



AFREC

African Energy
Commission

*Securing Africa's
Energy Future*

AFRICAN ENERGY EFFICIENCY STRATEGY AND ROADMAP

A CONTINENTAL STRATEGY TO ACCELERATE
ENERGY EFFICIENCY ACROSS ALL SECTORS



PART I — STRATEGY AND ROADMAP

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The African Energy Commission (AFREC) is a specialized agency of the African Union (AU) responsible for developing the African energy sector by coordinating, harmonizing, protecting, conserving, developing, and promoting the rational exploitation, marketing, and integration of energy resources in Africa. In collaboration with a network of partners and experts from all AU Member States, AFREC possesses the necessary capacity and expertise to ensure that all energy initiatives undertaken within the AU meet the future needs of the African energy sector, in line with the AU's Agenda 2063 and the vision of "The Africa We Want."

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AFRICAN ENERGY EFFICIENCY STRATEGY AND ROADMAP (AFEES)



FOREWORD

The African continent and its people stand at a defining moment in its energy journey. The continent’s dynamic economies and rapidly growing population are driving an ever-increasing demand for energy. Yet, millions of people in the continent still live without access to reliable, affordable, and clean energy.

Energy efficiency is a promising solution to addressing these challenges. It remains the “first fuel” of Africa’s sustainable future. By saving energy: we can power homes, schools, and industries; reduce pressure on energy supply systems while at the same time curbing emissions. This is in addition to the potential of saving energy costs.

To anchor energy efficiency programmes in Africa, the African Energy Commission (AFREC), with support from the European Union’s Global Technical Assistance Facility for Sustainable Energy, has undertaken a transformative initiative — the development of the African Union Energy Efficiency Strategy and Roadmap (AfEES) together with sectoral action plans for the industrial, buildings, agricultural, transport, and energy supply sub sectors. The action plan further outlines measures to promote the adoption of efficient electric and clean cooking appliances and equipment.

AfEES is a culmination of a consultative process that brought together African Union Member States and organs, Regional Economic Communities, Regional Centres for Renewable Energy and Energy Efficiency, development partners, industry stakeholders, non-government organizations, academia among other stakeholders. It forms a cornerstone of the African Union’s broader energy agenda, guided by Agenda 2063: The Africa We Want, and represents a continental commitment to achieving sustainable, inclusive, and efficient energy systems.

Through AfEES, Africa commits to improving its energy productivity by 50% by 2050 and 70% by 2063, aligning economic growth with environmental responsibility and equitable access.

This strategy does more than outline policies, it creates a framework for action. Its six sectoral roadmaps translate ambition into measurable progress across industry, transport, power, buildings, and households. The approach integrates short, medium, and long-term goals across Member States, ensuring that energy efficiency becomes not just a



technical aspiration but a cultural shift in how we can create more value from the available energy resources.

Digitalization, innovation, and capacity building lie at the heart of this transformation. From data-driven monitoring and smart infrastructure to workforce training and market incentives, these elements together can redefine Africa’s energy landscape. The success of this vision depends on collaboration between Member States, regional energy centres, development partners, private sector actors, academia, and the African people themselves.

The African Union Energy Efficiency Strategy and Roadmap is not an end in itself but a call to action. It challenges us to integrate efficiency into every energy policy design and programme. In doing so, we can unlock Africa’s vast potential, create sustainable livelihoods, and build resilient economies that thrive.

AFREC is at the forefront and committed to working with all stakeholders in translating the aspirations in the Strategy into real action. Together we can translate the 137 ambitious sectoral actions at the national, regional and continental levels into meaningful outputs that can contribute to the transformation of Africa’s energy landscape.

Let this Strategy together with the Action Plan mark the beginning of a continental movement that sees energy efficiency not as an abstract concept, but as an opportunity to shape an Africa that is brighter, cleaner and self-sustaining for generations to come.

Mr. Rashid Ali Abdallah
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ABBREVIATIONS

ACEC	Africa Clean Energy Corridor
ADMS	Advanced Distribution Management System
AEGEI	Africa-Europe Green Energy Initiative
AEIS	African Energy Information System
AFAPw	African Fertilizer and Agribusiness Partnership
AFC	African Railway Confederation
AfCFTA	African Continental Free Trade Area
AfDB	African Development Bank Group
AfEES	African Union Energy Efficiency Strategy
AFREC	African Energy Commission
AFSEA	African Sustainable Energy Association
AFSEC	African Electrotechnical Standardization Commission
AfSEM	African Single Electricity Market
AFUR	African Forum for Utility Regulators
AGPF	African Green Port Forum
AI	Artificial Intelligence
AMI	Advanced Metering Infrastructure
APUA	Association of Power Utilities in Africa
AREI	African Renewable Energy Initiative
ARSCP	African Roundtable on Sustainable Consumption and Production
ASBN	African Sustainable Building Network
AU	African Union
AUC	African Union Commission
AUC-DIE	African Union Commission's Department of Infrastructure and Energy
AUDA-NEPAD	African Union Development Agency-New Partnership for Africa's Development
CAADP	Comprehensive African Agricultural Development Programme
CEMAC	Central African Economic and Monetary Community
CMP	African Continental Power Systems Masterplan
COMESA	Common Market for Eastern and Southern Africa
CPD	Continuous Professional Development
CSO	Civil Society Organisation
DER	Distributed Energy Resource
DREA	AUC's Department of Rural Economy and Agriculture
DSM	Demand Side Management
EAMA	East African Manufacturers Association
EASA	Energy Services Companies Association of Southern Africa
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
EE	Energy Efficiency
EMS	Environmental Management System
EnMS	Energy Management Systems
ESCO	Energy Service Company
EU	European Union
FEWAMA	Federation of West African Manufacturers Associations
FIDIC	International Federation of Consulting Engineers
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GTAF	Global Technical Assistance Facility

HVAC	Heating, Ventilation and Air Conditioning
IAEA	International Atomic Energy Agency
ICAO	International Civil Aviation Organization
ICCT	International Council on Clean Transportation
ICT	Information and Communication Technologies
IEA	International Energy Agency
IFC	International Finance Corporation
IIoT	Industrial Internet of Things
IRENA	International Renewable Energy Agency
ISO	International Standards Organisation
KE	Key Expert
LAS	League of Arab States
LPG	Liquefied Petroleum Gas
M&V	Measurement and Verification
MEPS	Minimum Energy Performance Standards
MRV	Monitoring, Reporting, and Verification
NDC	Nationally Determined Contribution
NGO	Non-Governmental Organisation
NKE	Non-Key Expert
PAMA	Pan-African Manufacturers Association
PAQI	Pan-African Quality Infrastructure
PESTEL	Political, Economic, Social, Technological, Environmental, and Legal
PIDA	Program for Infrastructure Development in Africa
R&D	Research and Development
REC	Regional Economic Community
SADC	Southern African Development Community
SAEEC	Southern African Energy Efficiency Confederation
SCADA	Supervisory Control And Data Acquisition
SDG	Sustainable Development Goal
SEA	Sustainable Energy Africa
SSATP	Africa Transport Policy Program
STC	Specialised Technical Committee
STC-TTIIET	Specialised Technical Committee on Transport, Transcontinental and Interregional Infrastruc- ture, Energy and Tourism
SWOT	Strengths, Weaknesses, Opportunities, and Threats
U4E	United for Efficiency
UATP	African Association for Public Transport
UN	United Nations
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization

1. EXECUTIVE SUMMARY

The energy sector in Africa faces important challenges that adversely affect socio-economic development on the continent. Driven by a growing population and very dynamic economies, the demand for traditional and modern energy sources has been increasing at a sustained pace and consistently requires, as a response, important investment decisions at continental, regional and national levels to expand the energy infrastructure.

On the supply side, important challenges include limited electricity generation capacity, low transmission efficiency, high fuel import costs, unstable and unreliable energy supplies, and high losses in the provision of charcoal or woody biomass as cooking fuels. On the demand side, the challenges include low levels of access to electricity and clean cooking solutions, and low technical efficiency of existing private and commercial vehicle stocks, cooking stoves and electrical appliances.

Scaling up and integrating Africa's energy infrastructures at national, regional and continental level has therefore been identified as a key strategic component to achieve the transformative vision for the continent expressed in its Agenda 2063, "The Africa we want". Multiple supporting initiatives have been launched to operationalise and coordinate this strategic development for the continent. Among them and with the support of the European Union (EU) Global Technical Assistance Facility (GTAF) for Sustainable Energy, the following related energy efficiency (EE) activities were implemented between 2018 and 2021:

- Monitoring the implementation of Minimum Energy Performance Standards (MEPS) and energy labelling;
- MEPS enforcement and market surveillance;
- EE quality assurance frameworks for off-grid appliances;
- Reduction of technical losses of transmission and distribution lines and smart networks management.

In particular, recognising the significant potential for energy savings in Africa by improving the energy performances of various sectors, the African Energy Commission (AFREC) and the EU GTAF have

initiated a dedicated collaborative activity focusing on the development of the first African Union Energy Efficiency Strategy (AfEES). AfEES is an integral component of AU's energy strategic activities.

The present deliverable is the first stage of the development of AfEES, the elaboration of the African Union (AU) EE Strategy and Roadmap. Deliverable 4 will describe its second component, the AU EE Action Plan. The methodological approach followed to define the strategy is based on the experience of developing the strategy and action plan for a harmonised electricity market in Africa. It is fully aligned with adopted policies and strategies at the continental level. Starting from a stocktaking exercise describing the current EE policy environment, the core vision and purpose that drive the strategy were defined. Concrete element of this strategy where then specified: the strategic requirements, the high-level target, and the eight strategic objectives that are pursued. These foundational elements led to the specification of six sectoral roadmaps that will constitute the pillars for the transformation of the strategic objectives into effective action plans.

The overarching vision supporting AfEES is expressed as: "To establish a sustainable, efficient and inclusive energy system that benefits both the environment and the economy while ensuring universal access to energy".

The specific EE related purpose of the strategy is: "To accelerate the adoption of EE paradigms across all sectors of the economy, by fostering an enabling environment that facilitates trade and investment, and the adoption of energy-efficient technologies and practices".

The high-level target of AfEES is defined as an aspirational target covering the timeframe of the Agenda 2063: "The AU commits to achieving a 50% increase of its energy productivity by 2050 and a 70% increase by 2063 to ensure the long-term decoupling of economic growth from energy consumption, fostering energy-efficient and resilient economies and realizing universal access to modern, reliable and affordable energy in support of the Agenda 2063 goals."

The aim of AfEES is not to be an additional and parallel EE document, diverting attention from the challenges of practitioners involved in specific national EE projects. On the contrary, it is intended to show that EE should be massively scaled up, integrated as a smart development strategy that makes the most productive use of Africa's resources, and is supported by the formulation of ambi-

tious targets. To align with the requirements for implementation, this document proposes six sectoral roadmaps that will serve as pillars for the elaboration of detailed action plans.

A common approach has been adopted for each roadmap. To support EE actions for countries with different starting points in terms of prior experience and comprehensiveness of their EE policies, the roadmaps are organised around three dimensions:

- A timeframe reflecting three stages of implementation: Short-, medium- and long-term;
- A geographical scale: Continental, regional and national;
- Several thematic topics: Institutions and regulations, Standards and monitoring, Statistics and knowledge database, Technology (including flagship projects), Capacity building, Market orientation (targets, strategy, roadmaps), and Finance and fiscal.

The roadmaps highlight seven key observations and requirements that have been consistently stressed for all sectors:

Portfolio of measures: Transforming Africa's energy system to effectively observe energy productivity improvement at a macroscopic scale and to sustain such an improvement over a long period of time will require, for each sector, the fast adoption of enabling regulations, incentives, the availability of efficient technologies, and financial mechanisms to overcome the high upfront costs. It will also require a strong information and capacity building policy for both the general public and professionals to materialize the benefits of EE which are less visible than those of investments in large scale infrastructures such as power plants.

Accurate and more detailed data: For sound decision making supported by insightful planning and monitoring and evaluation tools, it is necessary to improve the accuracy of energy data and their resolution at the level of useful energy services.

Capacity to define standards and benchmarks: To support the implementation of real-life projects, higher data accuracy should also produce trusted standards and benchmarks.

Demonstration: the roadmaps stress that - in

parallel to the establishment of a fully functional and comprehensive set of policy tools - it is important to promote best practices by focusing on a few flagship projects that will create an innovative mind set and increase the practical know-how.

Transversal contribution of digitalization to EE: In all end-use sectors, the roadmap stresses the opportunity offered by digital technologies to accelerate Africa's energy productivity improvement. Digitalization is for instance pivotal for data collection, processing and analysis for optimized operations and maintenance in the electricity supply and distribution industry, for energy efficient buildings and appliances, for smart transport systems, for energy management and performances optimization in all industries, and for weather data analysis and smart agriculture practices.

Importance of capacity-building: To face the fast growth forecast while promoting new energy-efficient design processes, it is important to deploy comprehensive capacity building programmes for a skilled workforce.

