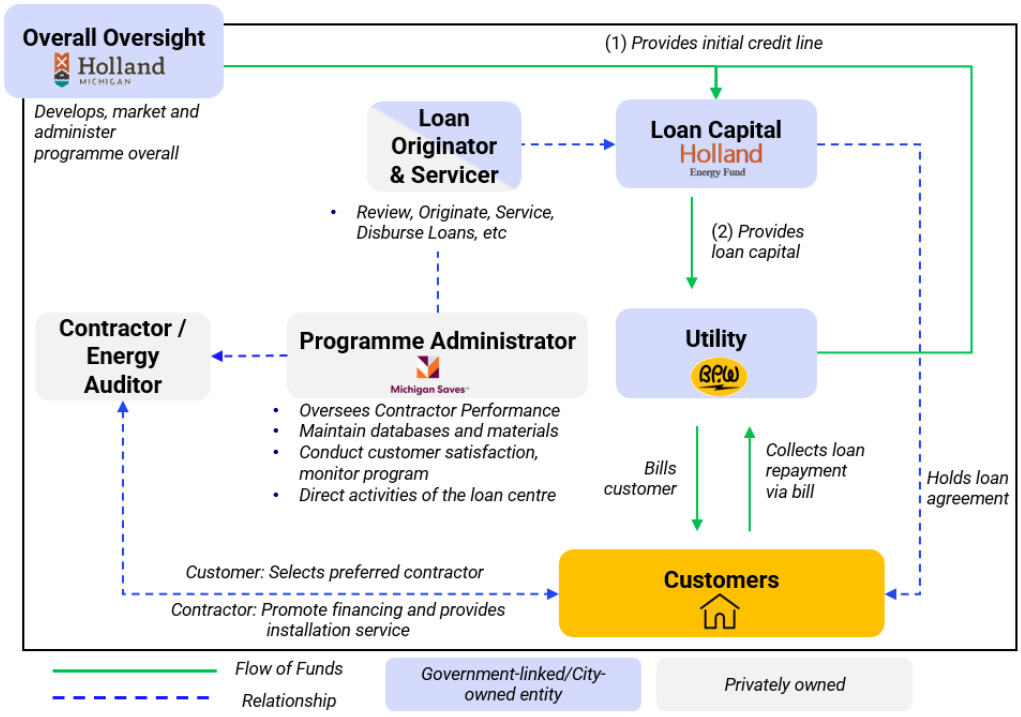

Figure 6. Relationship between Holland's OBL stakeholders and the flow of capital

Regulations

The OBL programme foundation was laid by the Municipal Utility Residential Clean Energy Programme Act (or HB-5397), which was passed by Michigan legislators and became the PA 408 act in 2014.[46] This act allowed municipal utilities to provide on-bill financing for residential EE projects. **Key aspects of HB-5397** in relation to the OBL operationalisation were:

- **Legal authority for municipal programmes**
  - HB-5397 enables municipalities with their own electric utilities to set up residential clean energy programmes through formal resolutions and public hearings. These programmes can fund EE upgrades or modifications for residential properties.
- **Programme administration flexibility**
  - Ability to administer via a non-profit corporation (including the municipal utility or any other non-profit organisation).
- **Eligible improvements**
  - The act allows eligible improvements to home insulation, energy control systems, heating, air-conditioning, lighting fixtures, and any other installation/modification approved as a utility cost-saving measure.

[46] Dewey, C. *Holland pilot program is underway*. Crain's Grand Rapids Business. https://www.crainsgrandrapids.com/news/holland-pilot-program-is-underway/

- **Loan origination, capital source and repayment**
    - Loan origination and servicing can be done by a utility, a non-profit, or a commercial lender.
    - Loan capital can be provided by the sale of bonds, funds available to the municipality through any other source, and by owner-arranged financing.
    - Financing includes the cost of materials and labour, audit costs, inspection fees, and generally other fees required to complete the energy project.
    - Loans can be treated as part of an electric service charge and repaid via utility bills. Non-payment can result in a service disconnection and a lien on the property.
- **Audit and quality requirements**
    - Every project must undergo an energy audit and post-installation quality assurance.

These provisions under HB-5397 represent foundational levers required to design, structure, and eventually operationalise Holland's OBL programme. They define the legal authority, parameters for improvements, financing mechanisms, and eligible actors in the implementation.

Programme design and key features

Table 6. Holland OBL design and features

Feature	Details
Launch date	Late 2016
Projects funded (~one year since launch)	31 households
Measures financed	Any measure or piece of equipment that has energy savings documented in the Energy Measures Database, e.g., A/C, heat pumps, appliances, boilers, furnaces, water heater. Renewable energy improvements are also permitted under certain circumstances.
Capital source	Co-provided loan capital from the City of Holland and HBPW
Tied to the meter	Yes
Market	Residential
Transferable	Yes (loans tied to property, not individual. Beneficial for rentals)
Underwriting	12 months of utility bill payment history
Loan amount, rate and duration	USD5,000-10,000 at 4.99% for up to 10 years USD10,000-30,000 at 5.99% for up to 15 years

For interest rate comparison, the National Credit Union Administration reported the average rate for a 15-year fixed-rate mortgage at 3.46%, as of December 2016.[47] The

[47] National Credit Union Administration. (2016, December 30). *Credit union and bank rates: 2016 Q4*. https://ncua.gov/analysis/cuso-economic-data/credit-union-bank-rates/credit-union-and-bank-rates-2016-q4

interest rates offered under Holland's OBL programme were higher than traditional loans. This could have reflected the financial sustainability for the programme, covering administrative and loan servicing costs while also offsetting potential credit risk.

Outcomes and **impact**

In 2017, a year after launch, the following indicators were noted:

- **Early adoption:** 31 households completed upgrades in the first year[49], and 116 within three years.[48]
- **Average project size (per household)**: USD14,255 — significantly above the ~USD10,000 average seen elsewhere by Michigan Saves, suggesting deeper interventions.[49]
- **Repayment performance:** Only one late payment was recorded in the first year.[49]
- **Energy savings:** While not quantified here, programme customers disclosed that "many homeowners don't even notice the loan…bills are often lower than their pre-loan rate thanks to energy upgrades."[50]
- **Customer experience:** "It was an affordable solution to the problems we were facing with our home's EE. It was a great experience overall." – Holland OBL Programme Customer[51]

Success factors

- **Customer-centric design:** Energy advisors ensured tailored solutions, bridging the gap between audits and action. Contractors/energy auditors had both the technical expertise and local knowledge. The consultative approach ensured that borrowers maximised the value of their investments, directing funds that delivered energy savings.
- **Inclusive financing:** Property-tied, non-credit-score-based loans expanded eligibility.
- **Repayment alignment with occupants:** Allowed renters and new occupants to benefit from and continue the loan payment.

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[48] Environmental and Energy Study Institute. (n.d.). *Michigan: Holland On-Bill Loan Program*. https://www.eesi.org/obf/case-study/hollandMI

[49] Uhlenhuth, K. (2017, October 5). *After first year, on-bill financing by Michigan utility enabling bigger efficiency upgrades*. Canary Media. https://www.canarymedia.com/articles/enn/after-first-year-on-bill-financing-by-michigan-utility-enabling-bigger-efficiency-upgrades

[50] Brockett Jr., B. (2018, June). *To improve energy efficiency, Holland turns to equitable financing*. West Michigan Environmental Action Council. https://wmeac.org/2018/06/improve-energy-efficiency-holland-turns-equitable-financing/

[51] Michigan Saves. (2021, June 8). *Five years of financing: How's the on-bill program in Holland doing?* https://michigansaves.org/news/five-years-of-financing-hows-the-on-bill-program-in-holland-doing/

These features built a flexible, resident-aligned financing ecosystem that drove early success and strong repayment, fostering trust and wider adoption. Crucially, enabling energy legislation supported the effective planning and rollout of OBF programmes.

Challenges

It was noted that the programme had limited uptake amongst lower-income households.[52] This may be due to a few factors, including that EE is often not a primary concern for households facing more immediate financial pressures, such as housing affordability, debt, or basic utilities, as noted in broader studies on low-income energy behaviour.[53, 54] To address this gap, the programme introduced targeted grant support to reduce the overall cost of participation for these households. These grants were available through the HEF, utility rebates, or wider City of Holland programmes, which helped reduce interest rates and/or the total amount to be financed.[55] In theory, OBF should not increase a customer's total utility expenditure due to its cost-neutrality design. However, challenges remain, in particular for low-income groups, where the presence of an additional line item on the utility bill may still be perceived as a financial burden, regardless of the net savings.

6.1.4.2. Case study #2: Hawaii – Unlocking equitable clean energy access through GEM$ on-bill financing

Summary

Hawaii aims to achieve 100% clean energy by 2045, leveraging a mix of renewables, EE and grid modernisation.[56] A key enabler is the **Green Energy Money $aver (GEM$)** programme, launched in 2019 by the Hawaii Green Infrastructure Authority (HGIA) as a tariff-based OBF initiative. GEM$ provides accessible capital for clean energy upgrades to underserved households and businesses. In its first year, GEM$ financed over USD6.6 million, with 78% of funds directed to low- and moderate-income customers, demonstrating equitable financing for EE.

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[52] Public Sector Consultants. (2019, April 16). *On-Bill Loan Program research* [Presentation]. Michigan Public Service Commission. https://www.michigan.gov/-/media/Project/Websites/mpsc/workgroups/EWR_Collaborative/2019/OBLP_Research_Presentation.pdf

[53] Prin, M., & Motherway, B. (2023, August 3). *How to maximise the social benefits of clean energy policies for low-income households*. International Energy Agency. https://www.iea.org/commentaries/how-to-maximise-the-social-benefits-of-clean-energy-policies-for-low-income-households

[54] European Parliament. Directorate-General for Internal Policies. (2016). *Energy efficiency and the potential for demand-side management in the EU* (Study No. IPOL_STU(2016)595339). https://www.europarl.europa.eu/RegData/etudes/STUD/2016/595339/IPOL_STU(2016)595339_EN.pdf

[55] Holland Energy Fund. (2021, December). *Holland Energy Fund On-Bill Loan Program implementation guide* (Version 2.0). https://hollandenergyfund.com/wp-content/uploads/2022/12/Holland-Implementation-Guide-V.-2.0-.pdf

[56] Riley, W. *How Hawaii is delivering on its ambitious net zero target*. Energy Insights. https://blog.energy-insights.com.au/how-hawaii-is-delivering-on-its-ambitious-net-zero-target

Context

Hawaii's ambitious clean energy transition is challenged by **high energy costs** and **limited access to capital**, especially amongst vulnerable communities. Acting as the State's green bank, the HGIA developed GEM$ to offer on-bill financing for clean energy upgrades and target low-income populations. Under GEM$, the State of Hawaii acts as a third-party lender and covers the upfront cost of the energy upgrade, while customers repay through their utility bill. The programme is funded through the **Green Energy Market Securitization (GEMS)** bond initiative, a municipal bond mechanism that blends public and private funds.[57]

Regulations

The development of the GEM$ programme reflects a multi-year legislative and regulatory effort to expand clean energy access in Hawaii. It began with **Act 204 of the 2011 Session Laws of Hawaii**, which directed and empowered the Public Utilities Commission to assess the feasibility of an OBF initiative for renewable energy and EE. The Act outlined key design considerations, including funding sources, cost recovery mechanisms, and enforcement provisions such as penalties for non-payment (e.g., service disconnection).

