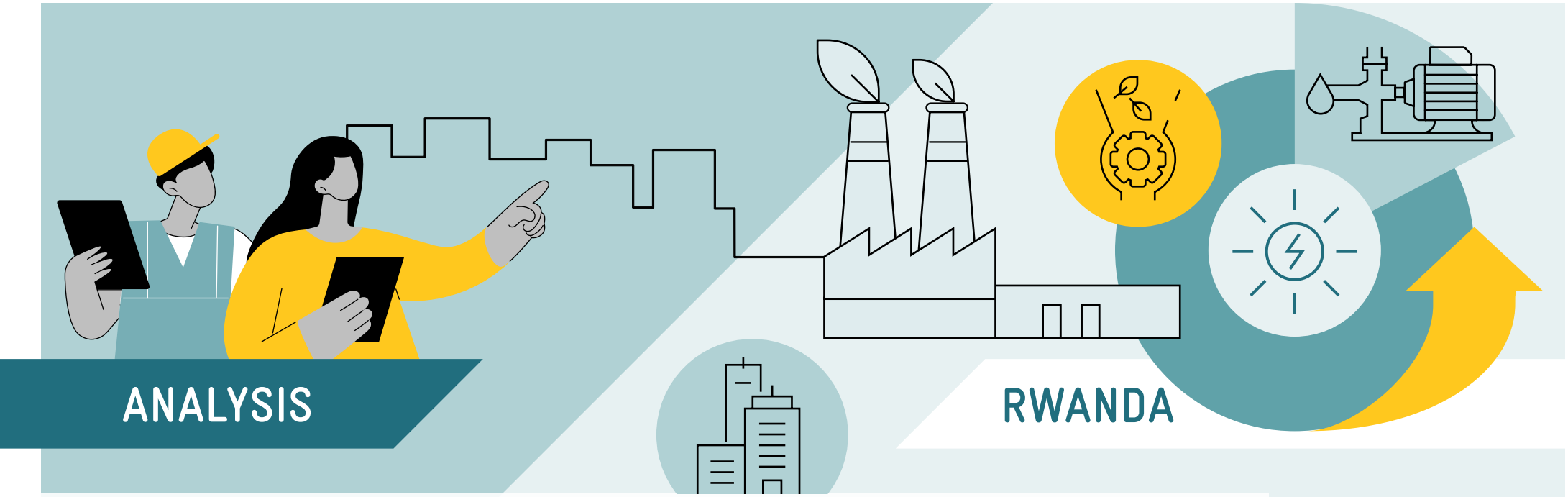

Sector Analysis Rwanda

Energy Efficiency in Commercial and Industrial Sectors

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

This publication was commissioned by the German Energy Solutions Initiative of the German Federal Ministry for Economic Affairs and Energy (BMWE)

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Abbreviations/acronyms

BEMS	Building energy management system
C&I	Commercial and industrial
COP	Coefficient of performance
EE	Energy efficiency
EMS	Energy management system
EPC	Engineering, procurement and construction
ESCO	Energy service company
ESP	Energy service provider
EU	European Union
GDP	Gross domestic product
GGGI	Global Green Growth Institute
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GoR	Government of Rwanda
HVAC	Heating, ventilation and air conditioning
ICT	Information and communication technology
IE1, IE3, IE4	International Efficiency Classes for motors
IRENA	International Renewable Energy Agency
LCPDP	Least Cost Power Development Plan
LED	Light emitting diode
MEPS	Minimum energy performance standards
MINECOFIN	Ministry of Finance and Economic Planning
MINICOM	Ministry of Trade and Industry
MININFRA	Ministry of Infrastructure
MRV	Monitoring, reporting and verification
MVE	Monitoring, verification and enforcement
NISR	National Institute of Statistics of Rwanda
NST2	National Strategy for Transformation
PPP	Public–private partnership
PV	Photovoltaic
RDB	Rwanda Development Board
REG	Rwanda Energy Group
REMA	Rwanda Environment Management Authority
RICA	Rwanda Inspectorate, Competition and Consumer Protection Authority
RRA	Rwanda Revenue Authority
RSB	Rwanda Standards Board
RSEER	Rwanda seasonal energy efficiency ratio
RURA	Rwanda Utilities Regulatory Authority
SEZ	Special economic zone
SMEs	Small and medium-sized enterprises
ToU	Time of use
VAT	Value added tax
VRF	Variable refrigerant flow
VSD	Variable speed drive

Currency units

RWF	Rwandan franc
EUR	Euro
USD	United States dollar

Conversion rate as of 18.09.2025

USD 1 = RWF 1,448

RWF 1 = USD 0.00069

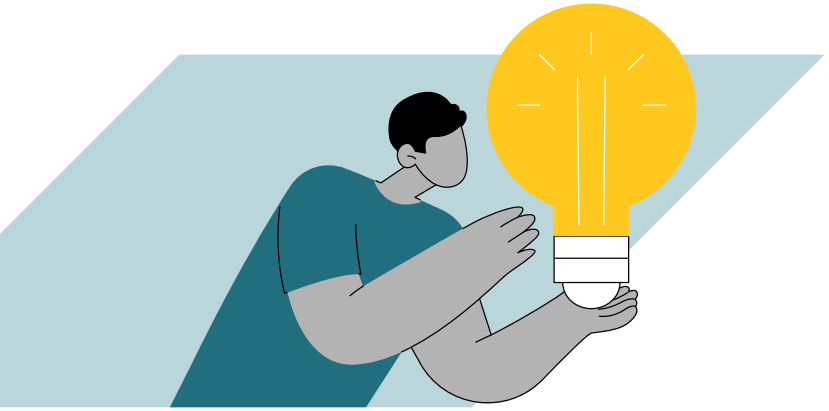
EUR 1 = RWF 1,711

RWF 1 = EUR 0.00058

Source: https://www.xe.com/currencyconverter/

Technical units

%	Per cent/percentage
°C	Degree Celsius
GWh	Gigawatt hour
km²	Square kilometre
kVA	Kilovolt-ampere
kW	Kilowatt
kWh	Kilowatt hour
m²	Square metre
MW	Megawatt
tCO_2e	Tonne of carbon dioxide equivalent
TWh	Terawatt hour



ENERGY SOLUTIONS – MADE IN GERMANY

The German Energy Solutions Initiative

The German Energy Solutions Initiative of the German Federal Ministry for Economic Affairs and Energy (BMWE) aims to globalise German technologies and expertise in climate-friendly energy solutions.

Years of promoting smart and sustainable energy solutions in Germany have led to a thriving industry known for world-class technologies. Thousands of specialised small and medium-sized enterprises (SMEs) focus on developing renewable energy systems, energy efficiency solutions, smart grids, and storage technologies. Cutting-edge energy solutions are also built on emerging technologies such as power-to-gas, fuel cells, and green hydrogen. The initiative's strategy is shaped around ongoing collaboration with the German business community.

The initiative creates benefits for Germany and the partner countries by:

- boosting global interest in sustainable energy solutions
- encouraging the use of renewables, energy efficiency technologies, smart grids, and storage technologies, while facilitating knowledge exchange and capacity building
- enhancing economic, technical and business cooperation between Germany and partner countries

THE PROJECT DEVELOPMENT PROGRAMME (PDP)

PDP is a key pillar of the German Energy Solutions Initiative and is implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. It connects development cooperation with private-sector engagement and supports climate-friendly energy solutions in selected developing and emerging countries, enabling local businesses to adopt solutions in energy efficiency, electricity and heat supply, and hydrogen, while facilitating market access for German solution providers.

Developing and emerging economies offer promising business potential for climate-friendly energy solutions but also pose challenges for international business partners. The PDP team works closely with local industries to develop financially viable projects by providing technical expertise, financial guidance, and networking opportunities.

It identifies project leads, collects and analyses energy consumption data, and assesses projects from both a technical and economic perspective. This includes outlining the business case, calculating payback periods, and evaluating profitability. Companies can then choose to finance projects using their own funds or explore leasing and other financing options. PDP provides cost-free advice to local companies and connects them with German solution providers for project implementation.

Additionally, by offering training, organising reference project visits, and publishing studies on the potential of climate-friendly solutions and on navigating regulatory frameworks, the programme supports market development and fosters private-sector cooperation.

Executive summary

Rwanda's rising energy demand, driven by industrialisation, urban expansion and increasing access to essential services, presents a timely opportunity to scale up energy efficiency (EE) as a strategic pathway for reducing energy intensity and supporting low-carbon development. This market assessment identifies three priority sectors with high potential for EE interventions: agro-processing, water pumping and treatment infrastructure, and commercial and institutional buildings.

The assessment identifies widespread inefficiencies in energy use, with significant potential for energy savings and greenhouse gas (GHG) emission reductions. Outdated equipment, including motors, boilers, pumps and heating, ventilation and air conditioning (HVAC) systems, is prevalent across industries and facilities. Potential improvements in energy performance range from 20% to 50%, depending on the sector and technology.

- In agro-processing, substantial energy savings can be achieved through modernisation of drying systems, boiler upgrades and motor replacements
- In the water sector, large-scale energy use in irrigation, pumping and treatment systems can be reduced through variable speed drives (VSDs), high-efficiency motors and automation
- In commercial and institutional buildings, EE improvements in lighting, cooling and ventilation systems offer immediate benefits in reduced electricity demand and operational costs

Achieving these energy savings will also yield considerable climate co-benefits. By improving system efficiency, Rwanda can significantly

Zusammenfassung

Angetrieben von Industrialisierung, Urbanisierung und dem größer werdenden Zugang zu grundlegenden Dienstleistungen steigt Ruandas Energiebedarf. Dies eröffnet die günstige Gelegenheit, Energieeffizienz (EnEff) als strategischen Ansatz auszubauen: für die Senkung der Energieintensität und die Unterstützung einer kohlenstoffarmen Entwicklung. Die vorliegende Marktanalyse identifiziert drei vorrangige Sektoren, die über ein hohes Potenzial für EnEff-Maßnahmen verfügen: Agrarverarbeitung, Wasserpump- und Wasseraufbereitungsinfrastruktur sowie gewerbliche und institutionelle Gebäude.

Die Analyse zeigt weit verbreitete Ineffizienzen im Energieeinsatz auf. Hier liegt ein erhebliches Potenzial für Energieeinsparungen und die Reduzierung von Treibhausgasemissionen (THG). Veraltete Geräte wie Motoren, Kessel, Pumpen sowie überholte Heizungs-, Lüftungs- und Klimatechnik) sind in vielen Branchen und Einrichtungen verbreitet. Die Möglichkeiten zur Verbesserung der Energieeffizienz liegen je nach Sektor und Technologie zwischen 20 % und 50 %.

- In der Agrarverarbeitung können erhebliche Energieeinsparungen durch die Modernisierung von Trocknungssystemen, die Erneuerung von Kesseln und den Austausch von Motoren erzielt werden.
- Im Wassersektor lässt sich der große Energieverbrauch in Bewässerungs-, Pump- und Aufbereitungssystemen deutlich reduzieren: durch den Einsatz von Drehzahlregelungen (VSDs), hocheffizienten Motoren und Automatisierung.
- In gewerblichen und institutionellen Gebäuden bieten Effizienzsteigerungen bei Beleuchtung, Kühlung und Belüftungssystemen unmittelbare Vorteile in Form geringeren Stromverbrauchs und reduzierter Betriebskosten.

reduce its CO_2 emissions while minimising the need for new generation capacity, thus aligning with national climate commitments and low-carbon development goals.

STRATEGIC OPPORTUNITY FOR GERMAN AND OTHER EUROPEAN COMPANIES

Rwanda presents a compelling first-mover opportunity for German/European EE companies entering an emerging market with exceptional potential. The country has established a supportive regulatory framework for EE, including Minimum Energy Performance Standards (MEPS) aligned with European Union (EU) frameworks, Value Added Tax (VAT) exemptions for certified energy-efficient equipment, and preferential corporate tax rates (15% vs. 30% standard) for energy investments.

German/European expertise in high-efficiency motors, automation systems, industrial heat recovery and building energy management directly addresses Rwanda's identified technical gaps and aligns with national development priorities. Rwanda consistently ranks among the top African countries for ease of doing business, offering 100% foreign ownership, streamlined company registration (under 15 working days) and one-stop investment facilitation through the Rwanda Development Board (RDB).

Rwanda has already taken foundational steps to promote EE, including the development of MEPS, energy audits and EE guidelines. The forthcoming Energy Law and the planned establishment of a national Super Energy Service Company (ESCO) will further strengthen implementation capacity and investment readiness, creating additional market entry opportunities for German/European technology providers and service companies.

Die Realisierung dieser Energieeinsparungen bringt zudem erhebliche Klimavorteile mit sich. Durch eine Steigerung der Systemeffizienz kann Ruanda seine CO_2-Emissionen deutlich senken und gleichzeitig den Bedarf an zusätzlicher Erzeugungskapazität verringern – und sich so im Einklang mit den nationalen Klimaverpflichtungen und Zielen für eine kohlenstoffarme Entwicklung positionieren.