Coordination and integration: All roadmaps stress the fact that there are important synergies to be gained by operating simultaneously at the continental, regional, and national level.

This EE related assignment is carried out in two phases. The present deliverable describes the "AU EE Strategy and Roadmap". It defines the content of the strategy up to the elaboration of the sectoral roadmaps. In a second phase, the "AU EE Action Plan" will be developed to disaggregate the content of the roadmaps into applicable action plans.

2- INTRODUCTION

This section covers the overall context, vision and purpose of the African Union Energy Efficiency Strategy, and introduces energy efficiency as a cross-cutting pillar of Africa's energy transition. It explains what energy efficiency means in practice, presents the main end-use sectors where progress is expected, and shows how these sectors link to wider continental initiatives such as the African Single Electricity Market and the African Continental Power Systems Master Plan. The reader is prepared to understand why a dedicated, continent-wide energy efficiency strategy is needed and how AfEES fits into the broader transformation of Africa's energy systems and development agenda.

2. INTRODUCTION

2.1. DEFINITIONS

Energy efficiency (EE) is the process of using less energy to achieve the same or higher level of output, whether in the form of electricity, heat, or other types of energy. It involves optimizing the use of energy resources to reduce waste, minimize energy losses, and increase productivity. The ultimate goal of EE is to reduce energy consumption while maintaining or improving the quality of life for individuals and communities.

The following are some of the common EE sectors:

1. **Appliances and devices:** Energy-efficient appliances and devices can reduce energy consumption, save money on utility bills, and reduce greenhouse gas (GHG) emissions. The most common measures adopted include Minimum Energy Performance Standards (MEPS) and energy labelling. These schemes are further expanded as there is – globally – a move towards circular economy paradigms.
2. **Electricity Supply Industry:** EE measures in the utilities sector include reducing transmission and distribution losses, optimizing power generation and distribution, and improving energy storage.
3. **Industry:** EE measures in the industrial sector involve improving equipment efficiency, optimizing industrial processes, and reducing energy waste.
4. **Buildings:** EE measures in buildings involve improving insulation, installing energy-efficient windows, using energy-efficient lighting, and using energy-efficient appliances and equipment.
5. **Transportation:** EE measures in the transportation sector include using electric or hybrid vehicles, improving vehicle aerodynamics, reducing vehicle weight, and using alternative fuels.
6. **Agriculture:** Energy is used in multiple ways in agriculture, both directly (electricity and fuels) and indirectly (such as fertilizers, which require large amounts of

energy to be produced). Post-processing of agricultural produce can also be energy intensive. At the global level, efforts are made to electrify agriculture, use renewable fuels (especially for larger machinery) and improve the EE of any appliances and devices used.

2.2. ALIGNMENT WITH THE DEVELOPMENT OF THE AFRICAN SINGLE ELECTRICITY MARKET AND THE CONTINENTAL MASTER PLAN

During the mid-2010s, the Program for Infrastructure Development in Africa (PIDA) was making progress in developing electricity interconnection projects across the continent. In 2011, the PIDA study on growth and demand was published, providing a macro-level outlook for infrastructure demand, including energy. In 2012, the African Union (AU) Summit adopted PIDA. Between 2012 and 2015, various activities were undertaken to enhance communication and financing, such as the launch of the Virtual PIDA Information Centre (<https://www.au-pida.org/>), the African Strategic Infrastructure Initiative, the Africa 50 Fund, the Continental Business Network, and the Dakar Financing Summit. The first PIDA Week was held in 2015, which also hosted the first PIDA Steering Committee Meeting.

Despite significant infrastructure-related activities, including power interconnector projects, there was still uncertainty about how electricity trade would be realized, particularly between power pools, once the interconnectors became operational. With the assistance of the European Union (EU) through its Global Technical Assistance Facility (GTAF) for Sustainable Energy, the AU Commission's Department of Infrastructure and Energy (AUC-DIE) began developing the **"Strategy for the Development of a Harmonized Regulatory Framework for the Electricity Market in Africa"** and the **"Action Plan for the Development of a Harmonized Regulatory Framework for the Electricity Market in Africa"** in 2015. The development of these documents included specific implementation steps. The table below presents the progress made so far.

Table 1: Activities implemented so far at the continental level

Transmission grids	Energy efficiency	Energy access	Horizontal tasks
T.1. Guidelines for Transmission Tariffs at Continental Level and Monitoring Plan for Transmission Tariffs at Continental Level	E.1. Continental MEPS and Labels Guidelines	A.1 Guidelines for an Institutional and Policy Model for Mini-Grids at Continental Level Including Model Contracts	H.1 Strategy for the Development of a Harmonized Regulatory Framework for the Electricity Market in Africa
T.2. Tariff Computational Model and Transmission Tariff/Wheeling Charge Results	E.2. Monitoring of the Implementation of the MEPS and Energy Labelling	A.2. Unlocking Africa's Mini-Grid Market	H.2. Action Plan for the Development of a Harmonized Regulatory Framework for the Electricity Market in Africa
T.3. Capacity Building and Training on Transmission Tariffs Calculation Tool	E.3. Road Map Strategy and Action Plan for Creation and Operationalization of Test Laboratories	A.3. Exploring Africa's Mini-Grid Tariff Methodology Assessment	H.3. Design of the African Single Electricity Market (AfSEM)–Policy Paper and Roadmap
T.4. Strategy and Roadmap for Evolving the Distribution Grids to Smart Grids	E.4. Market Surveillance Strategy and Action Plan		H.4. Preparatory Actions for the Association of Power Utilities in Africa (APUA) and its Electricity Supply Industry Members Towards AfSEM
T.5. Development of the African Continental Power Systems Master Plan (ongoing)	E.5. Strategy and Roadmap for Establishing a Market for Energy-Efficient Appliances in Africa		H.5. Policy Guidelines for Competitive Procurement Processes
C.1. Continental Guidelines and Strategies for Reducing and Maintaining Electricity Network Losses			H.6. AU Post-COVID19-Recovery Strategy for the African Energy Sector along with its Implementation Action Plan and Monitoring and Evaluation Framework
	C.2. Guide for Application of Standards for Appliances used in Rural Electrification Systems in Africa		H.7. Strategic Planning, Action Plan and Guidelines for AfSEM (ongoing)

As the positive impact of the results became clear, AUC-DIE established **AfSEM**, which encompasses policy and planning aspects of the entire electricity value chain at the continental, regional, and national levels, including generation, transmission, distribution, and end-use. The Cairo Declaration by the AU Specialised Technical Committee on Transport, Transcontinental and Interregional Infrastructure, Energy and Tourism (STC-TTIIET) requested the AU Commission (AUC), along with other relevant pan-African continental and regional institutions, to operationalize the electricity market in Africa. The Policy Paper and Roadmap for AfSEM have already been validated by the STC-TTIIET on November 26, 2020, and the market was launched on June 3, 2021, with a phased approach to be completed by 2023 and full operation scheduled for 2040. The main objective of AfSEM is to harmonize regulatory frameworks, integrate generation, transmission, and distribution masterplans across the continent, diversify energy sources, and ultimately ensure 100% electricity access by 2030.

Meanwhile, the AU Development Agency-New Partnership for Africa's Development (AUDA-NEPAD) has begun working on the **African Continental Power Systems Masterplan (CMP)**. The decision to develop the CMP was made by Africa's energy ministers during the AU STC-TTIIET meetings in Nouakchott and Cairo in 2018 and 2019, respectively. AUDA-NEPAD was tasked with leading the development of the masterplan, and the second phase is already underway, coordinated by the EU GTAF and partnering with the International Renewable Energy Agency (IRENA) and the International Atomic Energy Agency (IAEA) for the modelling exercise.

The CMP is expected to integrate the AU's vision expressed in various Specialised Technical Committees (STCs) and ministerial meetings, along with the African Development Bank (AfDB) New Deal for Energy in Africa, the concept of clean corridors, and several other continental strategic issues. These include the Geothermal Risk Mitigation Facility, the Program on Bioenergy Development in Africa, the Harmonized Continental Policy and Regulatory Frameworks in the Electricity Sector, and the Green Mini-Grids Africa Strategy. The CMP is expected to facilitate the creation of a continental energy market anchored on the five power pools and driven by well-functioning regional electricity markets.

Recognising the large potential for energy savings

in Africa by improving energy performances of the various sectors (buildings, industry including agriculture, transport, power sector, appliances and devices), the **African Energy Commission (AFREC)** and EU GTAF initiated a dedicated collaborative activity focused on the development of the AU Energy Efficiency Strategy and Programme, and under the Africa-Europe Green Energy Initiative (AEGEI) that was announced as part of the Africa Investment Package at the EU-AU Summit in February 2022.

AFREC is responsible for deploying the AU EE Programme. It is a specialised technical agency of the AUC, under the Department of Infrastructure and Energy created by Decision of the 37th Ordinary Session of the AU Assembly in July 2001 and officially launched by the AU Ministers in charge of energy in February 2008 in Algiers, Algeria.

Developed under the leadership of AFREC, the African Union Energy Efficiency Strategy (AfEES) is an integral component of AU's energy strategic activities together with AfSEM and the CMP. The objective of this specific initiative, which is of strategic relevance for Africa's energy system, is to develop a dedicated continental EE strategy spanning across all sectors.

By aiming for ambitious and systemic EE improvements in all sectors and for all energy sources, AfEES is fully aligned with the strategic objectives of AfSEM and the CMP. EE has been recognised as one of the six pillars of the harmonization of Africa's regulatory frameworks for the electricity market. Efficiency gains along the electricity supply, transmission and distribution value chain will reduce losses and improve the operational efficiency of Africa's integrated market. AfSEM thus emphasizes the importance of a dedicated and harmonised regulatory environment to support the definition of EE norms, standards, and enable the development of Energy Service Companies (ESCOs).

EE is also highly relevant for the CMP initiative to maximize the amount of electricity delivered to end-users per unit of capacity installed and per unit of primary energy consumed. Africa's abundant renewable resources can be pooled via an integrated transmission system at continental level and efficient distributed grids to meet the rapidly growing electricity demand. EE here plays an important role to free up more energy for increased connectivity thereby increasing energy access, availing energy for trade in the regional and continental market

and energy for productive uses including industry. On the supply side, EE will also induce fuel savings and delay investments in additional capacity.

2.3. VISION

Establish a sustainable, efficient and inclusive energy system that benefits both the environment and the economy while ensuring universal access to energy.

Africa is a vast continent spanning 30,244,049 km² and home to over 1.3 billion people. While Northern African countries boast an electrification rate of over 99%, this is not the case in Sub-Saharan Africa, where the electrification rate is much lower. According to the Electricity Access Database¹, the urban electrification rate in Sub-Saharan Africa is 80%, while the rural electrification rate is only 28%. Access to affordable and clean energy is the crucial Sustainable Development Goal (SDG) 7 of the United Nations (UN). Especially SDG 7.3 calls for doubling the global rate of improvement in EE by 2030. Achieving the SDG target for 2030 may be challenging, but many African countries are actively working towards it. To meet this goal, coordinated efforts are required for both on-grid and off-grid electrification activities, given the limited electricity infrastructure in Africa and low access in rural areas. It is worth noting that access to electricity is vital to achieving several SDGs, including poverty eradication (SDG 1), climate action (SDG 13), health (SDG 3), education (SDG 4), water supply (SDG 6), and industrialization (SDG 9). Therefore, achieving electrification and access to all forms of energy in general, is a critical prerequisite for many SDGs, especially for developing countries.

Climate action is critical to mitigate the impacts of climate change, which has far-reaching consequences for the environment, human health, and the global economy. The increase in GHG emissions over the last century, primarily from human activities such as burning fossil fuels and deforestation, has led to global warming and a host of relat-

ed issues such as sea level rise, ocean acidification, and extreme weather events. In order to limit these impacts and prevent the worst outcomes of climate change, the world must take concerted action to reduce emissions and transition to a low-carbon economy.

The Paris Agreement, adopted in 2015 by the United Nations Framework Convention on Climate Change (UNFCCC), is the most significant international agreement on climate change to date. Its goal is to limit global warming to well below 2°C above pre-industrial levels, while pursuing efforts to limit the increase to 1.5°C. The Agreement aims to achieve this goal by requiring countries to set and regularly report on their own emissions reduction targets, known as Nationally Determined Contributions (NDCs), and by providing a framework for financial and technological support to help developing countries reduce emissions and adapt to the impacts of climate change. Many countries have included EE measures in their NDCs under the Paris Agreement. For example, some countries have set targets for improving EE in buildings, industry, and transportation, while others have implemented policies and programs to promote the use of energy-efficient technologies and practices.

The Paris Agreement also includes provisions for international cooperation on EE. Article 10 of the Agreement calls for parties to cooperate in promoting EE, including through the transfer of technology, knowledge sharing, and capacity building. The Agreement also calls for the establishment of a «Technology Framework» to facilitate the development and transfer of climate-friendly technologies, including energy-efficient technologies.