Building on this foundation, **Act 211 of the 2013 Session Laws of Hawaii** established the GEMS bond programme, providing the financial, administrative and legal infrastructure necessary to realise the GEM$ programme. It established the HGIA to administer the loan programme, authorised the use of green infrastructure bonds and enabled on-bill repayment, a critical feature of OBF. Additionally, this act allowed utility companies to act as billing agents (not lenders) and made clear that fees collected were not considered utility revenue, and therefore not taxed.[58]

Table 7. GEM$ design and features[59, 60]

Feature	Details
Launch Date	April 2019
Projects funded (~ one year since launch)	149 households
Measures finances	Solar PV & EE retrofits
Capital source	HGIA via GEMS municipal bonds

[57] Yañez-Barnuevo, M. (2019, April 19). *A closer look at Hawaii's innovative financing model for green energy investments*. Environmental and Energy Study Institute. https://www.eesi.org/articles/view/a-closer-look-at-hawaiis-innovative-financing-model-for-green-energy-investments

[58] Hawaii State Legislature. (2013). *Act 211: A bill for an act relating to green infrastructure*. State of Hawaii. https://data.capitol.hawaii.gov/sessions/sessionlaws/Years/SLH2013/SLH2013_Act211.pdf

[59] Hawai'i Green Infrastructure Authority. (n.d.). *GEM$ On-Bill Program*. https://gems.hawaii.gov/gems-on-bill/#:~:text=Immediate%20estimated%20bill%20savings,rate%20of%205.5%25%20per%20annum

[60] Hawai'i Green Infrastructure Authority. (2024, November 15). *Residential & commercial loan programs: Contractor training presentation*. https://gems.hawaii.gov/wp-content/uploads/2023/08/Contractor-Training_11.15.24.pdf

Feature	Details
Tied to the meter	Yes
Market	Residential and commercial
Transferable	Yes
Underwriting	12 months of utility bill payment history
Rate	5.5%
Long-term financing	20 years or 25 years
Loan amount	Up to USD50,000

Programme design and key features

As the programme administrator for GEM$, HGIA focuses on providing access to low-income communities that have historically had restricted access to clean energy due to financial hurdles. This programme targets non-profits, small businesses, multi-family rental projects, and commercial tenants, effectively reaching vulnerable groups in the community.

Eligible applicants must not have had a utility disconnection notice in the past 12 consecutive months. Instead of traditional loan credit scores, a baseline of bill-pay history is used as part of the credit check. The repayment risks are mitigated via the utility's standard collection policies, which include the cessation of utility services for failure to pay the OBF charge.[57] A summary of the GEM$ programme is listed in Table 7. The loan is repaid through a **tariff-based charge on the utility bill**, which remains with the meter if ownership or tenancy changes, removing a major barrier for renters and multi-occupant dwellings.

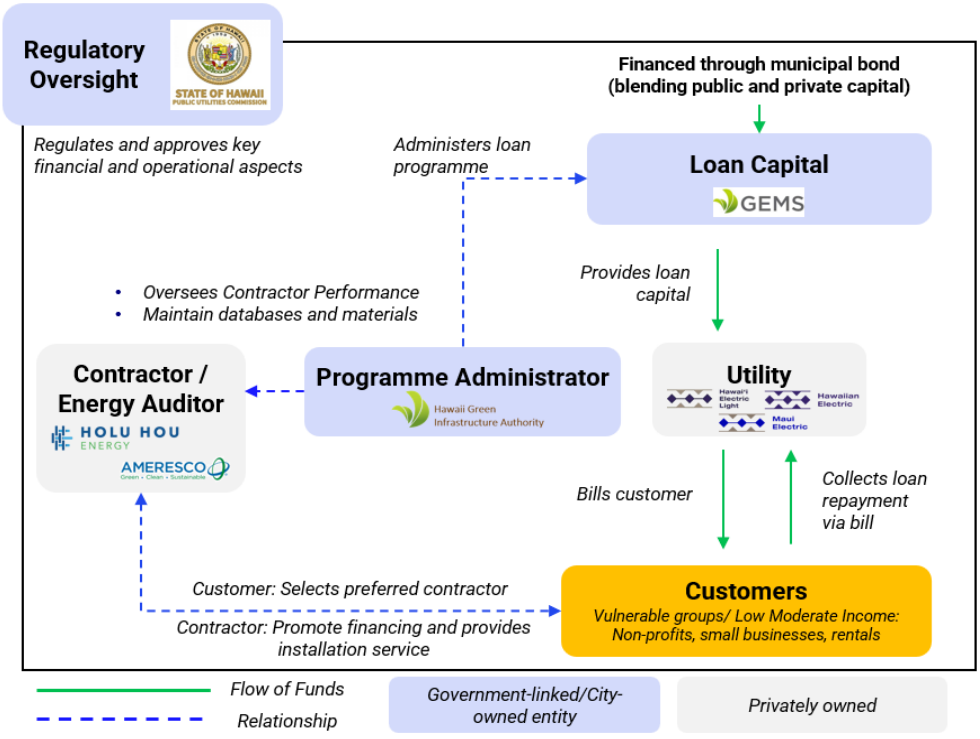


Figure 7. Relationship between GEM$ stakeholders and flow of capital

Table 8. Key stakeholders involved in the implementation of Hawaii's GEM$ OBF programme

Partners	Roles
Homeowner/Customer	Select an authorised contractor for improvements and apply for a loan.
State of Hawaii, Public Utilities Commission (PU	• Provides oversight, regulates and approves key financial and operational aspects of the GEM$ programme, and more widely, the OBF initiative is based on Act 204 (2011)
Hawaiian Electric Company (HECO), **Maui Electric Company** (MECO) and **Hawai'i Electric Light Company** (HELCO)	• Three major electric utility companies in Hawaii, serving 95% of the State's population • Integrate GEM$ charges onto customers' monthly utility bills
Green Energy Market Securitization (GEMS)	• Hawaii's innovative green infrastructure financing programme and loan management platform
Hawaii Green Infrastructure Authority (HGIA)	• State of Hawaii's official green bank and the programme administrator of GEM$, capitalised through the GEMS programme
Contractor/Energy Auditor (authorised by HGIA)	• Offers financing solutions to customers and delivers assessments of home energy systems • Installs energy-saving or renewable energy improvements

Outcomes and impact within the first year

- **Projects funded (per household):** 149.[61]
- **Targeting equity:** 78% of financing went to low- and moderate-income customers.[62]
- **Technology scope:** Rooftop solar, solar water heaters, heat pumps, LED lighting, and broader EE measures.[57]

[61] Yanez-Barnuevo, M. (2020), On- Bill Financing: Expanding Access to Energy Efficiency, Clean Energy Adoption, and Electrification for everyone, Environmental and Energy Institute. https://www.eesi.org/files/Report-On-Bill-Financing-For-Solar-Energy-Miguel-Yanez.pdf

[62] Hawaii: Green Energy Money $aver (GEM$) On-Bill Program, Environmental and Energy Study Institute. https://www.eesi.org/obf/case-study/hawaii

- **Market penetration:** Reached a mix of single-family homes, non-profits, and commercial tenants.

These results reflect the programme's success in addressing both capital access and delivery mechanisms that traditionally exclude disadvantaged communities.

Success factors

GEM$'s success relative to its predecessor, HEB$, can be attributed to several critical enhancements:[57]

- **Dedicated programme administration** – HGIA filled the administrative void that hindered the earlier HEB$ initiative (described in the next paragraph).
- **Stable funding** through the Green Energy Market Securitization (GEMS) – Provided a substantial USD150 million in bond capital to sustainably back the programme.
- **Targeting vulnerable households** – Focused on low- to moderate-income residents and renters by removing traditional credit score requirements.
- **Tariff-based, meter-anchored payment** – Enabled repayment obligations to transfer with ownership or tenancy, improving uptake.
- **Strategic utility partnership** with HECO – Ensured seamless billing and payment integration through an established utility billing system.

Challenges and evolution

The development of the GEM$ programme has been a multi-year journey in Hawaii's legislative and regulatory efforts to expand clean energy access. A predecessor to the GEM$ programme was the Hawaii Energy Bill $aver (HEB$) programme manual in 2015. HEB$ was ultimately placed on hold due to the absence of a financial programme administrator.

Recognising the potential of OBF to advance Hawaii's clean energy goals, the PUC in 2017 directed HGIA and HECO to revive the initiative. This directive laid the groundwork for what would become the GEM$ programme.

HGIA formally introduced GEM$ in 2018. Presented during a webinar under the US EPA's Energy programme, HGIA stated that a few challenges during GEM$ design and implementation included securing stakeholder buy-in and navigating the extensive IT programming and testing required. On the deployment side, HGIA faced hurdles in public outreach, contractor training, and internal resource constraints.[63]

The programme's evolution from HEB$ to GEM$ illustrates how addressing foundational gaps, such as administration, capital access, and delivery mechanisms, can transform policy into practice. GEM$ now stands as a model for equitable, scalable clean energy

[63] The Ins and Outs of On-Bill Financing, U.S. EPA's State and Local Energy and Environment Webinar Series. https://www.epa.gov/sites/default/files/2019-10/documents/webinar-onbill-financing-2019-09-25.pdf

financing. It demonstrates how targeted design improvements can make OBF a viable tool for inclusive climate action.

6.1.4.3. Case study #3: California – Pacific Gas & Electric (PG&E) on-bill financing programme

Summary

In 2009, the California Public Utilities Commission (CPUC) issued Decision 09-09-047, establishing the regulatory foundation for on-bill financing across California's investor-owned utilities (IOUs). Within this framework, Pacific Gas and Electric Company (PG&E) launched its OBF programme, offering **0% interest loans** ranging from **USD5,000** to USD**250,000,** with repayments collected directly through monthly utility bills.[64] Initially, loans were only available in conjunction with PG&E rebate programmes, where rebates subsidised part of the EE upgrade and loans financed the remainder. This OBF programme focused on non-residential customers, where loans were made possible through the Energy Efficiency Funds, a public fund.[71]

Figure 8. A post on LinkedIn by PG&E, advertising OBF

Recognising the need to simplify access and scale financing, PG&E introduced the **On-Bill Financing Alternate Pathway (OBF-AP)** in 2018. This decoupled loan eligibility from rebate programmes and significantly increased the maximum loan amount from **USD250,000 to USD4 million**, allowing broader participation from commercial and industrial users.[65] Like traditional OBF, loan repayments were structured to be **cost-neutral**, ensuring that energy savings offset monthly loan charges on utility bills. This is illustrated in Figure 9, where excellent cost savings through the OBF programme resulted in the customer paying USD20 less than the original bill. To date, PG&E's OBF programme continues to demonstrate resilience and effectiveness, supported by robust and critical marketing efforts, as shown in Figure 8.

