Investment Framework for Indonesia's Energy Efficiency Landscape

D2. Final Report

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D2. FINAL REPORT

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Executive Summary

Background

Indonesia's Enhanced Nationally Determined Contribution (NDC) includes a target of reducing greenhouse gas (GHG) emissions by 31.89% independently and 43.2% with international support by 2030. The energy sector is a major contributor to GHG emissions in Indonesia. Energy efficiency and energy management are key measures to reduce emissions from this sector.

The government of Indonesia has introduced Government Regulation Number 33 of 2023 (Peraturan Pemerintah Nomor 33 Tahun 2023) on Energy Conservation, detailing the stages of energy management, encompassing energy supply, production, utilization, and resource conservation. Indonesia's medium-term goal is to meet the enhanced NDC target of reducing CO_2 emissions by 358 $MtCO_2$ from the energy sector by 2030. The energy efficiency target is expected to contribute to 132.25 million tons of CO_2 equivalent.

Current data reveals a reduction of 91.5 million tons of CO_2e in greenhouse gas emissions from the Energy sector. The application of energy efficiency measures has contributed to a reduction of 20.54 million tons of CO_2e. These achievements are supported by the implementation of Minimum Energy Performance Standards (MEPS) or known as Standar Kinerja Energi Minimum (SKEM) in Indonesian for following appliances: air conditioner, LED lighting, refrigerators, fans, and rice cooker.

Despite the significant progress of the energy efficiency measures, it is crucial to acknowledge that these initiatives encounter various challenges. Financial assistance and investments are primarily required to:

- **Reduce Resistance**: Lower upfront costs through financing schemes.
- **Increase Availability**: Address market barriers to energy-efficient products and installers.
- **Increase Equity Returns**: With low electricity prices and high fossil fuel use, Indonesia's energy efficiency investment prospects provide good emissions reduction opportunities but they have low financial viability due to insignificant returns.
- **Boost Adoption**: Create retrofitting guidelines for energy-efficient appliances.

However, Indonesia's landscape for investing in energy efficiency presents a multitude of advantages:

- **Market Potential:** Household appliances market in Indonesia is booming (projected to reach US$17.68 billion by 2023) with an anticipated annual growth rate of 5.74%.
- **Enhanced Brand Perception:** Energy-efficient appliances align with global sustainability trends, boosting brand image**.**
- **Government Support:** Indonesian government actively supports energy-saving initiatives and awareness. Through various new laws and policies.

This report serves as an initial study that focuses on a limited selection of government-supported energy efficiency (EE) technologies and solutions. It analyses potential CO2 reduction based on existing policies and regulations. Given the short duration of the study (3 months), we make use of this study to:

- Project the investment needs in energy efficiency and energy management activities,
- Identify data gaps, and
- Recommend future activities to accelerate energy efficiency and energy management investment in Indonesia.

Energy Efficiency Financing and Investment Framework in Indonesia

The Indonesian government has implemented several policies to promote EE, including the following upcoming policies:

- General Plan of National Energy (RUEN), and
- Minimum Energy Performance Standards (MEPS) or known as Standar Kinerja Energi Minimum (SKEM) in Indonesian.

To support these policies, Indonesia has both international and domestic climate finance funding sources. Indonesia is a recipient of this international aid for climate action, which is delivered through different mechanisms, including bilateral and multilateral climate funds. This funding has been primarily allocated towards capacity building and the development of policies and energy audit projects in energy efficiency and energy management. Domestically, Indonesia manages energy conservation through a multi-level system involving national and regional budgets. Incentive and disincentive schemes further drive energy conservation development.

However, due to various challenges that persist, energy efficiency projects remain unattractive both from the investors and lenders point of view as well as the facility owners and electricity consumers. Some of the factors that significantly hinder the progress of financing energy efficiency and energy management initiatives:

- **Ineffective ESCO companies**: lack of knowledge and skills in developing baseline energy use model as the fundamental for the energy savings resulting in underperforming ESCO projects.
- **Scattered Data Management**: Data is spread across various sources, hindering progress evaluation and NDC target achievement.
- **Low Cost of Fossil Fuel Electricity**: Cheap electricity (US$0.07/kWh) makes energy efficiency projects financially unattractive.
- **Unappealing Energy Efficiency Projects**: Knowledge gaps and perceived financial risks discourage investment.
- **Ineffective ESCO Business Models**: Traditional models fail to address unique business challenges and fails to be implemented in accordance to bankability requirements and international best practices for ESCO business models (such as developing an energy model as a benchmark and baseline of the facility)
- **Inadequate Contractual Agreements**: Lack of clear timelines and project procurement procedures erode clients and investors trust.

Globally, there are some best practices that can be adopted by Indonesia to develop solutions to the challenges that are currently present against energy efficiency investments. In other countries where energy efficiency projects are more successful and abundant than Indonesia, some of the available financing schemes and incentives include:

- **On-bill financing**: This mechanism is also known as Energy Performance Contract (EPC). It eliminates upfront costs and avoids budget impact. However, this model requires ESCO companies to be highly skilled and knowledgeable at developing energy baseline calculations that accurately predict energy usage before and after the energy efficiency project has been implemented.
- **PACE Financing**: This approach allows property owners to fund energy efficiency upgrades through a special assessment added to their property tax.
- **Government Incentives**: Fiscal or financial incentives are considerably more attractive than non-fiscal incentives to encourage clients to invest in energy efficient appliances.

NDC Implementation Plan Analysis

Indonesia is vigorously pursuing its Nationally Determined Contribution (NDC) goals for carbon emission reduction in the energy sector with a clear vision and committed efforts. By 2030, the nation wants to

significantly reduce its carbon emissions by 358 $MtCO_2e$. Energy efficiency initiatives are essential to achieving this lofty goal. Energy management and improved efficiency in home appliances contributes in the following ways:

- **Energy Management:** Targeting a reduction of 36.14 MtCO2e, this program focuses on large energy consumers in industries and buildings, emphasizing efficient energy use practices.
- **Improved Efficiency of Home Appliances:** Implementing Minimum Energy Performance Standards (MEPS) for appliances like air conditioners, refrigerators, and fans has led to a substantial reduction of 83.84 MtCO2e.

Furthermore, Indonesia leverages innovative solutions to track and accelerate progress in energy efficiency opportunities. The first step and most crucial is having a monitoring platform managed by MEMR called POME (Energy Management Online Reporting). This online platform facilitates reporting of energy management activities across industries and buildings, providing valuable data for analysis and improvement. Additionally, an estimated US$19.805 billion is allocated for various initiatives, including energy audits, international studies, and sector-specific investments in industry and buildings.

Investment Schemes in Indonesia

This report offers an initial assessment, focusing specifically on a selection of technologies and solutions actively supported by the Indonesian government under the energy efficiency (EE) and Energy Management System (EnMS) activities. It is important to note that the scope of this report is limited to those active EE solutions that are currently addressed by existing policies and regulations.

This report analyses the investment needs and potential for achieving the Nationally Determined Contribution (NDC) targets in Indonesia's energy sector through two key sub-sectors: Energy Management and Improved Efficiency of Home Appliances.

- Energy Management:
  - Focus: Industries with annual energy consumption of 4000-6000 ToE.
  - Target: Reduce emissions by 36.14 MtCO2e.
  - Method: Analyse boiler efficiency for potential energy savings and calculate required investment.
  - Investment projection: IDR 2.234 trillion by 2030, with an annual requirement of IDR 186 billion to achieve 0,62 MToE CO_2 emission reduction
  - Key finding: To reduce 1 ton of CO2 emission, an investment of IDR 0.28 million is required.
- Improved Efficiency of Home Appliances:
  - Focus: Air conditioners (AC), the most energy-intensive appliance.
  - Target: Reduce emissions by 29.3 MtCO2e.
  - Assumptions:
    - National demand for installed AC is approximately 40 million units.
    - Gradual shift towards regulated AC with higher efficiency.
    - Price gap of IDR 939,000 between common and energy-saving AC models.
    - Discount factor of 12%, electricity bill rate of IDR 1,445 per kWh with 1% annual increase.
  - Investment projection:
    - IDR 35 trillion by 2030 to purchase regulated AC.
    - Potential energy savings of IDR 51 trillion, exceeding the investment.
    - Payback period of 4.18 years.
  - Initiatives needed:
    - Financing for new technology AC purchase.

        - Trade-in scheme for old AC models.
        - Tax benefits for manufacturers of energy-efficient AC.
        - Infrastructure for testing labs.
        - Capacity building for stakeholders in the AC value chain.
    - Additional notes:
        - AC contributes to 35% of the total energy savings from regulated appliances.
        - Total investment across all 11 regulated appliance categories is estimated at IDR 101 trillion to achieve the NDC target of 83.84 MtCO2e emission reduction.

Recommendations

This document outlines several key recommendations for accelerating Indonesia's progress towards its Nationally Determined Contribution (NDC) goals:

- Capacity Building:
    - Train ESCO companies to be able to conduct proper energy use surveys to develop an accurate and bankable energy baseline modelling for the facilities.
    - Raise awareness about the benefits of EE, including cost savings and environmental impact.
    - Increase awareness of the NDC program among private sector and domestic donors.
    - Engage with industry, banks, and financial institutions to promote NDC activities and secure private sector commitment.
- Policy Recommendations:
    - Regulators need to work with the parliament to approve regulations that allow PLN to structure consumer electricity tariffs that increases for consumers that use excessive amounts of energy. An increasing block tariff structure starting at subsidized lifeline tariff and ending at high energy use tariff that is a multiple of the non-subsidized base tariff allows minimal impact to the poor consumers while, charges normal tariffs to industries and businesses that use electricity at or below the benchmarks, and punishes those who use excessive electricity with higher tariffs.
    - Develop comprehensive policy frameworks encompassing tax reforms and market mechanisms.
    - Draw from international best practices to address identified barriers and select optimal policy options.
    - Formulate robust policies that attract investment in EE projects and enhance the overall investment environment.
- Insurance:
    - Develop and regulate Energy Saving Insurance to increase bank confidence in EE projects.
    - Guarantee energy saving performance in accordance with project design to mitigate financial risk.
    - Develop standard competencies and ESCO company certification for eligibility of Energy Saving Insurance
    - Develop standard guidelines and requirements for projects to be eligible for Energy Saving Insurance products.
- Enhanced Data Management:
    - Establish a centralized data repository to track progress across all sectors involved in energy efficiency (EE) projects.
    - Implement a standardized approach to data collection, analysis, and reporting for accurate evaluation of project impact.

    - Enhance transparency and accountability in reporting non-financial support, particularly training and technical assistance.
- Integrated and Cross-Sectoral Communication:
    - Develop a robust reporting mechanism for all forms of support, including both financial and non-financial.
    - Foster transparency and streamline reporting processes through an integrated communication system.
    - Strengthen accountability in the utilization of all forms of support.
- Regulatory Recommendations:
    - Simplify procedures for EE projects requiring government intervention.
    - Review public procurement practices to facilitate increased public spending on EE initiatives.
    - Conduct a comprehensive review of the PPP support framework to better accommodate EE projects.
    - Explore potential exceptions or conditions allowing multi-year contracts for local authorities and public entities.

These recommendations, if implemented effectively, have the potential to significantly accelerate Indonesia's progress towards achieving its NDC goals and creating a more sustainable energy future.

Next Steps

Further research and additional activities are required to guarantee that Indonesia's Energy Efficiency investments can quickly increase dramatically. According to the study's suggestions and findings, energy management conducted internally by facility managers and investments made by ESCO businesses through Energy Performance Contracts represent the primary areas with a high potential for energy efficiency investments. As a result, implementing a set of initiatives to encourage more ESCO businesses to create and finance EPC-based projects will greatly boost EE-based investments in Indonesia.

Activity 1 – Policy and Regulatory Technical Assistance:

Instead of using the Million Tonnes of Oil Equivalent (MTOE) limit that is now specified in the regulations, energy management for businesses and industries should be required based on the yearly revenues of the company. This can be validated through the tax submissions of each company, especially large domestic companies and multinational companies operating in Indonesia. It would be even better to collaborate with the Ministry of Finance and be able to provide tax incentives for companies who are investing in energy efficiency projects (whether internally or through ESCOs).

A strong and competent energy management program, which includes energy monitoring, enables every business to understand its energy costs and how they impact the company's bottom line. The new regulation should mandate the energy management, monitoring, and reporting for companies exceeding a certain annual revenue threshold. Additionally, the framework for the energy monitoring and the platform for reporting should be made available to the public.

Activity 2 – Capacity Development: Once the companies are aware of their own energy consumption, they will naturally be interested to have ESCO companies approach them with Energy Performance Contract proposals based on the Investment Grade Audits and the baseline modelling of the facility's energy consumption. If the electricity tariffs stay the same, the financial incentives to execute ESCO projects is still low. However, by being aware of the energy consumption, companies will be aware how their CO2 emissions and energy consumption compare to other companies in their sector. International companies have started to accelerate the speed by which the carbon emissions reporting throughout their value chain is becoming a requirement and many even require their value chain partners to significantly reduce their CO2 emissions beyond a certain threshold. Capacity development in this activity is not only to conduct

trainings, but also to ensure companies are monitoring their energy use and then reporting them to an MEMR platform that ideally will also publish benchmark average energy consumption for different industries and sectors. To enable scaling up of EE investments, additional investment grade audit trainings, energy consumption baseline modelling for buildings and industries trainings, and developing a business model and investment guideline for ESCO projects.

Activity 3 – Consumer Electricity Tariff Financial and Economic Modelling for PLN and Regulators: To further incentivize energy efficiency and reduction in energy consumption, a different consumer electricity tariff scheme is needed. Features of an increasing block tariff scheme:

- Allows lifeline tariff for the consumers that are eligible for subsidized tariffs.
- Allows a base unsubsidized tariff for the consumers that consume electricity within the normal energy use intensity of each consumer type.
- For the high energy use consumers, the tariffs will be charged at a premium multiple of the base unsubsidized tariff.

For most consumers who can keep their energy use within normal benchmark energy use intensity, there will be no penalty. This activity should include developing the benchmark of the energy use intensity for various industries and businesses. The scheme even allows for subsidized tariff to be applied to those who are eligible; with the new caveat that any energy use beyond the normal benchmark limits will be charged at subsidized rates.

This consumer tariff structure (including industrial and business tariffs) is still aligned by having affordable energy prices for Indonesia. The lifeline tariff is available for the residential consumers living below the poverty line. Normal tariffs are still available for the residential, industrial, and businesses who consume electricity at or below the applicable benchmark standards. The penalties are only applied to those consumers who unnecessarily consume electricity above the benchmark standards, and only to the electricity consumed above the benchmarked threshold. The consumers also have the option to execute energy efficient projects to reduce their energy consumption below the benchmark threshold.

The benefit of having a tariff scheme such as the increasing block tariff include:

- Little to no economic impact to normal energy users.
- Incentive for high energy consumption consumers to reduce their energy use because of the higher tariffs.
- Quicker payback period on energy efficiency investments to reduce high energy consumption industries and businesses.
- Additional revenue for PLN that can be used to support additional energy efficiency and renewable energy implementation toward supporting Indonesia's energy transition targets and meeting its NDC targets.

A techno-financial model should be developed and publicly available to predict the energy cost based on the new tariff scheme as well as predicting the investment performance (RoI, IRR, etc) of EE investments given the new tariff scheme. Additionally, an economic model should be developed to analyse the national impact of the new tariff scheme to various industries and businesses.

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List of Abbreviations

INSTITUTION

Abbreviation	*Definition*
UNOPS	United Nations Office for Project Services
TTA	Trama Tecnoambiental S.L.
EU	European Union
UNFCCC	United Nations Framework Convention on Climate Change
MEMR	Ministry of Energy and Mineral Resources
IEA	International Energy Agency
CLASP	Collaborative Labeling and Appliance Standards Program
IESR	Institute for Essential Services Reform
DGNREEC	Directorate General of New Renewable Energy and Energy Conservation
PLN	Perusahaan Listrik Negara
MenPANRB	Ministry of State Apparatus Utilization and Bureaucratic Reform
Mendagri	Ministry of Home Affairs
ADB	Asian Development Bank
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
USAID	United States Agency for International Development
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
METI	Ministry of Economy, Trade, and Industry (Japan)
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
CMMAI	Coordinating Ministry for Maritime Affairs and Investment
KfW	Kreditanstalt für Wiederaufbau
UNIDO	United Nations Industrial Development Organization

TECHNICAL TERMS

Abbreviation	*Definition*
NDC	Nationally Determined Contribution
EE	Energy Efficiency
GHG	Greenhouse Gas
BaU	Business-as-Usual
COP21	21st Conference of the Parties

MEPS	Minimum Energy Performance Standards
SKEM	Standar Kinerja Energi Minimum
RUEN	Rencana Umum Energi Nasional
DJEBTKE	Directorate General of New Renewable Energy and Energy Conservation
HVAC	Heating, Ventilation, and Air Conditioning
ESCO	Energy Service Company
CFPP	Coal-Fired Power Plant
MWh	Megawatt-hour
kWh	Kilowatt-hour
IGA	Investment Grade Audits
POME	Pelaporan Online Manajemen Energi
APBN	Anggaran Pendapatan dan Belanja Negara
APBD	Anggaran Pendapatan dan Belanja Daerah
GESI	Gender Equality and Social Inclusion
JCM	Joint Crediting Mechanism
AZEC	Asia Zero Emission Community
SOM	Senior Official's Meeting
CCS	Carbon Capture and Storage
JETP	Just Energy Transition Partnership
AJEEP	ASEAN-Japan Energy Efficiency Partnership
SHINE	Standards Harmonization Initiative for Energy Efficiency
SINAR	Sustainable and Innovative Natural Resource Management
INDODEPP	Indonesian Danish Development Program
UKPACT	United Kingdom Partnering for Accelerated Climate Transitions
MTRE3	Market Transformation for Renewable Energy and Energy Efficiency
ADLIGHT	Advancing High Efficient Lighting Market
ETP	Energy Transition Partnership
EMC	Energy Management Campaign
SEAD	Super-Efficient Equipment and Appliance Deployment
AEMAS	ASEAN Energy Management Scheme
PEEB	Programme for Energy Efficiency in Buildings
EBTKE	Directorate General of New Renewable Energy and Energy Conservation (Indonesia)
NPV	Net Present Value
IRR	Internal Rate of Return
CSPF	Cooling Seasonal Performance Factor

EER	Energy Efficiency Ratio
CFL	Compact Fluorescent Lamp
SINERGI	Sistem Informasi Konservasi Energi (Indonesian Greenhouse Gas Inventory System, Indonesia)
NZEB	Nearly Zero Energy Buildings
EnMS	Energy Management Systems
GWh	Gigawatt-hour
ToE	Tonnes of Oil Equivalent
ISO	International Organization for Standardization
PJU	Public Street Lighting (Indonesia)
KPBU	Kerjasama Pemerintah dan Badan Usaha (Public-Private Partnership, Indonesia)
CAGR	Consumer Annual Growth Rate
LTS-LCCR	Long-Term Strategy-Low Carbon and Climate Resilience

1. Background

In 2015, a significant milestone was reached in the global response to climate change. At the 21st Conference of the Parties (COP21), all 195 participating countries of the United Nations Framework Convention on Climate Change (UNFCCC), along with the European Union (EU), adopted the Paris Agreement. The Paris Agreement is a landmark accord that aims to intensify global efforts to combat climate change. Its primary goal is to limit the increase in global average temperature to well below 2°C above pre-industrial levels (1850-1900), and further, to strive to limit the temperature increase to 1.5°C above pre-industrial levels. However, the Paris Agreement goes beyond just temperature goals. The Paris Agreement aims to improve countries' resilience to the adverse impacts of climate change and encourages a shift towards low greenhouse gas (GHG) emission development pathways.