EE is an important component of the Paris Agreement, as it is a key strategy for reducing GHG emissions and limiting global warming. The Agreement recognizes the importance of EE measures and calls for all countries to take ambitious efforts to promote EE and reduce energy consumption, both domestically and through international cooperation.

EE is an appropriate solution to face energy challenges, particularly with the important increase of modern energy demand on the continent, while contributing to climate action goals. Indeed, there is significant potential for energy savings in Africa through improved energy performances in various sectors.

2.4. PURPOSE

The purpose of AfEES is to accelerate the adoption of EE paradigms across all sectors of the economy, by fostering an enabling environment that facilitates trade and investment, and the adoption of energy-efficient technologies and practices. This approach will drive sustainable socioeconomic development, alleviate poverty, strengthen energy security, minimize GHG emissions, and improve the resilience of African economies against climate change impacts.

2.5. ELEMENTS OF AfEES

AfEES consists of two documents:

1. The AU EE Strategy and Roadmap;
2. The AU EE Action Plan.

These two documents include:

Assessment and analysis: The definition of the EE Strategy includes an assessment of the status of EE activities in the AU. It is complemented by a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis and a Political, Economic, Social, Technological, Environmental, and Legal (PESTEL) analysis.

Strategic requirements: Strategic requirements are the essential conditions and resources needed to successfully implement the strategy and achieve its objectives. They set the foundation for strategic planning, identifying what is necessary to move from the current state to the desired future state. By outlining these requirements, the strategy is ensured to be realistic, achievable, and well-resourced, fostering a smoother and more efficient implementation process.

Strategic objectives: Strategic objectives are fundamental elements of a strategy, providing

clear direction and measurable targets that guide an organization's or nation's efforts towards its vision. They translate the broad mission and vision into specific, actionable, and time-bound goals. By defining strategic objectives, stakeholders have a clear understanding of what success looks like and what steps must be taken to achieve it. They promote alignment, accountability, and serve as a tool to track progress and adjust the course of action as needed.

Targets: The strategy includes one high-level target able to be measured at national, regional and continental levels. Sectorial targets are very closely related to the strategic objectives of the strategy. For each strategic objective, one or more targets are chosen to facilitate their implementation. They are presented in the Action Plan.

Action plan: AfEES includes a detailed Action Plan that outlines specific measures to be taken to achieve the strategic objectives set. This plan is structured per strategic objective, with different activities for the three levels (continental, regional, national) and three timeframes (short-term, before 2030, medium-term between 2030 and 2040, and the long-term covering 2040-2050-2063). The Action Plan will be detailed as a separate document. The **Roadmap** is essentially an outline of the activities of the Action Plan and is part of the present document.

EE and climate action: EE activities are at the core of climate action. The synergies and complementarities are analysed in this section of AfEES.

Financing: AfEES addresses as much as possible the financing modalities in the Action Plan.

Monitoring and evaluation: AfEES includes a plan to monitor and evaluate progress made. Since the stocktaking exercise has revealed that capacities regarding monitoring are low, the best currently available tools and approaches are used to set the baseline, and at the same time activities are planned to improve capacities and to achieve detailed monitoring of the progress made regarding EE per sector as the implementation of AfEES progresses.

¹ IEA (2023). Electricity Access Database 2022. <https://www.iea.org/data-and-statistics/data-product/sdg7-database#access-to-electricity>

3. ASSESSMENT AND ANALYSIS OF THE CURRENT SITUATION

This section covers the diagnostic foundation of AfEES, based on stocktaking exercises and data analysis across key sectors. It presents where African countries stand on minimum energy performance standards and labelling, losses and efficiency in the electricity supply industry, and the challenges and opportunities in buildings, industry, transport and agriculture. The reader is introduced to the main gaps, constraints and potentials revealed by the evidence, including the macro trends that shape demand, emissions and investment needs. The section also explains how PESTEL and SWOT analyses are used to capture political, economic, social, technological, environmental and legal factors that influence energy efficiency progress and risks.

3. Assessment and analysis of the Current Situation

3.1. RESULTS OF THE STOCK-TAKING EXERCISE

The sections below build on the outcomes of the stocktaking and data analysis exercises on a sectoral basis^{2,3}.

A. MEPS and Energy Labelling

- The Economic Community of West African States (ECOWAS) is the regional economic community (REC) that has adopted five policies regarding MEPS and three policies regarding energy labelling, leading the way for other African RECs to follow suit.
- 18 countries have already adopted policies regarding MEPS, while 12 countries have adopted policies on EE, indicating the potential for further expansion across the continent.
- The Regional Centres for Renewable Energy and EE are developing regional strategies and policies and offer support to their Member States for advancing MEPS and energy labelling initiatives.
- The adopted “Guidelines for MEPS Energy Labelling and Eco-Design at the Continental Level” highlights lighting, refrigerators, fans, and air conditioners as the first batch of appliances, prioritizing the most energy-intensive devices.
- The AU has adopted Guidelines for quality assurance frameworks for off-grid appliances, ensuring efficient energy use even for off-grid energy solutions.
- Electricity Supply Industry
- AU Member States have high transmission and distribution losses (both technical and non-technical). They are as high as 60%,

showing significant room for improvement⁴.

- Over 40% of the 55 AU Member States have electricity network losses above 20%, compared to 5-10% in developed countries, indicating the need for investment in more efficient infrastructure⁵.
 - Many centralized electricity generation plants suffer from imperfect maintenance, which has a heavy impact on their overall efficiency, highlighting the importance of proper maintenance and management.
 - Even a 1% improvement in the EE of centralized electricity production plants can translate to millions of euros saved on an annual basis, demonstrating the potential benefits of efficiency improvements⁶.
 - The AU has adopted Guidelines and Strategies for the Reduction of Technical Losses of Transmission and Distribution Lines and Smart Network Management, as well as a Strategy and Roadmap for Smart Distribution Grids, paving the way for more efficient energy systems.
- #### B. Buildings
- The sub-Saharan Africa region has the world’s worst housing conditions, with 60% of its population living in slums and informal settlements, emphasizing the need for improved housing solutions.
 - Housing deprivation is linked to income and employment deprivations and has a significant impact on other deprivations such as water, sanitation, hygiene, and living environments.
 - 472 million people (~40% of the total population) live in urban areas and cities in sub-Saharan Africa, which is the world’s fastest urbanizing region, with an annual urban population growth rate of 4.1%, compared to the

² EU GTAF (2023). AfEES Deliverable 1: African Energy Efficiency Policies Stock Taking, Log frame and data gathering

³ EU GTAF (2023). AfEES Deliverable 2: EE data collection, analysis and targets development.

⁴ EU GTAF (2020). Continental Guidelines and Strategies for the Reduction of Technical Losses of Transmission and Distribution Lines and Smart Network Management.

⁵ Ibid.

⁶ EU TAF (2017). ES-0071: Study Tour by SAPP Environmental Sub-Committee to Electricity Power Utilities in Europe - Final Report.

world's rate of 2%. Floor area is expected to double between now and 2050, highlighting the increasing demand for energy-efficient buildings.

- The investment opportunity (International Finance Corporation (IFC) estimation) in sub-Saharan Africa for commercial buildings is estimated at \$258.4 billion, while for residential buildings, it is \$509.6 billion, totalling \$768 billion, showcasing the potential for growth in the sector.
- Buildings account for 61% of final energy consumption and 32% of CO₂ emissions in Africa. The building sector is a key sector for tackling climate change, with over 90 MtCO₂ emissions savings possible by 2040. Few actions focused on the building sector are present in the NDCs.
- Increased access to services and a growing population could result in a net rise in direct emissions from today, but still 40% lower than they are currently on track to be, indicating the importance of efficient building practices.
- Energy codes that are well-designed, implemented, and enforced can lock in cost-effective energy savings of 30 to 40% at the time of construction compared to standard practices employed during the operational life of the building. In addition to lowering energy bills, energy codes can reduce load growth and the need for new energy generation capacity while limiting air pollution and GHG emissions.

C. Industry

- Major industry sectors in Africa include iron and steel, chemicals and petrochemicals, cement, aluminium, and pulp and paper.
- According to UNCTAD⁷, "Africa's industrial and manufacturing development has been weak, with the share of manufacturing in the gross domestic product (GDP) peaking

at 15.3% in 1990 before falling to 10.5% in 2008. The decline in manufacturing's contribution to the GDP since 1990 has occurred across all African subregions. In 2009, resource-based manufacturing made up 49% of total manufacturing value added, compared to 20% for low-technology manufacturing and 31% for medium- and high-technology manufacturing".

- South Africa's implementation of energy management systems (EnMS) in industrial companies has reduced energy costs and emissions. From January 2016 to April 2018, this initiative helped approximately 80 companies save 335 GWh of energy (334.1 tonnes of CO₂ equivalent), highlighting the potential for EE in Africa⁸.
- In the International Energy Agency (IEA) report⁹, the Sustainable Africa Scenario (SAS) scenario, energy demand in industry, freight, and agriculture grows by nearly 40% by 2030. Increased production of fertilizers, steel, and cement, as well as manufacturing appliances, vehicles, and clean energy technologies, help reduce the burden of imports in Africa, which currently stands at over 20% of the GDP.

D. Transportation

- African countries face rapid population growth, increasing national income, urbanization, and motorization rates.
- The transportation sector struggles to provide affordable, accessible, and clean transport to meet growing demand.
- Investment in sustainable transport infrastructure and modes is insufficient.
- Despite low motorization levels, most urban areas in Africa face numerous transport issues, including poor safety, environmental performance, exclusion of vulnerable populations, and inefficient public transport systems.

- Some African cities see their vehicle fleets double every seven years.
- Africa has only 2% of the world's vehicle population but 16% of global road deaths, resulting in the highest road deaths per capita worldwide. Pedestrians and cyclists account for 38% of these fatalities.
- The African Sustainable Transportation Forum has adopted several EE and emission reduction actions, including air quality monitoring in major cities, vehicle emission standards, vehicle import regulations, cleaner fuel regulations, and national policies to improve fuel economy.

Land transport systems activities by the AU

- The AUC, in partnership with the United Nations Environment Programme (UNEP), is implementing a project on safer and cleaner used/imported cars, aligned with the African Road Safety Action Plan.
- The AUC is developing the African Railway Market to encourage a shift from road to rail, supporting intra-African trade, industrialization, and the African Continental Free Trade Area (AfCFTA).
- Adopted Railway Technical Specifications of Interoperability promote electric traction trains.
- The AUC plans to develop a continental green, smart, and clean transport policy, intermodal transport strategy, and a non-motorized transport strategy based on the existing Continental Transport Policy.

Air transport system activities by the AU

- Offsetting CO₂ can help reduce emissions from air travel through individual actions before and after a flight.
- African Member States and airlines collaborate with the International Civil Aviation Organization (ICAO) to address aviation's GHG emissions. National policies should incentivize the development and deployment of sustainable alternative fuels.

Maritime transport and port activities by the AU

- The AU adopted the African Green Port Forum (AGPF) and road map during the fourth STC-TTIE in September 2023 in Zanzibar. The main objective of the AGPF is to bring together port authorities, maritime administrations, and technical and financial partners to examine the situation of ports and maritime transport on the continent, and to study the possibilities for these ports to incorporate green and smart solutions into their business models in order to reduce carbon emissions and decrease the environmental impact of ports on the local and international environment.

3.2. PESTEL ANALYSIS

A PESTEL analysis is a strategic tool used to evaluate the broad macro-environmental factors that impact a strategy. This includes political, economic, sociocultural, technological, environmental, and legal factors. Understanding these external influences is crucial for strategic planning, as they often drive opportunities and threats that can impact the feasibility and success of a strategy. A PESTEL analysis offers a comprehensive view of the wider context in which we operate, allowing us to proactively anticipate changes, adapt our strategy, and stay competitive in a dynamic environment.

⁷ UNCTAD (2013). The state of industrial development in Africa: unexploited opportunities amidst growing challenges, Policy Brief n°27. https://unctad.org/system/files/official-document/presspb2013d1_en.pdf#Key%20points

⁸ UNIDO (nd). Making Industrialization in Africa Sustainable. <https://www.un.org/en/un-chronicle/making-industrialization-africa-sustainable>

⁹ IEA (nd). Africa Energy Outlook 2022. <https://www.iea.org/reports/africa-energy-outlook-2022/key-findings>

A. Political factors

Political factors include government policy, political stability, restrictive trade policies, tax policies, and labour laws, among others.