[64] PG&E's Tier 2 Advice Letter describing the eligible technologies for On Bill Financing. https://www.pge.com/tariffs/assets/pdf/adviceletter/ELEC_7075-E.pdf

[65] On-Bill Financing Customer and Contractor Handbook, Pacific Gas and Electricity Company. https://www.pge.com/assets/pge/docs/save-energy-and-money/energy-savings-programs/handbook_obf.pdf

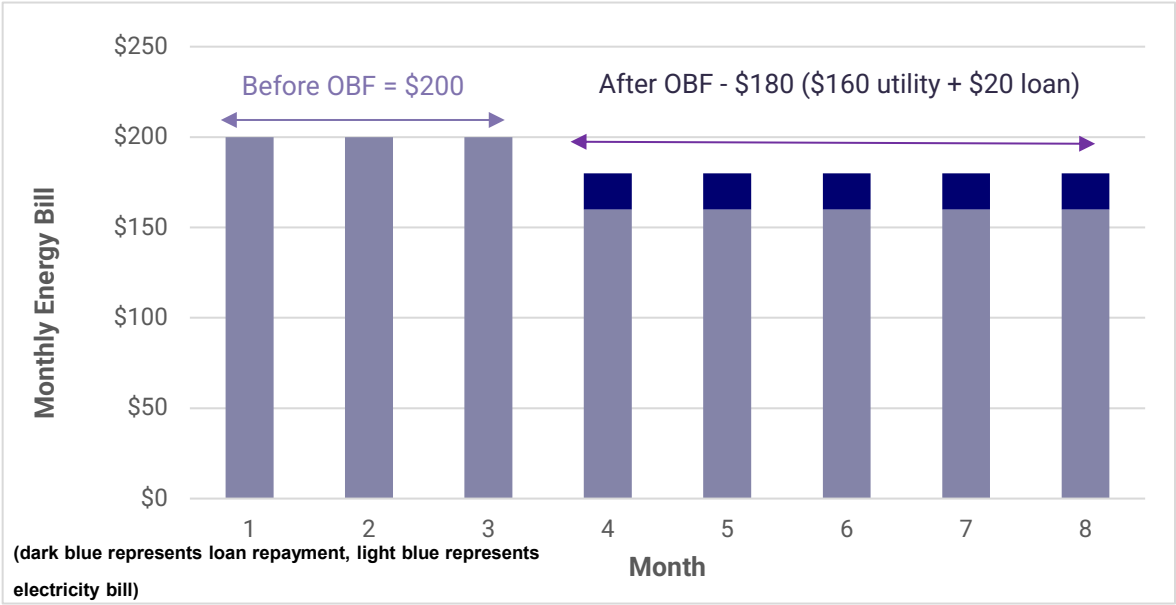


Figure 9. Cost neutrality illustration, with savings upside potential

Source: Adapted by EnergySage (https://www.energysage.com/energy-efficiency/financing/on-bill-financing-for-ee/)

Key stakeholders

Customers applying for OBF must work with a qualified industry professional, such as a developer or contractor, who is responsible for assessing the project and modelling the energy savings. This requirement ensures that any energy performance estimates are credible and can serve in structuring loan terms and conditions. To maintain quality and integrity, a third party should conduct an independent review of the projected savings.

Following this review, PG&E issued a loan agreement to the customer. Loan terms are designed such that the combined value of the customer's monthly loan repayment and post-installation energy bill is equal to or less than their pre-installation energy bill (i.e., cost neutrality). Additionally, the loan tenor does not exceed the expected useful life of the installed equipment, aligning financial obligations with the lifespan of the EE improvements.[65] Table 9 outlines the stakeholders in PG&E's OBF-AP programme.

Table 9. Stakeholders under California PG&E OBF-AP

Partners	Roles
Implementer Contractor/Project Developer	• Installs EE upgrades • Submits documents to PG&E as the Programme Manager
California Public Utilities Commission (CPUC)	• Approves key financial aspects like rate schedules and loan agreements • Provides regulatory oversight and programme authorisation
PG&E – Programme Manager	• Nexus between customer, contractor and OBF team • Assists customers with the application process, customer/contractor inquiries

	• Communicates and resolves issues related to the programme
PG&E – Credit Department	• Performs payment history screening • Communicates results of screening to the OBF team
PG&E – OBF Team ***(Could function as part of programme management, though it is up to the programme manager to decide)***	• Application processing, agreement distribution and billing setup in PG&E's billing system

Eligibility

Eligibility for PG&E's OBF is based on utility bill payment history (typically a retrospective 12-month review) rather than traditional credit checks or collateral requirements, a common key feature across the case studies analysed so far. Customers must demonstrate a strong record of timely PG&E payments. Starting in 2019, applicants were also required to confirm a genuine need for OBF through a clause in the loan agreement. This was likely used to ensure the programme was used by those who need it, given how a 0% interest rate may be very attractive.[66]

Although OBF-AP was formally approved as a separate programme with rebates from the original OBF, PG&E initially promoted it as an alternative participation track under the broader OBF umbrella. Following strong market uptake, detailed further in this section, PG&E repositioned OBF-AP as its primary offering, referring to it simply as 'OBF', while the rebate-linked option became 'OBF with Rebates'.[66]

Financing and interest

PG&E's OBF loans are offered at 0% interest and are free of fees, prepayment penalties, or other charges. Loan terms are structured to achieve payback through projected energy savings within the programme's maximum loan duration, as detailed in Table 10. This approach aims to ensure bill neutrality for customers, while supporting EE uptake.

[66] Kan, C. James, L. Evaluation of the On-Bill Financing – Alternative Pathway, PY 2018 – 2019. Prepared for Pacific Gas & Electric. https://www.calmac.org/publications/OBF-AP_PY18-19_Process_Evaluation_FinalES.pdf

Table 10. PG&E's OBF loan offerings

Loan terms	Business customers	Tier 1A**
Interest	0%	0%
Minimum loan amount	$5,000	$5,000
Maximum loan amount per premise	$250,000 *($4M by exception)	$100,000.00
Maximum loan term	120 months	72 months

Source: PG&E On-Bill Financing Programme. https://www.pge.com/en/save-energy-and-money/energy-saving-programs/energy-efficiency-programs-for-businesses/energy-efficiency-financing.html

To improve accessibility for small- and medium-sized enterprises (SMEs), PG&E introduced Tier 1A in 2021. This simplified track targets straightforward, single-measure EE upgrades, such as one-for-one equipment replacements, requiring minimal design or engineering inputs, and removes the need for third-party quality assurance (QA).[67] By relying on standardised procedures and benchmarks, Tier 1A reduces administrative complexity and costs, enabling easier participation for smaller projects.

OBF-AP insights

According to an internal study by PG&E, the launch of the OBF-AP in 2018 tested whether access to financing alone—without requiring rebates—could drive EE uptake. The results over six years strongly support this. By 2023, OBF-AP loans grew to USD53.4 million, up from just USD1.2 million in 2018. In contrast, loans issued through the original rebate-linked OBF model declined sharply from USD36.5 million to USD3.9 million over the same period [see Figure].

[67] Kialashaki, A. Knight, S. On-Bill Financing Alternative Pathway – Increasing Market Penetration through Scalable EE Financing.https://www.aceee.org/sites/default/files/proceedings/ssb24/pdfs/20240722163101640_6461a1bd-e281-449b-8e2d-2760471495cc.pdf

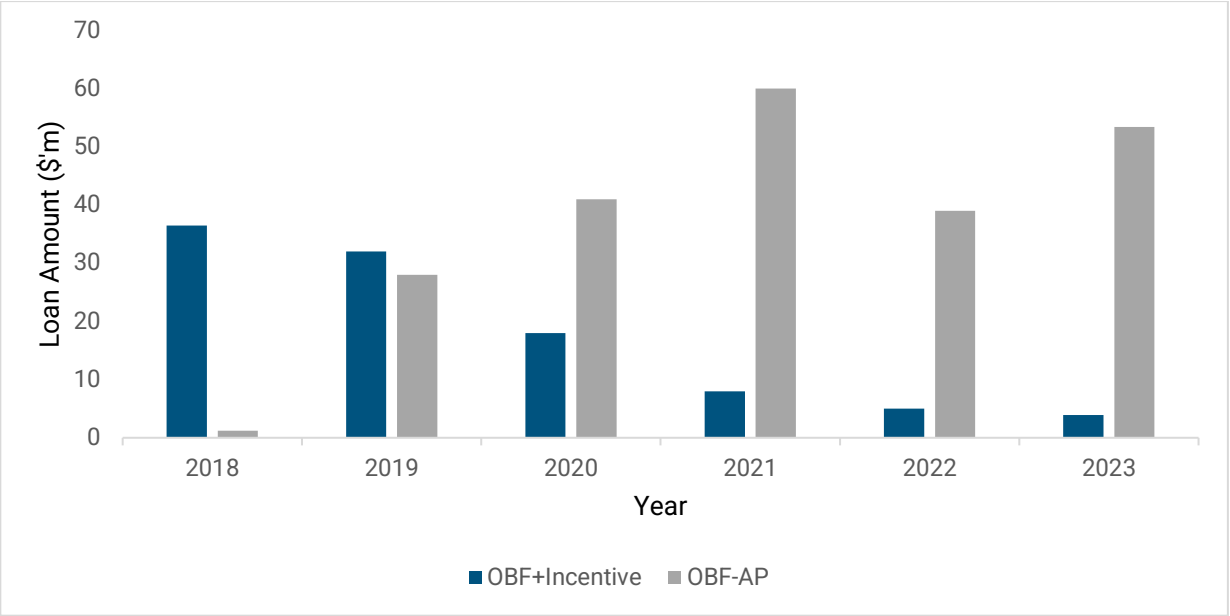


Figure 10. Loans issued between OBF+incentive and OBF-AP.[67]
Note for Figure 10, years 2019-2022 are not rounded to exact figures.

This shift could be partly attributed to enhanced programme design features, such as:

- A loan cap of USD250,000 for rebate-linked projects, versus USD4 million under OBF-AP; or
- A simplified QA process for OBF-AP, reducing time and cost.

While rebates have traditionally been seen as a primary motivator for EE adoption, or any product uptake, PG&E's experience depicts a different story. When administrative processes were streamlined and financing made more accessible (i.e., larger loan amounts), customers moved faster, even without rebates. It is also likely that the upfront bill neutrality contributed to a better overall programme experience, offering a more tangible and immediate benefits than traditional financial incentivses.

The increase in the loan cap from USD250,000 to USD4 million would have unlocked opportunities for participation in larger, more complex commercial and industrial projects. At the same time, the introduction of a streamlined Tier 1A pathway kept the door open for smaller, one-for-one upgrades. This dual-track approach demonstrates how a flexible, tiered design can widen access and strengthen OBF programme inclusivity across a broader customer base.