STRATEGISCHE CHANCEN FÜR DEUTSCHE UNTERNEHMEN

Ruanda bietet eine attraktive First-Mover-Chance für in Deutschland ansässige Energieeffizienzunternehmen, die in einen aufstrebenden Markt mit außergewöhnlichem Potenzial eintreten möchten. Das Land hat einen unterstützenden regulatorischen Rahmen für EnEff etabliert, darunter Mindestenergieeffizienzstandards (MEPS) in Anlehnung an EU-Vorgaben, Mehrwertsteuerbefreiungen für zertifizierte energieeffiziente Geräte und präferenzielle Körperschaftsteuersätze (15 % gegenüber 30 % regulär) für Energieinvestitionen.

Deutsche Expertise bei hocheffizienten Motoren, Automatisierungssystemen, industrieller Wärmerückgewinnung und Gebäudemanagementsystemen für Energie adressiert direkt die in Ruanda identifizierten technischen Lücken und steht im Einklang mit den nationalen Entwicklungsprioritäten. Ruanda gehört dauerhaft zu den afrikanischen Spitzenreitern beim Ease of Doing Business und bietet 100 % ausländisches Eigentum, eine vereinfachte Unternehmensregistrierung (unter 15 Arbeitstagen) sowie die zentrale Investitionsförderung über das Rwanda Development Board.

Ruanda hat bereits grundlegende Schritte zur Förderung von EnEff unternommen, darunter die Einführung von MEPS, Energieaudits und EnEff-Leitlinien. Das anstehende Energiewirtschaftsgesetz sowie die geplante Einrichtung einer nationalen Super-Energy-Service-Company (ESCO)

CHALLENGES AND MARKET DEVELOPMENT NEEDS

However, several challenges remain: limited awareness and technical capacity, the absence of viable ESCO models and inadequate financing mechanisms continue to constrain market growth. For German/European companies, these challenges present opportunities to establish market leadership through capacity building investments, partnerships with local engineering firms and demonstration projects that showcase technology performance and build market confidence.

The evolving regulatory framework, while presenting some uncertainty, offers German/European companies the opportunity to engage early with regulatory processes and influence market development standards. Initial projects may require companies to bring their own financing structures or partner with development finance institutions, although the planned Super ESCO model and the Energy Efficiency Revolving Fund will facilitate project aggregation and provide access to concessional financing.

Overcoming these barriers will require coordinated efforts across government, the private sector and development partners. For German/European firms with proven EE expertise and long-term market development vision, Rwanda represents an exceptional opportunity to establish market leadership in one of Africa's most promising EE markets, combining strong government support with substantial technical potential and first-mover advantages.

werden die Umsetzungskapazitäten und Investitionsbereitschaft weiter stärken und zusätzliche Markteintrittsmöglichkeiten für deutsche Technologieanbieter und Dienstleistungsunternehmen schaffen.

HERAUSFORDERUNGEN UND ANFORDERUNGEN AN DIE MARKTENTWICKLUNG

Dennoch bestehen mehrere Herausforderungen: Begrenztes Bewusstsein und mangelnde technische Kapazitäten, das Fehlen tragfähiger ESCO-Modelle sowie unzureichende Finanzierungsmechanismen bremsen weiterhin das Marktwachstum. Für deutsche Unternehmen ergeben sich daraus Chancen, durch Investitionen in den Kapazitätsaufbau, Partnerschaften mit lokalen Ingenieurbüros und Demonstrationsprojekte Marktführerschaft aufzubauen, indem sie die Leistungsfähigkeit ihrer Technologien aufzeigen und Marktvertrauen schaffen.

Der sich weiterentwickelnde regulatorische Rahmen bringt zwar gewisse Unsicherheiten mit sich, bietet deutschen Unternehmen jedoch die Möglichkeit, frühzeitig in Regulierungsprozesse einzusteigen und Standards für die Marktentwicklung mitzugestalten. Erste Projekte könnten es erforderlich machen, dass Unternehmen eigene Finanzierungsstrukturen mitbringen oder mit Institutionen für Entwicklungsfinanzierungen kooperieren. Das geplante Super-ESCO-Modell sowie ein EnEff-Revolving-Fund werden jedoch die Projektbündelung erleichtern und den Zugang zu konzessionärer Finanzierung ermöglichen.

Die Überwindung dieser Hürden erfordert koordinierte Anstrengungen von Regierung, Privatsektor und Entwicklungspartnern. Für deutsche Unternehmen mit ausgewiesener EnEff-Expertise und einer langfristigen Marktentwicklungsvision stellt Ruanda eine außergewöhnliche Gelegenheit dar, ihre Marktführerschaft in einem vielversprechenden EnEff-Märkte Afrikas zu etablieren – getragen von starker staatlicher Unterstützung, erheblichem technischem Potenzial und First-Mover-Vorteilen.

1

Legal and regulatory framework

Rwanda has made EE a core element of its sustainable development agenda, embedding it in national energy, climate and industrial policies to drive economic growth while lowering GHG emissions. With energy demand rising rapidly in industrial, commercial and public sectors, the government has developed a regulatory framework that promotes efficient technologies, enforces performance standards and encourages private sector investment in energy saving solutions (MININFRA, 2025).

This chapter provides an overview of the policies, regulations and institutional structures that shape Rwanda's EE landscape, the gaps identified and future developments needed to accelerate progress. Together, these measures form the enabling environment for scaling EE adoption and set the foundation for the commercial and industrial (C&I) sector analysis presented in the following chapter.

TABLE 1. Specific EE targets set by the Government of Rwanda (GoR) for 2035

Target area	Objective for 2035
Industrial EE	Reduce specific energy consumption by 25%
Energy audits	100% of public institutions audited by 2026
EE appliances (non-lighting)	80% market penetration for compliant products
Super ESCO projects	Implement energy audits in at least 100 institutions

Source: (MININFRA, 2025), (MININFRA & GGGI, 2023), (RSB, 2023)

1.1 Rwanda's EE regulatory framework

Rwanda's EE regulatory framework has evolved to support the transition towards a low-carbon and energy-efficient economy. This is particularly relevant in the industrial, commercial and public sectors, where energy demand is growing rapidly. The framework consists of policy instruments, technical regulations and institutional mechanisms that aim to promote the adoption of energy-efficient technologies, enforce compliance and encourage behavioural changes among consumers and suppliers. This section outlines the current and future landscape of Rwanda's EE regulatory instruments and the institutions tasked with their implementation.

Rwanda has put in place several sets of regulations and policies that establish the foundations for EE and MEPS. These include:

- **National Energy Efficiency Strategy (2016):** Developed by the Ministry of Infrastructure (MININFRA), the strategy outlines a national approach to enhancing energy productivity across sectors, particularly in buildings, industries and public lighting. It promotes energy audits, awareness campaigns and equipment retrofits (MININFRA, 2016).
- **MEPS and labelling:** MEPS for lighting, including street lighting, are fully approved and implemented. These are complemented by an energy labelling system modelled after the EU framework, which helps guide consumer choices and supports market transformation (RSB, 2023).
- **MEPS for electric motors:** Rwanda has developed MEPS for electric motors, although these currently exclude VSDs. The standards were approved by MININFRA but are pending formal standardisation and publication by the Rwanda Standards Board (RSB), which means that they are not yet enforceable.
- **Energy Efficiency Building Code (2019):** This code sets energy performance benchmarks for commercial and institutional buildings, including criteria for lighting, insulation, HVAC and equipment (GoR, 2019).
- **National Cooling Strategy (2018):** This strategy sets MEPS for air conditioners based on the Rwanda Seasonal Energy Efficiency Ratio (RSEER) and establishes a national labelling and registration system for cooling appliances (REMA, 2019).
- **Consumer protection role:** The Consumer Protection Unit, under the Ministry of Trade and Industry (MINICOM), ensures that energy performance labels are clear, accessible and reliable with a view to safeguarding consumer interests and preventing the entry of substandard products into the Rwandan market.
- **Lack of a monitoring, verification and enforcement (MVE) framework:** A critical gap in the current setup is the absence of an MVE framework, which hinders effective monitoring of compliance with MEPS and energy audits. This remains a priority area for regulatory strengthening.

1.2 Institutional framework

Rwanda's successful deployment of MEPS depends on a coordinated framework of institutions, each with a clear mandate under national law.

- **MININFRA:** Leads policy formulation and national strategy for EE, including MEPS adoption. It oversees the rollout of standards, such as those for motors (VSD inclusion pending), lighting and cooling (MININFRA, 2016).
- **Rwanda Energy Group (REG):** State-owned holding company comprising:
  - Energy Utility Corporation Limited (EUCL): Manages electricity distribution, billing and customer service
  - Energy Development Corporation Limited (EDCL): Oversees power generation and transmission infrastructure (REG, 2024)
- **Rwanda Standards Board (RSB):** Law No. 50/2013 of 28 June 2013 establishing the RSB and determining its mission, organisation and functioning. This legislation provides the RSB with legal personality and administrative and financial autonomy and defines its mandate to develop and publish national standards, including EE labels, conduct conformity assessments, coordinate stakeholder consultation and support market readiness (GoR, 2013a).
- **Rwanda Utilities Regulatory Authority (RURA):** Established under Law No. 09/2013, RURA regulates the energy sector, including licensing, compliance monitoring and tariff oversight. Its authority extends to enforcing MEPS once an MVE framework is operational (GoR, 2013b).
- **Rwanda Development Board (RDB):** Facilitates private investment and public–private partnerships (PPPs) (RDB, 2023).
- **Rwanda Inspectorate, Competition and Consumer Protection Authority (RICA):** Established under Law No. 31/2017, RICA ensures product quality and fair competition and protects consumers. This includes oversight of energy labels, standards conformity and sanctioning non-compliance (GoR, 2017).
- **Import control and inspection agencies (Rwanda Revenue Authority (RRA) and RSB):** Inspect and verify energy labelled appliances and MEPS compliance at the border, preventing non-conforming products from entering the market.
- **Planned Super ESCO:** Designed to support large-scale MEPS enforcement by financing and implementing efficient projects. Aggregates demand, de-risks investment and mobilises private sector participation (MININFRA & GGGI, 2023).

These institutions form the backbone of Rwanda's MEPS implementation strategy and lay the foundation for future enhancements, such as robust MVE mechanisms and expanded digital compliance platforms.

1.3 Regulatory gaps and future developments

Rwanda is in the process of expanding and consolidating its EE regulations. Key expected developments include:

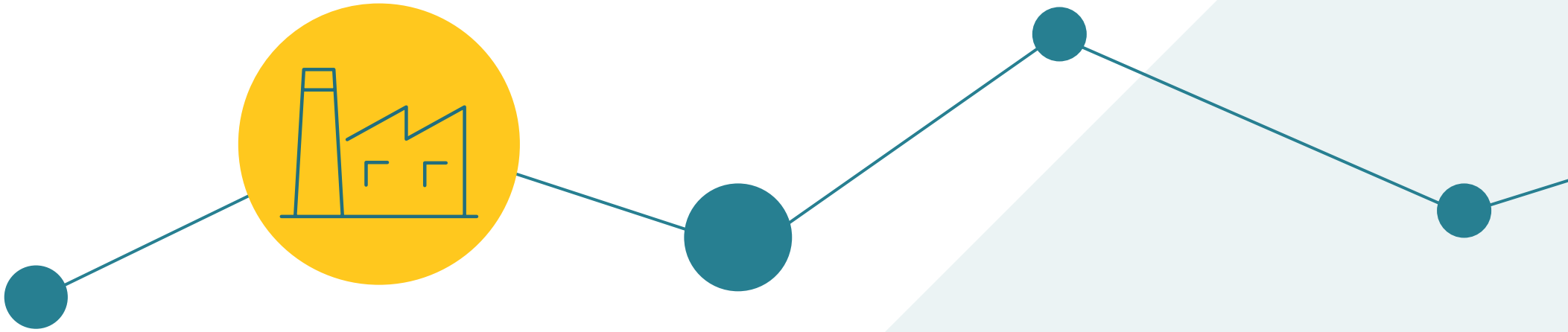
- **Finalisation and standardisation of motor MEPS:** The inclusion of VSDs and standardisation of motor MEPS through the RSB will enable legal enforcement and stimulate demand for efficient motor systems in the industrial sector (MININFRA, 2023).
- **Development of an MVE framework:** Establishing a comprehensive MVE framework will be essential for ensuring that MEPS are observed and that actual energy savings are achieved and reported.
- **Super ESCO operationalisation:** GoR, with support from development partners such as the Global Green Growth Institute (GGGI), is finalising plans for a Super ESCO model. This institution will implement large-scale EE projects, aggregate demand, bridge financing and address technical aspects (MININFRA & GGGI, 2023).
- **Expansion of MEPS:** Future MEPS will extend to refrigerators, fans, industrial boilers and other key appliances, providing a more comprehensive regulatory foundation.
- **Digital tools and compliance platforms:** New regulatory tools will likely include digital platforms for compliance tracking, performance reporting and appliance registration.
- **Alignment with national climate and development goals:** EE will continue to be mainstreamed into Rwanda's National Strategy for Transformation (NST2) and its Nationally Determined Contributions to the Paris Agreement (UNFCC, 2020)

2

Overview of C&I sectors

Rwanda's C&I sectors are key drivers of economic growth and among the largest electricity consumers. Their expansion is shaped by structural transformation towards industry and services, rising urbanisation and growing demand for modern infrastructure. National policies, including the 2025 Energy Policy and the NST2, place strong emphasis on universal access to affordable, reliable and sustainable energy, with EE recognised as a critical tool for reducing costs, improving competitiveness and supporting climate resilience (MININFRA, 2025).