Table 2: The political factors of the PESTEL analysis

POLITICAL FACTORS	Likelihood: high or low	Impact: + or -	Opportunities to be maximised OR threats to be minimised
1. Political will and commitment to EE among AU Member States.	High	+	Opportunity Leverage political commitment to drive policy development and resource allocation for EE initiatives.
2. The influence of international climate change policies and agreements on national energy policies.	High	+	Threat Ensure that national energy policies align with international climate change commitments to avoid potential conflicts and penalties.
3. The role of regional organizations, like the AU and RECs, in coordinating and harmonizing EE policies.	High	+	Opportunity Strengthen collaboration between regional organizations and AU Member States to facilitate policy harmonization and knowledge sharing.
4. The impact of political stability and security on EE project implementation.	High	-	Threat Monitor and address political instability and security concerns that may jeopardize EE projects.
5. The role of national and local governments in driving EE initiatives.	High	+	Opportunity Support and empower national and local governments to champion EE measures and projects.
6. The influence of global geopolitics on energy markets and technology transfer.	Low	+	Threat Monitor global geopolitical developments and devise strategies to mitigate potential risks to energy markets and technology transfer.

B. Economic Factors

Economic factors influence the implementation of EE activities. They include economic policies, economic activities, economic growth, interest rates, inflation, disposable incomes, unemployment rates, natural resource endowments, etc.

Table 3: The economic factors of the PESTEL analysis

ECONOMIC FACTORS	Likelihood high or low	Impact + or -	Opportunities to be maximised OR threats to be minimised
1. Economic disparities among AU Member States and the need for tailored EE solutions.	High	-	Opportunity Develop customized EE interventions that consider the unique economic contexts of each AU Member State.
2. Potential economic benefits of EE, such as job creation and reduced energy costs.	High	+	Opportunity Leverage EE initiatives to stimulate economic growth and improve living standards.
3. The availability of funding and financial support for EE projects.	High	-	Threat Explore diverse funding sources and mechanisms to minimize reliance on a single source and ensure financial sustainability for EE initiatives.
4. The potential impact of EE on industrial competitiveness and economic diversification.	High	+	Opportunity Promote EE measures that enhance industrial competitiveness and support economic diversification.
5. The role of the private sector in financing and implementing EE projects.	High	+	Opportunity Encourage public-private partnerships and create an enabling environment for private sector participation in EE initiatives.
6. The implications of global economic trends and fluctuations on energy markets.	High	-	Threat Monitor global economic trends and devise strategies to mitigate potential risks to energy markets and EE initiatives.
7. Informal markets.	High	-	Threat Strengthen the enforcement mechanisms which is essential to counter the negative impact of informal markets, which frequently feature unregulated and non-standardized products and practices. These markets pose a significant challenge to EE activities by introducing low-quality and non-compliant equipment into the market.

C. Sociocultural Factors

Sociocultural factors include demographic characteristics including population, population growth rates, household sizes, fertility rates, age distribution, geographic distribution, cultural barriers, lifestyle attitudes, career attitudes, etc.

Table 4: The social factors of the PESTEL analysis

SOCIAL FACTORS	Likelihood high or low	Impact + or -	Opportunities to be maximised OR threats to be minimised
1. Public awareness and acceptance of EE measures.	High	+	Opportunity Implement public awareness campaigns and educational programs to promote the benefits of EE and encourage behavioural changes.
2. Cultural factors influencing energy consumption patterns and preferences.	Low	-	Threat Consider cultural factors when designing EE interventions to ensure they are appropriate and effective.
3. The potential for EE initiatives to improve public health and living conditions.	High	+	Opportunity Design and implement EE projects that contribute to improved public health and living conditions.
4. The role of local communities in promoting and adopting EE measures.	High	+	Opportunity Engage local communities in the planning and implementation of EE projects to increase ownership and acceptance.
5. Gender disparities in access to energy services and decision-making.	High	-	Threat Address gender disparities through targeted interventions and promote gender equality in EE initiatives.
6. The influence of urbanization and demographic trends on energy demand.	High	-	Threat Monitor urbanization and demographic trends to anticipate future energy demand and tailor EE interventions accordingly.
7. Africa is characterized by a predominantly youthful demographic.	High	+	Opportunity Target the young population strategically in awareness-raising campaigns and capacity building actions which is crucial, as they often exhibit greater adaptability and receptiveness to technological advancements. This demographic holds significant potential to expedite the adoption of innovative energy-efficiency technologies.

D. Technological Factors

Technological factors include technological incentives, level of innovation, automation and research and development (R&D) policies, technological awareness, technological changes, trends, etc.

Table 5: The technological factors of the PESTEL analysis

TECHNOLOGICAL FACTORS	Likelihood high or low	Impact + or -	Opportunities to be maximised OR threats to be minimised
1. The potential for technology transfer and capacity building through international partnerships.	High	+	Opportunity Foster partnerships with international organizations and developed countries to facilitate technology transfer and capacity building.
2. The availability and affordability of energy-efficient technologies.	High	-	Threat Support the development and adoption of affordable and locally appropriate energy-efficient technologies.
3. The role of digital technologies in monitoring and evaluating EE progress.	High	+	Opportunity Invest in digital technologies and data infrastructure to enhance monitoring and evaluation of EE initiatives.
4. The potential for innovation and technological leapfrogging in the energy sector.	High	+	Opportunity Encourage R&D in EE technologies and practices to drive innovation and leapfrogging.
5. The influence of technological advancements on energy consumption patterns.	Low	-	Threat Monitor and adapt to the impact of technological advancements on energy consumption patterns to ensure effective EE interventions.
6. The need for capacity building and skills development in EE technologies.	High	+	Opportunity Develop workforce training and capacity building programs to build expertise in EE technologies and practices.

E. Environmental Factors

Environmental factors include environmental policies, climate change issues, global warming and GHG emissions, level of awareness about environmental issues, pressure from environmental Civil Society Organisation (CSO) / Non-Governmental Organisation (NGO) lobby groups, etc.

Table 6: The environmental factors of the PESTEL analysis

ENVIRONMENTAL FACTORS	Likelihood high or level	Impact + or -	Opportunities to be maximised OR threats to be minimised
1. The impact of climate change on energy resources and infrastructure.	High	-	Threat Implement climate-resilient EE measures to protect and enhance energy resources and infrastructure.
2. The potential for EE initiatives to contribute to climate change mitigation efforts.	High	+	Opportunity Integrate EE initiatives into national climate change mitigation plans and strategies.
3. The need to balance EE with other environmental considerations, such as biodiversity and natural resource conservation.	Low	-	Threat Adopt a holistic approach to EE initiatives, considering potential trade-offs with other environmental objectives.
4. The role of renewable energy sources in enhancing EE and reducing GHG emissions.	High	+	Opportunity Promote the development and integration of renewable energy sources into EE plans and projects.
5. The potential environmental and social impacts of EE projects, such as resource extraction or displacement of communities.	Low	+	Threat Conduct thorough environmental and social impact assessments to ensure the sustainability of EE initiatives.
6. The need for sustainable resource management in the context of EE initiatives.	Low	+	Opportunity Implement sustainable resource management practices to minimize the environmental footprint of EE projects and ensure long-term resource availability.

F. Legal Factors

Legal factors are closely related to political factors; however, they are more focused on the EE legal and regulatory framework conditions that enable the effective implementation of EE activities including anti-discrimination laws, anti-trust laws, copyright, patents and intellectual property laws, health and safety laws, etc.

Table 7: The legal factors of the PESTEL analysis

LEGAL FACTORS	Likelihood high or low	Impact + or -	Opportunities to be maximised OR threats to be minimised
1. The existence and enforcement of EE policies and regulations.	High	+	Opportunity Encourage the development and enforcement of comprehensive and harmonized EE policies and regulations across Member States.
2. Compliance with international climate change agreements and commitments.	High	+	Threat Ensure that EE initiatives align with international climate change commitments to avoid potential conflicts and penalties.
3. Intellectual property rights and technology transfer.	High	-	Threat Address intellectual property rights concerns to facilitate technology transfer and promote the development of locally appropriate energy-efficient technologies.
4. Legal frameworks governing public-private partnerships and private sector participation.	High	+	Opportunity Establish clear and supportive legal frameworks to encourage public-private partnerships and private sector participation in EE initiatives.
5. The influence of regional and international trade agreements on energy markets and technology access.	High	-	Threat Monitor and navigate regional and international trade agreements to ensure access to energy-efficient technologies and minimize potential disruptions in energy markets.
6. Regulations governing the environmental and social impacts of EE projects.	Low	-	Opportunity Ensure that EE initiatives comply with relevant environmental and social regulations to minimize negative impacts and promote sustainable development.

3.3. SWOT ANALYSIS

The SWOT analysis is undertaken to identify AfEES’ internal strengths and weaknesses, as well as its external opportunities and threats. Ultimately, this is a framework for leveraging AfEES’ strengths, improving on weaknesses, minimising threats, and taking advantage of opportunities.

A. Strengths

The table below presents AfEES’ internal strengths and the strategies to leverage them.

Table 8: The strengths of the SWOT analysis

STRENGTHS	Strategies to leverage strengths
1. Abundant and diverse renewable energy resources across the continent.	Promote the development and integration of renewable energy sources into EE plans and projects.
2. Existing regional and continental frameworks to support EE initiatives.	Strengthen collaboration and coordination among AU Member States, utilizing existing frameworks and institutions.
3. Increasing global focus on climate change, providing opportunities for international partnerships and funding.	Engage with international organizations and donors to secure funding and expertise for EE projects.
4. The potential for EE to contribute to economic growth and job creation.	Develop workforce training and capacity building programs to create jobs in EE-related sectors.
5. The AU’s role in facilitating policy harmonization and coordination among AU Member States.	Encourage the adoption of harmonized EE policies and standards across AU Member States.
6. A growing young and skilled workforce capable of driving innovation in EE.	Foster innovation by supporting R&D in EE technologies and practices.
7. The potential for leapfrogging by adopting advanced energy-efficient technologies.	Encourage the adoption of cutting-edge technologies to maximize EE gains.
8. Synergies between EE and other development goals, such as poverty reduction and improved health.	Integrate EE initiatives into broader development plans and policies.

B. Weaknesses

The table below presents AfEES’ internal weaknesses and the strategies to minimise them.

Table 9: The weaknesses of the SWOT analysis

WEAKNESSES	Strategies to minimise weaknesses
1. Limited access to reliable and affordable energy in many African countries.	Expand access to modern energy services through targeted EE measures and infrastructure development.
2. Insufficient infrastructure and resources to support large-scale EE projects.	Prioritize investments in energy infrastructure and capacity building to enable the implementation of EE projects.
3. Lack of comprehensive and harmonized EE policies and regulations across AU Member States.	Encourage the development and adoption of harmonized EE policies and standards.
4. Low awareness of the benefits of EE among the general public and decision-makers.	Implement public awareness campaigns and training programs to promote the benefits of EE.
5. Insufficient funding and investment for EE projects.	Mobilize domestic and international resources to finance EE projects and initiatives.
6. Limited availability of locally manufactured energy-efficient technologies.	Promote the development of local manufacturing capabilities for energy-efficient technologies.
7. Inadequate capacity for monitoring and evaluation of EE progress.	Strengthen institutional capacity for data collection, monitoring, and evaluation of EE initiatives.
8. Fragmented efforts and a lack of coordination among various stakeholders involved in EE initiatives.	Enhance coordination and collaboration among stakeholders, including public and private sector actors.

C. Opportunities

The table below presents AfEES' internal opportunities and the strategies to exploit them.

Table 10: The opportunities of the SWOT analysis

OPPORTUNITIES	Strategies to exploit opportunities
1. Growing global demand for clean and sustainable energy sources.	Position African countries as leaders in clean energy production and EE.
2. The potential for technology transfer and capacity building through international partnerships.	Foster partnerships with international organizations and developed countries to facilitate technology transfer and capacity building.
3. The increasing role of the private sector in driving EE innovation and investment.	Encourage private sector participation in EE projects through incentives and supportive policies.
4. Opportunities for regional cooperation and knowledge sharing through existing regional organizations and networks.	Strengthen existing regional organizations and networks to facilitate knowledge sharing and cooperation on EE.
5. The potential for EE to contribute to climate change mitigation efforts.	Integrate EE initiatives into national climate change mitigation plans and strategies.
6. Exploiting digital technologies for data collection, monitoring, and analysis of EE progress.	Invest in digital technologies and data infrastructure to enhance monitoring and evaluation of EE initiatives.
7. The possibility of creating new jobs and income-generating activities through EE initiatives.	Promote EE projects that generate local employment and contribute to economic development.
8. Leveraging existing infrastructure and energy resources to maximize EE gains.	Identify and prioritize EE improvements in existing infrastructure to optimize resource utilization.

D. Threats

The table below presents AfEES' internal threats and the strategies to counter them.