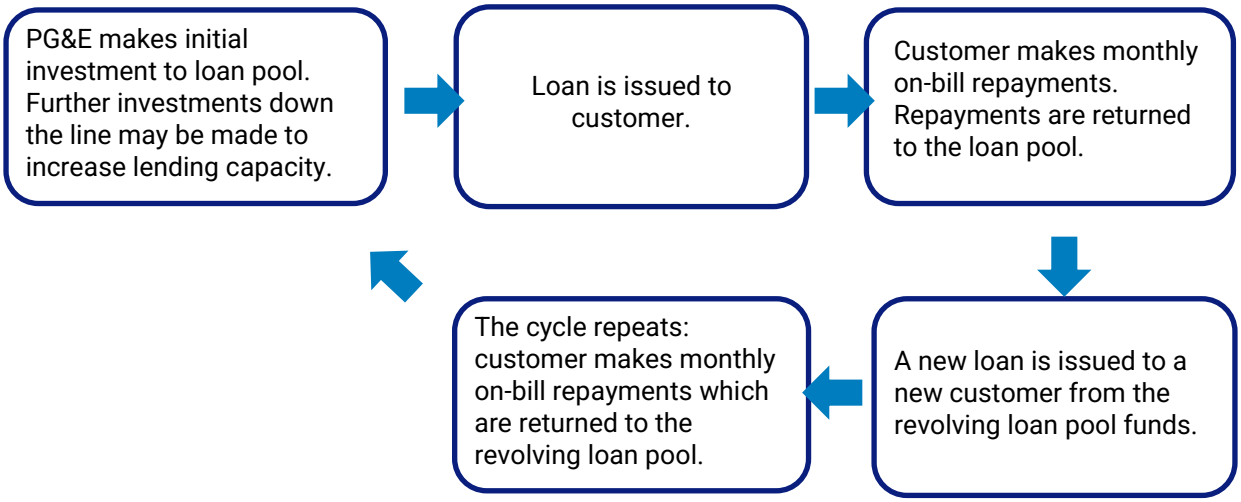
An independent evaluation (Opinion Dynamics, 2023) also found that customers who received both rebates and loans cited the loan as the more decisive factor in moving ahead with EE upgrades.**Error! Bookmark not defined.** OBF-AP's success reflects more than just access to capital; it demonstrates several critical enablers, such as:

- **Programme design clarity**: Cost-neutral repayment, simple processing, and higher loan caps improved customer uptake.
- **Tiered access model**: Tier 1A supported smaller, fast-track upgrades, while larger commercial users benefited from high loan ceilings.

- **Trusted contractor network:** Qualified contractors, reinforced by independent third-party assessments.
- **Operational integration:** The close integration of PG&E's credit, billing and implementation arms ensures efficient delivery.

The PG&E OBF-AP programme uses a ratepayer-funded revolving loan pool, enabling funds to be leveraged multiple times for greater impact.[67] Once PG&E issues a loan, the customer repays it through monthly instalments. These repayments are then re-issued into new EE projects, creating a cycle of ongoing funding, illustrated in Figure 11. This model recycles ratepayers' dollars to generate extended EE savings, promoting greater programme self-sustainability.

Figure 11. PG&E OBF-AP revolving loan pool cycle[67]



Challenges and strategic implications

On a broader note, while strong programme design can pave the way for OBF, external factors such as rising utility costs can still challenge its impact and customer sentiments. Even with bill neutrality, customers may face year-on-year increases in their total utility bills, driven by macro cost pressures and, in some cases, utility rate hikes or profit-seeking behaviours.[68] This highlights the need for OBF to be part of a wider system response. Policy alignment, proactive regulation, and ongoing engagement between utilities and stakeholders are critical to ensure that access to clean energy remains not just technically possible, but also financially sustainable.

6.1.5. Case study insights: Strategic enablers

Drawing from case studies and a broader understanding of OBF, key success factors have emerged for consideration in the ASEAN context. These insights should guide the design and execution of future programmes, with careful consideration of the diverse

[68] St.John, J. *California's utility bill crisis is clear to all. The solution, not so much*. Carnary Media. https://www.canarymedia.com/articles/utilities/californias-utility-bill-crisis-is-clear-to-all-the-solution-not-so-much

geographical and contextual realities across the AMS. Strategic enablers in Table 11 are high-level levers that must be present in the market for an OBF to viably operate.

Table 11. Strategic enablers for OBF implementation

Strategic enablers	High-level readiness criteria

Regulations instilled for success
 	
The implementation of OBF programmes is the result of deliberate, long-term regulatory groundwork aligned with broader national goals. In the case of OBF, this is typically aligned with national energy goals. Across regions, enabling legislation has proven essential in kick-starting programmes and shaping the operational, financial, and legal architecture required for OBF to function.
 	
Holland, Michigan's HB-5397, Hawaii's Acts 204 and 211, and California's Decision 09-09-047 were not isolated interventions; they served as policy instruments to translate high-level goals into actionable programme structures. Beyond signalling intent, the applicable laws help establish legal entities (e.g., HGIA), authorised financial mechanisms (e.g., green infrastructure bonds), and defined roles of utilities and programme administrators:
 	
• **Act 204** empowered Hawaii's PUC to explore OBF feasibility
• **Act 211** created HGIA and enabled repayment structures
• **HB-5397** authorised Holland BPW, a utility, to pilot OBF
• **09-09-047** enabled investor-owned utilities to provide OBF loans
 	
These case studies have shown that enabling regulations often precede programme launch by several years. It reflects the foundation that regulations need to play, and the time it required for eventual off-takers to formalise a programme. This underscores the critical role of regulators and policymakers, where policies must be clearly designed with both national goals and the long-term outcomes they aim to achieve. Delaying action can set progress back by years, so it's essential to implement policies early and refine them iteratively, recognising that their full impact often takes time to materialise.
	• Existence of an on-bill finance regulation
	  ○ Policies are well-defined, with measurable objectives and implementation pathways, and have the flexibility to support innovative programmes like OBF
	  ○ Strong institutional capacity, like the presence of capable regulatory bodies with resources to oversee OBF and the various actors.
	  ○ Utilities share the same national goals as governments (typically state-owned enterprises)
	
	• Regulatory pathways for loan issuance.

Fund raising Building on regulations, funding mechanisms for OBF may be mobilised through various channels – such as direct government budget, dedicated bond programmes, partnerships with multilateral finance institutions, or independently via the utilities. Enabling regulations must clearly define provisions that support one or more financing models.	• Legal provisions allowing utilities or a separate firm to act as financing intermediaries for OBF (if applicable) • Ability to identify financial sources • Entity (typically government agency) for fiduciary oversight
Stakeholder engagement and partnerships Effective stakeholder coordination is a critical enabler. OBF programmes inherently require multi-actor collaboration, where no single entity can deliver all ends of the programme in isolation. Success hinges on strong partnerships between public agencies, utilities, ESCOs, and community organisations. Actors play a distinct but interdependent role: utilities facilitate billing integration, ESCOs execute upgrades and audits, and public agencies ensure oversight. These relationships are essential not just for operationalisation, but also for building customer confidence and programme legitimacy.	• Presence of a regulatory body exercising national EE goals • Presence of a willing utility and a credible pool of ESCOs; ideal for the utility to have strong synergies with governing bodies (i.e., state-owned) and a strong influence over the customers it serves
Programme design principles Effective OBF programmes must be designed with a dual mandate: delivering measurable EE outcomes, while remaining accessible and attractive to consumers. Case studies show that successful programmes often incorporate features such as: • **Cost-neutral billing**: Ensuring that post-upgrade utility bills do not exceed pre-upgrade levels, which is key to ensuring customer uptake. • **Simplified credit checks**: Lowering barriers to entry, especially for underserved or low-credit populations, e.g., a 12-month history of utility bill repayment. Programme design must also reflect **targeted objectives**, meaning that repayment terms, loan caps, and eligibility criteria should be tailored to different customer segments. For instance, commercial clients may warrant higher loan	• Government openness to innovation, where there is a willingness to explore and pilot new programmes, including innovative financing or public-private partnerships • Availability of data on energy use and inefficiencies, plus insights into consumer and business priorities. Includes understanding behavioural drivers and financing preferences. For example, recognising that simplified credit checks (common in the US) may need adaptation for ASEAN's context

caps due to larger upgrade scopes, as seen in California's OBF models. Ultimately, programme design must balance **technical credibility** (i.e., real energy savings) with **consumer-centricity** (i.e., ease of participation), ensuring that the structure supports both uptake and impact.	
Customer experience Customers must trust that the programme will deliver real savings and operate reliably. Clear communication of expectations is essential — from projected outcomes to timelines and responsibilities. Contractors must be held to performance standards to ensure quality delivery and avoid reputational risks.	• Customers having trust in government institutions and state-owned enterprises, especially utilities, is essential for buy-in • Government or utility track record in effectively engaging the public on energy, infrastructure, or social programmes

6.1.6. Case study insights: Operational enablers

Operational enablers are practical capabilities, systems and resources required to implement and run an OBF effectively, as shown in Table 12.

Table 12. Operational enablers for OBF implementation

Operational enablers	High-level readiness criteria
Dedicated funding mechanisms OBF programmes require accessible and well-structured funding sources — public, private, or philanthropic. To activate these funds, jurisdictions must establish standard operating procedures across credit assessment protocols, secure licensing (where applicable), and set up financial accounts and safeguards, e.g., default handling mechanisms. Above all, a fit-for-purpose governance structure must be in place.	• Development of OBF-type credit assessment checks, which are typically bespoke to region/country and financier risk tolerance • Institutional capacity to manage risk and repayment structures
Utility billing management and integration Utilities must be able to incorporate OBF repayments into monthly bills, with flexibility to handle pre-payments, partial payments, and late payments. Billing systems/physical bills should support line-item adjustments and maintain transparency for consumers.	• Operational flexibility to manage varied payment scenarios • Utilities have digital billing systems capable of itemised charges • Willingness and capacity of utilities to integrate financing into billing workflows
Data and IT infrastructure	• Existing IT infrastructure within utilities or government agencies that

Robust systems are needed to track loan balances, repayment status, and energy savings. These must integrate with utility CRM and billing platforms to ensure seamless data flow and accurate savings verification.	can support data tracking and integration; commitment to data transparency/sharing and performance monitoring across actors • CRM or billing platforms that could be adapted for OBF
Programme administrator expertise Effective programme delivery requires an entity with the operational capacity to coordinate across utilities, financiers, contractors, and consumers. Administrators may also lead marketing and outreach efforts to drive uptake.	• Presence of institutions with experience in multi-stakeholder coordination • Capacity to manage programme logistics, reporting, and customer engagement • Existing marketing channels or partnerships to support outreach • Willingness to serve as a central coordinating body or designate one

6.2. Readiness level

Indonesia's energy sector regulatory landscape is evolving to support its transition toward cleaner energy. **Presidential Regulation No. 112/2022**, also known as the Acceleration of Renewable Energy Development for Power Supply, is one of the key instruments supporting the renewable energy transition. This established a roadmap for the retirement of coal power plants and the expansion of renewable energy sources. Complementing this is **MEMR Regulation No.10** of 2025 on the Energy Transition Roadmap, which requires funding and feasibility studies before any early retirement of power plants.

In November 2024, **the National Electricity Master Plan (RUKN) 2024- 2060** was unveiled, which outlines a strategy of balancing national economic and energy goals, acknowledging the role of coal in the short term. It aims to:

1. Strengthen industrial capacity;
2. Advance renewable energy integration with **battery storage** solutions; and
3. Achieve a sustainable energy transition alongside national development.

However, critics argue that recent policy developments may hinder Indonesia's coal phase-out, particularly through the expansion of captive coal capacity.

On the energy-efficiency (EE) front, Government Regulation No. 33/2023 aims to conserve domestic energy resources and improve utilisation efficiency across energy providers, users, importers, and producers. It seeks to promote rational and prudent energy use through measures such as energy audits and strengthened accountability via reporting requirements.

In parallel, Indonesia's Green Building and Smart Building Regulations and SNI standards set requirements relating to EE—covering air-conditioning, lighting, and energy audits—as

well as water usage and material selection.[69] Green-building mandates currently apply only to large buildings, including offices ≥50,000 m^2; commercial and residential buildings ≥5,000 m^2 with at least four floors; hospitals ≥20,000 m^2; and educational or cultural facilities ≥10,000 m^2.