The C&I sectors including agro-processing, water pumping and treatment, and the service industry operate within an energy system that is diversifying in terms of supply, integrating renewable energy and modernising infrastructure. However, seasonal variability in hydropower output, rising fuel prices and cost pressures on the national utility highlight the importance of demand-side solutions. EE measures feature prominently in the Least Cost Power Development Plan (LCPDP) to enhance supply security, lower operational costs and reduce GHG emissions. The following sections outline the institutional framework, supply and demand trends and tariff structures that shape energy use in C&I sectors, providing the basis for the detailed efficiency potential analysis presented in later chapters (REG, 2023).



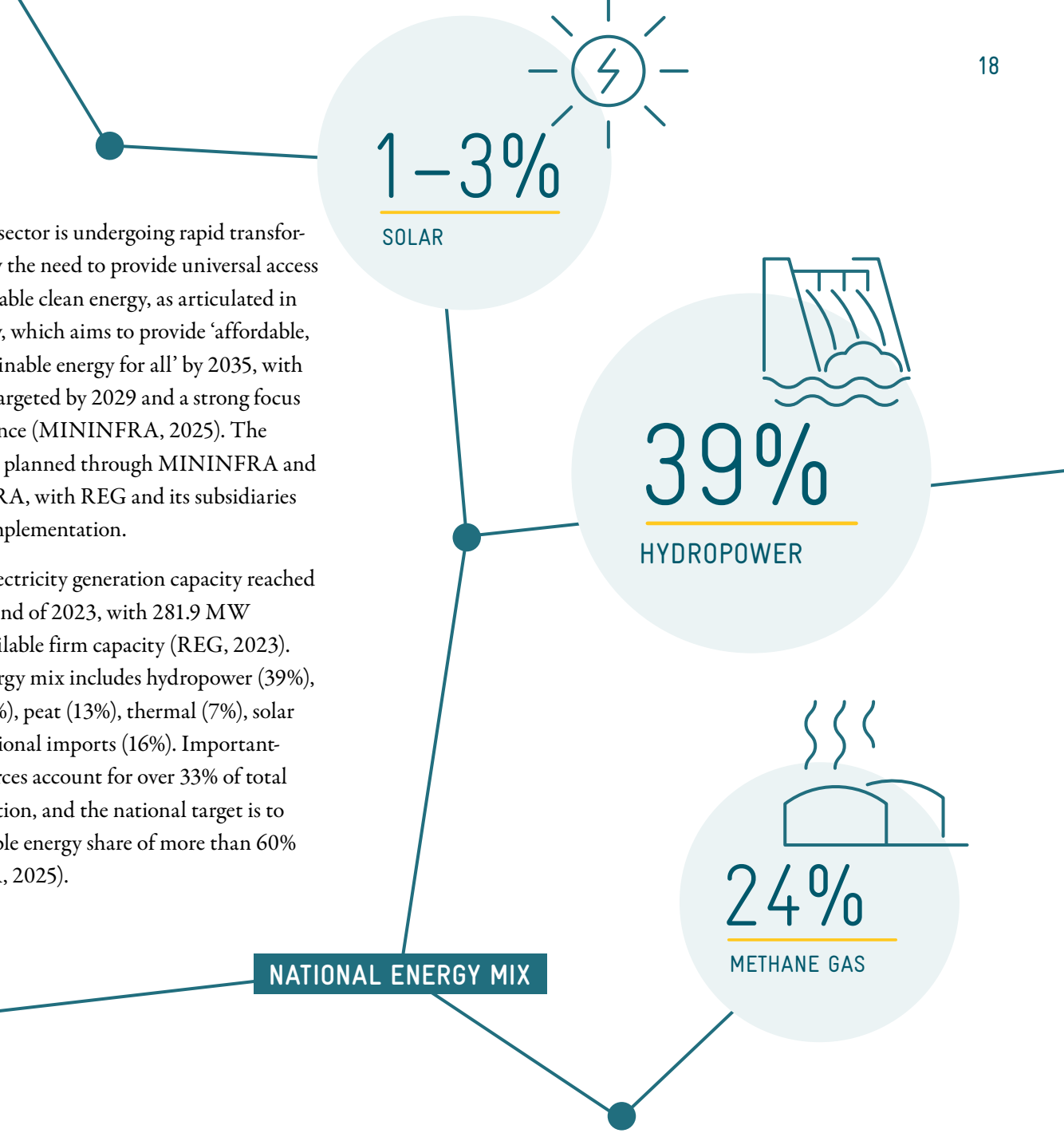
2.1 General information

The Republic of Rwanda is a landlocked country situated in Central Africa, bordered by Uganda, Tanzania, Burundi and the Democratic Republic of the Congo. It covers an area of 26,338 km^2 and is home to a population of approximately 13.25 million (NISR, 2022), making it one of the most densely populated countries in Africa, with over 500 inhabitants per km^2. Rwanda is characterised by a predominantly young population, with a median age of 22.7 years, a growing urbanisation rate that is influencing energy consumption patterns, industrial growth and increasing demand for modern infrastructure.

Over the last two decades, Rwanda has made significant economic strides, achieving average annual gross domestic product (GDP) growth of 8.3% and setting ambitious targets under its NST2 to maintain 9.1% annual growth between 2024 and 2029. The country's economic development is strongly linked to increased access to modern energy services, with electricity consumption per capita showing a near one-to-one correlation with GDP growth over the past 25 years.

Rwanda's energy sector is undergoing rapid transformation, driven by the need to provide universal access to affordable, reliable clean energy, as articulated in the Energy Policy, which aims to provide 'affordable, reliable and sustainable energy for all' by 2035, with universal access targeted by 2029 and a strong focus on climate resilience (MININFRA, 2025). The sector is centrally planned through MININFRA and regulated by RURA, with REG and its subsidiaries responsible for implementation.

Total installed electricity generation capacity reached 400 MW at the end of 2023, with 281.9 MW considered as available firm capacity (REG, 2023). The national energy mix includes hydropower (39%), methane gas (24%), peat (13%), thermal (7%), solar (1%–3%) and regional imports (16%). Importantly, renewable sources account for over 33% of total electricity generation, and the national target is to achieve a renewable energy share of more than 60% by 2030 (IRENA, 2025).

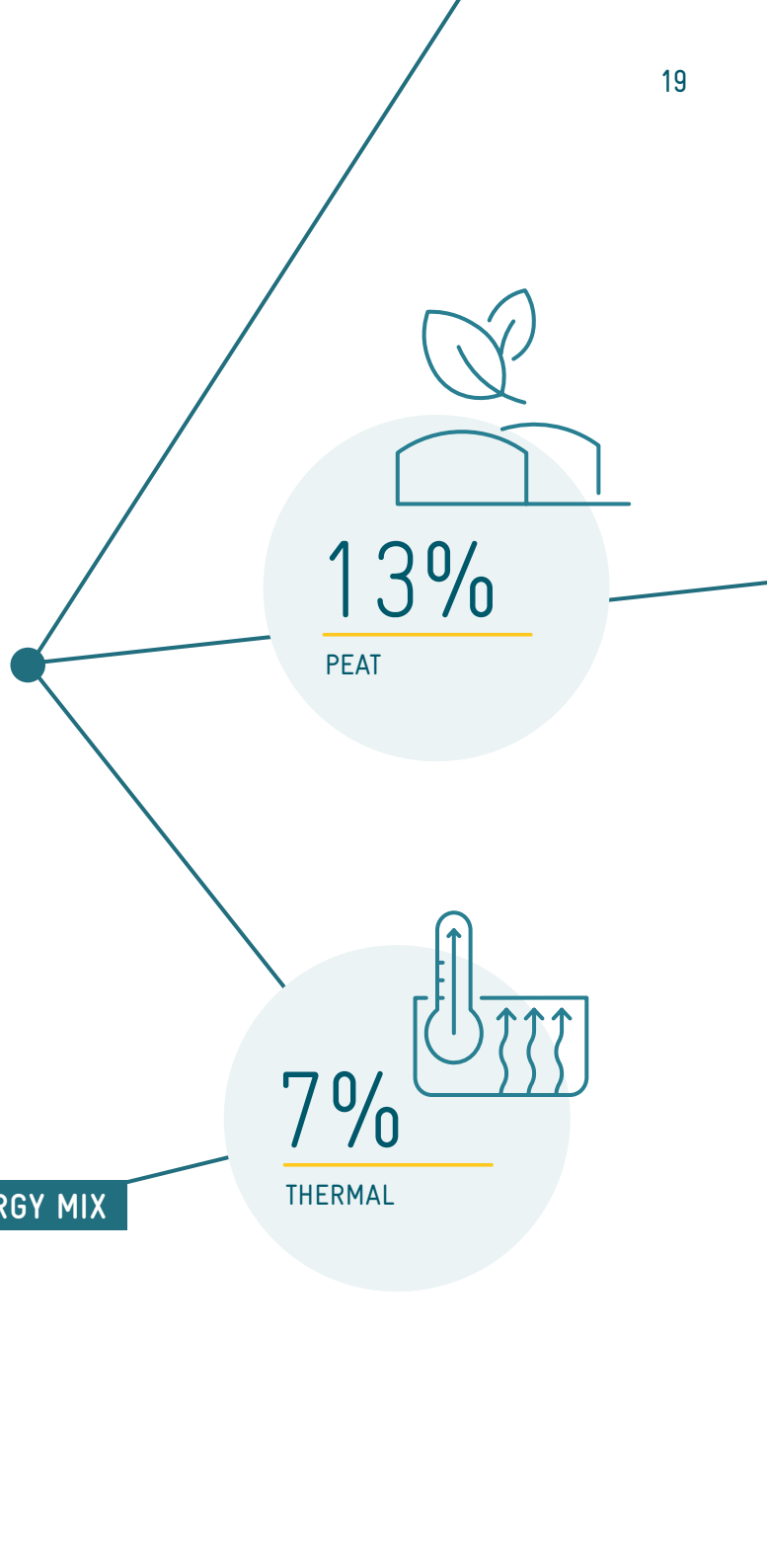


Given Rwanda's reliance on small-scale power generation and the high costs associated with peak demand supply, particularly during dry seasons when hydropower capacity declines, EE has emerged as a strategic imperative. The government is actively promoting demand-side management, as emphasised in the LCPDP, to reduce system costs. This includes MEPS for key appliances and equipment and encouraging private sector investment in generation, off-grid technologies and energy-efficient solutions across residential and C&I sectors.

The C&I sectors, comprising agro-processing, water pumping and treatment, and the broader service industry, are central to Rwanda's economic growth and among the largest electricity consumers. They present significant opportunities for EE adoption, offering cost savings, operational improvements and GHG emission reductions. However, uptake remains constrained by financing barriers, low technical capacity and limited enforcement of performance standards.

Rwanda's energy planning framework, anchored in the Model for Energy System Supply Alternatives and their Environmental Impact (MESSAGE), promotes least-cost generation, climate resilience and optimised energy use. This provides a clear foundation for assessing the market potential of energy-efficient technologies, identifying investment opportunities and aligning private sector efforts with national development priorities.

This market assessment aims to map the current EE technology landscape in Rwanda's C&I sectors, analyse current adoption trends and evaluate barriers and enablers for scaling up the use of such technologies. Its findings are intended to inform national strategies for EE, improving energy security, strengthening investment readiness and supporting Rwanda's transition towards a low-carbon, inclusive economy.



2.2 Energy supply and demand in C&I sectors

Rwanda's C&I sectors operate within an evolving energy supply system that has grown steadily in capacity, diversified in its generation mix and is increasingly shaped by the need for climate-resilient and efficient energy use. This section outlines the institutional framework, supply profile and demand characteristics that influence C&I energy consumption patterns.

2.2.1 Electricity supply profile

As of February 2025, Rwanda's installed electricity generation capacity stood at 406.4 MW, up from 353 MW in 2022/2023, an increase largely driven by solar photovoltaic (PV) and methane gas projects, alongside hydropower expansions (REG, 2024). The supply mix is shown in the table on the right.