Table 11: The threats of the SWOT analysis

THREATS	Strategies to counter threats
1. The impact of climate change on energy resources and infrastructure.	Implement climate-resilient EE measures to protect and enhance energy resources and infrastructure.
2. Political instability and conflicts that may hinder the implementation of EE projects.	Engage in conflict prevention and resolution efforts to create a stable environment for EE initiatives.
3. Economic disparities among AU Member States, affecting the feasibility of implementing EE measures.	Design tailored EE interventions that can be adapted to the unique economic contexts of each AU Member State.
4. Resistance to change and the adoption of new technologies in some sectors.	Promote stakeholder engagement and awareness-raising to foster acceptance of new energy-efficient technologies and practices.
5. Potential trade-offs between EE and other development priorities.	Strive for integrated planning and policy-making that balances EE with other development objectives.
6. Dependence on imported energy-efficient technologies, making local economies vulnerable to external shocks.	Encourage the development of local manufacturing capabilities and promote the use of locally-sourced technologies, while harvesting the benefits of the AfCFTA.
7. The potential for environmental and social concerns to undermine the acceptance of EE projects.	Conduct thorough environmental and social impact assessments to ensure the sustainability of EE initiatives.
8. Fluctuations in global energy prices, affecting the financial viability of EE initiatives.	Diversify energy sources and promote EE measures to increase resilience to global price fluctuations.

4. THE DEVELOPMENT PROCESS OF AFEES

This section covers how AfEES was designed, from initial analytical work to the final strategic framework. It explains the methodological pillars used to build the strategy, including stocktaking at African and global levels, consultations with stakeholders across continental, regional and national institutions, and the combination of bottom-up data collection with top-down target setting. The reader is guided through the reasoning that connects past African experience on electricity market harmonisation with the current approach to energy efficiency. The section clarifies why this process ensures both technical robustness and political alignment, and how it enables AfEES to be implementable across very diverse country contexts.

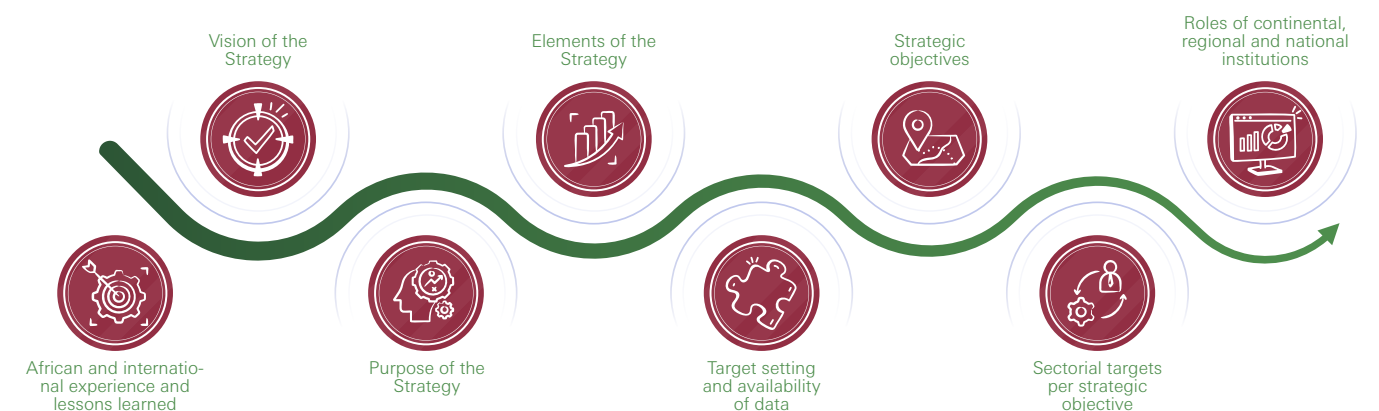
4. THE DEVELOPMENT PROCESS OF AFEES

The development process of AfEES was based on four pillars:

- Extensive stocktaking and desk research at both the African and global level;
- Consultation rounds with stakeholders at the continental, regional and national level in Africa, as well as consultations with international stakeholders;
- Bottom-up approach with the collection of data at the national level and an extensive analysis resulting in both qualitative and quantitative indicators;
- Top-down approach for the formulation of the aspirational high level target guiding the definition of the high level strategy.

The following figure presents the methodological approach followed for the development of AfEES. It has to be highlighted that this approach is based on previous African experiences (e.g. developing the Strategy and Action Plan for a Harmonized Electricity Market in Africa) and it is fully aligned with adopted policies and strategies at the continental level.

Figure 1: Development process of AfEES



5. STRATEGIC REQUIREMENTS

This section covers the enabling conditions that must be in place for AfEES to move from strategy to implementation. It details the types of coordination needed between institutions, the level of political commitment required from Member States, and how responsibilities should be allocated across agencies, regulators, utilities and partners. The reader is prepared to understand why human and institutional capacity, robust review and monitoring mechanisms, and sufficient financial resources are non-negotiable foundations. The section also underlines the importance of incentives, communication, and public and stakeholder engagement so that energy efficiency measures are understood, supported and sustained over time.

5. STRATEGIC REQUIREMENTS

Strategic requirements are the essential conditions and resources needed to successfully implement the strategy and achieve its objectives. They set the foundation for strategic planning, identifying what is necessary to move from the current state to the desired future state. By outlining these requirements, the strategy is ensured to be realistic, achievable, and well-resourced, fostering a smoother and more efficient implementation process

A. Strong coordination

Effective implementation of AfEES will require strong coordination among various stakeholders, including governments, the private sector, NGOs, and international partners. This coordination is essential to ensure that policies and initiatives are harmonized, resources are allocated efficiently, and best practices are shared. AFREC and the Regional Centres for Renewable Energy and EE can coordinate the activities at the continental and regional level, facilitating information exchange, minimizing the duplication of efforts, and aligning strategic objectives.

B. Strong political commitment

The success of AfEES depends on strong political commitment from AU Member States to prioritize EE in their national policies, plans, and budgets. Political commitment can be demonstrated through the establishment of clear targets, the allocation of resources, and the integration of EE into broader development agendas. High-level political support can also help drive investment, foster international cooperation, and create an enabling environment for the implementation of EE measures.

C. Allocation of responsibilities

Clear allocation of responsibilities among different stakeholders is essential for the effective implementation of AfEES. This includes defining the roles of national and regional authorities, utilities, regulators, and other relevant actors in the development, implementation, and monitoring of EE policies and programs. A well-defined division of responsibilities will help ensure that all stakeholders are accountable for their actions and will facilitate collaboration and coordination.

D. Human capacity and resources

Implementing AfEES will require sufficient human capacity and resources to design, manage, and monitor EE initiatives. This includes building the technical expertise of policymakers, regulators, utilities, and other stakeholders involved in the EE sector. Capacity building initiatives, such as training programs, workshops, and knowledge-sharing platforms, can help address skills gaps and ensure that stakeholders have the necessary knowledge and tools to support the implementation of AfEES.

E. Effective review mechanism and progress monitoring

To ensure the success of AfEES, it is crucial to establish an effective review mechanism and progress monitoring system. This will enable regular assessments of the implementation of EE policies and initiatives, the identification of areas for improvement, and the adjustment of strategies as needed. Regular reporting and tracking of progress towards EE targets can also help maintain transparency, accountability, and stakeholder engagement.

F. Financial resources and incentives

The implementation of AfEES will require substantial financial resources and incentives to support EE projects and initiatives. This may include the establishment of dedicated funds, the provision of grants or loans, or the implementation of innovative financing mechanisms to attract private sector investment. Adequate financial support will be crucial in overcoming barriers to investment and driving the widespread adoption of energy-efficient technologies and practices.

G. Public awareness and stakeholder engagement

Raising public awareness and promoting stakeholder engagement in EE initiatives is critical to the success of AfEES. This can be achieved through communication campaigns, educational programs, and community-based projects that inform and engage citizens, businesses, and other stakeholders in EE efforts. Building public support and understanding of the benefits of EE can help drive demand for energy-efficient products and services, encourage behaviour change, and foster a culture of energy conservation.

6. HIGH-LEVEL TARGET

This section covers the overarching energy productivity target adopted at continental level and the logic behind it. It explains the commitment to improve Africa's energy productivity by 2050 and 2063, and what it means to decouple economic growth from energy consumption while still expanding access and supporting development. The reader is introduced to the rationale for choosing energy productivity as the main indicator, the constraints linked to data availability, and the benefits of a realistic yet aspirational trajectory. The section also sets expectations about how this target can be revised over time as statistics improve and economic and energy conditions evolve.

6. HIGH-LEVEL TARGET

The AU commits to achieving a 50% increase of its energy productivity by 2050 and a 70% increase by 2063 to ensure the long-term decoupling of economic growth from energy consumption, fostering energy-efficient and resilient economies and realizing universal access to modern, reliable and affordable energy in support of the Agenda 2063 goals.

6.1. RATIONALE

This target combines two concepts: Energy productivity and the decoupling of economic growth from energy consumption.

Setting a target for energy productivity improvement is a positive approach that promotes efficient energy use and encourages innovation. This would allow countries to focus on maximizing the economic output generated from each unit of energy consumed. Given the available country level data, detailed modelling exercises cannot yet be implemented. Part of the strategy will specifically aim at improving this data availability. The proposed high-level target is a realistic aspirational target at the continental level. This target could be revised periodically based on the availability of better data and the evolution of the economic and energy landscape in Africa.

Emphasizing the need for sustainable decoupling at the same time ensures that countries strive to reduce the energy intensity of their economies without hindering economic development. By framing the target in terms of decoupling, African countries can focus on increasing EE, transitioning to renewable energy sources, and fostering economic growth in sectors that are less energy-intensive.

It is important to note that many African countries have already decoupled economic growth from energy consumption, but this can change as the economies grow, manufacturing activity increases and all people get access to electricity. This is why it is essential to highlight the importance of the decoupling aspect for sustainability.

6.2. BENEFITS

The proposed formulation has certain benefits:

Flexibility: By combining energy productivity improvement with the goal of sustainable decoupling, countries and RECs have the flexibility to adapt their strategies based on their unique contexts and challenges. This allows them to focus on the aspects of EE and decoupling that are most relevant to their economies and developmental trajectories.

Balance between development and efficiency: This approach ensures that countries are not forced to limit their economic development in the name of EE. Instead, it encourages them to find innovative ways to use energy more efficiently and decouple their economic growth from energy consumption. This can help them achieve sustainable development while also reducing the environmental impacts associated with energy use, while accelerating the growth of their economies.

Encourages innovation and investment: Setting targets for energy productivity improvement and sustainable decoupling can stimulate innovation and attract investment in energy-efficient technologies and practices. By focusing on both goals, countries can ensure that they are creating the right environment for technological advancements and attracting the necessary investments to drive sustainable growth.

Alignment with global climate goals: Pursuing a combination of energy productivity improvement and sustainable decoupling aligns with global climate goals, such as the Paris Agreement. This approach would contribute to reducing GHG emissions and mitigating climate change impacts while promoting sustainable economic development in Africa. Moreover, it allows the use of climate action financing for EE activities.

6.3. SETTING A TRAJECTORY FOR THE HIGH-LEVEL TARGET

Successful targets are both ambitious and feasible. The high-level target of AfEES represents a realistic aspirational target that could catalyse regional and national efforts in Africa and help make significant progress towards increasing energy productivity for the economy as a whole.

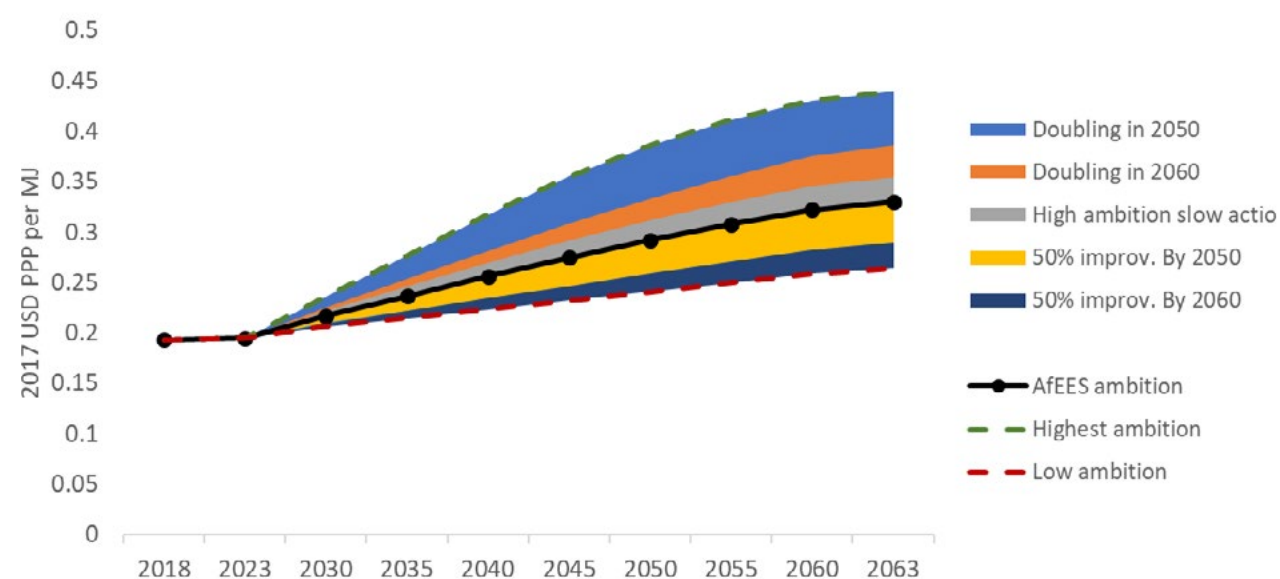


Figure 2. High-level AfEES energy productivity target over the horizon of Africa's Agenda 2063

The trajectory over the horizon of the AU's Agenda 2063 is depicted by Figure 2. This target is:

Ambitious yet achievable: The high-level target marks a commitment to a resource efficient economy that is ambitious and achievable for Africa. Africa's energy productivity will steadily increase to reach \$0.33 per megajoule over the next 40 years. This clear shift from the stagnation observed over the past decade can be achieved with progressive changes leading to a 12% increase relatively to 2018 by 2030, a 31% increase by 2040, a 50% increase by 2050 and a 70% increase by 2063. Africa has a vast untapped potential for EE improvements and the proposed trajectory is within reach technically while being sufficiently ambitious in terms of timing for implementation.