Additionally, the Just Energy Transition Partnership (JETP) outlines investment strategies to decarbonise off-grid power and strengthen EE across sectors. Despite these initiatives, implementation remains uneven and more robust enforcement will be required to achieve meaningful impact.

State of the electricity network

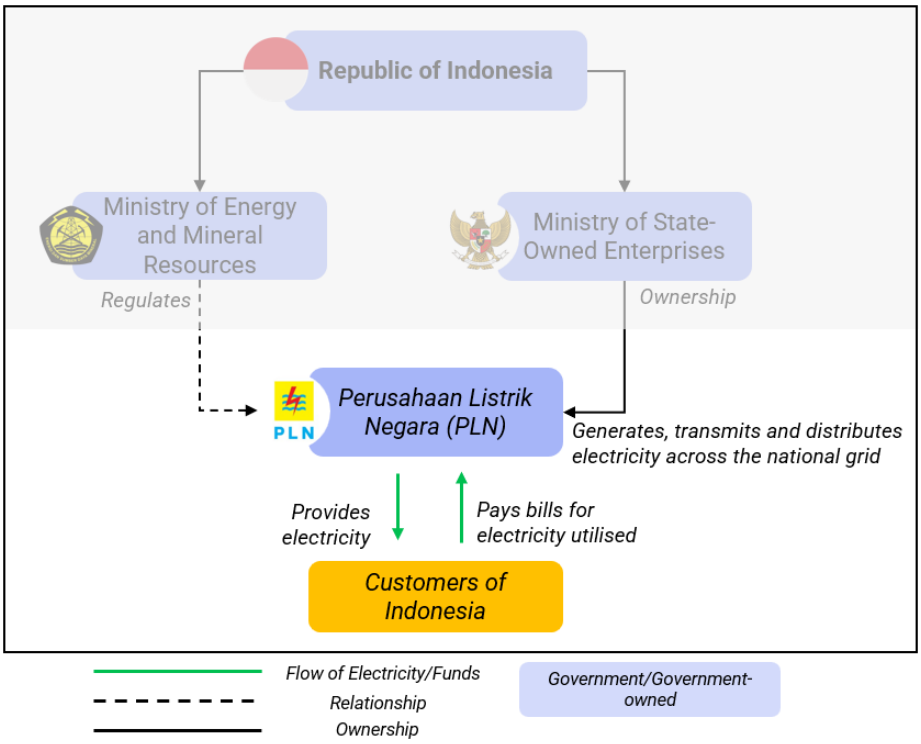
Indonesia's electricity sector remains largely vertically integrated, with PLN—the state-owned utility—dominating electricity generation, transmission, and distribution. PLN also develops supporting infrastructure, including transmission networks, substations, and distribution systems. It is responsible for planning and executing the Electricity Supply Business Plan (RUPTL), most recently issued in May 2025, which sets out national power-sector development strategies.

Although the sector has opened to independent power producers (IPPs), particularly in renewable energy, PLN continues to control the national grid and remains the primary electricity supplier, providing approximately 98% of household electricity (see Figure 12). Operating within a vertically integrated structure means competition and external influence are largely constrained by PLN's internal priorities. However, this structure may enable more streamlined decision-making—particularly for initiatives such as the implementation of OBF, which could support national decarbonisation objectives.

It is also understood that residential and small commercial sectors are now moving into a prepaid electricity payment structures, signalling a broader move across sectors. This limits the feasibility of the OBF described above, which typically relies on monthly billing for repayment. Further studies and adaptation of OBF may need to happen, such as integrating repayment into prepaid top-ups, developing smart meter-based deduction systems or exploring hybrid billing models to maintain repayment continuity.

[69] Global Building Performance Network, Indonesia: Country Info Sheet. https://library.gbpn.org/beet-3/country-infosheets/indonesia#:~:text=Indonesia%20has%20four%20energy%20standards,Best%20Practices

Figure 12: Relevant actors in Indonesia's electrical network



Collaborative growth

Indonesia has its fair share of collaboration and partnerships across government, state-owned enterprises and the broader sectors, showcasing a level of experimentation and transformation. Recently, in July 2025, the National Economic Council (DEN) of Indonesia signalled intent to advance a unified and interoperable Digital Public Infrastructure for identification, authentication, and data exchange with the United Nations Development Programme.[70] This initiative, named Digital Nusantara, aims to modernise public service delivery.

In early 2025, PLN and Huawei launched a Joint Innovation Centre aimed at accelerating PLN's digital transformation. The centre pilots advanced technologies, such as Internet of Things (IoT)– distribution networks, smart inspection systems, and grid digitalisation.[71]

While there has been progress in collaboration and innovation, there could be resistance or delays in implementing new initiatives, especially until proof-of-concept is achieved. Realising an OBF programme will be a multi-step and multi-actor approach and will, as such, take time to secure stakeholder buy-in.

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[70] United Nations Development Programme. (2025, July 7). *Indonesia moves toward one digital system: UNDP and DEN signed statement of intent to accelerate digital transformation*. https://www.undp.org/indonesia/press-releases/indonesia-moves-toward-one-digital-system-undp-and-den-signed-statement-intent-accelerate-digital-transformation

[71] Huawei. (2024, April 25). *Huawei–PLN reiterate commitment to stronger synergy to accelerate digitalisation with milestones on Joint Innovation Centre*. *https://e.huawei.com/sg/news/2024/industries/grid/milestones-joint-innovation-center*

Readiness review

Building on the strategic enablers [Section 6.1.5], this country-specific review benchmarks each country's readiness to adopt OBF. The scoring framework provides a high-level assessment of readiness, serving as a valuable input for shaping the next steps in each country's implementation roadmap. These findings are preliminary and will be further refined during in-country workshops to ensure contextual relevance, accuracy, and alignment with local perspectives.

Table 13. Strategic enabler high-level readiness scoring for Indonesia

Strategic enablers	High-level readiness criteria for Indonesia
Regulations instilled for success	• Presence of broad national goals that include EE agendas. However, OBF-specific regulations must be further developed. • Enforceability and permanence of regulations. • Regulations should build an environment where OBF success and/or broader national EE outcomes are indicators of utility performance.
Fund raising	• Potential for fundraising and/or repurposing of existing funds within government usage for OBF. • Regulations for the use of funds must be implemented in due course.
Stakeholder engagement and partnerships	• State-owned utility streamlines interactions. PT Energy Management Indonesia (EMI), under PLN, has the potential to serve as the public ESCO to support OBF. The wider ESCO market will need to be strengthened to keep up with potential demand.
Programme design principles	• Well-communicated programme outcomes will enable an already innovative state to shape a fit-for-purpose OBF. • Pre-payment introduction to Indonesia's utility system may require OBF to be adapted for compatibility and relevance.
Customer experience	• Effective communication of programme outcomes will build on the utility's existing public trust and drive uptake. • Customers may resist adoption unless the value proposition is clear and tangible.

Legend:

Chapter 7
Recommendations

7. Recommendations

Based on our assessment of the ESCO market landscape in Indonesia and OBF's potential as a strategic enabler, this section outlines thematic recommendations aimed at building a robust EE ecosystem. Indonesia faces challenges related to energy intensity and carbon emissions in its building sector. Addressing these challenges requires strengthening the ESCO business environment as a foundational pillar, as well as assessing how mechanisms such as OBF can complement regulatory frameworks, market structures, and ESCO operations to lower barriers to EE adoption.

A key lever studied in this report is the implementation of an OBF programme. International case studies — from Michigan, Hawaii, and California — demonstrate how OBF can deliver cost-neutral solutions for consumers, unlock demand for ESCO services, and support broader decarbonisation goals. In the Indonesian context, where state-owned entities play a dominant role, successful OBF deployment will depend on strong government leadership and policy alignment across ministries as an immediate step.

The recommendations that follow are structured thematically to support ESCO market development, with OBF integrated primarily under Theme 1 and focusing on operational understanding and regulatory readiness. This reflects Indonesia's current stage of market maturity, where foundational policy and institutional frameworks are critical to enabling both ESCO growth and OBF success.

Theme 1: Create a more conducive policy and regulatory environment for EE in Indonesia

Short term (Immediate-2 years)	Medium term (3-5 years)	Long term (5+ years)
Strengthen the enforcement of PP 33/2023 [Action by: EBTKE, ESDM] Develop a clear action plan to ensure Presidential and Ministerial Regulations are implemented [Action by: EBTKE, ESDM] Undertake a comprehensive study and pilot to explore potential regulatory pathways for OBF, with the goal of generating actionable insights to inform policy development and implementation [Action by: EBTKE, ESDM]	Evaluate the effectiveness of Presidential and Ministerial Regulations [Action by: EBTKE, ESDM] Consider promulgating a regulation on OBF based on pilot insights [Action by: EBTKE, ESDM]	Continuous refinement of policies based on evaluation of market feedback and performance [Action by: EBTKE, ESDM]

Short term:

ID – PR – ST.1: Strengthen the enforcement of PP33/2023 [Action by: EBTKE, ESDM]

PP 33/2023 mandates that large energy consumers across key industrial and commercial sectors report their energy consumption, appoint certified energy managers, conduct regular energy audits, and develop actionable plans to reduce energy use.

To ensure meaningful implementation, enforcement mechanisms must be significantly strengthened and institutionalised. This includes establishing clear compliance timelines, robust monitoring systems, and legal provisions for penalties in cases of non-compliance. Effective cross-ministerial coordination (particularly with the Ministry of Public Works for oversight of commercial buildings) is essential to ensure enforcement is not only consistent, but also aligned with broader national EE goals. Without strong enforcement and inter-agency collaboration, the potential of PP 33/2023 will remain limited.

ID – PR – ST.2: Develop a clear action plan to ensure Presidential and Ministerial Regulations are implemented [Action by: EBTKE, ESDM]

Experience indicates that a key challenge in Indonesia is the lack of effective implementation of promulgated regulations. While Ministerial Regulations have been passed to operationalise PP 33/2023, these remain high-level and lack detailed, actionable roadmaps. To bridge this gap, further elaboration is needed on implementation pathways for EE programmes, including specific timelines, sectoral targets, incentive structures, and programme evaluation mechanisms. These details are critical to provide clarity and direction for private sector actors.

Part of a robust implementation plan must include clear recognition and endorsement from governmental bodies to legitimise ESCO projects and encourage market uptake. Government agencies should acknowledge the strategic role ESCOs play in delivering EE solutions and define the scope of projects they undertake. This recognition will help stimulate demand for ESCO services, enabling the supply side of the market to grow in response. Such endorsement also sends a strong policy signal, reinforcing government commitment to EE and enhancing market confidence amongst investors and financial institutions, an issue repeatedly raised during stakeholder consultations.

ID – PR – ST.3 Undertake a comprehensive study and pilot to explore potential regulatory pathways for OBF [Action by: EBTKE, ESDM]

Case studies underscore that strong government leadership, clear KPIs, and institutional commitment are critical success factors relevant in the Indonesian context, where state-owned entities often dominate the energy landscape. Part of a successful OBF rollout in Indonesia will require clear government endorsement, policy stability, and possibly alignment across ministries.

To effectively initiate an OBF programme in Indonesia, a sandbox environment is recommended as a first step. This controlled pilot allows for real-world testing while managing risks. Key objectives include validating repayment mechanisms, assessing utility bill impacts, evaluating customer engagement, and refining stakeholder workflows. The pilot should be guided by a multidisciplinary team comprising financial, energy, legal, policy, and social sector experts to ensure technical rigour and, importantly, to shape future OBF policy. Government endorsement is essential for launching and legitimising the sandbox.