Renewables account for roughly one third of installed capacity and more than half of actual generation. Large-scale projects, such as Nyabarongo II (43.5 MW) and Rusumo Falls (80 MW), are expected to enhance supply security by 2027 (IRENA, 2025). However, hydropower's seasonality creates vulnerability during dry periods, often requiring costly thermal generation or imports to meet peak demand.

TABLE 2. Installed generation capacity by technology

Source: (MININFRA, 2025), (MININFRA & GGGI, 2023), (RSB, 2023)

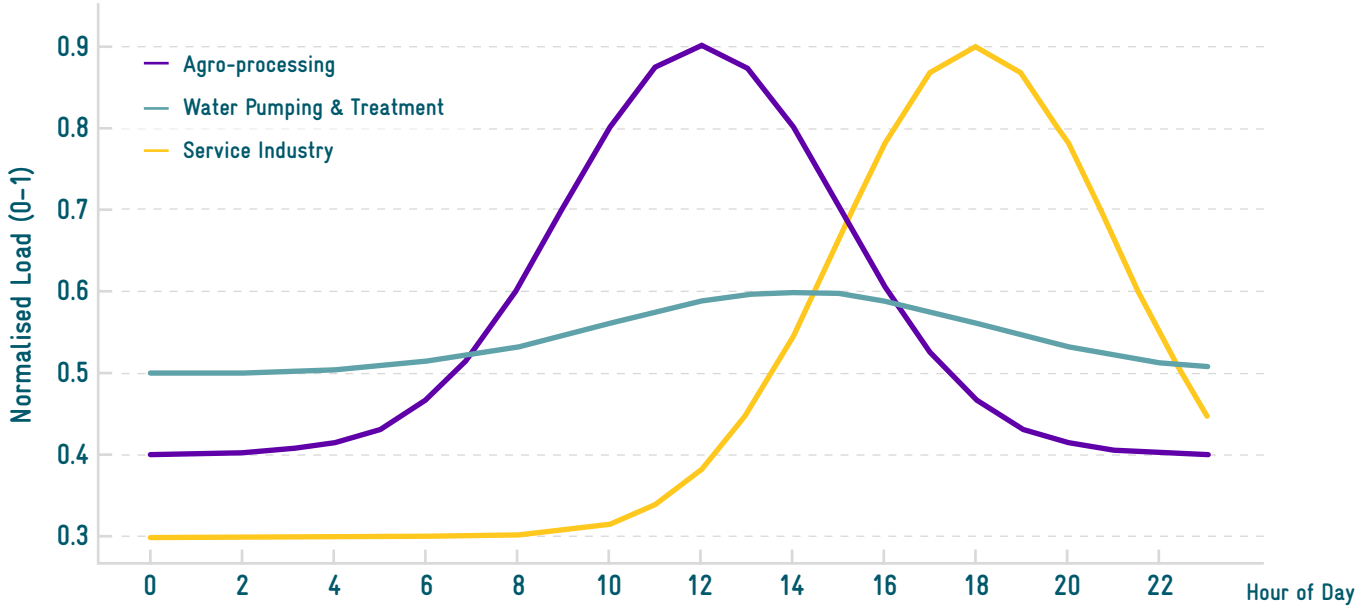
Energy source	Installed capacity (MW)	Share of total capacity (%)
Hydropower	109.66	27%
Imports	46.1	11.3%
Methane gas	85.79	21.1%
Peat-fired power plant	85	20.9%
Shared	39	9.6%
Solar power	12.05	3.0%
Thermal power	28.8	7.1%
Total	406.4	100%

2.2.2 Demand trends in C&I sectors

Electricity consumption is projected to grow from about 1,336 GWh/year in 2023 to 4,000 GWh/year by 2035, with C&I sectors representing a significant share of this growth (REG, 2024).

FIGURE 1. Typical daily load profiles for Rwanda's C&I sectors

Source: Authors' own compilation, Heden Engineering Solutions Limited (2025), based on field data collected



Agro-processing:
This subsector has high thermal and mechanical energy demands for processes such as drying, milling, refrigeration and steam generation. Energy use is often seasonal, with peaks during harvest and processing periods and operations typically running between 7 am and 7 pm. Where raw materials are consistently available, large industries show a preference for 24/7 operations, and some already operate around the clock.

Service industry:
Hotels, hospitals, schools and commercial complexes maintain relatively constant loads for lighting, HVAC, information and communication technology (ICT) and refrigeration, with pronounced evening peaks driven by lighting and cooling demand.

Water pumping and treatment:
Continuous base-load operations in urban water utilities and rural irrigation schemes, with higher pumping demand during dry seasons.

Figure 2 on the right illustrates the trajectory of Rwanda's economic development alongside its growing electricity demand over the period 2010–2023. The line graph highlights:

- A consistent rise in **GDP**, reaching approximately **EUR 12.8 billion** in 2023, based on a nominal GDP rate of USD 13.93 billion in 2023 (Worldometer, 2023) and an average exchange rate of USD 1 ≈ EUR 0.92
- A corresponding increase in electricity consumption, underscoring Rwanda's increasing energy intensity (REG, 2023)

The bar chart breaks down GDP by sector, showing:

- A decline in the share of agro-processing, which has fallen from 33% to 22% of GDP, mirroring the diminishing role of agriculture in the economy (Ministry of Agriculture and Animal Resources, 2018)
- The rising share of the service industry, accounting for over 57% of GDP in 2023 (MINECOFIN, 2025)

These shifts reflect Rwanda's **structural transformation** towards a **service-led economy**, with burgeoning energy requirements across urban C&I domains providing the backdrop for evaluating the market potential of energy-efficient technologies.

FIGURE 2. Rwanda's economic growth, priority sectors and energy demand trends

Source: World Bank and REG data (Worldometer, 2023), (REG, 2023)

2.3 Electricity and fuel tariffs, historical data and forecasts

Tariff structures and energy pricing in Rwanda have evolved over the past decade in response to shifts in global energy markets, domestic investment strategies and broader sector reform. Electricity and fuel prices directly impact on the cost of energy services, making them critical levers for the adoption of EE technologies. Price trends are shaped by a combination of factors, including:

- Global oil price volatility and fuel import dependence
- Foreign exchange fluctuations (notably USD to RWF), as most power purchase agreements signed are indexed to the USD
- Cost pass-through by independent power producers with foreign-indexed power purchase agreements
- Taxation and regulatory adjustments
- Increasing operating costs of the national utility and electrification targets

From a policy perspective, EE serves as both a demand management strategy and a cost containment measure, helping consumers hedge against rising energy costs. This section presents historical data and future projections for fuel and electricity tariffs and outlines key drivers influencing their trajectories.

2.3.1 Carbon-based fuel pricing

Fuel pricing in Rwanda is regulated by RURA in coordination with MINICOM. Prices are reviewed and published every two months, factoring in global oil market trends, transportation costs, local currency exchange rates and applicable taxes.

Historical trends: Rwanda's fuel prices have risen steadily over the last seven years due to international crude oil price fluctuations and depreciation of the Rwandan franc. As shown in Table 3, pump prices for both petrol and diesel have significantly increased, with 2025 levels among the highest recorded.

Future outlook: With Rwanda's continued dependence on imported fossil fuels, pump prices are expected to remain vulnerable to external shocks, especially in the context of global supply chain disruptions and foreign exchange pressures. Additionally, environmental policies and gradual subsidy reforms may further elevate costs.

These dynamics reinforce the case for energy-efficient thermal technologies and clean alternatives (e.g. electric boilers, solar water heaters), especially in industrial and agro-processing sectors.

TABLE 3. Historical annual average fuel prices in Rwanda (RWF/litre)

Year	Petrol	Diesel
2019	1,309	1,234
2020	1,264	1,190
2021	1,386	1,312
2022	1,527	1,455
2023	1,822	1,662
2024	1,764	1,684
Jul 2025	1,803	1,738

Source: Global Petrol Prices data (Global Petrol Prices, 2025)

2.3.2 Electricity tariffs

Electricity tariffs in Rwanda are regulated by RURA and revised periodically to reflect cost-of-service principles, currency fluctuations and energy sector sustainability. The current tariff structure, as approved under RURA Decision No. 01/BD/ER-EWS/RURA/2020 and effective from 21 January 2020, is designed to balance affordability, equity across user categories and recovery of operational costs for the national utility.

Tariffs for non-industrial customers

The tariff structure for residential and institutional consumers includes increasing block tariffs for households and fixed charges for institutional categories, such as water treatment plants, hotels and health facilities.

This tiered system incentivises energy conservation for residential consumers while promoting special rates for critical services, such as water and health, reinforcing social equity and service continuity goals.

TABLE 4. Non-industrial electricity tariffs – RWF/kWh, VAT exclusive (18%)

Source: Source: RURA data (REG, 2020)

Customer category	Consumption block (kWh/month)	Tariff (RWF/kWh)
Residential	0–15	89
	16–50	212
	>50	249
Non-residential	0–100	227
	>100	255
Telecom towers	All	201
Water treatment and pumping	All	126
Hotels	All	157
Health facilities	All	186
Broadcasters	All	192
Commercial data centres	All	179

Time-of-use (ToU) tariffs for industrial customers

Industrial consumers are classified by annual electricity consumption into small, medium and large industries. Each category is subject to a ToU tariff scheme based on peak, shoulder and off-peak periods as shown below.

Tariffs for industrial customers without smart meters

Industrial customers without smart meters, who do not benefit from ToU, are charged a flat rate, as shown below, until smart meters are installed at their facilities.

TABLE 5. Industrial consumer ToU tariff

Source: RURA data (REG, 2020)

Industry category		Annual consumption (kWh/year)			
Small		≤ 22,000			
Medium		> 22,000–660,000			
Large		> 660,000			
Industry category	Energy charge (RWF/Kwh)	Maximum demand charge (RWF/kVA/month)			Customer service charge (RWF/month)
		Peak (06:00 pm–10:59 pm)	Shoulder (08:00 am–05:59 pm)	Off-peak (11:00 pm–07:59 am)	
Small	134	11,017	4,008	1,691	10,000
Medium	103	10,514	3,588	1,292	10,000
Large	94	7,184	2,004	886	10,000

TABLE 6. Tariffs for industrial customers without smart meters

Source: RURA data (REG, 2020)

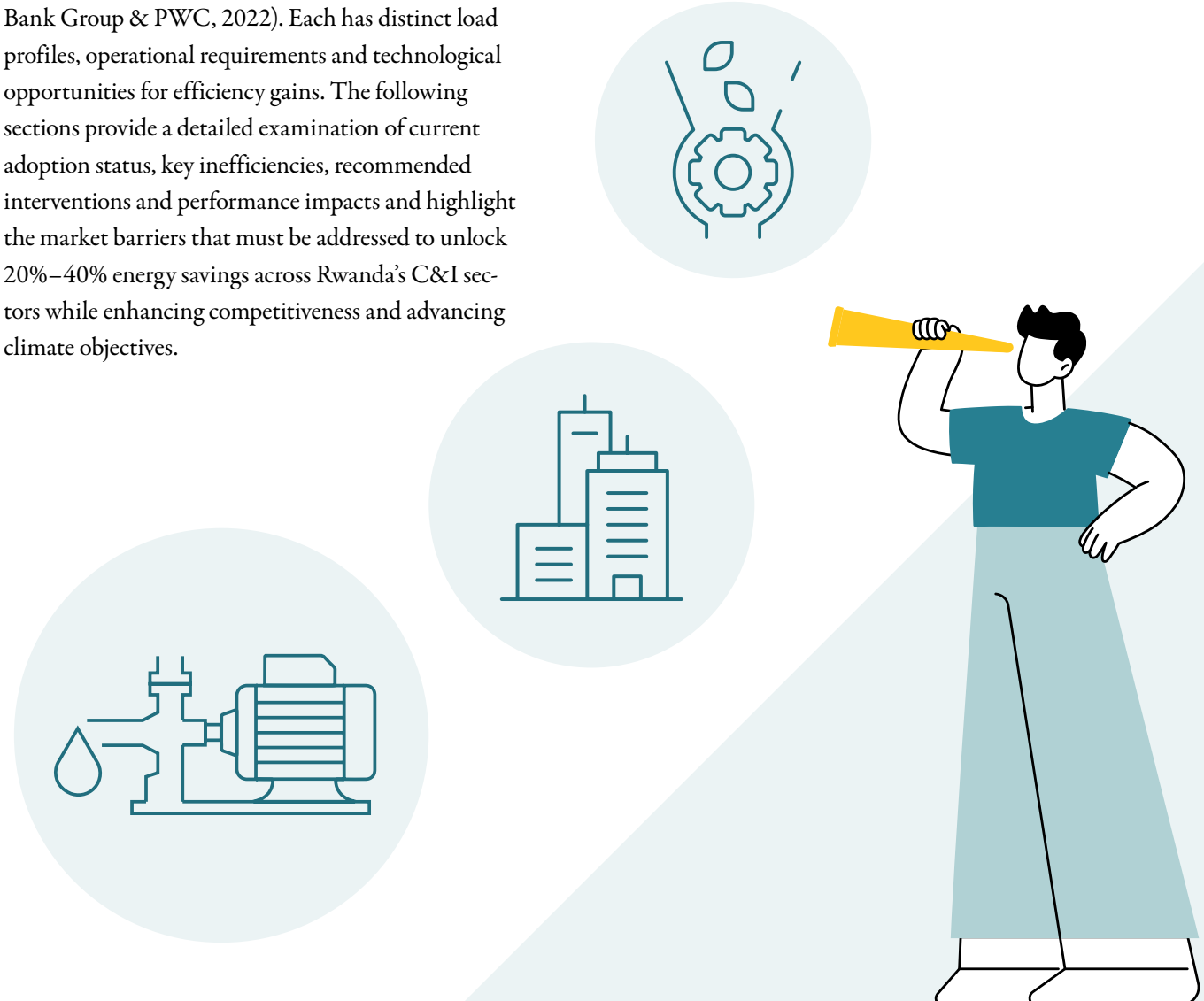
Industry category	Flat rate (RWF/kWh, VAT and regulatory fee exclusive)
Small	151
Medium	123
Large	106