A central component of the Paris Agreement is the introduction of nationally determined contributions (NDCs). These are individual commitments made by each country, detailing their planned efforts to reduce national emissions and adapt to climate change. The NDCs are crucial for achieving the long-term goals of the Paris Agreement. Each Party is required to prepare, communicate, and maintain successive NDCs that it intends to achieve. They are also expected to pursue domestic mitigation and adaptation measures with the aim of achieving the objectives of their NDCs. Moreover, Parties are required to regularly provide information necessary to track progress made in implementing and achieving their NDCs. This ensures transparency and accountability in the global effort against climate change.

In response to the Paris Agreement, Indonesia ratified its **First Nationally Determined Contribution (NDC) in 2016**. In this commitment, Indonesia pledged to reduce greenhouse gas emissions by **29% independently** and up to **41% with international assistance by 2030**, compared to a Business-as-Usual (BaU) scenario. As an indicator of their commitment, Indonesia revised its initial NDC in 2021, lowering the BaU. Subsequently, in the Enhanced NDC submitted in 2022, Indonesia raised its greenhouse gas emissions reduction targets to **31.89% independently** and **43.2% with international support**, reflecting their dedication to addressing climate change.

1.1. Enhanced Energy Target

1.1.1. Energy Sector Target

To support sustainable national development, enhance energy resilience, and reduce greenhouse gas emissions, the Indonesian government enacted Law Number 30 of 2007 (Undang-Undang Nomor 30 Tahun 2007) on Energy. This law emphasizes energy conservation as a systematic and integrated approach to preserve domestic energy resources and improve their efficiency. The responsibility for implementing national energy conservation falls on the central government, local governments, businesses, and the public.

Further regulations, such as Government Regulation Number 33 of 2023 (Peraturan Pemerintah Nomor 33 Tahun 2023) on Energy Conservation, detail the stages of energy management, encompassing energy supply, production, utilization, and resource conservation. To facilitate energy conservation in line with these regulations, the Indonesian government established the Directorate of Energy Conservation under the Directorate General of New Renewable Energy, Energy Conservation, and Energy Conservation (DJEBTKE) within the Ministry of Energy and Mineral Resources (MEMR).

In alignment with national development goals, energy resilience, and emissions reduction, President Indonesia issued Presidential Regulation Number 22 of 2017 on the General Plan of National Energy (Rencana Umum Energi Nasional or RUEN). This plan outlines energy conservation measures across all energy user sectors, including:

1. the implementation of energy management,
2. fuel savings,
3. equipment efficiency, and
4. equipment replacement

Those measures are collectively referred to as energy efficiency measures. These measures target a 1% annual reduction in energy intensity and an energy elasticity of less than 1 by 2025, aiming for a 17% energy savings compared to Business as Usual (BaU) by 2025 and 39% by 2050.

1.1.2. Energy Efficiency Target and Current Progress

Indonesia's medium-term goal is to meet the enhanced NDC target of reducing CO2 emissions by 358 MtCO2 from the energy sector by 2030. The energy efficiency target is expected to contribute to 132.25 million tons of CO2 equivalent.

Current data reveals a reduction of 91.5 million tons of CO_2e in greenhouse gas emissions from the Energy sector. The application of energy efficiency measures has contributed to a reduction of 20.54 million tons of CO_2e[1]. These achievements are supported by the implementation of Minimum Energy Performance Standards (MEPS) or known as Standar Kinerja Energi Minimum (SKEM) in Indonesian. The energy labelling standards have been enacted for various appliances, including:

- air conditioners (MEMR Decree No. 103.K/EK.07/DJE/2021),
- refrigerators (MEMR Decree No. 113.K/EK.07/DJE/2021),
- fans (MEMR Decree No. 114.K/EK.07/DJE/2021),
- rice cookers (MEMR Decree No. 115.K/EK.07/DJE/2021),
- and LED lighting (MEMR Decree No. 135.K/EK.07/DJE/2022).

Notably, the Ministry of Energy and Mineral Resources of Indonesia has issued six draft decrees on MEPS for additional home appliances: blender, drinking water dispenser, electric stove, washing machine, smoothing iron, and television.

[1] Kementerian Energi dan Sumber Daya Mineral, Direktorat Jenderal Energi Baru, Terbarukan dan Konservasi Energi, & Direktorat Konservasi Energi. (2023). *Kerja Sama Konservasi Energi Dalam Mendukung Pelaksanaan PP 33/2023 Bidang Bangunan Gedung*. Internal Presentation. Bogor.

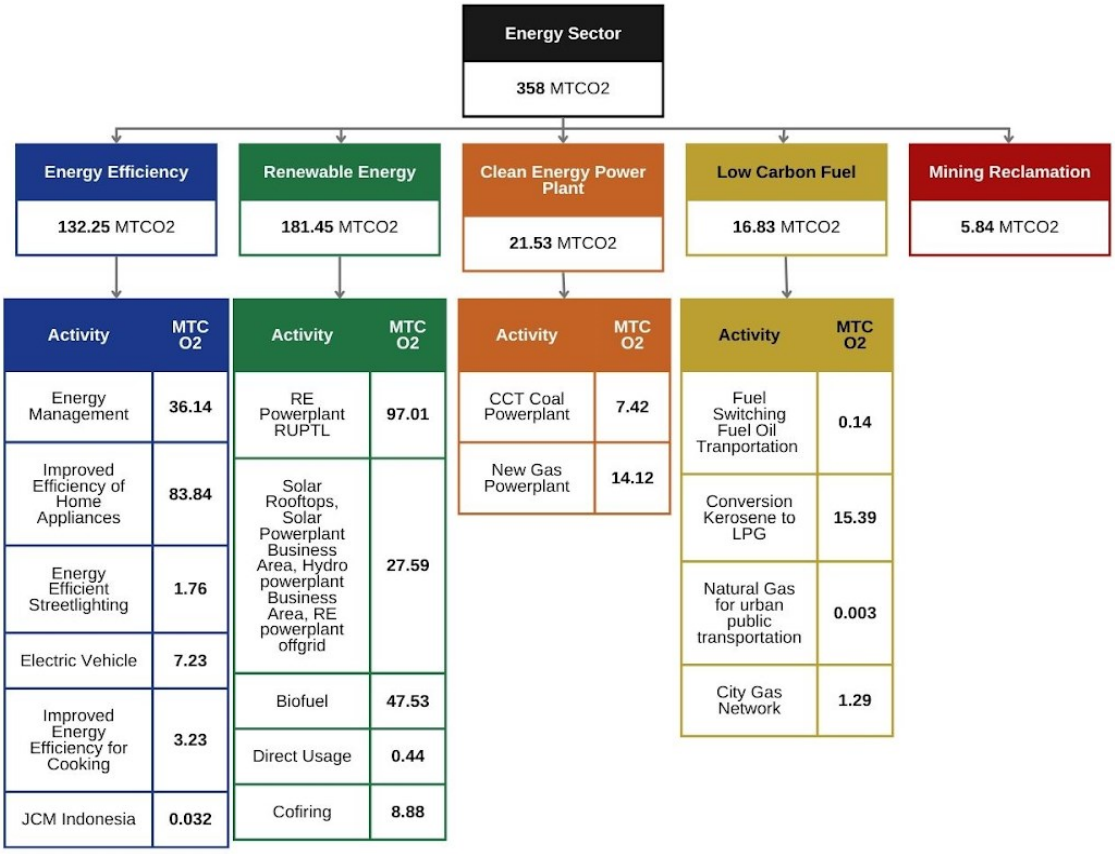

Figure 1-1. Target Emission Reduction on Energy Sector

Through the implementation of energy labelling, manufacturers are encouraged to enhance product quality, particularly in energy efficiency, contributing to national energy savings. From 2015-2020, the application of the Ministry of Energy and Mineral Resources' SKEM and Label policies for Air Conditioners (AC) and Swaballast Lights resulted in energy savings of 15,258 GWh, equivalent to IDR 22.4 trillion and a reduction in GHG emissions of 12,969 million tons of CO_2e[2]. Additionally, the potential energy savings from ten other appliances (Refrigerators, TVs, Fans, Washing Machines, Rice Cookers, Water Pumps, Blenders, Dispensers, Irons, and other equipment) are projected to reach 23.3 TWh from 2021 - 2025, equivalent to savings of IDR 34.2 trillion.

[2] Akselerasi Penghematan Energi Melalui Penerapan SKEM dan Label Hemat Energi," Sinergi - EBTKE, accessed 28 October 2023, [https://simebtke.esdm.go.id/sinergi/page/content/28/akselerasi-penghematan-energi-melalui-penerapan-skem-dan-label-hemat-energi

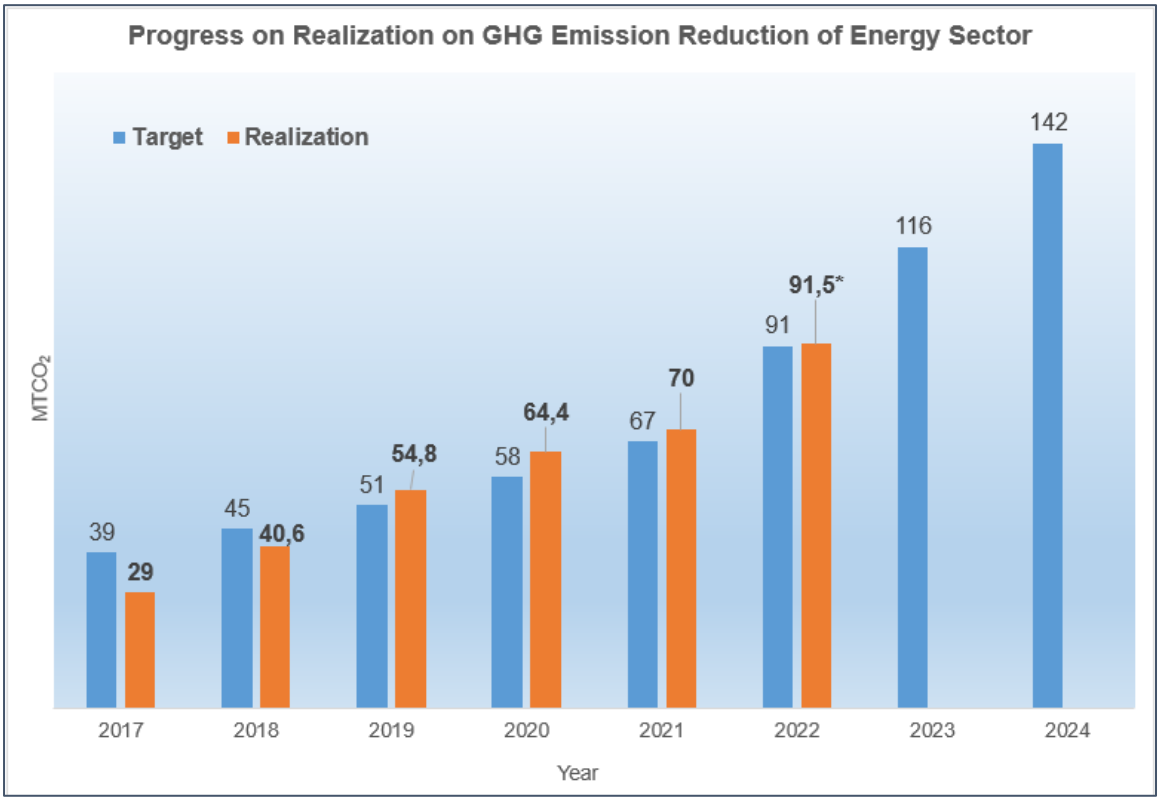

Figure 1-2. Target and Realization of GHG Emission in the Energy Sector

1.1.3. Challenges and Barriers in Implementing Energy Efficiency Measures

Despite the significant progress of the energy efficiency measures, it is crucial to acknowledge that these initiatives encounter various challenges. These obstacles can manifest in different ways and have the potential to affect the efficacy and scope of these programs. The subsequent points will provide a more detailed examination of these challenges:

a. Financial Challenges

- **Scattered Investment:** There is no focused and integrated effort to invest in energy efficiency projects. Most of the investments are made on a project-by-project basis rather than through a publicly available concerted effort.

- **High Upfront Costs:** Energy-efficient appliances and systems often come with higher upfront costs than less efficient alternatives, discouraging consumers, especially those with lower incomes, despite the long-term savings they offer.

- **Limited Financing Options:** Limited access to affordable financing options can be a significant barrier for individuals and businesses wanting to invest in energy-efficient technologies, making the upfront costs prohibitive.

b. Socio-economic Challenges

- **Informational Imbalance**: There is a lack of public information available about the personal and public impact of upgrading to more energy-efficient appliances and changing behaviors to be more energy-efficient in day-to-day activities.

- **Resistance to Change**: Changing established behaviors and habits can be challenging, particularly when it involves additional effort or cost. This can be a significant barrier to the adoption of energy-efficient practices.

- **Market Barriers**: The lack of availability of energy-efficient products, skilled installers, and service providers, as well as competition, can hinder the adoption of energy efficiency measures.

- **Lack of Awareness**: Many consumers and businesses are not fully aware of the benefits of energy efficiency, including potential cost savings and environmental impact. This lack of awareness can result in low adoption rates of energy-efficient technologies and practices.

c. Policy Challenges

- **Lack of a Supportive Regulatory Framework**: The absence of a supportive regulatory framework can hinder the implementation of energy efficiency measures, including a lack of enforcement of existing regulations and incentives for energy-efficient practices.

- **Lack of Policy and Its Enforcement**: There is no effective government policy to reward energy-efficient behavior and punish energy-wasting behavior.

- **Low Electricity Tariff**: Indonesia's electricity tariff for large businesses and industries, and residential consumers is US$ 0.07/kWh and US$ 0.09/kWh. The tariff is relatively similar with countries such as India (US$ 0.08/kWh), Vietnam (US$ 0.08/kWh), and Malaysia (US$ 0.1/kWh). However, these low tariffs do not encourage electricity users to seek energy-efficient appliances. Low tariffs also make additional investments in energy-efficient appliances not financially viable in many cases.

Addressing the challenges faced by energy efficiency programs is a complex task that requires significant efforts in resource mobilization. Resource mobilization plays a critical role in enabling countries to effectively implement and deliver climate change actions and programs. An accurate understanding of climate finance flows is crucial for Indonesia to make informed decisions regarding the planning, prioritization, and allocation of resources for energy efficiency measures. This information is vital for identifying sectors that require additional funding and can guide future investments.

Communicating this information to stakeholders, including investors and policymakers, is a key step in this process. By doing so, sectors that require additional funding can be identified and targeted for future investments. This approach ensures a strategic allocation of resources, enhancing the effectiveness of energy efficiency measures.

1.1.4. Investment in Energy Efficiency Measures

To realize the energy efficiency targets set in the General Plan of National Energy (RUEN), the Indonesian government seeks to encourage investment in energy efficiency, particularly from the private sector. Financial assistance and investments are primarily required to address the following challenges:

1. **Tackling high upfront costs to reduce resistance to change**. Financing schemes are necessary to facilitate the transition to energy-efficient practices.

2. **Overcoming market barriers** to increase the availability of energy-efficient products and skilled installers, and expanding financing options are critical for ensuring broader adoption of energy-efficient technologies.

3. **Increasing adoption by creating retrofitting guidelines** that would facilitate the effective adoption of energy-efficient electrical appliances. Such guidelines will boost adoption rates of such technologies and practices.

Investing in energy efficiency presents a multitude of advantages:

- **Market Potential**: The Household Appliances market in Indonesia is on an upward trajectory, projected to reach a value of US$17.68 billion by 2023[3]. With an anticipated annual growth rate of 5.74% (Compound Annual Growth Rate (CAGR) 2023-2028), the Major Appliances segment, expected to be worth US$11.93 billion in 2023, signifies a burgeoning market for energy-efficient appliances.

- **Enhanced Brand Perception**: Energy-efficient appliances are synonymous with reduced energy consumption, leading to lower greenhouse gas emissions and a diminished carbon footprint. Aligning with global sustainability trends, companies investing in this sector can bolster their brand image.

- **Government Support**: Indonesia has enacted energy-saving laws and institutions, and there is a high degree of awareness regarding energy-saving practices. This creates a supportive regulatory environment for investments in energy-efficient appliances.