Given Indonesia's current readiness and the lack of comprehensive operational oversight, the sandbox should remain iterative and adaptable to local contexts. Insights from international case studies highlight the importance of early regulatory development. However, regulation must evolve alongside pilot lessons to avoid misalignment and ensure long-term effectiveness.

Table 14. Step-by-step sandbox pilot initiation

Steps	Actions
(1) Define pilot goals	• Validate key success factors that the OBF programme must showcase (e.g., on-bill repayment mechanisms, administrative workflows, and confirm cost-effective scalability). • Ensure customer benefits (e.g., demonstrate that EE appliance upgrades result in overall utility bill savings). • Test stakeholder collaboration and governance (e.g., coordination between utilities, regulators, and programme administrator). • Identify potential programme managers (preferably an Indonesian government agency to start with). • Capture actionable insights for policy implementation (e.g., use a sandbox to collect data, identify friction points, and refine programme parameters to inform broader policy frameworks and expansion plans).
(2) Designating parameters of the sandbox environment	• Clear **start** and **end date for pilot.** • Define target customer segment (e.g., if OBF is envisioned to be rolled out across the country, the pilot should include various types of housing). • Select district or utility zone; ideally, this should be decided with the local government and utility. From stakeholder workshops, **Cikarang Industrial Park** could serve as a potential pilot site, with residential areas easily gazetted for pilot implementation. • **Identify regulatory requirements** that will need to be relaxed or modified for OBF. • Include **exit criteria** if the pilot needs to be paused or terminated.
(3) Onboard experts and advisors	• **Engage a multidisciplinary panel of experts**, including specialists in finance, legal frameworks, and the social sector, to ensure comprehensive impact coverage and provide independent, third-party perspectives. • Panel of experts should also **aid in helping to inform pilot goals in (1).**

Steps	Actions
(4) Form a stakeholder collaboration group	• Clarify responsibilities for utilities, financial institutions, regulators, community partners, programme administrators, ESCOs, etc. • Include an ongoing feedback loop for stakeholders.
(5) Design pilot architecture	• Structural framework includes eligibility criteria, financing terms, repayment mechanisms, customer journey mapping, and data governance protocols. • Pilot goals **(1) must be included in the design phase.**
(6) Marketing and customer experience design	• Marketing may be overlooked, but one lesson learnt from the Michigan case study was – Don't count on 'if you build it, they will come.' **Active marketing and customer buy-in are key.** • Outline onboarding process, billing integration, and available support channels. **Ensure transparency** in terms and conditions.
(7) Deploy and monitor the sandbox pilot	• Launch the programme with selected participants, integrating billing systems, and initiating customer engagement processes. • Track key metrics such as repayment rates, energy savings, and both stakeholder and customer feedback.
(8) Evaluate outcomes and refine the model	• Review key metrics such as repayment rates, customer satisfaction, energy savings, and stakeholder feedback • Use insights to refine financing terms, operational workflows, and engagement strategies. • **Leverage pilot findings to identify regulatory needs** essential for the successful rollout of OBF. **Insights should guide the development of enabling policies** that balance impact targets (e.g., energy savings and consumer affordability) with regulatory structures that support OBF scalability, operational integrity, and long-term alignment with Indonesia's EE goals.

Colour codes and timelines (indicative):

>	Setup (1 year)	>	Active testing (2 years)	>	Evaluation and reporting (ongoing)

Medium term:

ID – PR – MT.1: Evaluate effectiveness of Presidential and Ministerial Regulations [Action by: EBTKE, ESDM]

Evaluating the regulations is necessary to ensure progress is tracked and that targets are achieved. Once targets have been met, refinements can be made to facilitate further progress. Where targets have not been met, improvements will need to be made to address shortfalls. Evaluation helps to determine whether reductions in energy consumption are due to policy effectiveness or other factors, and enables a quick response to technological and market evolution. Meeting these targets is crucial as they will facilitate Indonesia in achieving its emission reduction targets, as indicated in its Nationally Determined Contribution.

Transparent evaluation will build confidence amongst investors, donors, and the public, as it is a testament to a clear policy direction and commitment.

ID – PR –MT.2: Consider promulgating a regulation for on-bill finance with a clear public consultation process [Action by: EBTKE, ESDM]

Insights from the sandbox pilot must be translated into regulatory guidance to address implementation needs for OBF. Case studies show a clear lead time between regulatory issuance and operational rollout, underscoring the importance of establishing a feedback loop between pilot lessons and policy development. This ensures that enabling regulations — such as billing integration, tax treatment for utilities, and financing eligibility — are responsive, forward-looking, and supportive of a robust OBF ecosystem. Following the outcomes of ID–ST.1, where OBF implementation is encouraged, a draft regulation should be prepared by EBTKE, followed by public consultation to ensure societal impacts are considered and the legal foundation is sound.

Establishing robust regulations will set a critical precedent for how ESCOs can scale their capabilities and capacity to manage larger volumes of projects. This regulatory foundation will also pave the way for more sophisticated and sustainable financing mechanisms, particularly in relation to OBF programmes, an area that will be further explored in ID – FIN – MT.1.

Long term:

ID – PR – LT.1: Continuous refinement of policies based on evaluation of market performance and feedback [Action by: EBTKE, ESDM]

Evaluation should occur regularly to ensure proper monitoring of policy outcomes. This enables continuous tweaks, which can increase effectiveness. As technologies are bound to advance over time, regulations will need to be continually reviewed to ensure they keep pace with technological and market advancements.

Theme 2: Increase mobilisation of finance

Short term (Immediate-2 years)	Medium term (3-5 years)	Long term (5+ years)
Explore the provision of financial incentives in coordination with the Ministry of Finance and the Ministry of Public Works [Action by: EBTKE, ESDM]	Create financial sandboxes to facilitate increased flows of equity investment and project aggregation [Action by: EBTKE, ESDM and OJK]	Consider the development of specific loan products for the EE projects [Action by: EBTKE, ESDM, OJK, and commercial and

Continue collaboration with PT PII to pilot a guarantee mechanism for EE projects in public buildings [Action by: EBTKE, ESDM] Work with development partners to pilot the implementation of de-risking mechanisms and to support schemes that can increase the mobilisation of EE finance [Action by: EBTKE, ESDM] Coordinate with OJK to develop guidelines for banks to explore EE projects with existing clients in their portfolio [Action by: EBTKE, ESDM]	Establish risk-sharing mechanisms post-pilot [Action by: EBTKE, ESDM and OJK]	state-owned banks in Indonesia]

Short term:

ID – FIN – ST.1: Explore provision of financial incentives in coordination with the Ministry of Finance and Ministry of Public Works [Action by: EBTKE, ESDM]

PP 33/2023 and accompanying Ministerial Regulations indicate that the government will provide incentives to stakeholders active in EE. This is a step in the right direction. However, stakeholder feedback has consistently highlighted that current incentives are not sufficiently attractive to catalyse large-scale action. It is understood that the incentives referenced in the regulations are primarily those within the purview of the Ministry of Energy and Mineral Resources.

Part of strengthening the incentive framework must involve deeper coordination with the Ministry of Finance and the Ministry of Public Works to design more compelling and far-reaching financial mechanisms. This includes exploring tax incentives, subsidies, and performance-based grants that can directly support EE implementation. Additionally, the Ministry of Energy and Mineral Resources can lead the charge in unlocking green finance and risk guarantees, which are critical enablers for scaling ESCO activity. Initial support for ESCOs — particularly at inflexion points in market development — can help them access capital, build credibility, and grow their service offerings over time.

ID – FIN- ST.2: Continue collaboration with PT PII to pilot a guarantee mechanism for EE projects in public buildings [Action by: EBTKE, ESDM]

Previous programmes funded through the UK Government's PACT programme have laid the foundation for collaboration between EBTKE and PT PII, who have both formally acknowledged the value and their intentions of working together to explore the development of an EE guarantee provided by PT PII for projects in public buildings. It is strongly recommended that EBTKE and PT PII continue this collaboration. PT PII has guaranteed various infrastructure projects, including those in the energy conservation sector, such as the West Lombok Public Street Lighting project. Continued collaboration can lead to the provision of guarantees to EE projects beyond public street lighting, including those financed by and implemented in the private sector.

On this front, formal engagements between EBTKE and OJK may also be useful. As private commercial banks are supervised by OJK, the design of the guarantee will need to align with guidelines published by OJK, to facilitate the uptake of any credit guarantees provided to private commercial banks. It is noted that there are ongoing engagements between EBTKE and OJK in relation to energy savings insurance. Enabling a set of engagements on credit guarantees will widen the discussions to cover other de-risking mechanisms that can facilitate increased mobilisation of finance to EE projects.

ID – FIN – ST.3: Work with development partners to pilot implementation of de-risking mechanisms and support schemes that can increase mobilisation of EE finance [Action by: EBTKE, ESDM]

The Korean Development Bank has received funding from the Green Climate Fund to provide a credit guarantee to EE projects in the industrial sector. It is encouraged that EBTKE strengthens its collaboration with KDB and its partners to synthesise lessons for potential replication in the building sector.

In addition to guarantees, EBTKE should continue advancing the development of other de-risking schemes, such as energy savings insurance. We understand that this is ongoing through support. Developing a suite of de-risking schemes (e.g., credit guarantees, energy savings insurance, etc.) can help to develop the market for EE.

ID – FIN – ST.4: Coordinate with OJK to develop guidelines for banks to explore EE projects with existing clients in their portfolios [Action by: EBTKE, ESDM]

Starting with existing client portfolios reduces the *'Know your client (KYC)'* and due diligence processes through established relationships. Some industry-wide activities can further encourage and support banks to explore EE opportunities and bring these into lending discussions with the clients. The provision of concessional financing for EE loans can also serve to encourage banks to reach out to specific client groups to offer lower-interest loans that are win-win for the bank and its clients.

Medium term:

ID – FIN – MT.1: Create financial sandboxes to facilitate increased flows of equity investment and project aggregation [Action by: EBTKE, ESDM and OJK]

Innovative financial mechanisms need to be created to increase the mobilisation of finance to EE projects and ESCOs. Without specific intervention from the government, it is unlikely that ESCOs would receive increased amounts of debt finance from banks due to creditworthiness challenges. As such, it is recommended that EBTKE and OJK jointly create spaces for financial innovation through sandboxes. The sandboxes should source innovative ideas from the market and provide them with a conducive environment for testing. These innovative ideas may include:

- **EE project pooling programmes**: Most banks see individual EE projects as small with too much overhead. Pooling small projects with similar scopes (e.g., retrofits across multiple SMEs) into standardised portfolios can reduce due diligence costs and enable larger ticket sizes. The sandbox could support project pooling by assisting banks in identifying clients within similar industries to be pooled and to explore partnerships with utilities or ESCOs to build and manage portfolios.