3

Detailed analysis of EE potential in C&I sectors

Rwanda's C&I EE market is in the early stages of development, with activity concentrated among a small number of engineering firms and contractors working with technology suppliers on project-based imports of high-efficiency motors, VSDs and advanced lighting (MININFRA & GGGI, 2023). Demand is largely driven by donor-funded initiatives, government-supported energy audits and targeted investment projects, with uptake constrained by high upfront costs, import duties, long lead times and the absence of scalable financing mechanisms, such as leasing or energy performance contracting (GIZ, 2021). While the 2025 Energy Policy and the 2016 National Energy Efficiency Strategy provide a strong policy framework, limited enforcement and low market awareness mean procurement decisions often prioritise lowest upfront cost over life-cycle value (NISR, 2020).

Within this landscape, **three priority subsectors** – agro-processing, commercial and service sector buildings, and water pumping and irrigation systems – offer the highest potential for cost savings, operational improvements and GHG emission reductions (World Bank Group & PWC, 2022). Each has distinct load profiles, operational requirements and technological opportunities for efficiency gains. The following sections provide a detailed examination of current adoption status, key inefficiencies, recommended interventions and performance impacts and highlight the market barriers that must be addressed to unlock 20%–40% energy savings across Rwanda's C&I sectors while enhancing competitiveness and advancing climate objectives.



3.1 Market insight: EE products for Rwanda's C&I sectors

In Rwanda, the market for EE solutions is still in its early stages of development, with only a limited number of firms actively engaged in the sector. These companies are primarily engineering consultancies or general electrical contractors who collaborate with technology suppliers to deliver efficiency-oriented projects. As in many emerging markets, supply is predominantly project-based rather than supported by a steady retail or distribution network. Most EE equipment, such as high-efficiency motors, VSDs and advanced lighting systems, is imported on an order-by-order basis, with typical lead times ranging from two to four months. Demand is often initiated by donor-funded programmes, government-supported industrial energy audits or specific investment projects, rather than driven by organic market pull.

The prevailing procurement model is still dominated by outright purchase, with limited or no adoption of alternative financing arrangements, such as leasing, lease-to-own or energy performance contracting. This limits uptake among businesses with constrained capital budgets, even when long-term operational savings are demonstrable.

While Rwanda has introduced a number of policy and regulatory initiatives aimed at promoting EE, such as provisions under the Energy Policy and energy management requirements for large consumers, enforcement remains limited. Compliance is generally encouraged rather than mandated, meaning that what influences uptake is often individual corporate sustainability priorities or external project incentives rather than binding obligations.

High initial investment requirements, combined with import duties on specialised efficiency equipment, remain significant barriers. Awareness of life-cycle cost benefits is improving, especially in sectors facing high electricity tariffs, but procurement decisions are still frequently based on lowest upfront cost rather than on efficiency performance. This has kept the market fragmented and dependent on short-term project opportunities.

Opportunities for EE adoption are most evident in Rwanda's growing industrial base, particularly in food processing, cement, beverages and textiles, where peak electricity demand is typically under 1,000 kW. Larger industrial facilities also present strong potential, but investment decisions in such enterprises are often made at regional or international headquarters, resulting in delays and limiting local responsiveness.

3.2 Priority C&I subsectors for EE

Rwanda's EE potential is concentrated in several high-impact sectors, and Rwanda's path to sustainable economic growth hinges on reducing the energy intensity of its productive sectors, with agro-processing, water and agricultural pumping systems, and commercial and institutional buildings representing the most promising opportunities. These sectors account for a significant share of national energy consumption, particularly electricity, and each presents distinct opportunities for the adoption of EE technologies that can lower operational costs, reduce GHG emissions and enhance system reliability. (GIZ, 2021) (NISR, 2020) (NISR, Labour Force Survey: Annual Report 2023, 2023).

3.2.1 Current status of EE adoption

Rwanda's EE market remains nascent but is steadily evolving in line with national policy ambitions. While the country has articulated a strong political commitment to EE through the 2025 Energy Policy and the 2016 National Energy Efficiency Strategy, the implementation of large-scale EE retrofits and adoption of standardised business models, such as ESCOs, is still at an early stage.

Unlike countries with more mature EE ecosystems, such as South Africa or Morocco, Rwanda's private sector-led EE market is yet to fully materialise. The deployment of EE solutions has largely been fragmented, driven by donor-funded pilots, government demonstration projects and a few active local engineering firms providing energy-efficient equipment and installation services.

Several structural and institutional barriers continue to hinder the full emergence of an EE retrofit market in Rwanda:

- **Absence of a formal ESCO regulatory framework,** including standard contracts, accreditation mechanisms and performance-based contracting rules
- **Lack of EE-specific public procurement guidelines,** which limits government demand aggregation and energy savings performance contracting
- **Limited fiscal incentives and financing mechanisms,** despite the existence of VAT exemptions and recognition of EE as a priority investment sector
- **Low awareness among industrial, commercial and residential actors** about the long-term cost-saving potential of EE solutions
- **Weak MVE capacity,** especially for tracking compliance with energy performance standards and labels
- **Lack of access to tailored EE finance,** with high upfront costs remaining a key obstacle to technology adoption

3.2.2 Energy demand and market characteristics

Electric motors account for approximately 45% to 65% of energy consumption in Rwanda's industrial and utility operations. Many of these motors operate without VSDs, leading to significant energy waste, mechanical wear and thermal stress. Further inefficiencies arise from unlabelled compressors, lack of metering, non-insulated steam distribution systems and fixed-speed pumping systems. In rural water and irrigation schemes, reliance on diesel generators exacerbates the problem, driving up operational costs and emissions.

In the agro-processing segment, Rwanda has at least 15 medium-to-large facilities, such as those engaged in tea, rice and maize processing, each requiring an estimated investment of EUR 750,000 to EUR 1,000,000 for comprehensive EE upgrades. Similarly, the water utility and decentralised schemes operate hundreds of water and irrigation pumping stations with substantial scope for EE retrofits. Rwanda's service sector, particularly in urban centres such as Kigali, is also experiencing growing electricity demand due to expanding HVAC, lighting and plug load needs.

3.3 EE potential in agro-processing industries

The agro-processing sector is a cornerstone of Rwanda's economy and a priority sector in the country's industrialisation strategy, leveraging Rwanda's strong agricultural base. These sectors encompass tea and coffee processing, diary, flour milling, fruit drying and storage, rice processing, transportation and conservation industries, which contribute significantly to GDP and employment. Such facilities typically consume over 2.5 GWh/year, relying on electrical energy for mechanical processes and biomass or diesel for steam production.

3.3.1 Key inefficiencies

- IE1-rated or outdated motors and compressors without energy performance labels
- Lack of VSDs on fans and pumps
- Biomass fired and low-efficiency boilers with poor combustion control
- Non-insulated steam lines and absence of condensate recovery

3.3.2 Recommended interventions

- Replace motors with IE3 models and above and install VSDs (IE2 motors are recommended as transitional solutions to be phased out after a two-year transition period)
- Upgrade boiler controls and add oxygen trim systems
- Retrofit steam networks with insulation and condensate return
- Implement electric boiler systems complemented by solar PV
- Deploy efficient refrigeration for milk cooling and fruit preservation
- Integrate solar thermal for pre-heating applications

3.3.3 Performance and impact potential

These measures offer energy savings of 25%–40%, with payback periods of two to four years. Facilities can reduce between 700 and 1,200 tCO_2e annually, earning EUR 3,000–EUR 10,000/year on voluntary carbon markets. EE retrofits in agro-processing could reduce energy use by 20%–30%, leading to significant cost savings and lower emissions. For instance, at a standard tea factory, an energy audit can identify potential annual savings of over EUR 820,000 through EE investments, primarily in steam and motor systems (MININFRA & GGGI, 2023).

Adoption status and market barriers:
Adoption remains limited, especially among small and medium-sized enterprises (SMEs). While some donor-supported audits have been conducted on a large tea factory, actual implementation of EE measures has been slow due to high upfront costs and limited awareness. Special economic zones (SEZs), such as Bugesera SEZ, offer promising platforms for scaling EE technologies, thanks to better infrastructure and investor interest (Africa for Investors, 2024), (Frick & Rodríguez-Pose, 2021).

3.4 EE potential in commercial buildings and the service sector

The growth of Rwanda's service sector has increased energy use in commercial buildings. As of the first quarter of 2025, the service sector accounts for 46% of GDP, while agriculture accounts for 24% and industry for 23% (MINECOFIN, 2025). It dominates electricity demand in urban areas, especially Kigali. It includes hospitality, health care, education, finance, retail and public services subsectors that require lighting, HVAC, ICT and refrigeration (MININFRA & GGGI, 2023). Key drivers include lighting, HVAC and water heating.

3.4.1 Key inefficiencies

- Use of incandescent and compact fluorescent lamps
- Low-efficiency HVAC systems (coefficient of performance (COP) < 2.5)
- Lack of building energy management systems (BEMSs)
- Underutilisation of solar water heating and passive cooling

3.4.2 Recommended interventions

- Light emitting diode (LED) lighting retrofits with motion sensing controls
- High-efficiency HVAC systems
- BEMS installation and sub-metering
- Rooftop solar water heaters
- Energy management systems (EMSs) in large facilities

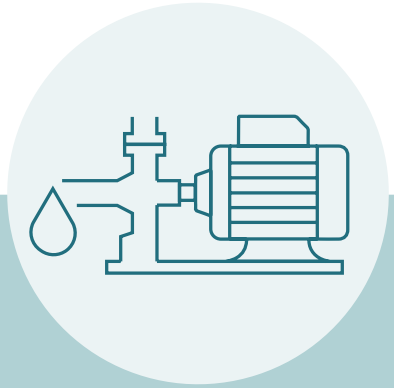
3.4.3 Performance and impact potential

These upgrades provide 20%–30% energy savings, with service sector facilities potentially reducing electricity use by 25%–35% through EE upgrades. Energy audits in hotels have shown savings of EUR 11,500–EUR 19,200 a year from the adoption of highly efficient technology improvements alone (MININFRA & GGGI, 2023). Buildings achieve 30–150 tCO_2e a year in avoided emissions, with payback periods of two to three years. Carbon credit value per site ranges from EUR 130 to EUR 650 annually.

Adoption status: Compared to agro-processing and water pumping, the service sector has made more progress, largely due to donor projects and higher customer expectations. Nonetheless, most interventions are isolated and not backed by national building energy codes or mandatory performance standards.

3.5 EE potential in water pumping and irrigation

This integrated sector includes water supply and treatment systems as well as irrigation infrastructure for agriculture. Water pumping is central to both irrigation and rural water supply, with these operations often powered by electric motors and diesel generators and suffering from poor hydraulic design, oversized components and manual control. Although 90% of Rwandans have access to improved water sources (NISR, 2020), less than 10% of irrigable land is actually irrigated, limiting agricultural productivity and resilience (Akaliza, et al., 2022).