1.2. Objectives of the Report

Considering the background and challenges associated with Indonesia's energy efficiency programs, this study **aims to equip stakeholders with a preliminary overview of the progress made, the necessary actions to be taken, and the pathways for resource allocation and investments in energy efficiency programs**.

The study acknowledges the significant role of international assistance and aspires to develop a preliminary strategy that can serve as a reference for decision-makers and investors (*see Section 2.2.1*). This document outlines prioritized initiatives and projects that necessitate collaboration among stakeholders.

To develop an effective energy efficiency investment strategy in Indonesia, the study emphasizes the importance of promoting programs within the Directorate General of New Renewable Energy and Energy Conservation (DGNREEC) at the Ministry of Energy and Mineral Resources (MEMR). By prioritizing and advancing these programs, strategic decision-making can be enhanced, and resources allocated more efficiently, significantly improving the impact of energy efficiency measures across Indonesia.

[3] Household Appliances - Indonesia," Statista, accessed 28 October 2023, https://www.statista.com/outlook/cmo/household-appliances/indonesia.

1.3. Limitations of the Report

This report offers an initial assessment, focusing specifically on a selection of technologies and solutions actively supported by the Indonesian government under the energy efficiency (EE) and Energy Management System (EnMS) activities. It is important to note that the scope of this report is limited to those active EE solutions that are currently addressed by existing policies and regulations.

Our analysis is primarily based on the research and findings of Indonesia's Directorate of Energy Conservation within the Ministry of Energy and Mineral Resources, which has evaluated the potential CO_2 reduction impact of these policies and regulations. However, it does not encompass a broader range of possible EE technologies or approaches that may be outside the current governmental focus or regulatory framework.

This report analyses a few sectors in energy efficiency that are ready for investment by the private sector. Some of the investment types include institutional financing of medium to large energy efficiency projects as well as individual customers purchasing energy efficient appliances.

Data and evidentiary information to be analysed were expected to come from the Ministry of Energy and Mineral Resources as well as private sector partners, development partners, and other stakeholders appointed by MEMR.

One of the data sources expected to be studied is the private sector companies' online reporting for energy management (Pelaporan Online Manajemen Energi – POME). Unfortunately, only selected aggregated data have been provided by MEMR to be studied. This created a large information gap for the consultants in providing data-driven and evidence-based analysis for the report.

Other expected information such as future pricing of energy efficient appliances and continued energy efficiency performance of various appliances were also unavailable. This report has had to rely on the results of the modelling performed by various stakeholders on behalf of MEMR. A preferred methodology would have been to perform our own modelling based on raw data. Lack of available data from the stakeholders have been the largest barrier in being able to provide a more in-depth analysis of Indonesia's energy efficiency investment landscape.

Finally, due to the short timeframe of the project, approximately 10 weeks, there was no time to research and obtain additional data and information required for an in-depth analysis. The short timeframe did not allow for delays in collecting the data from the stakeholders. Scheduling availability of the stakeholders and partners for interviews and data collection efforts within the short timeframe also created limitations in the type and depth of the analysis conducted in this report.

This study serves as an initial study to exercise our assumption on the investment strategy based on currently available data. We acknowledge that there is limited availability of data, which we try to address using assumptions built from previous studies. Given the short duration of the study (10 weeks), this study will address the following topics:

1. Project the investment needs in energy efficiency and energy management activities,
2. Identify the gaps in data, and
3. Recommend the next activities to further accelerate the investment in energy efficiency and energy management activities in Indonesia.

1.4. Methodology

In this report, energy efficiency investment is defined as the total investment required to gain the energy consumption reduction. This definition is what is commonly used by the industry, consumers, banks,

financial institutions, investors, and regulators. Only identifying the portion of the investments needed beyond the "business as usual" or only identifying the portion of the investments directly contributing to the energy savings/reduced consumption is only relevant for academic studies and institutional reports. In practice, holistic investment amounts to ensure that energy reduction activities are implemented is the most common way to define investments in energy efficiency projects.

The process is divided into three main stages: M1 (Preparation), M2 (Data Collection), and M3 (Final Report) (Figure 1-3).

M1 - Preparation: This initial stage involves conducting desk research to gather preliminary information and define the objectives of the research project. The desk research is supported by internal or publicly available reports from various sources, including the Ministry of Energy and Mineral Resources (MEMR), Indonesia LTS-LCCR 2050, Ministry of Finance, UNIDO, International Energy Agency (IEA), CLASP (Collaborative Labeling and Appliance Standards Program), and IESR (Institute for Essential Services Reform). Key areas that become the focus of our study, based on initial discussions with the main stakeholders from the Ministry of Energy and Mineral Resources, are as follows:

- **Activities**. This could include specific actions or initiatives undertaken in the areas of Heating, Ventilation, and Air Conditioning (HVAC) for commercial buildings, appliances, and industry.

- **Target NDC.** Data related to the Nationally Determined Contributions (NDCs) targeted by these activities would be needed. NDCs are the efforts by each country to reduce national emissions and adapt to the impacts of climate change.

- **Program Implementation.** Information about how these activities are being implemented would be necessary. This could include details about timelines, resources used, and entities involved. Some success stories of private sector initiatives will be taken as case studies.

- **Program Output.** Data on the results or outputs of these activities would be crucial. This could include metrics like energy saved, emissions reduced, or the number of appliances upgraded to more efficient models.

- **Available Data.** Finally, any existing data related to these activities should be collected. This could include previous studies, surveys, or reports that are available in the abovementioned resources.

This study is limited to the selected technologies and solutions actively pursued by the Indonesian government. Currently, the policies and regulations only address active EE solutions, and this report will focus on selected policies and regulations. Indonesia's Directorate of Energy Conservation within the Ministry of Energy and Mineral Resources has conducted its research and studies on the potential CO2 reduction of the current policies and regulations.

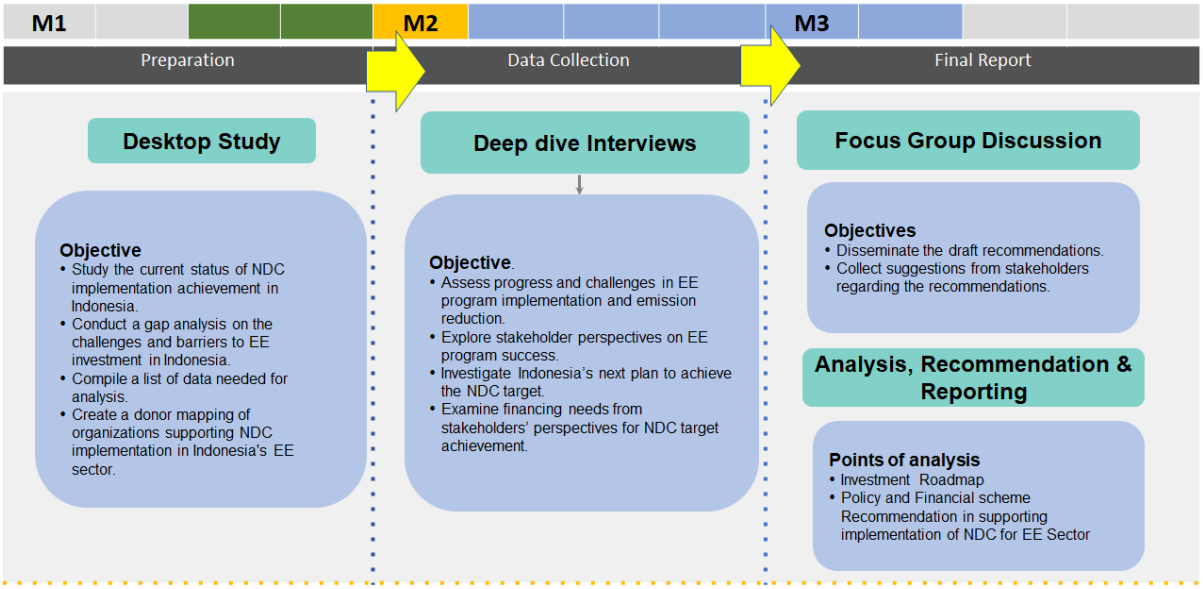

Figure 1-3. Methodology

This report will solely examine the EE solutions identified by the Indonesian government as priorities through the available data. Once this report, based on the priority policies and regulations, is published, it is recommended to conduct additional studies on other EE solutions that can further significantly improve Indonesia's carbon emissions using improved methodology and approach. The analysis primarily focuses on active energy efficiency strategies, which fall under the scope of the energy conservation program managed by the MEMR. The main tasks and functions of DGNREEC MEMR are concentrated on these active energy efficiency solutions, specifically Energy Management and Minimum Energy Performance Standards (MEPS). These solutions enable MEMR to monitor data and swiftly implement strategies for immediate energy savings. Currently, passive energy efficiency strategies are not measured as part of these solutions. However, they may be proposed for inclusion in future studies.

M2 - Data Collection: This stage involves several activities aimed at collecting detailed data and gaining insights from relevant stakeholders. The information gathered serves as the foundation for the analysis in the next stage. The sources of data will be gathered from several methods.

1. **Interviews with Directorate of Energy Conservation (DEC) MEMR and Relevant Stakeholders**: We will conduct interviews with the Directorate General of New Renewable Energy and Energy Conservation (DGNREEC) at the Ministry of Energy and Mineral Resources (MEMR), as well as other key stakeholders. These interviews will serve as a primary source of data, allowing us to collect information on the current milestones achieved in energy efficiency program investments.

2. **Previous Energy Modeling Results**: Assumptions for the project will be based on previous energy modeling results available at DGNREEC MEMR. This historical data can provide valuable insights into energy usage patterns and efficiency. The consultant will utilize the modelling to ensure alignment with DGNREEC MEMR plan.

3. **NDC Achievement Data**: The project will also use Nationally Determined Contributions (NDC) achievement data provided by DGNREEC and proxy. The potentially available data such as the report on NDC targets, status, and achievement, the strategic plan of DGNREEC MEMR to achieve the target, the previous and current investment on EE projects, POME, reports on EE projects by international

donors, and so forth. This data can help assess the progress made toward national energy efficiency goals.

4. **Reports and Academic Papers**: Our analysis will draw upon a variety of internal or publicly accessible reports from sources such as the Ministry of Energy and Mineral Resources (MEMR), Indonesia LTS-LCCR 2050, Ministry of Finance, UNIDO, International Energy Agency (IEA), CLASP, and IESR. To enrich our analysis, we will also incorporate insights from relevant academic papers.

Please note that the energy efficiency of the power sector will be treated separately from this study. The primary focus of this study will be on developing an Energy Efficiency (EE) investment roadmap for the demand side. This approach ensures that the study's findings are directly applicable to efforts aimed at improving energy efficiency in these key sectors.

- **Deep-dive Interviews:** We will conduct deep-dive interviews with representatives of the Ministry of Energy and Mineral Resources to understand current milestones in energy efficiency. These interviews also help us gather data about ongoing initiatives and projects reported to Pelaporan Online Manajemen Energi (POME), a platform that monitors and manages annual energy consumption and efficiency based on self-reported data.

  The interviews are conducted with relevant stakeholders from donors and the Ministry of Energy and Mineral Resources. These discussions allow us to examine current barriers and challenges in implementing energy efficiency initiatives in Indonesia. They also provide an opportunity to explore stakeholder perspectives on energy efficiency achievements and investigate Indonesia's plan to achieve its NDC target.

- **Desk Research:** We will examine the reports collected from the preliminary studies conducted in Stage M1. This data (such as approved NDC target by sector and achievement, POME, investment reports by private enterprises, previous EE project reports) offers insights into various crucial areas such as the activities carried out, targeted NDCs, details of program implementation, program outputs, and any pre-existing data related to these activities. We will utilise these reports to update the donor mapping and their corresponding outputs. This updated information will then be used to evaluate the progress of ongoing investments and identify any gaps in achieving the set targets.

M3 - Final Report: This is the concluding stage where we analyse the collected data. Based on this analysis, we formulate recommendations for the investment roadmap as well as policy and financial schemes.

This project started in September 2023 and is expected to be completed in November 2023. Due to this time limitation, the information, and data to be used in the Investment Roadmap for Energy Efficiency is limited to only those already available based on the priority policies and regulations from the Ministry of Energy and Mineral Resources' Directorate of Energy Conservation.

M4 - **Next Step**: As this study serves as an initial study to project investment strategies based on assumptions and limited availability of data, further studies are required to verify its findings. There are gaps that we found in our study that require further attention. The assumptions made here can serve as a foundation for informing stakeholders, such as governments, donors, and investors, about the necessary actions to improve energy efficiency and management in Indonesia. The outcomes of this study provide a basis for planning future steps and initiatives in these areas.

1.5. Project Risks and Mitigation

In the following section, we outline project risks and our corresponding mitigation strategies. This process involves identifying potential risks that could impact the project, assessing both their likelihood and potential impact, and then developing strategies to effectively manage and mitigate these risks. By proactively addressing these potential challenges, we ensure that our study can deliver its intended outcomes within the expected timelines. Table 1-1Table 1 presents the project risks mitigation plan.

Table 1-1. Risks and Mitigation Plan

No.	Risk Cause	Risk Effect	Likelihood	Consequences	Mitigation Strategies
1	Any necessary data for technical review is not available due to data sharing limitation	Comprehensive analysis cannot be conducted	Likely	Crucial	1. Identify other possible sources of documents. 2. Identify the availability of proxy data.
2	Information delay and perception delay during the coordination	Delayed project deliverables	Possible	Crucial	1. Continuous regular meetings to allow smooth communication and anticipate misunderstanding. 2. Close project supervision by team coordinator. 3. Regular team meetings, clear and open communication channels.
3	Scope creep	The project scope may expand beyond the original plan	High	Crucial	Clearly define project scope and manage change requests effectively.
4	Relevant stakeholders were not present during data collection or meeting due to conflicting schedules	Delay in data collection and lack of necessary data	Possible	Minor	Use a centralized work schedule integrated to online services (such as Google Calendar) to inform schedule availability. Remind stakeholders about meeting schedule or check availability of another date if rescheduling of appointment is required.
5	Miscommunication with stakeholders regarding project requirements and expectations	Failure in collecting required data	Possible	Crucial	1. Prepare field handbooks and examples of required data to avoid miscommunication. 2. Communicate regularly on designated communication platforms. 3. While the chain of command is hierarchical, a chain of communication uses an all-channel network
6	Data is available in different format or stored in outdated technologies	Data cannot be accessed	Unlikely	Minor	Communicate to stakeholders about file format for data submission
7	Data is corrupted during storage due to cyber attack or hardware stolen	Data is lost and cannot be accessed	Possible	Crucial	1. Regular cloud backup of data 2. Data storage redundancy

2. Energy Efficiency Financing and Investment Framework in Indonesia

2.1. Financing and Investment Circumstances

2.1.1. Investment in Energy Efficiency Projects Remain Unappealing

Energy efficiency projects often struggle to gain traction due to a widespread lack of understanding among financial institutions' loan officers and risk managers about the technologies and business models involved in energy efficiency. This limited knowledge is a significant barrier to attracting interest from owners and investors. Adding to this challenge is the general scarcity of information on the benefits of energy management. Owners and facility managers frequently find themselves without access to crucial data, such as energy consumption benchmarks and impact measurement metrics for energy efficiency projects[4].

Energy Service Companies (ESCOs) play a pivotal role in promoting energy efficiency business models. Yet, they face difficulties in gaining confidence from investors and clients in their energy-saving projects. This lack of confidence could be mitigated by focusing on three main areas: conducting thorough initial analyses and audits, enhancing communication around the energy-saving mechanisms and their performance, and ensuring the availability of financing options. However, the perceived financial risks by clients and investors stand as the most significant obstacle in the development of energy-efficient projects. These risks are primarily categorized as economic and financial, resource-based, and regulatory.

The business models of energy efficiency, particularly those offered by ESCOs in Indonesia, face their own set of challenges. The two traditional models—the shared savings model and the guaranteed savings model—have not been successful in overcoming these challenges. The shared savings model struggles due to the difficulties in securing finance from banks, while the guaranteed savings model places ESCO clients in a precarious position by making them assume the debt risk associated with bank loans. A solution to these issues could lie in updating standard contractual agreements to address these key concerns, thereby fostering a greater sense of trust between clients and financial institutions.

Other solutions involve developing on-bill financing schemes that have not been common in energy efficiency investment in Indonesia[5]. On-bill financing schemes can reduce the hurdles, such as upfront capital, so clients and investors would be more willing to invest in energy efficient technologies. Adjusted to Indonesian conditions, we need to identify risks and potential in loan repayment using on-bill financing schemes. Additionally, pricing and incentives need to be structured to allow on-bill financing, presumably designed as loan repayment, to be attractive to financial institutions.

2.1.2. Cost of Electricity Generation from Fossil Fuel Remains Low

Indonesia's energy sector is heavily influenced by its continued reliance on fossil fuel subsidies, particularly for electricity generation. This policy significantly favors the use of fossil fuels, making it

[4] Wijaya, M. E., & Siagian, A. P. (2023). Exploring Viable Energy Efficiency Business Models in Indonesia. Retrieved from https://www.climatepolicyinitiative.org/wp-content/uploads/2021/11/Exploring-viable-energy-efficiency-business-models-in-Indonesia.pdf.

[5] USAID. (n.d.). Developing Programs: Financing Barriers. Retrieved from https://2017-2020.usaid.gov/energy/efficiency/developing-programs/financing/barriers.

challenging for more sustainable energy sources to compete. According to a 2022 report by the International Institute for Sustainable Development[6], Indonesia's total fossil fuel subsidy expenditure reached IDR 206 trillion (approximately USD 14.3 billion) in 2020. This substantial amount includes subsidies for coal, electricity, and transport fuels, in addition to support provided to state-owned enterprises as part of the COVID-19 recovery package.

The cost dynamics of electricity generation in Indonesia further underscore the country's dependence on fossil fuels, particularly coal. Coal-fired power plants (CFPPs) remain the most cost-effective option for bulk electricity generation. The cost of electricity from CFPPs ranges from $66 to $95 per MWh, making them a more financially viable choice compared to alternative energy sources[7]. This economic preference for coal-fired power significantly impacts the country's energy landscape.