Aligned with Africa's energy access and sustainability goals: As a commitment to address inefficient uses of energy in all sectors, the high-level target will support the achievement of universal energy access in Africa (SDG 7, affordable and clean energy), ensure that Africa's biomass resources are used in the most productive manner for cooking or as green fuel, and reduce the demand for fossil

fuels (SDG 13, climate action). By setting a clear EE target for the whole system, African countries can demonstrate the reality of this commitment, mobilize and coordinate global or local financing possibilities more efficiently, track progress, and modernize Africa's economy.

Strategic for Africa's energy infrastructures: Achieving Africa's Agenda 2063 goals will require a very dynamic economy with GDP growth rates as high as 7 to 10% over the next 40 years¹⁰. However, realising this economic transformation with an inefficient energy system will imply very high losses and oversized investments in energy supply options to compensate for these losses.

A catalyst for innovation and investment: Aiming for ambitious improvements in energy productivity can serve as a catalyst for innovation, driving the development and adoption of energy-efficient technologies and practices. This target can also attract investment in the energy sector, supporting economic growth and job creation.

An incentive for regional collaboration: Mobilizing actions at the continental, regional, national

and even local level will be required to achieve a sustained energy productivity improvement over several decades. This provides an opportunity for African countries to collaborate and share best practices, fostering regional cooperation and synergies.

Setting the stage for higher ambitions and periodic revisions: Higher energy productivity levels could in theory be reached by 2030, 2035, and 2040 assuming institutional and regulatory barriers have been removed and there is a faster diffusion of the best available technologies. The current level of detail of collected statistics does not enable a precise sectoral and regional disaggregation. The African Energy Information System (AEIS) is continuously improved and the proposed target could, according to the measured progress, be periodically revised and its ambition raised. A five year time frame is proposed.



¹⁰ AfDB (2023, February 19). Sustain minimum growth rate of 7-10% of GDP to achieve inclusive growth and sustainable development in Africa, experts say at AU Summit. <https://www.afdb.org/en/news-and-events/press-releases/sustain-minimum-growth-rate-7-10-gdp-achieve-inclusive-growth-and-sustainable-development-africa-experts-say-au-summit-59153>

7. STRATEGIC OBJECTIVES

This section covers the set of strategic objectives that translate the high-level vision of AfEES into actionable directions across sectors and governance levels. It explains how objectives are structured around regulatory frameworks, performance improvements in industry and commercial end users, efficiency in the electricity supply industry, minimum performance and labelling schemes, clean cooking, buildings, transport and agriculture. The reader is prepared to see how these objectives guide investments, policies, capacity building and technology deployment. The section also highlights the importance of strengthening monitoring capacity so that progress on energy efficiency can be tracked across all Member States and sectors in a coherent way.

7. STRATEGIC OBJECTIVES

Based on the previous analysis, the following Strategic Objectives have been identified:

SO1. Develop a conducive regulatory and institutional framework to support EE investments

A well-designed regulatory and institutional framework is essential to promote EE investments across Africa. This objective aims to establish clear policy guidelines, targets, and standards to facilitate private and public investments in energy-efficient technologies and practices. Collaboration among governments, international organizations, and the private sector will help create an enabling environment that encourages innovation, knowledge sharing, and capacity building. The framework should also foster the development and implementation of EE financing mechanisms, such as loans, grants, and incentives, which are essential for scaling up energy-efficient projects across various sectors.

SO2. Achieve energy-efficient operation of industrial and commercial end users

Enhancing EE in the industrial and commercial sectors is a crucial component of the energy transition in Africa. This objective focuses on promoting best practices, technologies, and management systems to optimize energy use in these sectors. Energy-efficient operation will not only reduce operational costs and increase competitiveness, but also contribute to a more sustainable and resilient energy system. This includes fostering EnMS, retrofitting existing facilities, and promoting energy-efficient design in new industrial facilities and mining operations, along with encouraging the adoption of renewable energy sources where possible.

SO3. Improve the EE of the Electricity Supply Industry (centralized generation and grids)

The objective is to reduce energy losses and optimize the efficiency of power generation, transmission, and distribution systems across Africa. Addressing technical and non-technical losses in the electricity network is crucial for enhancing energy security and reducing GHG emissions. This can be achieved through modernizing infrastructure, implementing smart grid technologies, enhancing

maintenance practices, and promoting regional interconnectivity. Additionally, encouraging decentralized and renewable energy generation can contribute to a more efficient and resilient Electricity Supply Industry.

SO4. Implement MEPS and energy labels, and promoting clean cooking

Establishing and enforcing MEPS and energy labelling programs are essential to promote energy-efficient products and appliances in the African market. This objective seeks to develop and harmonize MEPS and energy labels across the continent, ensuring that manufacturers and importers comply with these requirements. Consumer awareness campaigns can help educate the public about the benefits of energy-efficient products, ultimately driving market demand for these products and contributing to significant energy savings. This strategic objective also covers efficiency improvements along the clean cooking value chain.

SO5. Enhance EE in the building sector

With rapid urbanization and population growth, the building sector represents a significant opportunity for EE improvements in Africa. This objective aims to develop and enforce energy-efficient building codes, promote the use of energy-efficient materials and construction techniques, and encourage retrofitting of existing buildings. Green building certifications, incentives, and training programs can further stimulate the adoption of energy-efficient practices in the building sector, leading to reduced energy consumption, lower GHG emissions, and improved living conditions.

SO6. Boost EE in the transportation sector

The transportation sector is a major contributor to energy consumption and GHG emissions in Africa. This objective focuses on promoting sustainable transport solutions, such as efficient public transportation systems, non-motorized transport, and the adoption of electric vehicles. Encouraging fuel-efficient technologies, improving transport infrastructure, and implementing policies to reduce traffic congestion and emissions are essential components of this objective. These efforts can contribute to more sustainable and resilient urban and rural transportation systems across the continent.

SO7. Support EE in agriculture

The agricultural sector is vital for food security and economic growth in Africa. This objective aims to promote energy-efficient technologies and practices in agricultural production, processing, and distribution. This includes adopting energy-saving irrigation systems, improving the efficiency of agricultural machinery, and promoting the use of renewable energy sources. Supporting research, innovation, and capacity building in energy-efficient agricultural practices can lead to increased productivity, reduced energy costs, and a more sustainable and resilient agricultural sector.

SO8. Strengthen capacity at national, regional, and continental levels to monitor EE progress across all sectors

Effective monitoring and evaluation of EE progress are critical for identifying gaps, informing policy decisions, and ensuring the success of EE initiatives. This objective aims to establish robust data collection and reporting mechanisms at the national, regional, and continental levels. Strengthening the capacity of governments, institutions, and stakeholders to analyse and utilize EE data can help guide policy development, track progress against targets, and identify best practices. Additionally, fostering regional cooperation and knowledge sharing can facilitate the exchange of experiences and lessons learned, further contributing to the advancement of EE across Africa.



8. EXPECTED BENEFITS

This section covers the range of benefits that AfEES is expected to deliver for African societies, economies and environments. It presents how energy efficiency can expand access to modern and affordable energy, strengthen energy security, and support economic growth while reducing costs for households and businesses. The reader is invited to consider the links between efficiency, poverty reduction, job creation, air quality, climate change mitigation and adaptation, and the preservation of natural resources. The section also explains how the strategy can enhance regional integration, improve policy coherence, stimulate innovation, mobilise finance, and contribute to more inclusive and gender-responsive development outcomes.



8. EXPECTED BENEFITS

The expected benefits of AfEES can be summarized as follows:

- **Improved energy access:** AfEES can help increase access to modern, reliable, and affordable energy services across the continent.
- **Enhanced energy security:** By promoting EE, AfEES can contribute to reducing energy import dependence and increasing energy self-sufficiency.
- **Job creation:** Implementing EE measures can create new jobs in various sectors, such as construction, manufacturing, and services.
- **Economic growth:** EE can lead to cost savings for businesses and households, freeing up resources for investment and consumption, which can stimulate economic growth.
- **Poverty alleviation:** Improved EE can help reduce energy costs for low-income households and contribute to poverty alleviation efforts.
- **Sustainable development:** EE can support sustainable development by reducing the environmental impact of energy consumption and promoting the efficient use of natural resources.
- **Climate change mitigation:** EE can help reduce GHG emissions and contribute to global climate change mitigation efforts.
- **Climate change adaptation:** Improved EE can enhance the resilience of African economies to the impacts of climate change, such as increasing energy demand due to temperature changes.
- **Improved air quality:** EE measures can help reduce air pollution from fossil fuel combustion, improving public health and environmental quality.
- **Reduced pressure on natural resources:** EE can contribute to the conservation of natural resources, such as water and forests, by

reducing energy demand and associated resource extraction.

- **Strengthened regional integration:** AfEES can promote regional cooperation and integration by fostering collaboration among African countries in the development and implementation of EE policies and programs.
- **Enhanced policy coherence:** AfEES can contribute to the harmonization of EE policies, regulations, and standards across the continent, creating a more consistent and coherent policy environment.
- **Capacity building:** AfEES can support capacity building efforts in the energy sector, helping African countries develop the necessary skills and expertise to implement EE measures effectively.
- **Knowledge sharing:** AfEES can facilitate the exchange of knowledge, best practices, and lessons learned in EE among African countries.
- **Technology transfer:** AfEES can promote the transfer of energy-efficient technologies and know-how from more advanced countries to those with less developed energy sectors.
- **Enhanced energy infrastructure:** AfEES can contribute to the improvement of energy infrastructure, such as electricity transmission and distribution networks, by promoting investments in EE.
- **Increased private sector participation:** AfEES can help create an enabling environment for private sector investments in EE projects and technologies.
- **Greater energy diversification:** By promoting EE, AfEES can encourage African countries to diversify their energy mix, reducing reliance on a single energy source.
- **Improved energy management:** AfEES can support the development and implementation of effective EnMS in various sectors, such as industry, buildings, and transport.
- **Increased consumer awareness:** AfEES can raise awareness among consumers about

the benefits of EE and encourage the adoption of energy-efficient behaviours and practices.

- **Strengthened institutional frameworks:** AfEES can help African countries establish and strengthen institutional frameworks to support the effective implementation of EE policies and programs.
- **Improved energy planning:** AfEES can support the integration of EE considerations into national and regional energy planning processes.
- **Better access to finance:** AfEES can help African countries mobilize resources for EE investments, including from international sources such as development banks and climate funds.
- **Foster innovation:** AfEES can stimulate innovation in the development and application of energy-efficient technologies and solutions.
- **Support gender equality:** By promoting access to affordable and reliable energy services, AfEES can contribute to empowering women and girls and reducing gender disparities.
- **Encourage sustainable urban development:** AfEES can support the planning and implementation of energy-efficient measures in urban areas, such as energy-efficient buildings, public transport systems, and smart city technologies.
- **Strengthen multi-stakeholder partnerships:** AfEES can foster collaboration and partnerships among governments, the private sector, civil society, and international organizations to advance EE across the continent.
- **Enhanced monitoring and evaluation:** AfEES can support the development of robust monitoring and evaluation systems to track progress on EE goals and inform evidence-based decision-making.



9. INSTITUTIONAL FRAMEWORK

This section covers the architecture of institutions and stakeholders that will shape the implementation of AfEES at continental, regional and national levels. It introduces the stakeholder power-interest mapping and explains how different actors, from African Union organs and regional organisations to utilities, regulators, financial institutions, industry bodies and civil society, are positioned in terms of influence and engagement. The reader is prepared to understand who leads, who supports, who regulates and who implements within the strategy. The section also points to the roles of sector-specific organisations and international partners, showing how coordinated action and clear mandates are essential for delivering the strategy's objectives.