3.5.1 Key inefficiencies

- Oversized pumps leading to throttling losses
- Lack of VSDs for flow and pressure regulation
- Inefficient or mismatched pipe systems
- Manual irrigation scheduling with excessive water use

3.5.2 Recommended interventions

- Resize pumps and deploy high-efficiency motors
- Install solar PV–diesel hybrid pumping solutions
- Install solar-powered pumps for off-grid locations
- Implement VSDs and automated irrigation controls

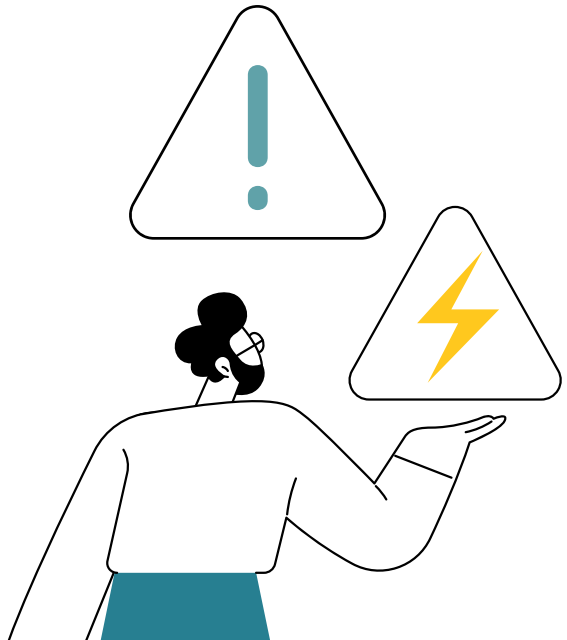
3.5.3 Performance and impact potential

Water storage integration improves energy savings by 20%–50%, with payback periods of three to five years. Energy-efficient pumping can cut energy use by 25%–40%, lowering costs and enabling year-round cultivation. Improved pumping efficiency also reduces reliance on diesel generators, contributing to climate targets and reducing operational costs in rural water schemes. Emission reductions of 50–200 tCO_2e a year per facility, depending on the scale of the intervention, can be achieved. These values reflect total potential savings per pumping station or irrigation scheme where the full suite of upgrades (motors, VSDs, solar hybridisation and hydraulic improvements) is implemented. Carbon revenue potential ranges from EUR 200–EUR 850 a year per upgraded facility.

Adoption status: Adoption remains low. While some solar pumping pilots exist, most systems rely on inefficient diesel or grid-connected pumps. Lack of technical capacity and access to capital are key barriers to scaling EE solutions in this sector.

3.6 Technology solutions and energy saving potential

This section presents priority EE measures identified for Rwanda's C&I sectors, focusing on agro-processing, water and irrigation pumping, and commercial and institutional buildings. The measures target proven technologies and operational improvements that can enhance performance, reduce energy consumption and improve reliability in each subsector. The following tables outline sector-specific interventions, their descriptions, indicative energy saving potential and recommended implementation timeframes. Together, they provide a practical reference for policy-makers, investors and service providers to guide project planning and prioritisation in line with national EE objectives.



3.6.1 Priority EE measures by sector

TABLE 7. Priority EE measures for the agro-processing sector (tea, rice, maize, cassava)

Source: Authors' own compilation, Heden Engineering Solutions Limited (2025), based on analysis of field data

Measure	Description	Energy saving potential	Window of opportunity
Electric boiler integration	Replacement of firewood boilers with electric boilers, complemented by solar PV to reduce biomass dependency in steam generation, a transition that promotes clean alternatives to tree cutting, particularly in tea and other heat-intensive agro-industries (MININFRA, 2023)	+++	Medium to long term
Steam pipe insulation	Retrofit of steam lines with thermal insulation and flange covers to reduce thermal losses	++	Short term
VSDs	Application on induced draft fans, pumps and conveyors to match speed with process demand, reducing load and wear	+++	Short term
>IE3 motor replacement	Upgrade from unlabelled or IE1 motors to IE3 and above high-efficiency motors in milling and drying equipment	++	Medium term
Heat recovery in dryers and boilers	Capture of waste heat from flue gases or dryer exhausts for use in pre-heating and drying	++	Medium to long term

LEGEND:

Low priority
(<10% savings, long-term impact)

++ Medium priority
(10%–20% savings, impact in three to six years)

+++ High priority
(>20% savings, short to medium term)

TABLE 8. Recommended EE measures for water and irrigation pumping

Source: Authors' own compilation, Heden Engineering Solutions Limited (2025), based on analysis of field data

Measure	Description	Energy saving potential	Window of opportunity
Pump resizing and VSDs	Replace oversized pumps and introduce flow control using VSDs	+++	Short term
Solar–diesel hybrid pumping	Integrate PV and diesel backup with automatic controls for decentralised pumping systems	++	Medium term
Pipe network optimisation	Reduce friction losses through better pipe layouts, diameters and flow path design	++	Medium term

TABLE 9. Recommended EE measures for commercial and institutional buildings

Source: Authors' own compilation, Heden Engineering Solutions Limited (2025), based on analysis of field data

Measure	Description	Energy saving potential	Window of opportunity
Chiller and HVAC system replacement	Replace outdated chillers and air conditioning with inverter and variable refrigerant flow (VRF) technology	+++	Near term
LED lighting retrofits	Replace fluorescent lamps with high-efficiency LED systems	+++	Near term
BEMSs	Install sub-metering and automated controls for HVAC and lighting	++	Medium term

LEGEND:

Low priority
(<10% savings, long-term impact)

++ Medium priority
(10%–20% savings, impact in three to six years)

+++ High priority
(>20% savings, short to medium term)

3.6.2 Technology performance and implementation

Heat pump system assessment: Heat pump systems provide compelling alternative heating technology that is particularly suited to Rwanda's climate conditions. Air-source heat pumps achieve a COP of 3.0 to 4.5, delivering 3 to 4.5 units of heat per unit of electricity consumed, with temperature capabilities up to 65 °C, which makes them suitable for many food processing applications. Investment costs range from EUR 80,000 to EUR 200,000 per facility including installation, with a payback period of three to five years. They deliver 40%–60% energy savings compared to electric resistance heating.

Solar thermal applications: Solar thermal systems complement electric boiler installations, offering specialised solutions for hot water and drying applications. In tea processing facilities, solar thermal systems with 50 to 100 m^2 collector areas deliver 40%–60% reductions in fuel consumption for water heating, generating annual cost savings of EUR 8,000 to EUR 15,000, with a payback period of four to six years.

3.7 Investment requirements and financial return

The financing landscape for EE projects in Rwanda remains underdeveloped, mirroring the early-stage nature of the EE market itself. Although detailed market data is limited, existing EE initiatives have largely relied on public financing, donor grants and pilot-driven interventions rather than commercially viable business models.

Energy service providers (ESPs) operating in Rwanda typically require commercial or industrial clients to self-finance EE upgrades. In most cases, clients cover upfront costs directly or provide partial capital contributions before ESPs proceed with equipment procurement and installation. Follow-up payments tied to project implementation phases are often agreed upon but rarely structured around performance-based energy savings contracts.

In the absence of a mature ESCO market, there is no standardised financing framework for EE retrofits. Local ESPs tend to rely on grants from development partners and internal capital and loans from commercial banks, although these are limited in availability and offered at relatively high interest rates. Only a few local firms have secured credit facilities tailored to EE investments, and risk perception in the financial sector remains high due to a lack of awareness and technical capacity.

To address these barriers, GoR, through MININFRA and REG, is pursuing several policy and financial innovations aimed at unlocking EE financing:

- **Super ESCO development:** A national Super ESCO is under development with technical support from GGGI. It is expected to play a catalytic role by aggregating public sector EE demand, mobilising concessional and commercial capital and offering turnkey solutions including project preparation, implementation and performance monitoring.
- **Energy Efficiency Revolving Fund:** Rwanda is in the process of re-establishing a dedicated public revolving fund to finance EE upgrades in public buildings and strategic industrial facilities. A previous iteration of this fund operated under REG between 2012 and 2015, with support from the Nordic Development Fund through the Nordic Climate Facility. The earlier scheme was specifically designed to promote the uptake of solar water heaters, providing a blended financing model that offered part of the investment as a non-repayable grant and the remainder as a low-interest loan to eligible residential and commercial consumers and industries.

Although the original fund formally closed after the project cycle ended, the remaining capital is still being used by REG to continue supporting the adoption of solar water heaters in both residential and commercial segments. The envisioned next-generation revolving fund is expected to expand the scope of eligible technologies beyond solar water heaters to include a broader range of EE measures. Once operationalised, it will offer concessional loans and results-based financing to address the persistent upfront capital barrier that hinders widespread EE adoption in Rwanda.

This instrument is anticipated to play a critical role in catalysing private sector participation and strengthening the ESCO ecosystem, particularly for projects with longer payback periods or uncertain investor uptake (GGGI & MININFRA, 2023).

- **Integration into public investment planning:** The government is also considering the inclusion of EE performance criteria in public procurement and infrastructure budgeting processes. These changes would create predictable demand for EE services and enable the use of longer-term payback models.

While these mechanisms are still being finalised, a number of enabling policies are already in place. These include VAT exemptions for certified EE equipment, preferential tax treatment for EE investments under the Investment Code (2021) and the recognition of EE as a priority sector by the RDB. Despite these incentives, EE financing in the private sector remains limited, with most retrofits dependent on donor co-financing or results-based grants.

The **draft Energy Law**, currently under review, is expected to significantly enhance the bankability of EE projects by mandating **energy audits for C&I consumers** and strengthening monitoring, reporting and verification (MRV) obligations. These measures would help generate a pipeline of investment-grade EE projects and reduce perceived performance risks for financiers.

	Key EE interventions	Investment/ facility (EUR)	Energy savings (%)	Payback (years)	GHG reduction (tCO_2e/year)	Carbon revenue (EUR/year)
Agro-processing	IE3 motors, boiler retrofits, steam insulation, solar thermal, VSDs	750,000–1,000,000	25%–40%	2–4	700–1,200	3,000–10,000
Water and agricultural pumping	Pump resizing, VSDs, solar–diesel hybrids, efficient motors, pipe layout optimisation	85,000–255,000	20%–50%	3–5	50–200	200–850
Commercial and institutional buildings	LED retrofits, HVAC upgrades, BEMSs, solar water heaters, passive cooling	42,500–212,500	20%–30%	2–3	30–150	130–650

TABLE 10. Sector-wise investment and returns for EE interventions in Rwanda Rwanda

Source: Authors' own compilation, Heden Engineering Solutions Limited (2025), based on analysis of field data

3.8 Local capacity for project implementation

The successful implementation of EE projects in Rwanda hinges on the strength of local capacity across four key dimensions: an enabling regulatory environment, human resource capabilities, supply chain readiness and financial sector support. Although Rwanda has made significant progress in policy development and awareness raising, several capacity gaps still hinder the scale-up of EE deployment.

3.8.1 Regulatory framework

Rwanda has taken critical steps towards building a policy and regulatory foundation for EE. The 2025 Energy Policy identifies EE as a national priority and outlines measures to strengthen enforcement, monitoring and investment frameworks. Existing legal instruments, such as the Investment Code (2021), the National Cooling Strategy (2018) and technical regulations issued by the RSB, support the adoption of MEPS and energy labelling systems. However, a comprehensive EE law is still pending. The draft Energy Law, now under cabinet review, proposes mandatory energy audits for C&I users and will further institutionalise EE obligations once passed.

Despite this progress, regulatory enforcement mechanisms remain weak, and the lack of standardised ESCO contracts, procurement rules tailored to EE and dedicated MRV protocols continue to limit the uptake of EE services.

3.8.2 Human resource capacity

The availability of skilled professionals remains a bottleneck in Rwanda's EE market development. Two categories of competencies are essential:

- **Core technical competencies,** such as energy auditing, measurement and verification, energy management, appliance installation and system optimisation
- **Market and managerial competencies,** including EE project financing, contracting, business development and ESCO business modelling

Currently, Rwanda has a limited pool of accredited **energy auditors and consultants,** and most engineering firms lack exposure to end-to-end EE performance contracting. Some expertise exists within solar engineering, procurement and construction (EPC) firms, industrial maintenance service providers and consulting engineers, particularly those active in clean energy and building services. However, their business models are largely equipment-focused, with few offering integrated design, implementation and monitoring services as required under typical ESCO frameworks.

Capacity building programmes remain fragmented and largely donor-driven. The **Super ESCO initiative** aims to address this by offering technical assistance, certification pathways and training programmes for public officials, facility energy managers and local service providers.

3.8.3 Supply chain and technology access

Rwanda's EE supply chain is still developing. Imports of efficient equipment, including motors, pumps, boilers and HVAC components, dominate the market, with limited local manufacturing or assembly. Distribution networks are concentrated in Kigali and a few secondary cities, creating logistical and cost barriers for rural and industrial consumers.

Despite these limitations, the existing ecosystem of engineering firms, solar integrators and appliance distributors forms a strong base for market expansion. The Made in Rwanda Policy Implementation Framework developed by MINICOM encourages

local assembly and value addition in energy technologies, which may eventually support job creation and improve equipment affordability.

3.8.4 Financial and institutional capacity

Local financial institutions continue to show limited understanding of EE business models, particularly performance-based lending or project-based risk assessment. The lack of project aggregation and MRV capacity also reduces the bankability of EE investments. Nevertheless, recent reforms such as the proposed Energy Efficiency Revolving Fund, the establishment of priority investment status for EE projects under the Investment Code and the development of the Super ESCO are designed to overcome these challenges and crowd in capital for energy saving investments.