Additionally, the average cost of electricity in Indonesia is notably low, standing at around US$ 0.07 per kWh. While this may seem beneficial for consumers, it poses a substantial challenge for energy efficiency (EE) projects. The low cost of electricity prolongs the payback period and diminishes the financial returns of such projects. This economic factor, therefore, acts as a significant deterrent to the implementation and advancement of energy efficiency initiatives, as the financial incentives are considerably reduced.

2.2. Climate Finance Network in Indonesia

A favorable financial landscape is necessary for securing the necessary funding for implementing climate change mitigation and adaptation actions in Indonesia, particularly in the energy efficiency sector. The aim is to ensure that the necessary funds are identified, secured, mobilized, and monitored for successful climate action implementation and attainment of energy efficiency targets. This is particularly important as Indonesia's Enhanced NDC includes mitigation targets conditional to international assistance, making the effective flow of aid necessary.

One of the first steps for creating the necessary climate finance landscape is to develop an accurate estimate of the financial needs towards meeting the goals and targets in energy efficiency. This will help identify both funding availability and gaps to be closed. However, this task has proven challenging as Indonesia currently has no integrated platform that records the flow of climate change-related funds and projects. While online energy reporting is available, its source of funding is not identified, and its energy efficiency achievement is not verified.

Current projections show that Indonesia requires a significant amount of funding to achieve its NDC targets (Figure 2-1)[8]. As climate action is multidimensional in nature, the acquisition and deployment of the necessary means of implementation requires the mobilization of a multitude of stakeholders from diverse domestic, national, public, and private funding channels.

[6] International Institute for Sustainable Development. "Switching Fossil Fuel Subsidies in Indonesia to Support a Green Recovery." IISD, July 2021, https://www.iisd.org/system/files/2021-07/switching-fossil-fuel-subsidies-indonesia-green-recovery.pdf.

[7] IESR. (2023). Making energy transition succeed: A 2023's update on the levelized cost of electricity and levelized cost of storage in Indonesia. Institute for Essential Services Reform. https://iesr.or.id/wp-content/uploads/IESR-2023-LCOE-and-LCOS-Report.pdf

[8] Institute for Essential Services Reform (IESR). (2020). Climate Finance in Indonesia. Retrieved from https://iesr.or.id/wp-content/uploads/2020/11/IESR_PKPPIM.pdf.

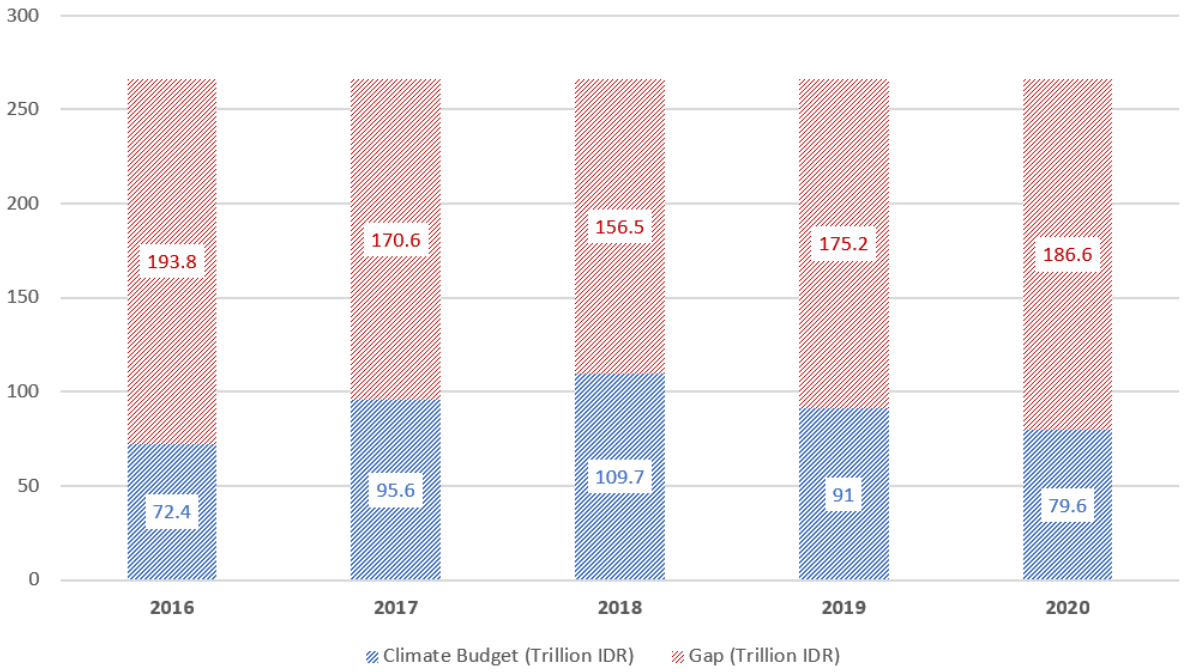

Figure 2-1. Current projection that shows the budget gap to achieve NDC targets.

While climate financing is required to achieve the NDC targets, climate finance should also aim to support investment climate, capacity building, and job creation, in line with the nation's inclusive green economic growth agenda in Indonesia. Finance for climate change-related projects in Indonesia is already available through private funding channels, domestic budgets, domestic funds, incentive mechanisms, and international bilateral and multilateral cooperation and investments dedicated to climate change efforts. National and provincial governments, along with international development financial institutions are currently the major financial source for climate action in Indonesia.

However, while financing for climate change-related projects in Indonesia is widely available, **it varies among sectors and there is no integrated platform to monitor the flow of aid**. It is difficult to measure how each sector achieves its targets and how much more fundings is required to close the gaps from each sector. Therefore, it is important to build robust data management for securing and mobilizing adequate channels to close the existing funding gaps under the energy sector.

2.2.1. International Climate Finance

International climate finance is integral to climate adaptation and mitigation. It encompasses various activities such as capacity building, improving energy efficiency, facilitating energy transitions, and aiding policy development. Indonesia is a recipient of this international aid for climate action, which is delivered through different mechanisms, including bilateral and multilateral climate funds. These funds enhance Indonesia's ability to address climate change in an effective and sustainable manner by providing the financial resources needed for the implementation of innovative solutions, the transition to more efficient energy systems, and the creation of comprehensive policies that align with global climate objectives.

Currently, there is no centralized platform that consolidates the data on international assistance for climate action projects in Indonesia. While existing websites offer some information about donor involvement in Indonesian climate action, they fall short of providing the necessary detail for comprehensive understanding. Ideally, a dedicated portal would function as a centralized dashboard,

presenting a breakdown of donor activities and expenditures by project or theme. Each project or activity could be easily tagged according to the relevant workstream within the Ministry of Energy and Mineral Resources (MEMR). Examples such as https://www.sipet.org/project_mapping_listing.aspx, the OECD database on the ODA: https://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/official-development-assistance.htm or GFANZ: https://www.gfanzero.com/ are available. However they are still inadequate to provide comprehensive data that can be used in Indonesia to coordinate and consolidate climate action projects in Indonesia.

The electronic Aid Information Management System (eAIMS) in Georgia (https://eaims.ge/) provides a strong example of such good practice. This online database allows both bilateral and multilateral donors to voluntarily report information on their projects, including project status, sector of activity, funding sources, amount of funding, and implementing agencies. This transparency facilitates tracking progress within the green climate finance context and provides valuable insights for the government, enabling them to monitor sector progress and identify gaps in climate action efforts.

Information about the donors, the funds they provide, and the projects they support is dispersed across various sources. This dispersion of data poses a significant challenge in collecting accurate information about the classification of projects related to climate change. The lack of a unified platform hinders the ability to track, analyze, and report on the impact and effectiveness of these international climate finance initiatives. Therefore, the development of such a platform could greatly enhance the transparency, accountability, and overall management of climate action projects in Indonesia. It could also provide valuable insights for policy-making and strategic planning in the country's climate change mitigation and adaptation efforts.

To address the issue, a systematic approach has been adopted. Data is collected through comprehensive desk research and interviews with key stakeholders from the Ministry of Energy and Mineral Resources. This strategy aids in understanding the flow of aid to Indonesia and offers a more transparent view of the current state of international financing mechanisms associated with climate change projects in the country.

In the following sections, we provide information about the bilateral and multilateral donors involved in energy efficiency and energy management programs. It's important to note that similar projects might be funded by different donors, leading to potential overlap. Unfortunately, detailed data explaining each project is not available; we only have access to the total budget allocated by each donor. As a result, there may be instances of overlap in the data. This limitation underscores the need for a more robust and centralized data management system to track and analyze climate finance in Indonesia.

a. Bilateral Donors

Indonesia has been a recipient of substantial funding through bilateral cooperation from various international agencies. This funding has been primarily allocated towards capacity building and the development of policies and financing mechanisms in energy efficiency and energy management. The financial support has enabled Indonesia to enhance its capabilities, formulate effective policies, and establish robust financing mechanisms, thereby promoting energy efficiency and effective energy management in the country. This contributes to Indonesia's broader objectives of sustainable development and climate change mitigation.

Table 2-1. Bilateral donors and their extending agencies

Country	Agency	Project Description/Activities
USA	USAID	The USAID's SINAR project (2021-2025) includes several activities: ● Technical assistance for energy transition ● Development of academic studies for energy regulations ● Implementation of energy audits ● Development of performance standards for equipment ● Implementation of green buildings ● Bureaucratic reform on energy conservation These initiatives aim to: 1. Enhance energy efficiency. 2. Contribute to Indonesia's net-zero emissions goal by 2060
Denmark	INDODEPP	**Capacity Building** Development of an Energy Management Network for Governmental Buildings [DKK] **Policy Development** Providing input to Nationally Determined Contributions (NDC) on Buildings and a National Definition of Nearly Zero Energy Buildings (NZEB) [DKK] **Academic Study** Creating a catalogue for Best Available Technologies for Energy Renovation of Buildings in Indonesia and Collection of Key Performance Indicators (KPI) for different building types [DKK] **Energy Audit** Improving energy efficiency in provincial government buildings [DKK] **Financing Mechanism** Exploring financing opportunities for implementing energy efficiency measures in governmental and regional buildings [DKK]
UK	UKPACT	**Capacity Building** ● Workstream 1: Ongoing energy manager/auditor training ● Workstream 2: Providing training and technical assistance. **Academic Study** ● Workstream 1: Completed guidebooks on Climate Change (CC) ● Workstream 1: An academic paper on energy-saving superintendent ● Workstream 2: Developing a guidebook on Energy Management Systems (EnMS) ● Workstream 3: Working on a study on RPP 70/2009 regulation and a GESI brief. **Policy Development** ● Workstream 2: Strengthening SINERGI & POME
Germany	GIZ	**Capacity Building** Activities for energy management in government and commercial buildings **Policy Development** The Subroto Energy Efficiency Award **Technological Development** ● GIZ PEEB Cool project ● Energy calculator application upgrade ● residential energy efficiency
Japan	METI	The 1st Asia Zero Emission Community (AZEC) Senior Official's Meeting (SOM) was held on June 24, 2023, at Hotel Mulia Jakarta. The key topics of discussion included: ● Development of a master plan for hydrogen and ammonia. ● Development of specific standards related to Carbon Capture and Storage (CCS) technology. ● Enhancement of activities under the framework of the Joint Crediting Mechanism (JCM).

b. Multilateral Partners

Climate finance is channeled through two primary mechanisms. Some countries prefer to direct their climate funds through their own extending agencies. This allows them to maintain control over the allocation and utilization of the funds. On the other hand, some climate finance is managed by implementing agencies. These agencies are responsible for handling funds from various donor countries and directing them to recipient countries. Their role extends beyond fund management; they are also tasked with procuring and supervising climate-related projects. This ensures that the funds are used effectively and that the projects align with the donors' climate objectives and the recipients' needs.

In both cases, the goal is to facilitate climate action in recipient countries, whether it's through capacity building, policy development, or direct interventions. However, the mechanisms through which the funds are channeled and managed can vary, depending on the preferences of the donor countries and the specific requirements of the climate projects.

The effectiveness of climate-related projects is significantly influenced by the collaboration between implementing agencies and local governments. Implementing agencies, while managing and supervising the projects, often work closely with local governments to ensure the initiatives align with local needs and priorities. This collaboration typically involves supporting initiatives that the local government has already prepared. By doing so, the implementing agencies can leverage local knowledge and resources, while the local government can benefit from the international expertise and funding provided by the agencies. This synergy not only enhances the feasibility and relevance of the projects but also promotes local ownership and sustainability. Therefore, fostering strong collaboration between implementing agencies and local governments is crucial for the successful implementation of climate-related projects.

The table presented below offers insights into various implementing agencies and their respective programs in Indonesia. By comprehending the scope and objectives of these programs, stakeholders can acquire a deeper understanding of the prevailing climate action landscape in Indonesia. This knowledge serves as a valuable resource, informing decision-making processes, fostering collaboration, and aiding in the identification of potential opportunities for further action.

Implementing Agencies	Program	Project Description/ Activities	Counterpart
UNDP	MTRE3 (Market Transformation for Renewable Energy and Energy Efficiency	• SEC survey of commercial buildings • Survey and socialization of PV Rooftop in commercial buildings • Compilation of GHG Inventory in the Energy Sector in 4 Provinces • Development of GHG Mitigation Action Calculation Methodology in the Energy Sector • Assistance and ISO 50001 Certification for EBTKE Building • Implementation of IGA in 6 Building Structures	EBTKE MEMR
UNEP - UNDP	Advancing High Efficient Lighting Market (ADLIGHT)	• Improved quality, energy efficient and affordable locally produced EEL products and • Improved conditions for fair market competition of EE lighting products, informed by robust policy and institutional framework, • Increased penetration of high quality and efficient lighting	EBTKE MEMR

ADB	Institutional and Capacity Building Support for the Just Energy Transition Partnership Secretariat	The Technical Assistance (TA), through its knowledge and support, will bolster the Just Energy Transition Partnership Secretariat (JETP Secretariat). Established in February 2023, the JETP Secretariat will receive institutional support and implementation capacity from the TA. This assistance aims to enhance the technical work, coordination, and operationalization of Indonesia's Just Energy Transition Partnership (I-JETP).	Coordinating Ministry for Maritime Affairs and Investment (CMMAI)
	TA-930 INO: Scaling Up Energy Efficiency 2018 – 2020	• Technical Assistance for SKEM Preparation (iron, washing machine, water pump, dispenser) • Creation of Website Database and Online Reporting (Standards and Labels) • Preparation of PJU Procurement Scheme based on KPBU (PPP-Public/Private Partnership) • Review and Refinement of Academic Study for Revision of PP 70/2009 • Training and Certification for Certified Investment Grade Auditor and Certified Energy Savings Verifier	
ADB - Loan (Ordinary capital resources, ASEAN Infrastructure Fund, Export-Import Bank of Korea, KfW Bankengruppe)	Sustainable and Inclusive Energy Program	The programmatic approach of this program supports the energy sector reform priorities of the Government of Indonesia. It symbolizes a sustained partnership between the Asian Development Bank (ADB), the government, and other development partners.	MEMR
IEA	Joint Work Programme 2020 – 2021	• Creation of Business Information Website for energy conservation and upgrading of Online Energy Management Reporting • Study for Energy Efficiency in the Transportation Sector	
CLASP	Collaborating towards Net Zero in Indonesia	The collaboration helps reform national policies and regulations and supports capital investment projects that increase energy efficiency in the power sector and end-user sectors. The main objective of this agreement is to strengthen measures for energy conservation and reduce the negative effects of climate change. Primarily through promoting stringent MEPS and energy labels.	MEMR
ETP	Streamlining Government of Indonesia Plans as a Pathway to Achieve Net Zero Emissions	ETP supports capital investment projects that increase energy efficiency in the power sector and end-user sectors such as industry and transport. ETP helps reform national fiscal policies, regulations, and investment policies to create an investment climate that is conducive to energy efficiency and renewable energy.	
Clean Energy Ministerial		• Energy Management Working Group (EMWG) and Energy Management Campaign (EMC) • Super-Efficient Equipment and Appliance Deployment Initiative (SEAD)	MEMR
Asia-Pacific Economic Cooperation		• APEC Low Carbon Model Town • Peer Review Energy Efficiency -10	MEMR
ASEAN	ASEAN Standards Harmonization Initiative for Energy Efficiency (ASEAN SHINE)	• Initiation of standard harmonization, policy, and Mutual Recognition Agreement for household appliances in the ASEAN region • In 2020, Indonesia was involved in the Technical Working Group and Policy Working Group	MEMR

	ASEAN Energy Awards	• Every year, Indonesia sends its representatives to participate in the ASEAN Energy Efficiency and Conservation Awards event. • In 2020, Indonesia sent 14 representatives divided into 3 categories: 3 for Energy Efficient Buildings; 9 for Energy Management for Industries and Buildings; and 2 for Green Building.	MEMR
	AEMAS (ASEAN Energy Management Scheme)	Regional training on standards and certification mechanisms for ASEAN Energy Managers	MEMR
	ASEAN-Japan Energy Efficiency Partnership (AJEEP)	Exchange of experiences in creating best practices regarding energy management technology and systems in the field of energy efficiency and conservation	MEMR

2.2.2. National and Private Climate Finances

In Indonesia, the management of energy conservation is a structured process that involves both national and regional levels of government. At the national level, the central government allocates budgets from the APBN (Anggaran Pendapatan dan Belanja Negara, or State Budget) for various initiatives, including energy management and infrastructure. Similarly, at the regional level, local governments allocate resources from the APBD (Anggaran Pendapatan dan Belanja Daerah, or Regional Budget) for these purposes. These funds are crucial in ensuring that public institutions have the necessary resources to manage and implement energy conservation measures effectively. Based on the MEMR annual achievement document, in 2022, there have been US$ 15.7 million of investments in Indonesian energy efficiency projects (https://ebtke.esdm.go.id/flippdf/elibrary.html#pdfflip-lakin2022/).