9. INSTITUTIONAL FRAMEWORK

9.1. STAKEHOLDER MAPPING

AfEES is a sector-wide energy strategy. This means that apart from the energy sector stakeholders, other sectorial stakeholders need to also be included in the overall institutional framework. These include stakeholders from the industrial sector, the transportation sector, the buildings sector and the agricultural sector.

A stakeholder power-interest matrix was developed, where the energy sector stakeholders are mapped in accordance with their perceived levels of influence and interest. It shows the stakeholders' level of involvement and engagement in AfEES, thus enabling the more effective engagement of AU institutions with them, leading to the successful implementation of AfEES.



Figure 3: AfEES stakeholder power-interest map

Examples of sectorial organizations include:

- African Association for Public Transport (UATP) / transportation sector;
- African Sustainable Building Network (ASBN) / buildings sector;
- United Nations Industrial Development Organization (UNIDO) / industry sector;
- African Fertilizer and Agribusiness Partnership (AFAP) / agriculture sector;
- African Roundtable on Sustainable Consumption and Production (ARSCP) / horizontal.

9.2. KEY STAKEHOLDERS AND THEIR ROLES

A detailed analysis of the roles of key stakeholders is provided in the table below. It has to be highlighted that given the extent and reach of AfEES, more sectorial stakeholders can be integrated during the implementation of AfEES.

Table 12: Stakeholders’ roles in AfEES

Level	Stakeholder	Role in AfEES
Continental	AFREC	AFREC has a key role in coordinating the implementation of AfEES. This includes providing support at the regional and national levels for energy policies and setting standards for EE across the continent. This could involve developing continent-wide EE targets, guidelines, and regulations, as well as monitoring and evaluating progress towards these targets.
Continental	AUC	The AUC can act as the political and diplomatic leader of the initiative. This role includes advocating for and communicating the importance of EE at regional and global levels, coordinating with AU Member States to integrate EE into national energy plans, and ensuring the alignment of AfEES with other continental strategies. The AUC could also play a significant role in mobilizing resources for the implementation of AfEES.
		The AUC-DIE is an essential stakeholder for infrastructure, including energy-efficient buildings. They can support AU Member States in developing and implementing policies and regulations promoting energy-efficient construction and retrofitting of existing buildings.
		The AUC’s Department of Rural Economy and Agriculture (DREA) is a key stakeholder in promoting EE in agricultural practices. They can advocate for the use of energy-efficient farming equipment, irrigation systems, and post-harvest processing technologies.
Continental	AUDA–NEPAD	AUDA-NEPAD can serve as the operational arm of AfEES, responsible for developing and implementing key continental EE projects. This would involve collaborating with AU Member States, RECs, and the private sector to promote investment in EE technologies and infrastructure. It is important to note that AUDA-NEPAD also leads the Comprehensive African Agricultural Development Programme (CAADP).
Continental	AfDB	The AfDB can provide critical financial support and expertise for AfEES. This could include funding for EE projects, capacity-building initiatives, and research. The bank could also leverage its relationships with international donors and investors to attract additional funding for AfEES. Finally, it can lead the way in mobilizing climate action financing for EE investments.
Continental	UNECA	UNECA can provide research, data, and policy advice to support the implementation of AfEES. This could involve conducting economic and policy analyses of EE measures, providing technical assistance to AU Member States, and advocating for EE at regional and international forums.

Level	Stakeholder	Role in AfEES
Continental	APUA	APUA can promote EE among its members by sharing best practices, providing training and capacity building, and advocating for supportive policies and regulations.
Continental	AFUR	AFUR can promote EE interventions in terms of the regulatory framework. This activity can focus on the power market facilitating harmonisation and by sharing best practices, providing training and capacity building, and advocating for supportive policies and regulations.
Regional	Regional Centres for Renewable Energy and EE	These centres can drive the implementation of EE measures at the regional level, providing technical expertise, capacity building, and advocacy as well as facilitating harmonization. They could also serve as hubs for innovation and knowledge sharing in EE.
Regional	Power Pools	Power Pools are instrumental in promoting and implementing EE measures within their respective regions. This could involve integrating EE into regional power planning and operations, facilitating cross-border EE projects, and sharing best practices among AU Member States.
Regional	Regional regulatory authorities	Regional regulatory authorities can ensure the integration of EE principles into the power sector. This could involve harmonizing regulations across countries, promoting transparency in the energy sector, and enforcing compliance with EE standards and regulations.
Regional	Regional regulatory associations	Regional regulatory associations could support their members in incorporating EE into regulatory frameworks.
Sectoral stakeholders		
Continental	UATP	The UATP can play a pivotal role in promoting EE in the transportation sector. They can advocate for the adoption of more energy-efficient vehicles, the development of public transportation systems, and the integration of urban planning and transportation strategies to reduce energy consumption.
Continental	ASBN	The ASBN can support EE in the building sector by promoting the adoption of sustainable building practices and materials, sharing best practices, and providing training and capacity building.
Continental	AFAP	AFAP could play a role in promoting energy-efficient fertilizer production and use, which is a significant component of the agricultural sectors energy consumption.

Level	Stakeholder	Role in AfEES
Continental	ARSCP	The ARSCP can help promote energy-efficient consumption and production practices in various sectors, including industry, agriculture, and buildings. This could include promoting the use of energy-efficient appliances and equipment, as well as energy-saving behaviours.
Continental	African Railway Confederation (AFC)	The AFC can influence EE in the transportation sector, specifically in railways.
Continental	Africa Transport Policy Program (SSATP)	The SSATP can influence EE in the transportation sector and support the operationalisation of mobility surveys.
Continental	Sustainable Energy Africa (SEA)	SEA can provide technical assistance in the development and harmonisation of EE policies and benchmarking of these policies against international best practices.
Regional	Southern African EE Confederation (SAEEC)	SAEEC can provide awareness raising training on EE, training of energy professionals, promote EE knowledge sharing and networking and support implementation of EE programmes.
Regional	Energy Services Companies Association of Southern Africa (EASA)	EASA supports activities of ESCOs. It can assist in addressing funding and training challenges.
Continental	African Sustainable Energy Association (AFSEA)	AFSEA can support in the development of EE policies and awareness raising activities.
Continental	Pan-African Manufacturers Association (PAMA)	PAMA can promote and support implementation of EE programmes in manufacturing industry.
Regional	East African Manufacturers Association (EAMA)	EAMA can assist in awareness raising activities and in promoting EE interventions to reduce energy consumption.
Regional	Federation of West African Manufacturers Associations (FEWAMA)	FEWAMA can assist in awareness raising activities and in promoting EE programmes to reduce energy consumption.

Level	Stakeholder	Role in AfEES
Continental	International Federation of Consulting Engineers (FIDIC) Africa (Association of Consulting Engineers in Africa)	FIDIC Africa can provide capacity building on EE among consulting engineers in Africa to ensure implementation of EE in industry.
Other international stakeholders		
International	The Global ESCO Network	The Network can provide support in the development of ESCOs in Africa.
International	IEA	The IEA can provide capacity building support for data collection and statistics. It can also support sector assessment and in particular end-use level analyses.
International	International Council on Clean Transportation (ICCT)	While not solely focused on Africa, the ICCT could provide valuable support in implementing energy-efficient transportation policies and technologies in African countries. Their work includes research, policy development, and advocacy in the field of clean transportation.
International	UNIDO	UNIDO can help African industries transition to more energy-efficient processes and technologies. Its roles include the provision of technical assistance, capacity building, policy advice, and fostering partnerships for sustainable industrial development. UNIDO had a leading role in the creation of the Regional Centres for Renewable Energy and EE.
International	UN Global EE Accelerator Platform	The UN Global EE Accelerator Platform can support the development of EE policies and the implementation of EE programmes.
International	Global Environment Facility (GEF)	GEF can provide support in the development and implementation of regional industrial EE programmes.
International	International Standards Organisation (ISO)	ISO can support the adoption of EnMS, ISO 50001 standard in the industrial sector.
International	UN Development Programme (UNDP) Sustainable Energy Hub	The UNDP Sustainable Energy Hub can support the development of human and institutional capacity to support the implementation of EE in industry.

Level	Stakeholder	Role in AfEES
International	<i>United for Efficiency (U4E) - UNEP programme</i>	U4E works to help countries implement an integrated policy approach to enable a sustainable and cost-effective transformation to energy-efficient lighting, equipment and appliances.
International	<i>Clean Cooking Alliance</i>	The Clean Cooking Alliance is an international network of actors promoting clean cooking solutions and industries. This alliance can provide sector analyses and market survey data.



10- ALIGNMENT WITH OTHER CONTINENTAL AND REGIONAL INITIATIVES

This section covers how AfEES connects to and supports existing African and regional strategies on energy, infrastructure, climate and economic integration. It explains the links with Agenda 2063, the African Development Bank's New Deal on Energy for Africa, PIDA, regional efficiency policies and other initiatives on renewables and clean energy corridors. The reader is shown how AfEES reinforces and complements nationally determined contributions on climate, including energy efficiency actions in power, buildings, industry, transport and agriculture. The section also highlights opportunities to leverage climate finance and cooperation mechanisms, so that implementation of AfEES can benefit from and strengthen broader continental commitments.

10. ALIGNMENT WITH OTHER CONTINENTAL AND REGIONAL INITIATIVES

AfEES is in full alignment with other continental and regional initiatives in Africa.

10.1. CONTINENTAL INITIATIVES

1. AU's Agenda 2063

Agenda 2063 is a strategic framework for the socio-economic transformation of the African continent over the next 50 years. EE is a crucial component of this transformation, as it contributes to sustainable development, increased access to energy, and the promotion of low-carbon technologies.

2. AfDB's New Deal on Energy for Africa

The New Deal on Energy for Africa aims to achieve universal access to energy in Africa by 2025. It emphasizes the importance of EE in achieving this goal, particularly through the promotion of clean energy technologies and capacity building for efficient energy management.

3. PIDA

PIDA is a strategic continental initiative that seeks to address Africa's infrastructure deficit, including energy infrastructure. It includes projects related to regional Power Pools and EE.

4. African Renewable Energy Initiative (AREI)

AREI is an Africa-led effort to accelerate the development of renewable energy on the continent, contributing to enhanced energy access, security, and efficiency.

5. Africa Clean Energy Corridor (ACEC)

ACEC is an initiative of the AU, IRENA, and Power Pools, aiming to promote the development of renewable energy resources and enhance EE across the continent.

6. AfCFTA

The synergy between AfEES and AfCFTA paves the

way for an energy-efficient, economically vibrant Africa, enhancing productivity while reducing environmental impacts. The success of AfCFTA depends on a reliable and sustainable energy sector, making the objectives of AfEES critical to achieving the goals of AfCFTA.

10.2. REGIONAL INITIATIVES

1. ECOWAS Regional EE Policy

The ECOWAS Regional EE Policy was adopted in 2013 to promote EE in the West African region. It sets specific EE targets for various sectors, including buildings, appliances, lighting, and transportation, and establishes a framework for coordinating and monitoring progress.

2. Southern African Development Community (SADC) Renewable Energy and EE Strategy and Action Plan

The SADC EE Strategy aims to improve EE in the Southern African region through the development and implementation of regional policies, standards, and programs. This strategy supports the broader goals of energy security, economic development, and environmental sustainability in the SADC region.

3. Common Market for Eastern and Southern Africa (COMESA) Energy Programme

COMESA has established an Energy Programme that promotes renewable energy, EE, regional cooperation, and energy trade among its Member States.

4. Livre Blanc Energie de Economic Community of Central African States (ECCAS)/ Central African Economic and Monetary Community (CEMAC)

The Livre Blanc de CEEAC/CEMAC is a white paper on energy policy for CEMAC and ECCAS. It includes provisions for EE.

5. Arab Sustainable Energy Strategy 2030

The Arab Sustainable Energy Strategy 2030 is a regional policy framework adopted by the League of Arab States (LAS) in 2013, with the aim of ensuring universal access to modern energy services and promoting sustainable development in the Arab

region. It covers both renewable energy and EE aspects.

10.3. ENERGY EFFICIENCY AND CLIMATE ACTION

A. Analysis of the African countries' NDCs

In their most recent NDC reports (from 2021 for almost all countries), African countries emphasize EE to reduce GHG emissions, lower energy costs, and enhance energy security. Several sectors, including power generation, buildings, industry, and transportation, are listed as requiring EE improvements by 2030. Based on the analysis of the AU's countries' NDCs, some high-level outcomes are summarized below:

- EE measures in the power generation sector of African countries' NDCs focus on reducing transmission and distribution losses and improving the efficiency of power plants. Upgrading grid infrastructure, implementing smart grid technologies, and enhancing the maintenance of power generation facilities are key strategies. By implementing these measures, African countries aim to reduce energy losses during electricity transmission and distribution, increase the overall efficiency of power plants, and ultimately lower GHG emissions.
- The building sector is another important area of focus in African countries' NDCs. Energy-efficient building codes, retrofits, and the use of energy-efficient appliances are targeted to reduce energy consumption and minimize CO₂ emissions. By implementing these measures, African countries aim to promote sustainable urban development, decrease energy costs for building owners and occupants, and contribute to climate change mitigation efforts.
- In the industrial sector, African NDCs emphasize the implementation of EnMS, efficient industrial processes, and the adoption of clean technologies. These initiatives aim to enhance productivity and competitiveness while simultaneously reducing energy consumption and GHG emissions. By optimizing industrial processes and adopting cleaner technologies, African countries seek to improve EE, lower

production costs, and mitigate the environmental impact of industrial activities.