GoR, through MININFRA, plans to develop a comprehensive roadmap for workforce development and institutional capacity building to support the national EE agenda once the draft Energy Law is enacted by Parliament. The law will introduce a legal requirement for mandatory energy audits in C&I sectors. In anticipation of this, the roadmap will be designed in coordination with RURA and will include the establishment of national accreditation systems for energy auditors, energy managers and ESCOs. It will also promote the integration of EE-related competencies into the curricula of technical and vocational education and training institutions and universities. This forward-looking approach aims to ensure that Rwanda develops the skilled workforce and institutional infrastructure necessary to implement and sustain EE measures effectively across key sectors.

3.8.5 Financial and policy incentives

GoR, through the **Investment Code (Law No. 006/2021**) and Official Gazette provisions, offers tax-based and structural incentives designed to catalyse energy-efficient investments:

- **VAT and import duty exemptions:** Energy-efficient technologies, such as high-efficiency electric motors, solar thermal systems and certified EE appliances, are exempt from VAT and may qualify for import duty waivers. Eligibility is subject to compliance with national technical standards, coordinated by the RSB and the RRA.
- **Accelerated depreciation and zero corporate income tax:** The RDB recognises EE and green investments as priority sectors. Investors implementing industrial EE retrofits may benefit from accelerated depreciation of capital expenditures and 0% corporate income tax for strategic projects.
- **Preferential access to industrial infrastructure:** Firms investing in energy-efficient processes may be granted priority access to SEZs and industrial parks, where subsidised utilities and infrastructure lower the total cost of operations.
- **Local manufacturing support:** MINICOM, through its Made in Rwanda Policy Implementation Framework, promotes the assembly and retrofitting of local industrial facilities with EE products. This qualifies for VAT and import tax holidays, reducing import dependency and supporting affordability for domestic adopters.

4

Opportunities and challenges for EE measures

This chapter outlines market opportunities and challenges for scaling EE measures, with a focus on the strategic potential for German/European companies to establish a presence in Rwanda's emerging EE market. Subsequent sections explore sector-specific opportunities in agro-processing, water pumping and irrigation, and commercial and institutional buildings and look at investment incentives, regulatory frameworks and the advantages provided by strong German/European–Rwandan bilateral relations. The discussion also highlights how German/European engineering expertise, technology leadership and quality standards align with Rwanda's sectoral priorities and infrastructure development needs.

4.1 Market opportunities for German/European companies

Rwanda's EE sector presents a compelling first-mover opportunity for German/European companies entering an emerging market with exceptional potential. The country has established one of Africa's most supportive regulatory frameworks for EE, including MEPS aligned with EU frameworks, VAT exemptions for certified energy-efficient equipment and preferential corporate tax rates for energy investments (MININFRA, 2025).

4.1.1 Strategic market position

Rwanda's EE market is at a formative stage, with strong political commitment, emerging legal frameworks and institutional readiness laying the foundation for future growth. While demand for EE solutions is rising, particularly in the industrial, agro-processing and service sectors, market development remains nascent, presenting a rare first-mover opportunity for international actors (MININFRA & GGGI, 2023). Foreign ESCOs, technology providers and financiers can leverage Rwanda's favourable investment climate, policy incentives and sectoral needs to establish long-term commercial presence.

GoR has shown strong political will by integrating EE into key strategic frameworks, including the 2025 Energy Policy, the National Cooling Strategy and the upcoming Energy Law, which mandates energy audits for C&I facilities. International ESPs and ESCOs stand to benefit from several entry points, particularly as Rwanda operationalises its EE strategies (MININFRA, 2016).

4.1.2 Sector-specific opportunities

The agro-processing sector is a particularly good fit for German/European engineering capabilities, presenting investment opportunities in advanced energy-efficient technologies for drying, milling, cooling and refrigeration systems. German/European companies specialising in industrial automation, precision manufacturing and renewable energy integration can capitalise on the government's prioritisation of agro-industrial parks in Bugesera and Nyabihu, where fiscal incentives for machinery acquisition create a conducive environment for high-quality German/European EE solution providers (MINICOM, 2017). German/European expertise in steam systems, industrial heat pumps and biomass-to-electric conversion technologies aligns perfectly with Rwanda's transition from traditional biomass-fired systems to modern electric boiler installations complemented by solar PV integration.

Water pumping sector potential offers substantial opportunities for German/European companies with expertise in hydraulic engineering, solar-pump integration and intelligent control systems. With only 10% of irrigable land currently under irrigation,

Rwanda's National Irrigation Master Plan identifies a critical need for efficient water pumping solutions that German/European firms can address through advanced solar pumping systems, smart irrigation controls and high-efficiency motor solutions (Akaliza, et al., 2022). German/European companies with experience in precision agriculture, monitoring systems enabled by the Internet of Things and VSD technology are particularly well-positioned to capture market share in this expanding sector.

Service sector growth creates exceptional market potential for German/European companies specialising in building automation, HVAC optimisation and EMSs. Growing energy demand in the hospitality, health care, banking and education sectors creates strong demand for EE interventions that align with German/European strengths in HVAC engineering, intelligent building controls and integrated energy management solutions. Kigali's business hotels, hospitals and educational institutions are actively upgrading infrastructure, opening direct avenues for German/European companies to provide premium service contracts and advanced equipment supply arrangements.

4.1.3 Investment incentives and regulatory framework

GoR provides extensive fiscal and non-fiscal incentives that are particularly advantageous for German/European companies. Preferential corporate tax rates offer compelling advantages for German/European companies investing in EE technologies or establishing export-oriented operations. Companies investing in energy solutions or achieving at least 80% export production may qualify for a reduced 15% corporate income tax rate instead of the standard 30% (RDB, 2021).

Tax holiday provisions create exceptional opportunities for substantial German/European investments. Investors contributing at least USD 50 million and maintaining a 30% equity stake are eligible for up to seven years of corporate income tax holidays. These incentives apply specifically to large-scale projects in energy, manufacturing and agro-industrial zones, where German/European companies typically excel (RDB, 2021).

VAT exemptions under government policy provide direct cost advantages for German/European companies supplying designated energy products and systems, including energy-efficient lighting, solar

water heaters and clean energy technologies, all areas where German/European companies maintain global leadership positions (RRA, 2023). These exemptions improve the competitive positioning of German/European EE solutions and reduce total project costs for end-users, enhancing market acceptance of premium German/European technologies.

4.1.4 Germany–Rwanda bilateral relations

Rwanda and Germany maintain exceptionally strong bilateral relations that provide additional advantages for German companies entering the Rwandan market. German development cooperation, through GIZ, has established deep institutional relationships and technical expertise networks that German private sector companies can leverage for market entry and project development (GIZ, 2021).

German engineering standards and quality certifications are recognised and respected in Rwanda's regulatory framework, which reduces compliance barriers and accelerates approval processes for German EE technologies. This recognition of German technical standards creates competitive advantages for German companies compared to firms from countries with less established technical cooperation relationships.

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4.2 Technical and financial barriers to EE implementation

Despite the strong enabling policy environment, several structural and market challenges persist and must be navigated for successful EE implementation in Rwanda.

4.2.1 Regulatory and institutional barriers

The evolving regulatory framework presents both opportunities and challenges. While the draft Energy Law and EE-related regulations (e.g. MEPS, labelling, mandatory audits) are being developed, the timing of secondary legislation and enforcement mechanisms remains uncertain. This regulatory flux may delay market activation or introduce compliance risks (MININFRA, 2025)

The absence of a formal ESCO regulatory framework, including standard contracts, accreditation mechanisms and performance-based contracting rules, continues to hinder market development. Additionally, the lack of EE-specific public procurement guidelines limits government demand aggregation and energy savings performance contracting (MININFRA & GGGI, 2023).

Weak MVE capacity, especially for tracking compliance with energy performance standards and labels, represents a critical gap. There is still no comprehensive MVE framework, which hinders effective monitoring of compliance with MEPS and energy audits (RSB, 2023).

4.2.2 Technical capacity constraints

Human capital limitations represent a significant bottleneck in Rwanda's EE market development. The domestic supply of skilled EE professionals, especially in fields such as energy auditing, measurement and verification, and the structuring of energy performance contracting, is currently limited. International firms may face difficulties sourcing qualified local staff and may need to invest in on-the-job training or bring in expatriate teams during the initial stages.

Currently, Rwanda has a limited pool of accredited energy auditors and consultants, and most engineering firms lack exposure to end-to-end EE performance contracting. Some expertise exists within solar EPC firms, industrial maintenance service providers and consulting engineers, particularly those active in clean energy and building services. However, their business models are largely equipment-focused, with few offering integrated design, implementation and monitoring services as required under typical ESCO frameworks.

4.2.3 Supply chain and technology access barriers

Rwanda's EE supply chain is still developing, with imports of efficient equipment, including motors, pumps, boilers and HVAC components, dominating the market. Limited local manufacturing and assembly creates logistical and cost barriers. Distribution networks are concentrated in Kigali and a few secondary cities, creating accessibility challenges for rural and industrial consumers.

The market is characterised by unlabelled products, which dominate equipment procurement, and poor quality assurance mechanisms. Equipment is often procured based on upfront cost rather than efficiency considerations, limiting the adoption of high-quality, energy-efficient technologies.

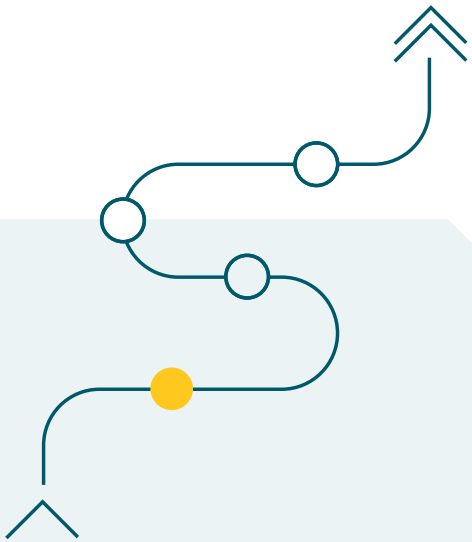
4.2.4 Financial and market development barriers

Financing constraints represent a major obstacle to EE implementation. Although Rwanda is preparing to operationalise a public Energy Efficiency Revolving Fund, current access to commercial financing for EE retrofits is limited, and most local financial institutions have limited technical capacity to assess EE projects. Local ESPs typically require commercial or industrial clients to self-finance EE upgrades, as there is no standardised financing framework for EE retrofits.

Low EE awareness among end-users persists across many C&I enterprises, where upfront cost remains a dominant decision factor and appreciation of life-cycle cost savings is limited. A lack of familiarity with the ESCO business model further compounds this challenge, as local stakeholders, both public and private, are largely unfamiliar with concepts such as shared savings, guaranteed savings and performance-based contracts.

4.3 Market entry strategies and business models

To successfully enter and establish themselves in Rwanda's EE market, German/European companies should consider a comprehensive approach that addresses both opportunities and challenges while building long-term market presence.



4.3.1 Strategic partnership development

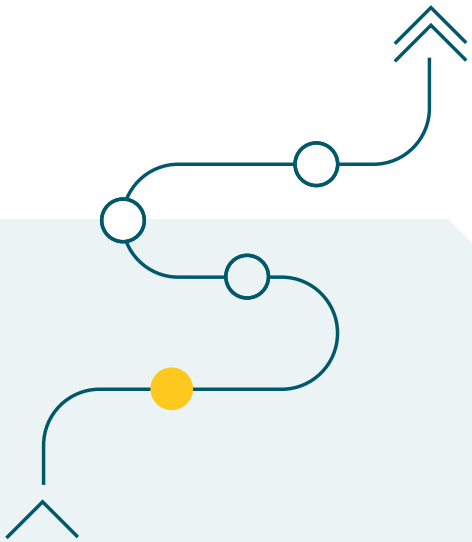
Partnering with local institutions and ESCOs represents a critical success factor. Given the nascency of the ESCO model in Rwanda, new entrants are encouraged to form joint ventures or technical partnerships with local engineering firms or government-supported programmes, such as the Super ESCO which is being developed with the support of GGGI and MININFRA. Such partnerships can enhance market credibility and facilitate bundled project development.

German/European companies should leverage the opportunities presented by Rwanda's Investment Code by applying for 'strategic investment project' or 'priority sector' status through the RDB to take advantage of tax holidays, accelerated depreciation, import duty exemptions and preferential access to industrial zones. Application processing for investment certificates typically takes fewer than 15 working days (RDB, 2021).

4.3.2 Market development and capacity building

Investment in awareness and quality assurance should be part of go-to-market strategies. EE is often not prioritised by end-users due to a lack of understanding of life-cycle savings. Market entrants should include awareness raising, quality assurance protocols and client education components. The development of recognisable quality control labels, in collaboration with the RSB, could enhance user trust in EE technologies.