To ensure the effectiveness and efficiency of these energy conservation efforts, a comprehensive system of monitoring and evaluation is in place. This system is managed by local governments, who are responsible for overseeing the various initiatives and projects in their respective regions. The outcomes and progress of these efforts are then reported to several higher authorities. These include the MenPANRB (Ministry of State Apparatus Utilization and Bureaucratic Reform), the Mendagri (Ministry of Home Affairs), as well as to the Governors and the Regents/Mayors. This multi-tiered approach to oversight ensures that energy conservation initiatives are implemented effectively and in alignment with both national and regional objectives.

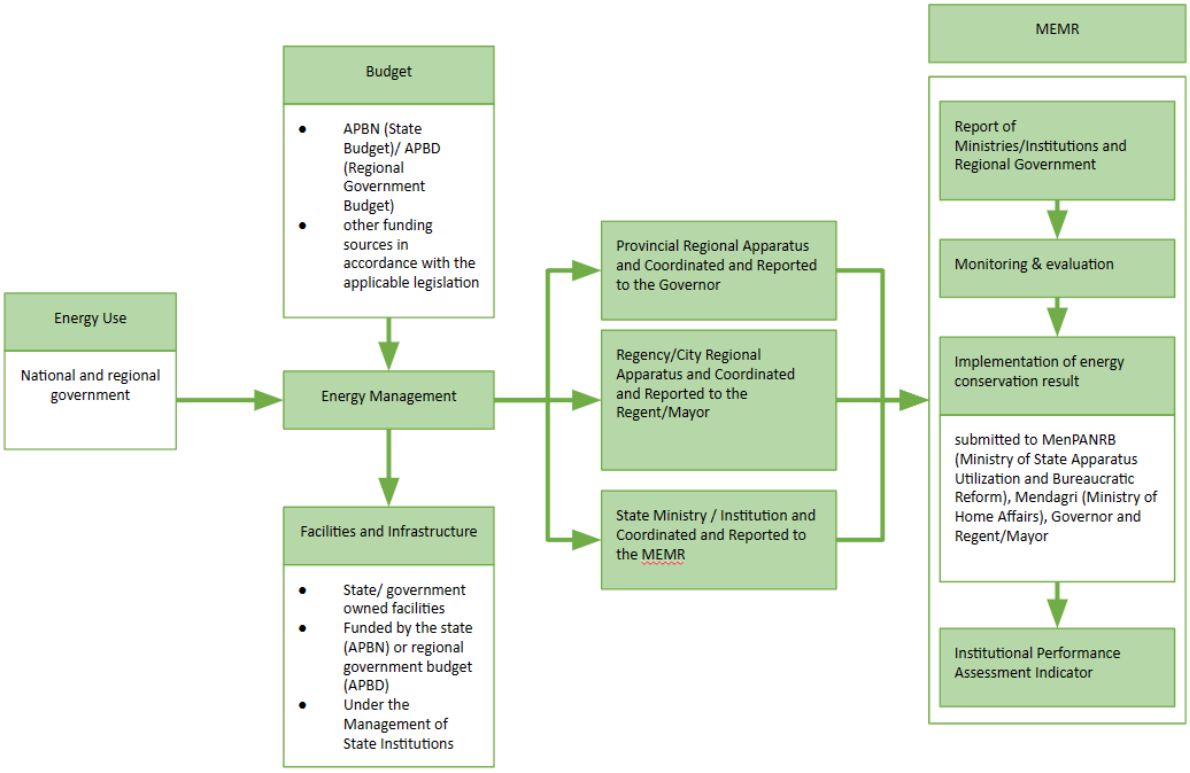

Figure 2-2. Energy Conservation Implementation in National and Regional Government

Incentives are a key tool utilized to foster the development of energy conservation measures. These incentives are provided by both national and regional governments, reflecting a commitment to promoting sustainable energy practices. The beneficiaries of these incentives are categorized into two distinct groups. The first group encompasses energy providers and users, who are directly involved in the energy supply chain and consumption processes. The second group consists of manufacturers of appliances, where the focus is on encouraging the production of equipment that is more energy-efficient and contributes to energy savings.

The effectiveness of these incentives is evaluated based on two primary metrics: the enhancement of energy performance (energy audit) and the increased production of energy-efficient appliances (MEPS label). These criteria serve as objective measures to assess the impact of the incentives on promoting energy conservation. The incentives provide the following benefits to promote reduction in energy use:

- **the enhancement of energy performance (energy audit):** Many industries and building's owner focusing their productivity on the production and services and there is lack of budget allocated with the purpose of improving energy performance. With the availability of incentives in form of technical assistance, energy auditor and energy manager certification, will enable these sectors to be more energy efficient
- **the increased production of energy-efficient appliances (MEPS label)**: The incentives allocated to enhanced the production of energy efficient appliances will obviously contribute to the availability of energy efficient appliances in the market with lower price. Thus, will increase the use of energy-saving equipment and reduce energy waste from household sector

These criteria serve as objective measures to assess the impact of the incentives on promoting energy conservation.

Regarding the nature of these incentives, they are offered in both fiscal and non-fiscal forms. Fiscal incentives are administered in alignment with the prevailing state financial legislation. This may include, but is not limited to, tax rebates, subsidies, and other financial benefits designed to economically support the adoption of energy-efficient practices. Non-fiscal incentives, in contrast, are provided in forms that do not involve direct financial benefits. These include the provision of training programs, the offering of certification for energy-efficient products or practices, and the conducting of energy audits. These non-fiscal incentives are designed to build capacity and knowledge in energy conservation, thereby complementing the fiscal incentives. Together, these incentives form a comprehensive approach to promoting energy conservation across different sectors and levels of involvement.

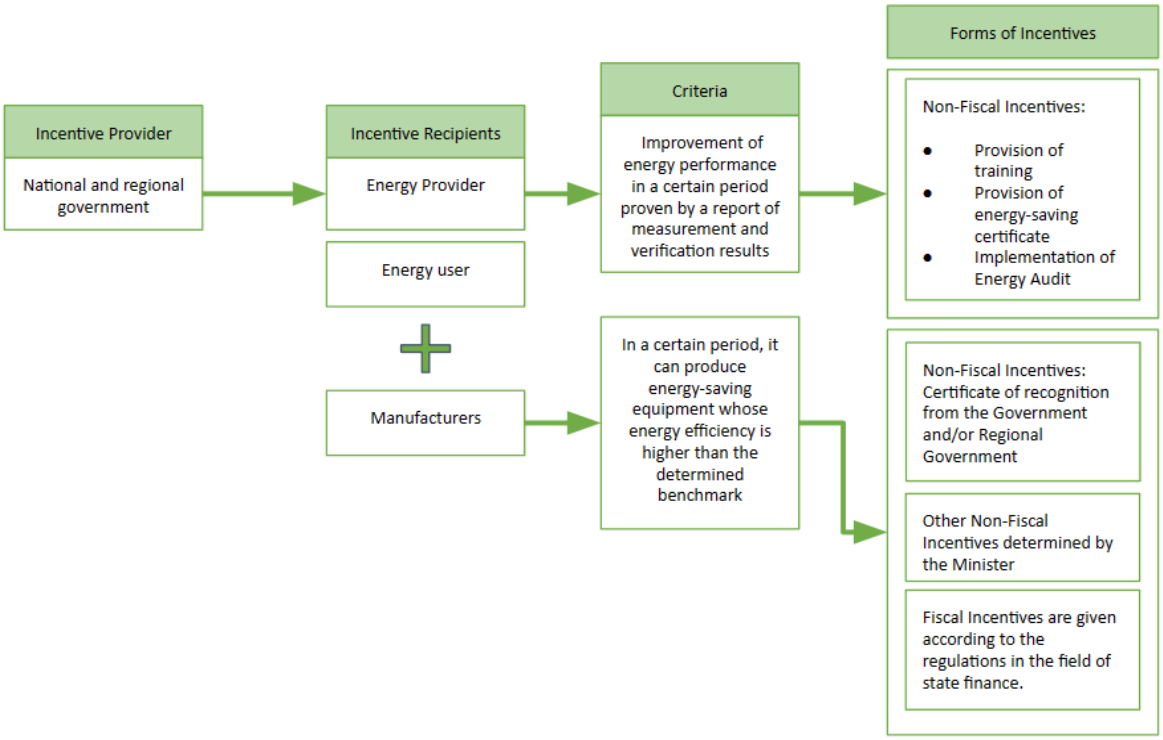

Figure 2-3. Incentives are given to energy provider, energy user, and manufacturers to promote energy efficiency.

Disincentives form an integral part of the regulatory framework managed by both national and regional governments to ensure adherence to energy efficiency management practices. These measures are specifically applied to energy providers or users who fail to comply with established energy efficiency norms. The application of disincentives is methodically structured into three distinct stages to ensure fairness and proportionality in enforcement.

In the initial stage, the process begins with the issuance of a written warning to the non-compliant entities. The procedure allows for up to three such warnings, with each warning carrying a maximum duration of one month. Compliance within any of these warning periods leads to the cessation of further disincentive actions. Should the entity fail to comply after the warning stages, the process escalates to a more public form of censure. In this phase, the Ministry takes the step of publicly announcing the names of the non-compliant energy providers or users through mass media channels. This public declaration serves as both a penalty and a deterrent. However, if the entity rectifies its non-compliance after this announcement, no further disincentives are pursued.

The final stage of the disincentive process is invoked if non-compliance continues beyond the first two stages. At this juncture, the Minister takes a more stringent approach by recommending to the relevant

higher authority - which could be another minister, the governor, or the regent/mayor as appropriate to their jurisdiction - to undertake more severe actions. This could include the revocation of any existing incentives previously granted to the non-compliant energy providers or users. This step underscores the seriousness with which energy efficiency management practices are regarded and enforces compliance through significant punitive measures.

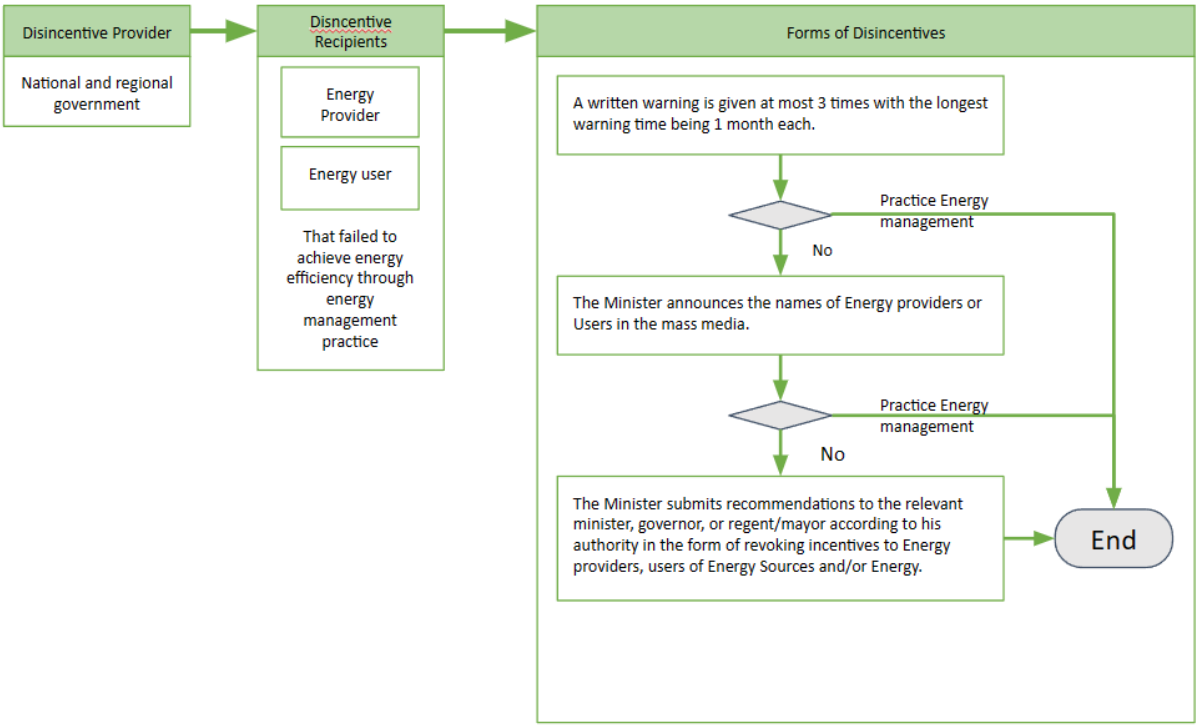

Figure 2-4. Disincentives are given to entity through several forms of warning.

2.3. Current Challenges in Energy Efficiency Financing

Various countries and multilateral partners contribute to the financing of climate-related projects in Indonesia. These entities operate through a variety of channels, utilizing different mechanisms to deliver their financial support. This multi-channel approach allows for a broad reach, ensuring that funds are allocated to diverse areas of climate action.

In addition, these financiers work in collaboration with various counterpart agencies in Indonesia. These agencies, which range from governmental departments to non-governmental organizations, serve as the local partners for these international financiers. They play a crucial role in the implementation of the projects, leveraging their local knowledge and networks to ensure the effectiveness of the initiatives. This collaborative model, involving international financiers and local agencies, facilitates a comprehensive approach to climate action. It allows for the integration of international resources and local expertise, thereby enhancing the impact of the climate-related projects in Indonesia.

However, challenges persist that might hinder the progress of financing energy efficiency and energy management initiatives:

2.3.1. Lack of Competencies of ESCO Companies

There have been several ESCO companies (such as Enertec and PT. Indra Karya) who have conducted and implemented Energy Performance Contract based investments. One of the more successful companies with potentially the largest amount of investments and the largest number of Investment Grade Audits

being done is Synergy Energy Solutions (https://synergy.id/). Synergy provided Indonesia's first non-vendor financed comprehensive ESCO contract with Adi Husada Hospital in 2014. This project financed multiple technologies and investments types within the hospital (lighting, air conditioning, heating, etc) with a shared savings Energy Performance Contract. The source of finance is a private venture investor and financed through both equity and loan.

Funding was available through the investment of the ESCO companies including financial institutions. However, Indonesian banks and international financial institutions have been known to be reluctant in recent investments in Indonesia. The ESCO association, APKENINDO (*Asosiasi Perusahaan Pendukung Konservasi Energi Indonesia* or Association of Indonesian Energy Conservation Supporting Companies) has also been known dormant in the last 10 years[9]. Many of the shared savings Energy Performance Contract projects have been proven to underperform and do not achieve the energy savings that were predicted. This resulted in significantly lower revenue to the project and the inability of the project to pay back the investors and lenders.

The key issue lies within the ESCO companies themselves who are unable to properly model the energy consumption of the facilities they are investing in. This results in models that are predicting a much higher energy savings that do not match with the reality of the project. In this case, not only the investors and lenders who are reluctant to invest in these types of projects. There are no insurance companies who are willing to underwrite the projects' risks without knowing that the ESCO companies have developed a bankable energy modelling calculations, bankable contract structure, and bankable financial model for the project.

2.3.2. Scattered Data Management

The data pertaining to these collaborations is dispersed across various sources. This scattered nature of information presents a significant challenge in measuring the progress of these climate-related projects. Without a centralized data repository, it becomes difficult to track the performance of each sector involved in these initiatives.

Moreover, this lack of consolidated data makes it challenging to identify the existing gaps in achieving the Nationally Determined Contributions (NDC) targets. The NDC targets, which are central to Indonesia's climate action plan, require comprehensive data for effective monitoring and evaluation. Currently, there is no integrated platform to monitor the flow of aid directed towards energy efficiency and energy management initiatives. This absence of a centralized system poses a significant challenge in measuring the achievements of each sector involved in these initiatives.

The availability of comprehensive and accurate data is crucial for assessing the success of funding efforts. It allows for effective tracking of progress, identification of areas for improvement, and evaluation of the impact of the initiatives. However, without such data, determining the success of each funding effort becomes a complex task. This highlights the need for an integrated platform that can consolidate data related to aid flow, sectoral achievements, and funding success. Such a platform could significantly enhance the monitoring, evaluation, and overall management of energy efficiency and energy management initiatives. It could also provide valuable insights for future planning and decision-making processes.

[9] Energy Transition Partnership. (2022). Diagnostic Analyses Report of Energy Efficiency Development in Indonesia, the Philippines and Vietnam. [PDF Document]. https://www.energytransitionpartnership.org/resource/diagnostic-analyses-report-of-energy-efficiency-development-in-three-countries-indonesia-the-philippines-and-vietnam/

Therefore, the current state of data management poses a hurdle in the effective implementation and assessment of climate-related projects. It underscores the need for a more systematic approach to data management, one that can provide a holistic view of the collaborations, their progress, and their contribution towards the NDC targets.

2.3.3. Low Cost of Fossil Fuel Powered Electricity

In Indonesia, the cost of electricity generation powered by fossil fuels is comparatively low, at approximately US$ 0.07 per kWh. This low cost presents a significant challenge to the implementation and financial viability of energy efficiency projects, as it tends to extend the payback period and diminish the financial returns from such initiatives. The current tariff structure in place may not sufficiently incentivize energy conservation, thereby necessitating a review and potential restructuring.

A viable solution to this challenge could involve the Perusahaan Listrik Negara (PLN), the state electricity company, adopting a revised tariff system, perhaps reverting to a modified increasing block tariff system. This proposed system would include several tiers:

- **Lifeline Block Tariff:** This would be a subsidized rate intended for low-income and low-energy users, ensuring that the most vulnerable populations are not adversely affected by changes in the tariff structure.
- **Base Block Tariff:** Aimed at low-energy users, such as residential consumers using up to 100 kWh per month, this tier would feature an unsubsidized tariff, reflective of their minimal energy consumption.
- **Medium Block Tariff:** For medium-energy users (for example, residential consumers using between 100 kWh and 250 kWh per month), the tariff would be set at 1.25 times the unsubsidized rate.
- **High Block Tariff:** The highest tier would apply to high-energy users, such as residential users consuming above 250 kWh per month, with a tariff set at 1.6 times the unsubsidized rate.