- **Design of performance-linked financial products:** Design corporate loan products where repayment terms are directly linked to realised energy savings, with features such as:
    - Flexible repayment schedules or interest levels that can be adjusted based on verified energy savings performance;
    - Grace periods aligned with energy savings realisation timelines; and
    - Integration of energy bill payment history into credit assessment**.**
- **Design project-specific drawdown mechanisms:** To emulate certain aspects of project financing in an ESCO corporate loan structure, a mechanism is in place where drawdowns from the corporate loan are released in phases based on the approval of an EE project and a project owner. This project approval process enables stronger risk management by allowing banks to assess both technical feasibility and creditworthiness of each underlying project and its owner before committing funds, while still providing greater control over fund usage (e.g., project milestone-based) and maintaining the scaling benefits of a corporate loan structures.
- **Explore options to increase the flow of venture capital into ESCOs:** ESCOs in Indonesia are in the infancy stages of development. Many, if not all, are not yet able to obtain debt finance, due to a lack of creditworthiness and a poor balance sheet. Therefore, equity investment is key to driving the growth of the ESCOs. EBTKE and OJK should come together to explore approaches to increase the flow of venture capital into ESCOs.
- **Specific to the OBF initiative in Theme 1 – Beyond public funds, explore blended finance or philanthropic capital**: **Case studies demonstrate that OBF funding can originate from multiple sources, although most programmes to date have relied predominantly on public finance. Where external financial partners are available, additional fundraising options, such as blended finance models, should be considered. Blended finance involves the use of public and/or philanthropic capital to leverage private investment for projects that deliver social or environmental impact. Philanthropic funding has also been used to directly support operational functions within OBF programmes. Philanthropic capital should therefore be considered carefully, taking into account the need for sustained long-term commitments. In the Michigan case, for example, programme funding was provided to the administrator, Michigan Saves, through the Mott Foundation**.

ID – FIN – MT.2: Establish risk-sharing mechanisms post-pilot [Action by: EBTKE, ESDM and OJK]

Development partners are currently providing technical assistance to pilot risk-sharing mechanisms such as credit guarantees and energy savings insurance. Outcomes of the pilots and the barriers identified through those studies must be addressed. Tangible action needs to be taken by both EBTKE and OJK to ensure that these pilots do not remain pilots, but can be scaled more widely across the economy. These may include adjusting existing

guidelines and frameworks to facilitate the creation of institutions capable of providing risk-sharing mechanisms.

Long term:

ID – FIN – LT.3: Consider the development of specific loan products for EE projects [Action by: EBTKE, ESDM, OJK and commercial and state-owned banks in Indonesia]

As discussed, there needs to be significantly more ESCOs for them to meaningfully contribute to the reduction in TFEC in the Indonesian building sector. This will require increased maturity in the entire EE ecosystem, including on the part of ESCOs and the financial instruments available. Equity capital is needed to support an ESCO's initial growth stages; however, debt finance will be needed past a certain maturity level to ensure that ESCO projects remain price competitive. [72] The U-Energy Indonesia is the first loan product specific to EE in Indonesia. More such loan products are needed to increase the flow of finance to EE projects. It is recommended that a set of guidelines for developing EE loan products be jointly developed by OJK and EBTKE, to facilitate the development of such loan products. State-owned banks could lead the way in creating such products to support Indonesia's overall aim of reducing its greenhouse gas emissions and meeting its Net Zero target. The application of such a product can be applied beyond Indonesia into other AMS.

Theme 3: Increase individual and institutional capacity for EE

Short term (Immediate-2 years)	Medium term (3-5 years)	Long term (5+ years)
EBTKE, MASKEEI, and APKENINDO to jointly design and deliver training programmes that cover all aspects of the EE project development chain [Action by: EBTKE, MASKEEI, and APKENINDO] Curate training programmes for financiers and investors [Action by: EBTKE, OJK, IIF] Promulgate Ministerial Regulations on ESCOs that include voluntary ESCO registration schemes [Action by: EBTKE, ESDM]	Evaluate the effectiveness of capacity-building programmes, with a focus on capacity retention within institutions [Action by: EBTKE, Development Partners]	N/A

Short term:

ID – CB – ST.1: EBTKE, MASKEEI, and APKENINDO to jointly design and deliver training programmes that cover all aspects of the EE project development chain [Action by: EBTKE, MASKEEI, and APKENINDO]

[72] This is because equity investments incur higher risks and, therefore, require higher rates of return. Debt finance from banks is generally cheaper than equity investments.

As the energy-efficiency (EE) market expands, ESCOs must scale accordingly. To address the current gap in technical capacity amongst ESCOs and technology suppliers in Indonesia, comprehensive training programmes could be developed and delivered by a consortium including EBTKE, MASKEEI, and APKENINDO. These programmes should begin with foundational modules covering the technical skills required to conduct Level 1 and Level 2 energy audits, before progressing to the delivery of investment-grade energy audits that meet financing standards.

Subsequent modules should focus on financial modelling tailored to EE projects, enabling participants to evaluate project viability and expected returns. Training should also address the structuring of financial mechanisms that support ESCO operations, such as performance-based contracting and third-party financing. A final critical component should be the measurement and verification (M&V) of EE projects, ensuring that energy savings are accurately monitored and reported.

This targeted training approach will build the technical and financial capability required to accelerate EE project deployment and enhance the credibility and effectiveness of ESCOs in the market.

Proposed modules for ESCO capacity building

- Foundational technical modules
    - Introduction to EE principles and project life cycle
    - Conducting Level 1 energy audits: Walk-through assessments and basic data analysis
    - Conducting Level 2 energy audits: Detailed energy use analysis and preliminary savings estimate
- Advanced audit and assessment
    - Delivering investment-grade energy audits: Data collection, analysis, and reporting to meet financing standards
    - Identifying and quantifying EE opportunities with high confidence levels
- Financial modelling and project viability
    - Financial modelling for EE projects: Cash flow analysis, payback period, internal rate of return, and net present value calculations
    - Risk assessment and sensitivity analysis for EE investments
- Structuring financial mechanisms
    - Designing performance-based contracts for ESCOs
    - Exploring third-party financing options and public-private partnership models
    - Navigating regulatory and institutional frameworks for EE financing
- Measurement and verification (M&V)

- Introduction to M&V protocols (e.g., IPMVP)
- Setting baselines and tracking energy savings
- Reporting and documentation for stakeholders and financiers

ID – CB – ST.2: Curate training programmes for financiers and investors [Action by: EBTKE, OJK, IIF]

To improve the flow of financing into EE projects, there is a need to curate tailored training programmes specifically designed for financiers and investors. These programmes should be role-specific to ensure relevance and practical application across different functions within financial institutions.

For loan officers, the training should focus on equipping them with the technical and financial knowledge needed to accurately appraise EE loan applications. This includes understanding EE technologies, project structures, and how to assess savings potential and associated risks.

For relationship managers, equipping them with the knowledge and benefits of EE would help them to identify EE opportunities in client interactions and effectively communicate the value of EE to commercial and industrial clients.

Additionally, equity investors should be included in the training programmes to help them better understand how to appraise investment risks and returns associated with EE projects and ESCOs. This includes due diligence processes, business model evaluation, and portfolio integration strategies. By building capacity across these key financial roles, the programmes will help unlock more capital for EE projects and strengthen the overall ecosystem for sustainable energy investment.

To strengthen institutional capacity for financing EE projects, financial product design teams should undergo comprehensive training to assess financial risks associated with EE initiatives and ESCOs, which are often overstated. This knowledge will inform the development of tailored financial instruments, such as guarantees for performance-based contracting models utilised by ESCOs.

Ideally, such training would support the creation of dedicated units within financial institutions that specialise in EE projects, thereby complementing and expanding the capabilities of existing sustainable finance teams. By moving beyond individual capacity building to foster long-term institutional expertise, financial institutions will be better equipped to support EE investments. This ultimately contributes to national emission reduction targets over the long term.

ID – CB – ST.3: Promulgate Ministerial Regulation on ESCOs, which includes voluntary ESCO registration schemes [Action by: EBTKE, ESDM]

A draft of the Ministerial Regulation on ESCOs, which includes provisions for voluntary registration, has been completed and is currently pending promulgation. This regulation serves as a critical milestone toward the formal recognition of ESCOs, enhancing their credibility amongst financiers, and building owners. The regulation should be promulgated and implemented promptly to unlock the full potential of the ESCO market and foster investor confidence.

Medium term:

ID – CB – MT.1: Evaluate the effectiveness of capacity building programmes, with a focus on capacity retention within institutions [Action by: EBTKE, Development Partners]

Once foundational training programmes have been delivered, it becomes essential to ensure the capacity to support EE and ESCO projects is not only developed, but also retained within key industry stakeholders. Amongst these, financial institutions play a particularly critical role. Strengthening their internal capacity to assess EE projects can significantly enhance confidence in EE financing and unlock broader market potential. In this regard, expanding targeted outreach to banks may be a strategic step forward. Targeted actions to increase the internal capacity of financial institutions to assess EE projects and ultimately increase confidence in EE financing more broadly include:

- **Develop standardised toolkits for assessing EE projects in Indonesia:** Further EE sector support could focus on developing a standardised and easily accessible set of guidance on EE project evaluations, targeted at financial institutions in Indonesia. Standardisation could address key barriers in a nascent EE market, including perceived performance risks and high transaction costs.

  Initiatives such as the Investor Confidence Project[73] and EE Financial Institutions Group (EEFIG) Underwriting Toolkit[74] provide useful frameworks for reducing due diligence costs, increasing certainty of projected energy savings, and speeding up the underwriting process of financial institutions. For Indonesia, there could be an opportunity to bring together the EE industry and financiers to co-develop a similar initiative.

  In the long term, using standard documentation and processes can also enable aggregation of projects across regions and programmes. Further analysis of the needs of financial institutions in Indonesia could help to identify how standardised toolkits could be applied across the project life cycle. For example, it could reveal whether the most immediate needs arise during the origination of EE projects, during value and risk appraisals, or M&V mechanisms.

- **Targeted training programmes:** In parallel with developing accessible standardised toolkits, direct and sustained capacity building to financial institutions can improve banks' understanding of the levers of EE, how ESCOs can provide confidence in energy savings, the potential cashflow and risk management in financing EE projects, and ensure that EE project evaluation guidance is well integrated into wider processes. Such training can also emphasise that investments in EE can generate attractive returns with measurable risks.

[73] The Investor Confidence Project is a global initiative that provides a framework for developing EE projects, to increase investors' confidence in the financial and environmental performance of these projects and therefore make them more attractive to invest in. More information on the initiative is available here.

[74] The EEFIG Underwriting Toolkit is a tool for FIs to conduct value and risk appraisals for EE financing. More information available here.

Build dedicated technical knowledge by establishing an EE financing unit: Currently, each relationship manager must independently determine how to gain confidence in EE projects on a case-by-case basis. This perceived additional risk may reduce their willingness to lend. Establishing dedicated EE financing units—or programmes specifically focused on EE financing—would be a useful first step in developing financial products that integrate EE considerations.Such a unit can serve as a focal point within the bank for building a standardised internal knowledge base, including methodologies for calculating energy savings, assessing the quality of technical evaluations, prioritising industrial sectors and client engagement, and establishing or updating technology and sector benchmarks. With a dedicated team equipped with technical expertise, banks can more consistently balance risk management and build confidence in EE investments over time.