Workforce development should be supported through training programmes, internships or knowledge sharing initiatives. International actors who contribute to capacity building are more likely to build long-term institutional relationships and secure preferred status in public procurement or PPP arrangements. This approach aligns with Rwanda's emphasis on technology transfer and skills development.



4.3.3 Financial model innovation

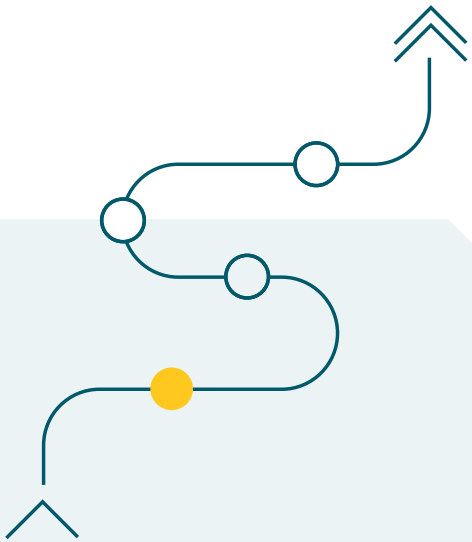
Financing models need to be adapted to mitigate upfront cost barriers. Market entrants should explore the option of offering energy performance contracts or lease-to-own schemes or work with development partners to bundle financing through results-based mechanisms. Participating in the revival of the Energy Efficiency Revolving Fund, managed by REG, may also unlock concessional finance windows.

The Super ESCO initiative represents a significant opportunity for market entry. A national Super ESCO, currently under development with technical support from GGGI, is expected to play a catalytic role by aggregating public sector EE demand, mobilising concessional and commercial capital and offering turnkey solutions including project preparation, implementation and performance monitoring.

4.3.4 Regulatory engagement strategy

It is advisable to engage early with regulatory processes to position as technical partners and ensure compliance readiness. Although Rwanda has published MEPS and labelling guidelines for selected appliances, further expansion into C&I technologies is underway. Participating in stakeholder consultations led by the RSB and MININFRA can help position new entrants advantageously.

Market entrants should also prepare for the mandatory energy audit requirements that will be introduced under the forthcoming Energy Law. This regulatory change will create systematic demand for EE services and provide a foundation for performance-based contracting models.



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Workforce development should be supported through training programmes, internships or knowledge sharing initiatives. International actors who contribute to capacity building are more likely to build long-term institutional relationships and secure preferred status

4.4 Risk assessment and mitigation strategies

Understanding and managing risks is crucial for successful market entry and long-term operations in Rwanda's evolving EE market.

4.4.1 Regulatory and policy risks

Regulatory uncertainty poses the primary risk, as the draft Energy Law and implementing regulations are still under development. The timing of secondary legislation and enforcement mechanisms remains uncertain, potentially affecting market activation timelines and compliance requirements.

Mitigation strategies include engaging early with regulatory processes, maintaining flexibility in business models to adapt to changing requirements and building relationships with key regulatory bodies, including MININFRA, the RSB and RURA. Companies should also consider phased market entry approaches that can be scaled based on regulatory developments.

4.4.2 Market and commercial risks

Limited market awareness and unfamiliarity with ESCO business models represent significant commercial risks. The focus of end-users on upfront costs rather than life-cycle savings can limit market acceptance of EE solutions.

Mitigation approaches include comprehensive awareness raising programmes, demonstration projects to showcase technology performance and partnerships with local institutions to build market credibility. Developing local success stories and case studies can help overcome market resistance and build confidence in EE technologies.

4.4.3 Technical and operational risks

Skills shortages and limited local technical capacity pose operational risks for project implementation and ongoing maintenance. The absence of standardised quality assurance mechanisms can also affect project performance and customer satisfaction.

Risk mitigation involves investing in local capacity building, establishing quality control protocols and developing local service networks. Companies should consider bringing in initial technical teams while simultaneously training local staff to ensure knowledge transfer and operational sustainability.

4.4.4 Financial and credit risks

Limited financing options and weak local financial sector understanding of EE projects create significant financial risks. The absence of standardised project evaluation criteria and performance guarantees can affect project bankability.

Financial risk mitigation includes developing flexible financing structures, partnering with development finance institutions and participating in government-supported financing mechanisms, such as the planned Energy Efficiency Revolving Fund. Companies should also consider results-based financing models that align payment with performance outcomes.

4.5 Recommendations for market development

Based on the comprehensive assessment of opportunities, challenges and market dynamics, several strategic recommendations emerge for developing Rwanda's EE market and supporting German/European company engagement.

4.5.1 Immediate actions (0–2 years)

Strengthen regulatory framework implementation by accelerating the passage of the Energy Law and implementing regulations for mandatory energy audits. Establish clear guidelines for ESCO operations, including standard contracts and performance measurement protocols.

Operationalise the Super ESCO model to aggregate public sector demand and demonstrate viable business models for EE investments. This institution should serve as a catalyst for private sector participation while providing technical assistance and capacity building support.

Launch pilot demonstration projects at representative facilities across priority sectors – agro-processing, water pumping and commercial buildings – to showcase technology performance and build market confidence. These projects should emphasise integrated solutions that combine multiple EE measures for maximum impact.

4.5.2 Medium-term development (2–5 years)

Establish comprehensive capacity building programmes for local ESPs, including training on energy auditing, project development and performance contracting. Develop certification programmes in collaboration with international partners to ensure quality and standardisation.

Create dedicated financing mechanisms through the Energy Efficiency Revolving Fund and partnerships with commercial banks to provide accessible financing for EE investments. Develop risk sharing instruments and guarantee mechanisms to improve project bankability.

Implement market transformation initiatives, including strengthened MEPS enforcement, expansion of energy labelling programmes and public procurement guidelines that prioritise life-cycle cost considerations over upfront costs.

4.5.3 Long-term market development (5+ years)

Build a sustainable EE ecosystem with robust private sector participation, competitive service markets and standardised business models. Establish performance benchmarking systems and carbon credit aggregation mechanisms to monetise environmental benefits.

Integrate EE into broader development planning including urban development, industrial policy and climate strategies. Ensure that EE considerations are embedded in infrastructure investments and economic development initiatives.

Develop regional market linkages by positioning Rwanda as a hub for EE technology and services in East Africa, leveraging German partnerships and technical expertise to serve broader regional markets.

For German companies specifically, the assessment recommends a coordinated approach involving early market entry through partnerships, investment in local capacity building and adaptive business models that can evolve with the regulatory framework. Companies should leverage existing bilateral relationships and development cooperation programmes while building local presence and technical capabilities.

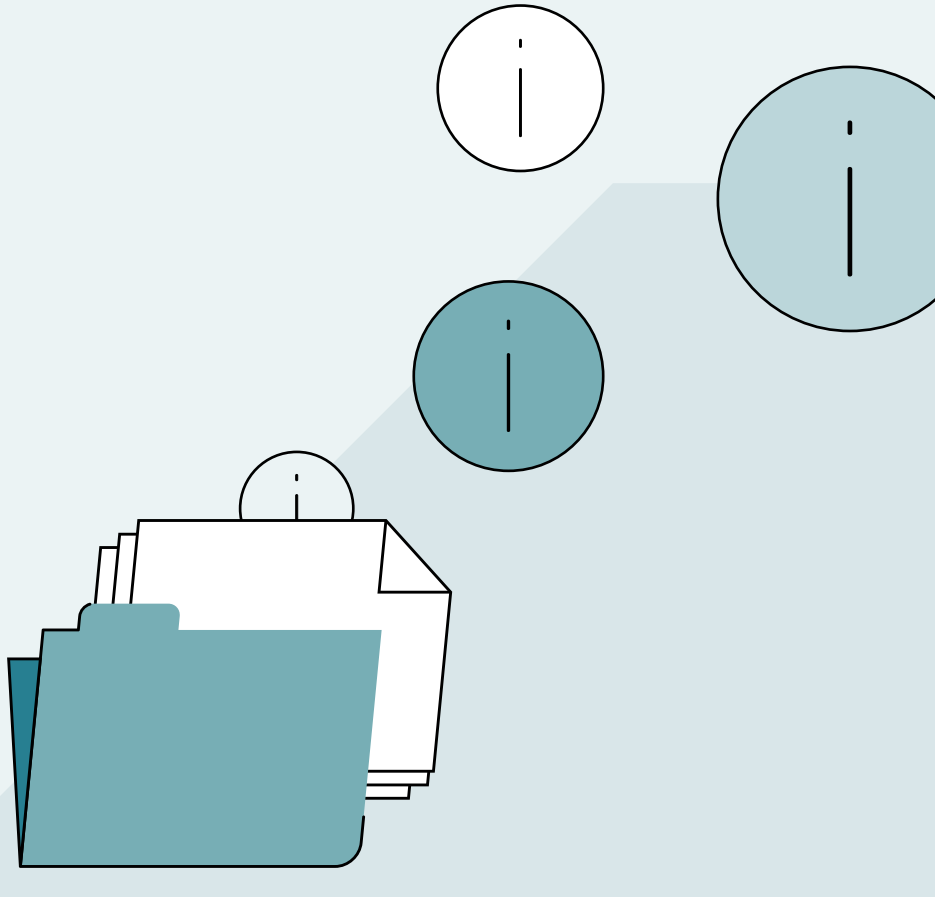
The successful development of Rwanda's EE market requires coordinated efforts across government, the private sector and development partners. For German/European firms with proven EE expertise and long-term market development vision, Rwanda represents an exceptional opportunity to establish market leadership in one of Africa's most promising EE markets, combining strong government support with substantial technical potential and first-mover advantages.

TABLE 11. Key players and services along the EE value chain in Rwanda

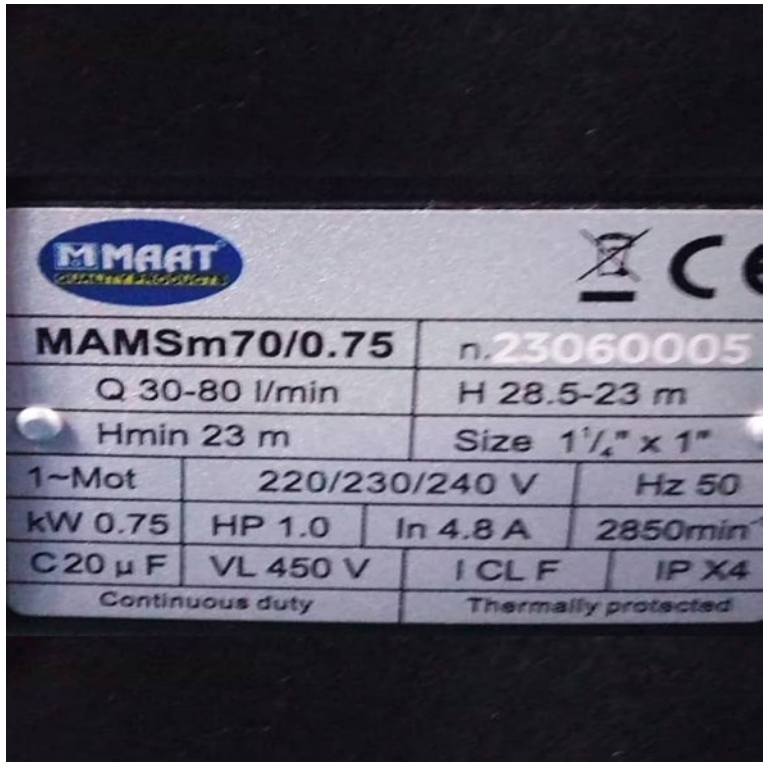
Source: Authors' own compilation, Heden Engineering Solutions Limited (2025), based on analysis of field data

Value chain segment	Market actors	Gaps/challenges
Project development	Energy consultants, NGOs (e.g. EnDev), MININFRA, Private Sector Federation (PSF)	Limited project pipelines; lack of pre-investment support for SMEs
Energy audits and feasibility	Licensed energy auditors (e.g. RSB-certified), universities)	Few skilled energy auditors; lack of standardised energy audit methodologies
Design and engineering	EPC firms (mostly solar), private sector engineers	Lack of multidisciplinary teams for HVAC, steam, motors, etc.
Procurement and supply	Equipment importers (motors, boilers, compressors)	Unlabelled products dominate; poor quality assurance
Installation and commissioning	Local installers, manufacturers' representatives	Limited capacity outside Kigali; lack of commissioning protocols
Financing and incentives	Development banks (Development Bank of Rwanda), private banks, donors	Few EE-dedicated products; weak uptake of green finance
Monitoring and verification	Limited to large donor projects	Absence of MRV frameworks; no carbon credit aggregation mechanism

Annexes



Annex 1 Electric motor name plate labels with no EE rating (classified as IE1)



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