While Indonesia's government have been working on restructuring the electricity tariff for a number of years, the block tariff idea is not new in Indonesia. In the early 2010s through mid-2010s, PLN already use a block tariff scheme for their consumers including residential, business, industry, and social consumers. This scheme is not new, and it is something that is needed now in order to accelerate emissions reductions and reduce excessive use of electricity from the various consumers. Having this tariff structure encourages energy efficiency and enables consumers who use excessive electricity to either pay more for their excessive electricity use or to implement energy efficiency programs to reduce their electricity cost.

The impact to most consumers with normal electricity use within the benchmark standards should be minimal. Even to the excessive energy use, the higher tariffs are only applied to the electricity used beyond the normal amounts (for their industry and sector). As can be seen below, different consumer types have different levels of normal energy uses and have different tariffs applied to each block of energy use.

LAMPIRAN III PERATURAN MENTERI ENERGI DAN SUMBER DAYA MINERAL
NOMOR : 07 TAHUN 2010
TANGGAL : 30 Juni 2010

TARIF DASAR LISTRIK UNTUK KEPERLUAN BISNIS

NO.	GOL. TARIF	BATAS DAYA	REGULER		PRA BAYAR (Rp/kWh)
			BIAYA BEBAN (Rp/kVA/bulan)	BIAYA PEMAKAIAN (Rp/kWh) DAN BIAYA kVArh (Rp/kVArh)	
1.	B-1/TR	450 VA	23.500	Blok I : 0 s.d. 30 kWh : 254 Blok II : di atas 30 kWh : 420	535
2.	B-1/TR	900 VA	26.500	Blok I : 0 s.d. 108 kWh : 420 Blok II : di atas 108 kWh : 465	630
3.	B-1/TR	1.300 VA	*)	795	795
4.	B-1/TR	2.200 VA s.d. 5.500 VA	*)	905	905
5.	B-2/TR	6.600 VA s.d. 200 kVA	**)	Blok I : H1 x 900 Blok II : H2 x 1.380	1.100
6.	B-3/TM	di atas 200 kVA	***)	Blok WBP = K x 800 Blok LWBP= 800 kVArh = 905 ****)	-

TARIF TENAGA LISTRIK UNTUK KEPERLUAN RUMAH TANGGA
BERLAKU MULAI 1 NOVEMBER 2014

NO.	GOL. TARIF	BATAS DAYA	REGULER		PRA BAYAR (Rp/kWh)
			BIAYA BEBAN (Rp/kVA/bulan)	BIAYA PEMAKAIAN (Rp/kWh)	
1.	R-1/TR	s.d.450 VA	11.000	Blok I : 0 s.d. 30 kWh : 169 Blok II : di atas 30 kWh s.d. 60 kWh : 360 Blok III : di atas 60 kWh : 495	415
2.	R-1/TR	900 VA	20.000	Blok I : 0 s.d. 20 kWh : 275 Blok II : di atas 20 kWh s.d. 60 kWh : 445 Blok III : di atas 60 kWh : 495	605
3.	R-1/TR	1.300 VA	*)	1.352	1.352
4.	R-1/TR	2.200 VA	*)	1.352	1.352
5.	R-2/TR	3.500 s.d. 5.500 VA	*)	1.352	1.352
6.	R-3/TR	6.600 VA keatas	*)	1.352	1.352

Catatan :
*) Diterapkan Rekening Minimum (RM):
RM1 = 40 (Jam Nyala) x Daya Tersambung (kVA) x Biaya Pemakaian.

The intent of this graduated tariff structure is to mitigate any negative impact on low-income electricity consumers while simultaneously influencing the consumption behavior of higher-energy users. The increased cost of energy at higher consumption levels would not only generate additional income for PLN but also serve as a powerful motivator for consumers to adopt energy-saving measures. These could include implementing energy management and monitoring systems, investing in energy-efficient appliances, installing rooftop solar PV systems, and other similar initiatives. By aligning the cost of electricity more closely with consumption levels, this revised tariff structure could play a pivotal role in advancing energy conservation efforts in Indonesia.

2.3.4. Energy Efficiency Projects remain unappealing.

The development of energy-efficient projects in Indonesia faces several significant challenges, primarily stemming from a knowledge gap within financial institutions regarding energy efficiency technologies. This lack of understanding often leads to a perception of high financial risks associated with financing such projects. Energy Service Companies (ESCOs), which are crucial in this sector, struggle to gain the confidence of investors and clients, partly due to the underperformance of energy savings in past projects.

A major obstacle in the path of developing energy-efficient projects is the perceived financial risk, a concern shared by both clients and investors. The risks are multifaceted, encompassing economic and financial aspects, availability of financial resources, and regulatory uncertainties. These perceived risks significantly hinder the initiation and implementation of such projects.

Furthermore, the traditional business models employed by ESCOs in Indonesia – namely, the shared savings model and the guaranteed savings model – have not been effective in overcoming the unique business challenges in the region. The shared savings model, which relies on funding from banks, has been largely unsuccessful due to difficulties in accessing financial support. On the other hand, the guaranteed savings model transfers the debt risk to the ESCO client, which is a deterrent for many potential clients.

Indonesia could potentially develop solutions to financial challenges:

1. **On-bill financing schemes**. Currently, the on-bill financing mechanism has not been developed yet in Indonesia. In developed countries, the on-bill financing mechanism attracted clients for its unique mechanism as it eliminates upfront capital investment and does not incur additional cost on existing client's budgets[10]. This mechanism is also known as Energy Performance Contract (EPC). However, its risks and potentials have not been identified yet in Indonesia. It is important that risks and potentials are studied extensively considering the low-cost tariffs of fossil fueled electricity in Indonesia.
2. **Property Assessed Clean Energy (PACE) Financing**: This approach allows property owners to fund energy efficiency upgrades through a special assessment added to their property tax, with repayment over a set period (typically up to 20 years) and energy savings offsetting the costs.
3. **Government Incentive Programs**: Governments can also be actively involved in offering financial incentives and grants to encourage energy efficiency initiatives, providing support such as tax credits or subsidized loans. Fiscal or financial incentives are considerably more attractive than non-fiscal incentives to encourage clients to invest in energy efficient appliances[11].

Another critical issue lies in the contractual agreements that govern energy efficiency projects. The current standard contracts do not adequately address key concerns, such as clear timelines and project procurement procedures[12]. It adversely affects the level of trust between clients and financial institutions. This lack of trust in the contractual framework further exacerbates the challenges faced by ESCOs in

[10] Energy5. (2023). Overcoming financial barriers to energy efficiency. Retrieved from https://energy5.com/overcoming-financial-barriers-to-energy-efficiency.

[11] United Nations Environment Programme Finance Initiative (UNEP FI). (2009). Energy efficiency and the finance sector. Retrieved from https://www.unepfi.org/fileadmin/documents/Energy_Efficiency.pdf.

[12] Institute for Energy Economics and Financial Analysis (IEEFA). (2022). Governance challenges in Indonesia's energy transition. Retrieved from https://ieefa.org/articles/governance-challenges-indonesias-energy-transition.

securing investment and client confidence for energy-efficient projects. Addressing these issues is essential for the advancement and success of energy efficiency initiatives in Indonesia.

3. NDC Implementation Plan Analysis

3.1. Energy Sector Analysis

Based on the Annex I Enhanced NDC of the Republic of Indonesia, 2022, Indonesia has targeted GHG emission reduction from some sectors as shown in Table 3-1.

Table 3-1. Enhanced NDC 2030

No	Sector	GHG Emission by 2010 ($MTCO_2e$)	Target GHG Emission 2030			Emission Reduction (Target BAU – Target CM1)	
			BAU	CM1	CM2	CM1	CM2
1	**Energy**	**453,2**	**1.669**	**1.311**	**1.223**	**358**	**446**
2	Waste	88	269	246	253	40	45,3
3	IPPU	36	70	63	61	7	9
4	Agriculture	111	120	110	108	10	12
5	Forestry	647	714	217	-15	500	729
	TOTAL	**1.334**	**2.869**	**1.953**	**1.632**	**925**	**1.240**

Table 3-1 shows that the target of emission reduction from the Energy sector, by 2030 is 358 $MTCO_2e$. The breakdown of this sector consists of five sub-sectors, namely Energy Efficiency (132,25 $MTCO_2e$), Renewable Energy (181,45 $MTCO_2e$), Clean Energy Power Plant (21,53 $MTCO_2e$), Low Carbon Fuel (16,83 $MTCO_2e$) and Mining Reclamation (5,84 $MTCO_2e$).

3.2. Energy Efficiency Program – Energy Management

The report details various activities within the energy sector projected to contribute to a greenhouse gas (GHG) emission of 132.25 MtCO2e, as outlined in Table 3-2. Accompanying this data is a graphical representation depicting the annual targets for emission reduction. These targets are designed to escalate incrementally over the specified period, reflecting an evolving and intensifying approach to emission reduction.

Table 3-2. Target on Emission Reduction under Energy Sector

Activity	Emission Reduction ($MTCO_2e$)
Energy Management	36,14
Improved Efficiency of Home Appliances	83,84
Energy Efficient Streetlighting	1,76
Electric Vehicle	7,23
Improved Energy Efficiency for Cooking	3,23
JCM Indonesia	0,032
TOTAL	132,25

The commencement of this target-setting begins in the year 2020, with an initial goal of reducing emissions by 15.9 $MtCO_2e$. As the timeline progresses towards 2030, the ambition of these targets increases significantly. By the end of this decade-long period, the emission reduction target is expected to reach 109.4 $MtCO_2e$. It is crucial to note that the increment in these targets is not linear; instead, there is a noticeable acceleration in the later years. This pattern indicates a strategic shift towards a more aggressive emission reduction strategy as the timeline advances. This approach underscores the growing urgency and commitment to mitigating GHG emissions in the energy sector as the decade progresses.

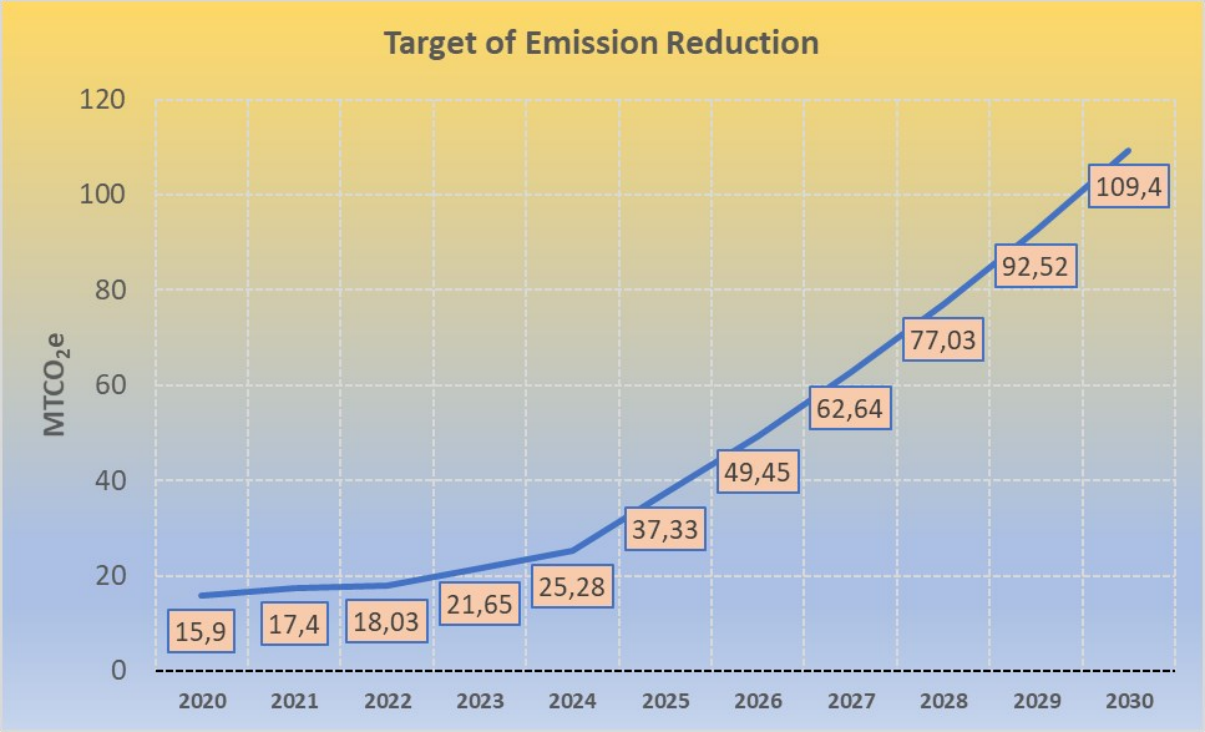

Figure 3-1. Target of Emission Reduction[13]

The emission reduction target set for the implementation of Energy Management is established at 36.14 $MtCO_2e$. This specific target is derived from various sub-sectors, as enumerated in Table 3.3 of the report. The basis for setting this target is the baseline value of greenhouse gas (GHG) emissions, determined with reference to the status as of the year 2021. This approach provides a clear and quantifiable benchmark against which progress can be measured.

The sub-sectors identified as significant contributors to the emission reduction include a range of energy producers and users. Specifically, the focus is on entities with an annual energy consumption exceeding 6000 ToE (Tonnes of Oil Equivalent). This category involves approximately 450 industries, representing a substantial segment of the industrial sector. Additionally, industries that have an annual energy consumption in the range of 4000 to 6000 ToE are also included, encompassing an additional 135 industries. These industries are pivotal in the overall strategy to reduce emissions through more efficient energy management.

Furthermore, the strategy extends beyond industrial settings to include buildings with significant energy consumption. The target includes buildings that exceed an annual energy consumption of 500 ToE, accounting for a total of 679 buildings. This comprehensive approach, encompassing a wide array of

[13] Enhanced NDC Indonesia, presentation of DGNREEC MEMR, 2021

energy-intensive sectors, underscores the commitment to achieving significant emission reductions through enhanced energy management practices across diverse sectors.

Table 3-3. The Potential of Emission Reduction from Sub Sector Energy Management

The Potential of Emission Reduction	$MTCO_2e$
The Potential of Emission Reduction from Energy Producers (Power Plants)	8,20
The Potential of Emission Reduction from Industries	25,05
The Potential of Emission Reduction from Industries (4000 - 6000 ToE)	0,62
The Potential of Emission Reduction from Transportation Sector 4000 ToE	1,29
The Potential of Emission Reduction from Building Sector 500 ToE	1,00
Total Cumulative Emission Reduction	**36,14**
Annual Emission Reduction (10%)	**3,614**

3.3. Energy Efficiency Program – Improved Efficiencies of Home Appliances

In Indonesia, the implementation of Minimum Energy Performance Standards (MEPS) for various appliances began with the introduction of MEPS for Compact Fluorescent Lamps (CFL) in 2014. This initiative marked a significant step towards enhancing energy efficiency in lighting solutions. Subsequently, in 2017, MEPS for air conditioners were enacted, with the application of these standards commencing from July 2018. These standards specifically apply to air conditioners with a capacity of up to 27,000 BTU/hr and include both inverter and non-inverter types.

To ensure compliance with the MEPS, a system of certification and testing has been established, to be conducted by accredited agencies. This process is crucial in maintaining the integrity and effectiveness of the MEPS, ensuring that all applicable products meet the required energy performance criteria.

Additionally, a star rating system has been established to provide clear and consumer-friendly information on the energy efficiency of air conditioners. This system ranges from 1 star, indicating a minimum Energy Efficiency Ratio (EER) of 8.53, to 4 stars, which denotes a minimum EER of 10.41. This rating system not only aids consumers in making informed purchasing decisions but also encourages manufacturers to produce more energy-efficient appliances. The adoption of these standards and the rating system represents a significant advancement in Indonesia's efforts to promote energy conservation and efficiency.

It was then renewed in 2021 after a review of the previous regulations. The energy star rating is now widely used for all types of products. Since then, the progress of energy efficiency labeling and Minimum Energy Performance Standards (MEPS) in Indonesia demonstrates significant advancements in recent years. Here are some key developments:

- **Air Conditioners:** As of August 16, 2021, Indonesia established the Minister of Energy and Mineral Resources Decision No.113/2021. This decision set MEPS and energy efficiency labels for air conditioners, effective 12 months post-establishment. It outlines the scope of regulated products, exemptions, test methods, the design of the energy-efficiency label, energy efficiency rating criteria, and other factors. Energy efficiency of air conditioners is calculated using the Cooling Seasonal Performance Factor (CSPF), with MEPS set at CSPF=3.10 W/W. Labels range from one

star (corresponding to MEPS) up to five stars and must be completed in the country of origin for imported products.

- **Refrigerators, Fans, and Rice Cookers:** On September 20, 2021, the Indonesian government established three ministerial decisions for these appliances, also effective 12 months after their establishment. These decisions also stipulate the scope of regulated products, exemptions, test methods, the design of the energy-efficiency label, and energy efficiency rating criteria. Labels indicate products' energy performance, starting from one star and going up to five stars, like air conditioners.
- **General Energy Efficiency Labeling and MEPS:** On June 22, 2021, Indonesia promulgated and enacted Regulation of the Minister of Energy and Mineral Resources No. 14/2021. This regulation applies MEPS to various energy-consuming equipment.
- **Support from International Organizations:** Programs like the United Nations Environment Programme United for Efficiency (UNEP-U4E) have provided support to Indonesia's ADLIGHT project since September 2020. This collaboration has helped in the capacity building necessary for the development of MEPS and energy labels.