Theme 4: Raise awareness of EE across the economy

Short term (Immediate-2 years)	Medium term (3-5 years)	Long term (5+ years)
Conduct targeted outreach to commercial and industrial sectors [Action by: APKENINDO] Donor programmes should be designed with a longer-term tangible exit strategy beyond raising awareness [Action by: EBTKE, APKENINDO, Development Partners]	Showcase success stories to build trust [Action by: APKENINDO]	Foster long-term partnerships with large energy users [Action by: EBTKE, APKENINDO]

Short term:

ID – RA – ST.1: Conduct targeted outreach to commercial and industrial sectors [Action by: APKENINDO]

Stakeholders should initiate focused outreach campaigns targeting commercial buildings, manufacturing facilities, and industrial parks to accelerate ESCO market adoption. This can be done through sector-specific workshops, webinars, and direct engagement with facility managers and sustainability officers. Government agencies and industry associations can collaborate to develop tailored materials that highlight the benefits of ESCO models, including cost savings, operational efficiency, and environmental impact. Outreach should also include energy audits and pilot projects to demonstrate feasibility.

Mapping high-energy-use clusters and leveraging existing business networks will help identify priority targets and maximise impact.

ID – RA – ST.2: Donor programmes should be designed with a longer-term tangible exit strategy beyond raising awareness [Action by: EBTKE, APKENINDO, Development Partners]

Many donor programmes in Indonesia currently focus on energy efficiency (EE), often by providing energy audits in industrial and commercial buildings. These audits are typically delivered by certified energy auditors and aim to demonstrate energy-saving opportunities (ESOs) to site owners. While valuable, such interventions tend to deliver benefits only at the individual-site level. Donor programmes should therefore expand beyond standalone audit activities and move towards models that enable longer-term and scalable impact.

One such opportunity is to support the implementation of EE projects through ESCOs. Programmes of this nature would focus on the full end-to-end development of EE projects, including conducting energy audits to identify ESOs, supporting business-model development, arranging financing, and overseeing installation and commissioning—all delivered by an ESCO.

Given the challenges currently facing ESCOs, it is critical that donor initiatives provide a platform for them to build practical experience and credibility. Such programmes can help ESCOs establish a portfolio of implemented EE projects, strengthening their balance sheets and improving their creditworthiness over time. As ESCOs gain experience, they will be better positioned to implement and finance EE projects independently.

Medium term:

ID – RA – MT.1: Showcase ROI and success stories to build trust [Action by: APKENINDO]

Trust remains a significant barrier in the ESCO market, particularly amongst first-time clients. To address this, stakeholders should proactively document and publicise successful ESCO projects, highlighting return on investment, payback periods, and operational improvements. Case studies should be sector-specific and include before-and-after data, testimonials, and third-party verification. These examples can be disseminated through digital platforms, industry publications, and public events.

ESCOs should also seek partnerships with trusted institutions—such as chambers of commerce or trade associations—to co-host forums and strengthen credibility. A centralised repository of success stories would provide a valuable reference point for prospective clients.

Long term:

ID – RA – LT.1: Foster long-term partnerships with large energy users [Action by: EBTKE, APKENINDO]

Establishing strategic, long-term partnerships with large energy consumers, such as hotels, hospitals, and manufacturing plants, can anchor the ESCO market and drive sustained demand. These partnerships should be built on performance-based contracts that align incentives and ensure accountability. ESCOs can offer multi-year service agreements that include ongoing monitoring, maintenance, and upgrades. Governments can support this by offering tax incentives or recognition schemes for companies that commit to long-term EE goals. Joint innovation initiatives, such as co-developing new technologies or pilot projects, can further deepen collaboration and create shared value.

Theme 5: Advance market infrastructure and standards

Short term (Immediate-2 years)	Medium term (3-5 years)	Long term (5+ years)
Initiate development of standardised contracts and M&V processes [Action by: EBTKE] Promote use of EMS, IoT, and digital tools for M&V [Action by: EBTKE, APKENINDO]	Strengthen the ESCO Association [Action by: EBTKE, APKENINDO, Development Partners] Support tech startups in EE [Action by: EBTKE]	Contribute to creating regional (ASEAN) frameworks [Action by: EBTKE, Green Building Council Indonesia] Integrate AI and advanced analytics into ESCO offerings [Action by: ESCOs, EE technology providers]

Short term:

ID – MIS – ST.1: Initiate development of standardised contracts and M&V processes [Action by: EBTKE]

EBTKE should prioritise the development of standardised contracts and M&V protocols to reduce transaction costs and build confidence in ESCO engagements. This can be led by government agencies in collaboration with legal experts, ESCOs, and industry associations. Templates should cover key elements, such as performance guarantees, payment terms, dispute resolution, and risk-sharing mechanisms. For M&V, adopting internationally-recognised frameworks like the International Performance Measurement and Verification Protocol (IPMVP) can ensure consistency and credibility. Pilot testing these templates with early adopters will help refine them before broader rollout.

ID – MIS – ST.2: Promote use of EMS, IoT, and digital tools for M&V [Action by: EBTKE, APKENINDO]

Digital technologies can significantly enhance the accuracy and transparency of energy saving verification. Stakeholders should promote the adoption of Building Energy Management Systems (EMS), Internet of Things (IoT) sensors, and cloud-based platforms for real-time monitoring. This can be achieved through subsidies, technical training, and demonstration projects. ESCOs should be encouraged to integrate these tools into their service offerings, while clients should be educated on the benefits of data-driven decision-making. Partnerships with tech providers can help tailor solutions to local needs and ensure interoperability across systems.

Medium term:

ID – MIS – MT.1: Strengthen the ESCO Association [Action by: EBTKE, APKENINDO, Development Partners]

A strong industry association is vital for representing ESCO interests, setting standards, and facilitating market development. Efforts should be made to expand membership, improve governance, and enhance the association's capacity to provide services such as training, certification, and advocacy.

The association can also serve as a central hub for knowledge sharing, policy dialogue, and dispute resolution. Government support in the form of funding, recognition, and inclusion in policymaking processes will further empower the association to drive sector growth.

ID – MIS – MT.2: Support tech startups in EE [Action by: EBTKE, APKENINDO]

Tech startups are key drivers of innovation in EE, offering new tools, platforms, and business models. Governments and investors should create targeted support mechanisms such as incubators, grants, and access to testbeds. Public-private partnerships can help startups pilot their solutions in real-world settings, while regulatory sandboxes can allow experimentation with new approaches.

Linking startups with ESCOs and large energy users will accelerate commercialisation and integration into mainstream energy services.

Long term:

ID – MIS – LT.1: Contribute to creating regional (ASEAN) frameworks [Action by: [Action by: EBTKE, Green Building Council Indonesia]

National stakeholders should actively participate in developing regional ESCO frameworks under ASEAN platforms to harmonise standards and unlock cross-border opportunities. This includes aligning M&V protocols, contract standards, and accreditation systems. Regional collaboration can also facilitate knowledge exchange, joint ventures, and pooled financing mechanisms. Governments should designate focal points to engage in ASEAN energy working groups and advocate for the inclusion of ESCOs in regional EE strategies.

ID – MIS – LT.2: Integrate AI and advanced analytics into ESCO offerings **[Action by: ESCOs, EE technology providers]**

As the ESCO market matures, integrating artificial intelligence (AI) and advanced analytics will be essential for optimising energy performance and delivering predictive insights. ESCOs should invest in data science capabilities and partner with AI firms to develop customised solutions. These technologies can enable automated fault detection, dynamic energy modelling, and personalised efficiency recommendations. Governments can support this transition by funding R&D, facilitating data access, and ensuring ethical use of AI in energy services.

Chapter 8
Conclusion

8. Conclusion

Indonesia stands at a pivotal moment in its energy transition, where policy reform, market readiness, and innovative financing can unlock energy efficiency (EE) in buildings. To identify the actions and reforms required, this study assesses regulatory needs, market conditions, and readiness for on-bill financing (OBF) as a mechanism to accelerate EE uptake.

Indonesia has established important foundations through mandatory energy audits under PP 33/2023 and national green-building performance standards. However, the country still lacks a dedicated ESCO policy framework. A new Ministerial Regulation on ESCOs is reportedly under development and could formalise roles and implementation pathways. Incentives remain limited: although a GCF-backed credit guarantee managed by KDB exists, it has not yet benefited ESCOs due to credit-worthiness constraints and market immaturity. The revocation of earlier ESCO-specific regulation in 2018 underscores the need for a coherent and enabling policy environment.

The ESCO market remains nascent, with limited project deployment and modest contributions to TFEC-reduction targets. Despite high electricity consumption in the building sector (approximately 85,000 GWh annually), current ESCO activity represents less than 0.5% of potential savings, indicating substantial untapped opportunity. Stakeholder feedback highlights regulatory gaps, inconsistent enforcement, and financing barriers that dampen demand and weaken ESCO credit profiles. Nevertheless, a draft ESCO regulation and emerging risk-sharing instruments show potential to support market scaling, particularly in existing commercial and residential buildings.

OBF directly addresses the principal barrier to EE adoption—high upfront cost—by integrating repayment into utility bills. Indonesia's vertically integrated electricity system and national decarbonisation ambitions create favourable conditions for piloting OBF at scale. Success will depend on a credible ESCO ecosystem, standardised measurement and verification (M&V), and alignment amongst utilities, regulators, financiers, and consumers. While policy and technical structures will take time to develop, sustained and proactive communication of OBF's benefits across building segments is critical. If effectively deployed, OBF can serve as a catalytic and inclusive financing lever across ASEAN.

Scaling EE will require coordinated action across three pillars: policy, market, and finance. Government ministries must translate regulations into enforceable frameworks with clear incentives and compliance mechanisms. ESCOs, financiers, and technology providers should co-design practical solutions, adopt common toolkits, and monitor delivery outcomes. Transparent milestones, performance indicators, and alignment to a shared EE "north star" will support disciplined execution.

When policy ambition is matched by market capability and accessible financing, Indonesia can lead the region's low-carbon buildings transition. A combination of a formalised ESCO framework, enforceable regulations, targeted incentives, and a scalable OBF pilot pathway can convert intent into measurable TFEC reductions—establishing a replicable model for ASEAN.

9. Appendix 1

Market sizing data and estimates

Data sources for estimating Indonesia's market size, the following data sources were used:

Table 15. Tabulation of data sources for estimating Indonesia's market size

No	Data points	Source
1	Total final energy consumption (TFEC) of the commercial and residential building sectors from 2020 to 2050, Business as usual scenario Total final energy consumption of the commercial and residential building sectors from 2020 to 2050, ASEAN targets scenario Average energy use index (EUI) in kWh/m^2/year for the different types of commercial and public buildings	Data provided by the ASEAN Centre for Energy
2	Number of public buildings (P1, P2, and S3) Average floor area of each type of public building *Energy savings potential from air-conditioning, lighting, ventilation, air pump, and hot water systems* *Energy savings potential in public holdings (P1, P2, and S3)*	*Kajian Model Bisnis Efisiensi Energi di Sarana dan Prasarana Pemerintah and Pemerintah Daerah, IREEM*
3	Average building floor area	Energy efficiency of buildings, Presentation by Andriah Feby Misna
4	Efficiency indicators for residential refrigerators, room air conditioners, and lighting	Regional Savings Assessment Association of Southeast Asian Nations, United for Efficiency
5	*Stock of residential refrigerators in Indonesia*	Indonesia Refrigerator Market Study and Policy Analysis, CLASP
6	*Stock of residential air conditioners in Indonesia*	Indonesia's National Cooling Action Plan 2024
7	*Stock of residential lighting in Indonesia*	Indonesia Lighting Market Study and Policy Analysis, CLASP

Note: Data points in italics were not directly applied in the model, but informed the viability of the model outputs.

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