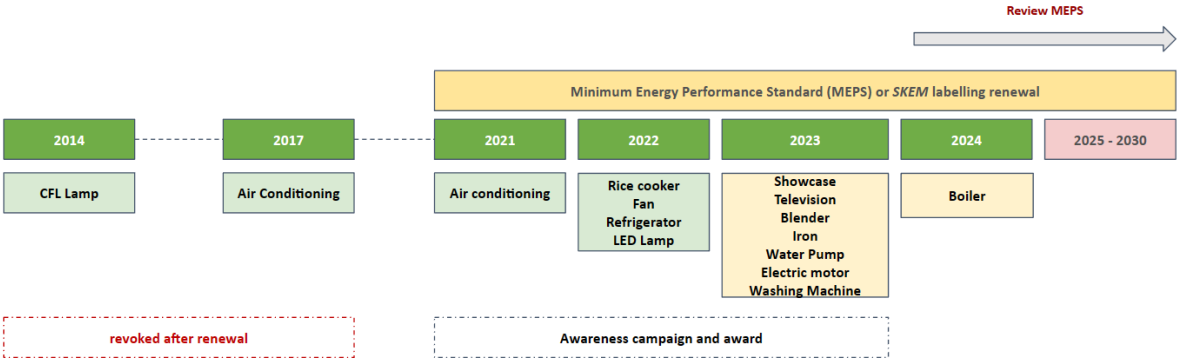

Figure 3-2. MEPS labelling development

3.4. Investment Potential in Energy Efficiency Project

An internal report from the Ministry of Energy and Mineral Resources (MEMR), which draws upon the findings of the Investment Grade Audits (IGA) conducted between 2014 and 2018, estimates Indonesia's potential for energy efficiency investment at approximately US$19.805 billion. This substantial figure reflects the growing focus on energy efficiency in the country and underscores the scale of investment required to achieve significant improvements in this sector.

The report details the allocation of these investments across various initiatives. A portion of the investment, amounting to $74.65 million, is earmarked for conducting energy audits, which are critical in identifying areas for efficiency improvements. Additionally, $30 million is allocated for investment-grade audits (IGA), a more detailed and rigorous form of energy audit. A significant bulk of the investment, ranging from $4.4 to $19.7 billion, is set aside for international studies. These studies are expected to provide insights and best practices from global perspectives, further aiding the country's energy efficiency endeavors.

Focusing on sector-specific investments, the report identifies the Industry Sector as a major recipient, with investments targeting 15 entities amounting to $26 million. This investment is expected to bolster energy efficiency practices within the industrial sector, which is a significant energy consumer. In the Building Sector, investments cover 7 entities, totalling $4 million. This investment recognizes the growing importance of energy efficiency in the building sector, which has a considerable impact on the overall energy consumption profile of the country. These targeted investments in both the Industry and Building

Sectors are indicative of a strategic approach to enhancing energy efficiency across critical sectors of the economy[14].

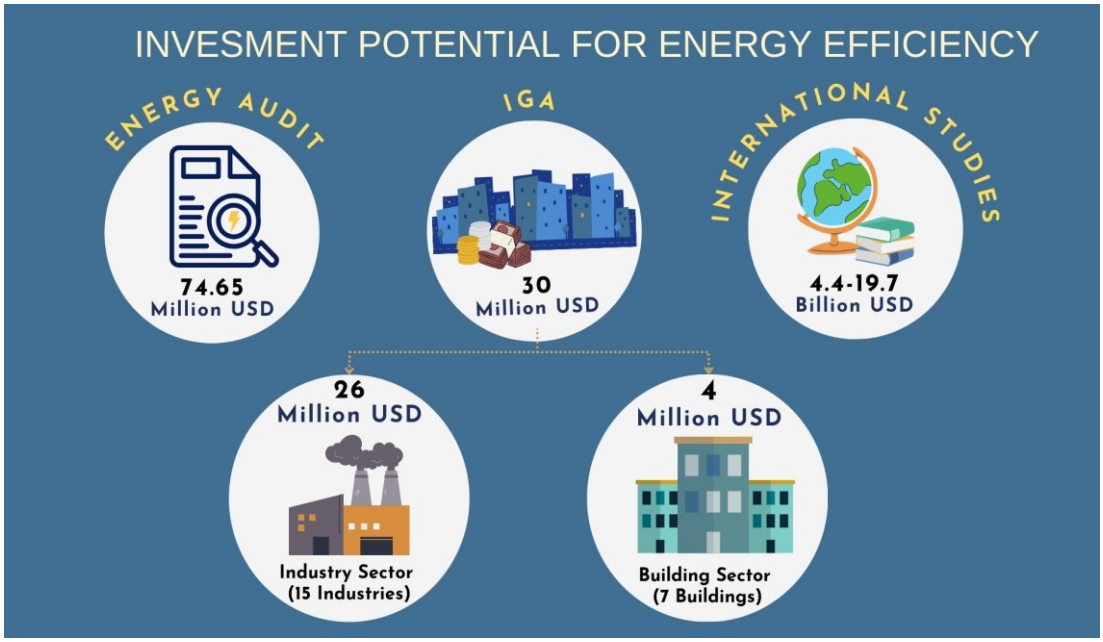

Figure 3-3. Investment Potential for EE Projects

Table 3-4 presents the data collected from the POME (Energy Management Online Reporting) platform. POME, managed by DGNREEC (Directorate General of New, Renewable Energy and Energy Conservation), is an innovative online system designed to streamline the reporting process for both buildings and industries regarding their energy management activities. This system facilitates the submission of detailed reports on energy management activities directly to the government, enabling more efficient tracking and assessment of energy efficiency initiatives across various sectors.

Table 3-4. Investment and Saving 2018 – 2020 (POME)

Year	Activities	Building		Industry	
		Investement (IDR)	Saving (GJ)	Investement (IDR)	Saving (GJ)
2018	Service Equipment	N/A	N/A	200.000.000,00	
	Setting Operational Parameter			55.000.000,00	17.720,80
	Maintenance			168,00	427.760,00
	Modification			9.564.750.144,00	31.643,00
	Replacement			53.752.999,62	7.206,00
	Others				1.457.625,00
	Total 2018			9.873.503.311,62	1.941.954,80
2019 - 2022	System Optimation			50.000.000,00	12.409,41
	Service Equipment	38.085.000,00	0,00	205.172.165.619,00	16.948.131,43
	Setting Operational Parameter	65.877.100,00	111,83	201.110.341.815,00	100.178.837,51
	Maintenance	3.159.261.428,00	7,71	1.009.853.422.642,00	16.948.131,43
	Modification	1.352.538.032,00	844,73	1.609.873.680.642,65	44.187.993,67
	Replacement	20.520.276.676,00	36.385,43	6.565.327.023,13	22.459.447,57
	Others	5.701.515.008,00	121.988,46	1.997.666.523.359,00	53.865.277,02
	Total 4 years	30.837.553.244,00	159.338,16	5.030.291.461.100,78	254.600.228,04
	Average 4 years	5.139.592.207,33	26.556,36	718.613.065.871,54	36.371.461,15

[14] Ministry of Energy and Mineral Resources (2019). Energy Conservation Investment in Indonesia

The establishment of POME is in line with the mandate set forth in Government Regulation 70/2009, which underscores the government's commitment to enhancing energy management practices. POME was launched in 2018, marking a significant step in the digitalization of energy management reporting. Initially, the system was utilized predominantly by the industrial sector to report on their energy management activities. The following year, in 2019, the system began to gather data from the building sector as well. This expansion reflects a growing recognition of the importance of comprehensive energy management across different sectors and the role of digital platforms in facilitating effective data collection and analysis. The data in Table 3-4, thus, offers valuable insights into the progress and outcomes of energy management activities reported through the POME system.

4. Investment Scheme in Indonesia

A strategy that outlines the nation's vision and budgetary requirements is essential to secure funding for national programs and actions. Proper insight into climate finance flows will enable Indonesia to make informed decisions regarding climate change planning, prioritization, and resource allocation, as well as to track and assess progress.

In this chapter, the investment scheme in Indonesia's Energy Sector will be discussed, along with an analysis of the funding required to achieve the NDC target through a financial model. As mentioned in the previous chapter, the focus will be on Energy Management and the Improved Efficiency of Home Appliances sub-sectors.

4.1. Investment Projection for Energy Sector – Energy Management

As previously mentioned in Table 3-3, the target of emission reduction from Sub Sector Energy Efficiency, specifically from the Energy Management activities, is 36,14 $MTCO_2e$. However, due to limited availability of the data, the calculation on investment projection will be focused on the energy management activities for industry with annual energy consumption between 4000 - 6000 ToE of which its target emission reduction is 0,62 $MTCO_2e$ until 2030 (see Table 3-3).

The method of calculating investment needs is described in Figure 4-1. This diagram outlines the methods used to calculate required investment to achieve NDC target under the energy sector.

- **Site Data Collection - Industry**: It begins with the collection of site-specific data for an industrial setting, which is essential to understand the current energy usage patterns.
- **Analysis of Boiler Efficiency:**
    - Energy Consumption Boiler: Evaluates the energy consumption of boilers to identify inefficiency.
    - Saving Potential: Assesses potential energy savings achievable through optimization or upgrades.
    - Required Investment for Saving: Estimates the financial outlay necessary to realize these energy savings.
- **Financial Viability Assessment:**
    - Calculate Payback period, NPV, IRR: Computes the Payback period, Net Present Value (NPV) and Internal Rate of Return (IRR) to determine the financial viability of the investment towards energy savings.
- **Budgeting for Climate Goals:**
    - Budget to Achieve Target NDC: Allocates budget based on the calculated NPV and IRR to meet the Nationally Determined Contributions (NDC) targets, reflecting the commitment to reducing greenhouse gas emissions.

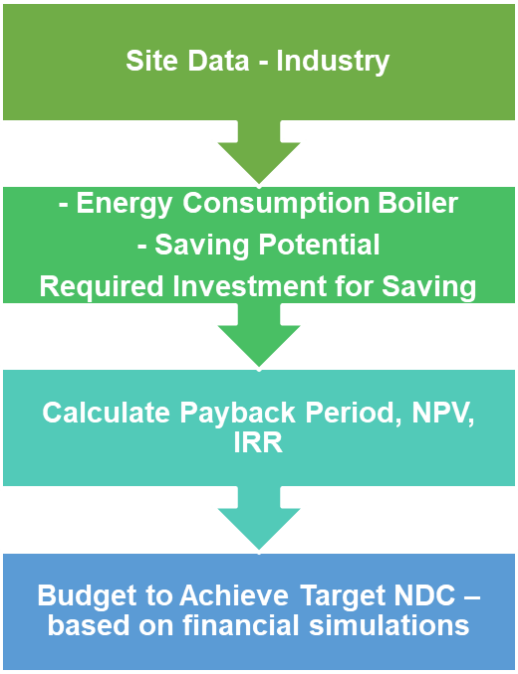

Figure 4-1. Flow chart on methods to calculate investment for Energy Management

To determine the budget needed to reach the NDC target within the Energy Management sub-sectors, certain key assumptions are made:

- Sample data from Food and Beverage industries in Indonesia, specifically those consuming 4000 - 6000 ToE of energy, are derived from previous audit reports.
- Due to data limitations, calculations were based on four industry sites.
- Industry energy consumption is primarily represented by boiler electricity usage, which constitutes 60% of the total energy in food industries (Source: Energy Efficiency Benchmarking Study of Food Manufacturing Plants in Singapore, 2016).
- A discount factor of 12% is assumed.
- The industrial electricity tariff is set at IDR 1,036/kWh (based on the 2023 tariff).
- An estimated annual electricity rate increases of 1% is anticipated.

The summary of all audit reports (the financial section) from four sites of F&B industries is shown in Table 4-1.

Table 4-1. Financial Calculation for Industry Sector 4000 – 6000 ToE Table 4-1

Sample Sites	Estimated of consumption MWh	Share of consumption %	Saving potential, MWh	Estimated CO2 emission reduction, ton	Estimated investment Mn IDR	Estimated payback period	NPV, Mn IDR	IRR	Saving MWh/ Mn IDR Investment	CO2 emission reduction, ton/ Mn IDR Investment
INDUSTRI I	12,663	94.1	1,075	197	3,000	5.9	-127.0	-1%	0.4	15.23
INDUSTRI II	15,341	49.5	1,360	275	4,200	5.2	363.6	2%	0.3	15.27
INDUSTRI III	2,177	13.0	228	186	565	1.9	1,115.2	36%	0.4	3.04
INDUSTRI IV	56,746	100.0	3,157	1,935	1,590	1.5	4,399.2	48%	2.0	0.82
Total	**86,927**	**256.6**	**5,820**	**2,593**	**9,355**				**0.6**	**3.61**

The audit results provide varying results among the location observed. Although all investments did produce energy saving results, the results provided do not correlate positively with the investment value. In Industry I, for example, an investment of IDR 3 billion gave a result of 1.075 MWh saving potential, while in Industry IV, which invested half of Industry I, could produce a saving of three times than of Industry I. This shows that project selection is key to generating optimal CO_2 emission reductions.

Referring to Table 4-2, and it is assumed that Boiler energy consumption is accounted for 60% of total energy consumption for an industry, then it can be calculated the requirement of budget to reduce emission reduction to achieve the NDC target of 0,62 $MTCO_2e$ by 2030.

Table 4-2. Financial Calculation on Investment Required for Industry Sector 4000 – 6000 Toe

Facility	Emission Reduction, (Ton CO2)	Investment in Mn IDR per Emission Reduction, (Ton CO2)	Estimated total investment until 2030 (IDR Billion)
Boiler (60%); assumption boiler consumes 60% of the total energy in an industry	371,601	3.61	1,341
Total (100%). target emission reduction for industry consumes energy of 4000-6000 ToE	619,336	3.61	2,234

The annual requirement of investment can be seen in Table 4-3.

Table 4-3. The breakdown of annual investment for Industry Sector 4000 – 6000 ToE

Year	2024	2025	2026	2027	2028	2029	2030	Total
Investment (IDR Billion)	89	358	358	358	358	358	358	**2,234**
No. of months	3	12	12	12	12	12	12	75

Based on the above calculation, it can be summarized that to reduce **1 ton of CO_2 emission, an investment of IDR 0.28 million is required**. Therefore, to **achieve target of emission reduction of 0,62 Mton CO_2 the total investment of IDR 2.2 trillion** is expected.

4.2. Investment Projection for Energy Sector – Improved Efficiency of Home Appliances

In the sub sector of Energy Efficiency, under the activity of Improved Energy of Home Appliances, the calculation of projected investment required to achieve NDC target will focus on AC, as AC is the most energy-intensive appliance compared to others. Furthermore, according to the charts below (Figure 4-2 and Figure 4-3), the potential of GHG emission reduction of AC is the highest (29,3 $MTCO_2$) even though its projected energy consumption from 2021 to 2023 (BAU) is only 19% of the total energy consumption of 11 home appliances (smaller than lamps energy consumption).

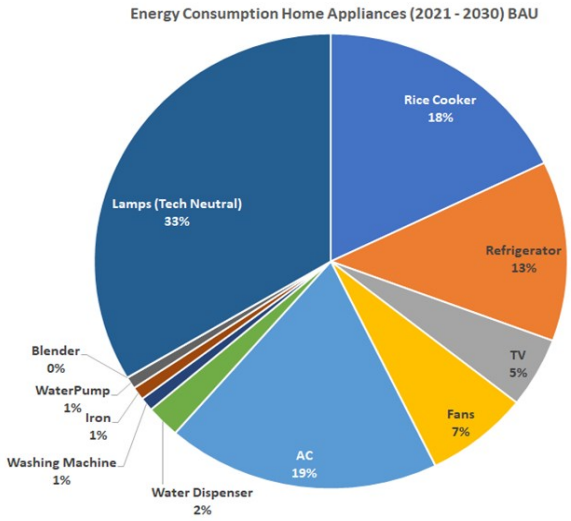

Figure 4-2. Energy Consumption Home Appliances (2021 – 2030) BAU

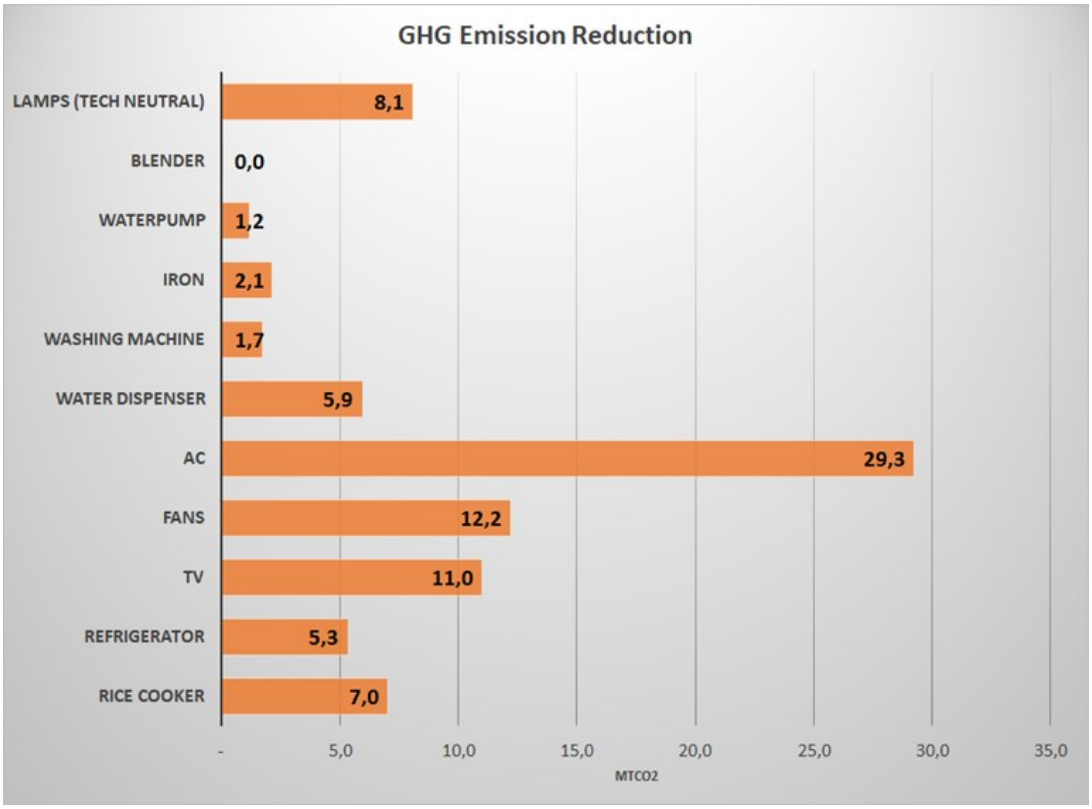

Figure 4-3. Target of GHG Emission Reduction

To assess the investment projection for improving efficiency in home appliances, following assumptions were taken into consideration:

- The national demand for installed AC is approximately 40 million units. The assumption was taken from the approximate number of families in Indonesia, coming from the total population (200 million) divided by 5 (1 family consist of 5 family member, and 1 family has 1 AC).
- From 2021 to 2030 there will be gradual shift of consumer preference towards regulated AC (the AC with energy saver technology).
- In the assumption, a market leader brand was used as an example since this brand has the highest

market share (34%) among other marketed brands in Indonesia[15]. It has a price gap of IDR 939,000, - (or 26.4%) between AC model with common feature and AC model with latest energy saving feature.

- We assume discount factor of 12%, electricity bill rate of IDR 1,445 per kWh and expect 1% increase per year starting 2025.

The calculation of the required total budget to achieve NDC target in 2030 as well as annual investment is shown in Table 4-4.

Table 4-4. Financial Calculation for AC

Year	Regulated	Unregulated	Total	+/- Regulated	+/- Unregulated	Add. Spending to Purchase Regulated AC Bn IDR	Potential Saving, Bn IDR
2019	-	22.945.423	22.947.442	-	22.945.423	-	-
2020		21.599.697	21.601.717	-	- 1.345.726	-	-
2021	3.446.500	20.802.099	24.250.620	3.446.500	- 797.598	3.236	20
2022	6.992.875	18.548.378	25.543.276	3.546.375	- 2.253.721	3.330	41
2023	10.692.733	16.172.031	26.866.787	3.699.858	- 2.376.347	3.474	62
2024	14.532.159	13.734.478	28.268.661	3.839.425	- 2.437.552	3.605	84
2025	18.486.706	11.310.178	29.798.909	3.954.548	- 2.424.300	3.713	5.396
2026	22.496.353	8.985.875	31.484.254	4.009.646	- 2.324.303	3.765	6.566
2027	26.485.862	6.856.080	33.343.969	3.989.509	- 2.129.795	3.746	7.808
2028	30.379.356	5.009.289	35.390.673	3.893.494	- 1.846.791	3.656	9.046
2029	34.124.247	3.505.978	37.632.254	3.744.891	- 1.503.311	3.516	10.262
2030	37.711.858	2.360.157	40.074.045	3.587.611	- 1.145.821	3.369	11.455
					Total	35.411	50.740

The calculation above assumes the following Unit Energy Consumption

UEC BAU	UEC MEPS	UEC MEPS Revision
784	780	582

According to the calculation shown in Table 4-4, in order achieve the emission reduction as stated in the NDC target in 2030, **consumer will have to invest IDR 35 trillion** to purchase regulated AC. This regulated AC will then have potential energy saving worth of IDR 51 trillion IDR (or +143% of investment).

The budget required to achieve emission reduction target in 2023, there are two scenarios presented in Table 4-5. The first scenario was assuming that there will be immediate replacement of AC and the second scenario considers the AC is replaced when the lifetime is ended.

It is found that in the first scenario, the simple payback period is more than 5 years (unattractive), while in the second scenario it resulted the simple payback period is 4.18 years.

[15] https://databoks.katadata.co.id/datapublish/2023/03/03/mayoritas-buatan-korsel-jepang-ini-merek-ac-paling-banyak-digunakan-konsumen-indonesia

Table 4-5. Scenarios of Investment Projection

Description	2024	2025	2026	2027	2028	2029	2030
SCENARIO 1							
Immediate Replacement	-4,499,000						
UEC Saving (KWh)		202	202	202	202	202	202
UEC Saving IDR		294,809	297,757	300,735	303,742	306,779	309,847
UEC Saving IDR (PV)		263,222	237,370	214,057	193,033	174,075	156,978
Cumulative Cash Flow (PV)		-4,235,778	-3,998,408	-3,784,351	-3,591,317	-3,417,243	-3,260,264
Payback Period (PV)	**N/A**						
SCENARIO 2							
Lifetime Replacement	-939,000						
UEC Saving (KWh)		202	202	202	202	202	202
UEC Saving IDR		294,809	297,757	300,735	303,742	306,779	309,847
UEC Saving IDR (PV)		263,222	237,370	214,057	193,033	174,075	156,978
Cumulative Cash Flow (PV)		-675,778	-438,408	-224,351	-31,317	142,757	299,736
Payback Period (PV)	**4.18**						

The Table 4-6 below shows a look at home AC value chain stakeholders and possible initiative to achieve NDC target. There are four groups of stakeholders that may be able to influence the increase of energy efficient AC in the market.

Table 4-6. A look at Home AC Value Chain Stakeholders and Possible Initiative to achieve NDC Target

	Manufacturer	Mechanical Electrical Contractor/Installer	Users (Home Owner)	Bank
Objections	""Market prefers low price AC"	"I just follow customers needs". "I don't know how to advise my customers on EE"	"It's beyond my budget"; "Payback is too long".	"Can this earn profit?"
Direct initiatives	Provide tax incentive, subsidy for R&D.	Provide incentives for designing or installing regulated AC to customers (e.g. free labor cost)	Provide trade-in scheme, and soft financing/subsidy to close the price gap of regulated AC.	Provide incentives if banks finance regulated AC for their customers.
Indirect initiatives	Testing facility, Award	Capacity building of EE; Certification	Capacity building	Capacity building on financing EE initiatives; Award.

Based on the financial model and analysis above, it can be summarized that

- Demand for AC in Indonesia is estimated to be **4.6 million units per year**, with market size 40 billion units by 2030.
- The use of SKEM AC is estimated to generate **50,4** trillion IDR savings until 2030, **94%** of market is expected to shift to SKEM AC by end of 2030.
- This move is expected to contribute to **29.3 $MtCO_2e$** of GHG emission reduction.
- Consumers will have to spend **26%** more for installing AC with new energy saving technology.
- This translates to **35,4** trillion IDR for national market, until 2030 or in average **3,5** trillion IDR per year from 2021 to 2030. The annual investment required is shown in the Table 4-7.
- Investing in AC with EE technology will take **4,2 years** payback period. This is considered unattractive for consumer.
- To accelerate and ensure the target emission is achieved, some initiatives are needed:
    - financing for purchase of new technology of AC
    - trade in scheme for exchanging old tech AC to Energy Efficient technology of AC. these

two initiatives will attract manufacturer to produce more EE AC, as the demand shift (pull factor)
- tax benefits for manufacturer to produce more EE AC (push factor)
- infrastructure to conduct test lab.
- capacity building for stakeholders in AC value chain (manufacturer, installer, ME consultant, banking, and consumer).

Table 4-7. The breakdown of annual investment for Air Conditioner

Year	<2024	2024	2025	2026	2027	2028	2029	2030	Total
Investment (IDR Billion)	10,040	3,605	3,713	3,765	3,746	3,656	3,516	3,369	**35,411**

Based on previous information from DGNREEC MEMR Directorate of Energy Conservation, the home appliances that will be regulated consist of 11 types. Assuming all categories have the same pattern, **the total investment is estimated at IDR 101 trillion** to achieve the NDC target of 83.84 MTCO2e emission reduction.

4.3. Lessons Learned from some EE Projects

4.3.1. Energy Management System Implementation of Industrial Sector

With a vision to provide a significant and reliable contribution to consumers as well as society, an F&B company had been successfully increasing productivity in the field of energy efficiency by implementing ISO 50001:2018 energy management system. The company recorded energy savings of 36% in the 2018-2020 period at one of its factories.

Key initiatives that contribute to the success are:

- Establish commitment from top management, followed by forming internal energy efficiency organization.
- Conduct 16 EE programs in the period of 2018-2020 with total investment of IDR 18 billion
- Implement life cycle cost for their procurement process.
- Actively promote and involve employees to contribute to energy efficiency thru Idea for Improvement program (IFI) and analytical thinking and continuous improvement (ATCI)
- Upgrade the production technology.
- Implement web-based energy reporting.

Table 4-7. Fact bace of Food and Beverage Industry in Indonesia

Factbase of the company	
Location	East Java - Indonesia
Type of industry	F&B
Energy Saving	104,755 GJ
Annual Cost Saving/ year	29 Bn IDR
Investment	18 Bn IDR
Payback Period	0.62
GHG Emission Reduction	4,039 TCO2

Unleashing potential from other factories.
The energy savings resulting from EnMS initiatives can be financially attractive. From the industry examples above, the average portfolio of 16 initiatives implemented in three years produces a payback period of less than one year (0.62). To produce optimal returns, industry can carry out mapping during energy audits by classifying initiatives based on the size of the investment value and the resulting savings or duration of payback.

Some key initiatives that can help to replicate the success:

- Provide free technical assistance to the focused industrial sites (pilot group) – by having officers assigned to specific group on industries. For the period of 6-9 months, these officers basically will facilitate the industry to have energy assessments, assist them in implementing the "quick win" recommendations, filling in POME report, and –if industry needs external funding- connect them with the partner Banks to fund the initiatives that need investment.
- Collaborate with banks to establish a specific financing program (beyond BAU) for this pilot group. Set up to Business Matching events to connect industry stakeholders with the financial institutions.

4.3.2. Energy Management System Implementation of Office Building

Implementations of Energy Management System (EnMS) Resulted in a 12% Reduction of Annual Energy Consumption

The GU Office Building serves as the headquarters of PTU Tbk, a company that implements the concept of sustainability. Designed with a comprehensive blend of active and passive elements, as well as advanced energy management, GU Building is a testament to the company's commitment to energy efficiency. PTU Tbk has taken the initiative to enhance energy savings by utilizing technologies that support this goal, alongside the use of renewable energy sources.

The key initiatives contributing to success were:

- establish commitment from top management, followed by assigning energy team.
- develop house of rules as the standard operating procedures for energy management implementation
- commitment to use green energy, by its compliance with RE 100
- become an active member of energy efficient buildings; organizations, such as BOMA (Building Owners and Managers Association), GBCI (Green Business Certification Inc.) and MASKEEI (Masyarakat Konservasi dan Efisiensi Energi Indonesia / Indonesian Society for Energy Efficiency and Conservation) to increase sustainability activities including energy efficiency.
- continue to conduct training on soft skills, technical skills, technical skills, leadership abilities and certifications so that employees have the knowledge, skills, and confidence to support business development support.

Table 4-8. Factbase of GU Office Building

Fact base GU Building	
Location	Banten, Indonesia
Type of building	Private office building
Energy Saving	2.186,05 MWh/year
Annual energy cost savings	IDR 273.655.064
Investment	IDR 892.200.000
GHG Emission Reduction	1.790 tCO_2/year

Committed to be 'carbon positive' in its operations by 2030.

To achieve energy efficiency goals, clear criteria and benchmarks must be established. The energy management team of GU Building has determined the key performance indicator (KPI) as follows:

Table 4-9. Key Performance Indicators GU Office Building

No	Performance Indicator	Terget/Criteria	Parameter
1	Energy Saving Target	Reduce energy consumption of the building annualy during the first 5 years	2% per year
2	Maintenance	performed 100% of equipment maintenance	4 times per year
		Recording Energy Consumption	
3	Continual improvement	Initiative of Energy Efficiency Plan	1 time per year
4	Management Practice	Energy saving campaign for the tenants	3 times per year
		Energy Management Team training	twice per year
		Energy Management Team meeting	every 6 months

In the technical side, to facilitate the building's operational system, GU Building is is equipped with a Building Management System (BMS). The BMS is used to control and monitor all equipment systems, including the MVAC system, electrical system, and water system.

Awarded as the first champion in PSBE Subroto Award 2019 and ASEAN Energy Award 2020

- It is known that MVAC is one of Significant Energy Users for building and its account about 65-70% of the total energy. GU Building is equipped with a highly efficient MVAC system. The strategies in implementing energy efficient MVAC system consists of
- Some of the chillers used are chillers with magnetic bearing compressors which has high efficiency.
- Applying Chiller Optimizing Plant as an optimization of chiller system operation and sequencing automatically based on load requirements to increase efficiency.
- Cooling tower high-efficiency low noise type.
- Fans are equipped with VSD to control operating capacity.
- Using VSD on the compressor to avoid inrush current, increase chiller lifetime, and be more efficient under part load conditions.

Figure 4-4. Chiller Optimizing Plant GU Office Building

5. Recommendations

Based on the study and analysis on how to accelerate in achieving NDC target, there are some recommendations can be considered

- **Recommendation on Enhanced Data Management.** It is urgent to provide centralized data repository to enable to track the progress of each sector involving in the EE projects that support NDC target achievement. This comprehensive perspective is instrumental in identifying areas that require special attention and strategic interventions. In addition, an enhanced data management system serves as an invaluable resource for effective monitoring and evaluation. By establishing a standardized approach to data collection, analysis, and reporting, it becomes possible to evaluate the impact of EE projects accurately. This, in turn, empowers decision-makers with the information needed to make informed adjustments and enhancements to ongoing initiatives, ensuring their continued alignment with NDC objectives.

- **Recommendation on Integrated and cross sectoral communication.** To enhance accountability and transparency, it is imperative to establish a robust reporting mechanism for non-financial support, particularly in the realms of training and technical assistance. Currently, organizations often receive assistance without financial disclosure, as it is part of a global budget. This lack of financial transparency poses challenges in monitoring and reporting, as recipients may not have full access to funding and accounting details. Therefore, implementing an integrated and cross-sectoral communication system is essential. This framework should enable comprehensive reporting, ensuring that both monetary and non-monetary support are adequately documented. By addressing this issue, organizations can foster transparency, streamline reporting processes, and strengthen accountability in the utilization of all forms of support. MEMR should provide centralized data repository to track the progress of each sector involving in the EE projects that support NDC target achievements.

- **Policy recommendations**. The provision of policy recommendations is paramount for the establishment of an enhanced sectoral financial architecture. This comprehensive framework will encompass crucial elements such as tax reforms and market mechanisms. Drawing from international best practices, these recommendations will strategically address identified barriers, ensuring the selection of optimal policy options. The objective is to formulate a robust policy that not only catalyses investment in EE projects but also enhances the overall environment, making it more appealing for both public and private sectors. By aligning with global standards, this policy framework seeks to foster an environment that attracts increased investments in the energy sector, thereby propelling sustainable growth and innovation. Examples of additional policy and regulations include mandating internal energy managers and energy monitoring activities based on company annual revenues, improvements on electricity consumer tariff structure, individual competency certifications for energy consumption modelling at the facility level.

- **Bureaucracy Recommendation.** International and national financial institution should actively support EE projects through simplified procedures, which need government regulations, monitoring, and policy intervention. A critical aspect involves revisiting public procurement practices to facilitate and empower increased public spending on energy efficiency endeavours. Additionally, a comprehensive review of the support framework for public-private partnerships (PPPs) is essential. The current structure, primarily tailored for large infrastructure projects, proves challenging for the application to energy efficiency projects due to lower investment levels and a

lack of clear measurement metrics, amplifying the risk for financial institutions. Exploring potential exceptions or conditions under which local authorities and public entities can enter energy savings contracts exceeding one year is crucial. This adaptation would allow for multi-year contracts and budgeting, thereby fostering the growth of the local energy efficiency market. Energy monitoring and reporting to POME should be required under new MEMR regulations that includes a uniform monitoring framework and energy use reporting.

- **Insurance.** Energy Saving Insurance is useful to increase the bank's confidence that energy efficiency projects can be properly risk-controlled through insurance coverage. The insurance guarantees that the energy saving performance will be in accordance with the initial design submitted to the bank. Energy Saving Insurance products are normally utilized to further lower the risks and therefore cost of money so EE investments can be incentivized. ESI should not be used and is not a good fit to make up for the incompetencies of ESCO companies in developing bankable EE projects. ESI product providers should be encouraged to collaborate with MEMR to develop the standards, requirements, and guidelines of developing EE projects that are eligible for normal ESI products. The standards, requirements and guidelines need to be published to the public by MEMR.

- **Capacity Building.** Awareness raising and upgrading knowledge regarding the importance of the benefits of energy efficiency, including potential cost savings and environmental impact. Raise awareness of the NDC program among the private sector and domestic donors: engaged with industry and other banks and financial institutions in the country to present details of NDC activities; and promote and achieve commitment to the private sector's role in realizing and financing identified areas. The most important capacity development to scale up EE investment is for ESCO companies to develop bankable EE projects. This need to be supported by additional capacity development for companies, businesses, and industries to monitor, report, and manage their own energy consumption. Lastly, capacity development for the public at large regarding energy efficiency, energy consumption, and how to properly select low energy /energy efficient appliances to lower their energy spending.

Issue	Recommendation	Follow Up Activities
Data Management	Enhanced Data Management.	-provide centralized data repository to enable to track the progress of each sector involving in the EE projects that support NDC target achievement
		- establishing a standardized approach to data C10 analysis, and reporting
Governance	Integrated and cross sectoral communication	Design and implement a non-financial support communication framework involving cross-sector parties.
	Improvement Bureaucracy System	Review public procurement practices to facilitate and empower increased public spending in energy efficiency businesses that can last multi years. Design and implement more appropriate policies to accelerate the implementation of energy efficiency programs.
	Partnership	Design and implement an industrial technical assistance and support (TAS) program with the goal of helping industry re-implement EnMS best practices and accelerate the realization of emissions reduction potential
Policy	Establish an enhanced sectoral financial architecture	Conducting a review of best practices in the world, especially those relating to financing/investment architecture to provide recommendations for government policy making.
Finance	Insurance for EE Projects	Conduct a feasibility study on implementing the EE insurance program by involving related stakeholders
Capacity Building	Stakeholders' capacity building	Develop an analysis of the needs of parties related to the implementation of Energy Efficiency for each focus area, followed by designing initiatives and forms of capacity building for each party.
		Conduct and monitor the capacity building initiatives.
SKEM	Revision UEC number	Make an analysis of SKEM that is suitable for the Indonesian.

Table 5-1. Recommendations Proposed Follow Up Activities