- The transportation sector is also a key focus area in African countries' NDCs. Strategies include promoting public transportation, improving vehicle fuel efficiency, and adopting cleaner fuels. These measures aim to reduce emissions, improve air quality, and enhance the overall sustainability of the transport sector. By encouraging the use of public transportation, implementing fuel efficiency standards, and transitioning to cleaner fuels, African countries seek to reduce reliance on fossil fuels, decrease transportation-related emissions, and create more sustainable mobility systems.
- The agriculture sector is touched upon by only two countries: Eswatini, which aims to reduce its energy intensity from 3 to 15% by 2030, and Rwanda, which chose solar water pumps as an alternative to diesel pumps for irrigation. Some countries have not yet set up a comprehensive national Monitoring, Reporting, and Verification (MRV) system, but they will need to do so to enable them to effectively implement their NDC and fulfil their international climate commitments while enhancing EE. An MRV system is defined as the framework for developing, planning, coordinating, and integrating all activities related to the Paris Climate Agreement. This includes various aspects such as GHG inventory, mitigation and adaptation measures, finance, and technology transfer, where efficiency can make a substantial contribution.

B. Synergies and complementarities between AfEES and NDCs

AfEES complements the EE activities outlined in African NDCs by providing a comprehensive and coordinated framework to support the implementation of EE measures across the continent. AfEES can help harmonize approaches, share best practices, and facilitate regional cooperation, which can lead to more effective and cost-efficient implementation of NDC commitments.

By aligning AfEES objectives with those in the NDCs, African countries can leverage the resources and expertise provided by AfEES to accelerate the implementation of their EE goals. AfEES can also support capacity building and the development of

technical knowledge, which are essential for the successful implementation of EE initiatives. It is extremely important to mobilize climate action financing to implement the EE activities foreseen in AfEES. Many climate action instruments and mechanisms can also be used to finance EE activities such as the:

1. Establishment of a cap-and-trade system to create a market for trading carbon credits generated by EE projects;
2. Implementation of a carbon tax on fossil fuel consumption or carbon-intensive industries to create a price signal that incentivizes EE;
3. Encouragement on the development of voluntary carbon markets where companies or individuals can purchase carbon offsets or credits from projects generating verified emission reductions;
4. Incorporation of EE requirements aiming at decreased emissions into public procurement processes to create market demand for energy-efficient products and services;
5. Establishment of green investment banks utilizing climate action financing that also provide financial support for EE projects, offering favourable loan terms, grants, or equity investments.

C. Recommendations for utilizing AfEES in developing future NDCs

1. Incorporate AfEES objectives and strategies into future NDCs

African countries can strengthen their EE commitments by aligning them with AfEES objectives, ensuring consistency and coherence in their EE policies.

2. Utilize climate action financing for implementing AfEES actions

Governments can access climate finance through mechanisms like the Green Climate Fund (GCF) or GEF. Green bonds can be issued to raise capital specifically to finance EE projects. In general, all the financing avenues for climate action that are compatible with EE investments need to be utilized effectively and be included in the NDCs.

3. Leverage AfEES resources and expertise

African countries can tap into AfEES resources, knowledge, and expertise to support the implementation of EE measures in their NDCs, helping to overcome technical and financial barriers.

4. Enhance regional cooperation and coordination

AfEES can facilitate regional collaboration and the exchange of best practices among African countries, promoting the sharing of knowledge and experiences to improve the effectiveness of EE initiatives.

5. Strengthen capacity building

AfEES can support capacity building efforts in African countries, helping to develop the necessary skills and expertise for the successful implementation of EE measures outlined in the NDCs.

6. Monitor progress and report achievements

AfEES can support African countries in tracking progress towards their EE goals, facilitating the reporting of achievements and ensuring accountability in NDC implementation.

11. ROADMAPS

This section covers the sectoral roadmaps that operationalise AfEES, describing how they are structured and how they guide implementation over time and across geographies. It explains that six roadmaps focus on industry, the electricity supply industry, appliances and devices including clean cooking, buildings, transport and agriculture. The reader is introduced to the common framework used for each roadmap, with time horizons, continental, regional and national scales, and thematic blocks such as institutions, standards, data, technology, capacity building, markets and finance. The section also underlines cross-cutting requirements like better data, digitalisation, demonstration projects and coordination, which are recurrent across all sectors.

11. ROADMAPS

As a complement to the specification of an explicit high-level energy productivity target and to the definition of key strategic objectives, AfEES is further anchored on six sectoral roadmaps that will serve as pillars for the elaboration of detailed action plans.

The six roadmaps focus on:

1. Industrial sector;
2. Electricity Supply Industry;
3. Appliances and devices including clean cooking solutions;
4. Buildings;
5. Transportation;
6. Agriculture.

Regarding the Electricity Supply Industry and the appliances and devices sector, documents that have already been adopted by the AU Summit have been integrated in the current high-level and cross sectoral EE strategy to ensure full alignment with all on-going activities in these sectors.

A common approach has been adopted for each roadmap. To support EE actions for countries with different starting points in terms of prior experience and comprehensiveness of their EE policies, the roadmaps are organised around three dimensions:

- **A timeframe** that reflects three stages of implementation: short-, medium- and long-term;
- **A geographical scale:** Continental, regional and national;
- **Several thematic topics:** Institutions and regulations, Standards and monitoring, Statistics and knowledge database, Technology (including flagship projects), Capacity building, Market orientation (targets, strategy, roadmaps), and Finance and fiscal.

To rapidly provide a sense of the balance required between the different types of measures, the thematic concepts are represented using a colour code in the roadmaps:

Figure 4: Colour codes used for the sectoral roadmaps



The roadmaps highlight seven key observations and requirements that have been consistently stressed for all sectors:

Portfolio of measures: transforming Africa's energy system to observe energy productivity improve-

ment at a macroscopic scale and to sustain such an improvement over a long period of time will require, for each sector, the fast adoption of enabling regulations, incentives, the availability of efficient technologies, and financial mechanisms to overcome the high upfront costs. It will also require a strong information policy for both the general public and professionals to materialize the benefits of EE which are less visible than those of investments in large scale infrastructures such as power plants.

Accurate and more detailed data: For sound decision making supported by insightful planning and monitoring and evaluation tools, it is necessary to improve the accuracy of energy data and their resolution at the level of useful energy services.

Capacity to define standards and benchmarks: to support the implementation of real-life projects, higher data accuracy should also produce trusted standards and benchmarks.

Demonstration: the roadmaps stress that - in parallel to the establishment of a fully functional and comprehensive set of policy tools - it is important to promote best practices by focusing on few flagship projects that will create an innovative mind set and increase the practical know-how. Pilot projects will serve as test beds for key innovations and provide African references for capacity building and knowledge sharing activities.

A transversal contribution of digitalization to EE: In all end-use sectors, the roadmap stresses the opportunity offered by digital technologies to accelerate Africa's energy productivity improvement. Digitalization is for instance pivotal for data collection, processing and analysis for optimized operations and maintenance in the electricity supply and distribution industry, for energy efficient buildings and appliances, for smart transport systems, for energy management and performances optimization in all industries, and for weather data analysis and smart agriculture practices.

Importance of capacity-building: to face the fast growth forecast while promoting new energy-efficient design processes, it is important to deploy comprehensive capacity building programmes for a skilled workforce and to effectively share the lessons learned among the Centres for Renewable Energy and EE. To be effective, this capacity building dimension should include dedicated curriculums at African universities as well as training for practitioners.

Coordination and integration: all roadmaps stress the fact that there are important synergies to be gained by operating simultaneously at the continental, regional, and national level.

11.1. INDUSTRIAL SECTOR

Strategic Objective 2: Achieve energy-efficient operation of industrial and commercial end users.

There are two main types of industries, primary and secondary. Primary industries are involved in the extraction of natural resources from the earth for human use, e.g. forestry, agriculture, fishing and mining. Mining is highly energy intensive in extraction, smelting/processing, refining & transportation. Secondary industries are involved in the utilization of products from primary industries and develop them into finished goods. This mainly includes the construction and manufacturing industries.

The manufacturing industry includes the following industries:

- Analytical industries – these involve the breaking down of a raw material into several useful materials, e.g. oil refinery where crude oil is separated into petrol, diesel, liquefied petroleum gas (LPG), kerosene, waxes, lubricants, asphalt, etc.
- Synthetical industries – these involve bringing various ingredients together and combining them in a manufacturing process to produce a new product, e.g. cement, plastic, textiles, soap making, paint making, paper manufacturing, etc.
- Processing industries - these are industries where the primary production processes are either continuous, or occur in batches, e.g. pharmaceuticals, steel and aluminium processing, petrochemical, cosmetics, food and beverages, etc.
- Assembly industries – these are industries that combine finished products to produce a new product, e.g. automotive, aerospace, electronics, medical devices, etc.

Commercial end users include industries without smokestacks, which do not produce visible pollution. Such industries include:

- Agroindustry;
- Horticulture;

- Tourism;
- Information and communication technologies (ICT)-based business services including data centres;
- Logistics.

According to UNCTAD, Africa’s industrial and manufacturing development has been declining over the past few decades, with the share of manufacturing’s contribution to the GDP peaking at 15.3% in 1990 before falling to 10.5% in 2008¹¹. The performance of the manufacturing industry has generally been low due to changes to the global economy, old equipment and inefficient technologies, poor management practices and a shortage of energy.

However, the EE potential in industry has not been fully exploited due to several challenges, including:

- Lack of policies to support the implementation of industrial EE;
- Generally low awareness in industry of the benefits of EE. There is insufficient information on EE available to the industry;
- Inadequate capacity (technical and financial) to implement EE interventions;
- In some countries, the energy prices are relatively low and not set at cost-recovery levels. This makes investments in industrial EE less financially attractive;
- Lack of credible energy consumption baselines, making it difficult to make decisions on EE investments and on monitoring performance;
- Limited access to energy-efficient equipment and technologies, as most of these are imported;
- Lack of funding mechanisms to support industrial EE interventions.
- Lack of policies to support scaling up and sustaining implementation of industrial EE interventions.

In order to address these challenges, the industry roadmap will cover the following:

1. Regulations: Development and harmonisation of policies and standards that promote EE in industry

- Human and institutional capacity develop-

- ment;
- Energy auditing;
- Mandatory energy consumption reporting using energy meters and industrial Internet of things (IIoT) devices to ensure real-time monitoring;
- EnMS standards harmonisation including a diffusion of digital EMS platforms that provide comprehensive insights into energy usage and performance;
- Equipment and technologies;
- R&D.
- Information: Development of tools (digital technologies) to collect and manage industry energy consumption data
- Energy information systems;
- Database of energy consumption baselines with enhanced access to collected information using digital solutions;
- Benchmarking and energy performance indicators;
- Information sharing on best practices facilitated by information and communication technologies.

2. Demonstration projects: Implementation of EE demonstration projects in selected priority industrial sectors

- Guidelines for the selection of priority industrial sectors;
- Resources (technical and financial);
- Energy-efficient equipment and technologies;
- Dissemination of case studies from EE demonstration projects;
- Plan ahead for the scaling up phase of demonstration projects.

3. Financing: Establishment of funding mechanisms to support the implementation of EE in industry

- Tax rebates;
- Subsidies;
- Grants / soft loans / loans;
- Credit lines / Green funding;
- ESCOs;
- Climate financing.

Table 13: Sectoral roadmap: Industry

Continental level	Regional level	National level
Short term: Early stage interventions		
Institutions and regulation		
Establish a Steering Committee for the development of EE policies in industry. This action will assist with the coordination of regional initiatives and the harmonisation of EE policies. It will also assist in benchmarking the EE policies against international best practices.	Support the regional development of policies that promote EE in industry. This action will ensure the harmonisation of development of EE policies in the region. The Regional Centres for Renewable Energy and EE will provide technical assistance to their Member States.	Develop national policies aimed at promoting EE in industry. A regulatory framework will promote the adoption of EE in industry and ensure alignment with national industrial development plans and energy management policies.
Statistics and knowledge	Establish regional coordination structures for industrial EE policies. This action will facilitate the sharing of information, coordination of EE initiatives and harmonisation of regional policies.	Create national coordination structures for EE policies in industry. These structures will require coordination among national departments of energy, commerce and industry, and the alignment of EE policies and programmes with national development plans.
Establish a continental database with all national energy consumption baselines for industry. This action will assist in understanding energy consumption trends and in setting reduction targets through EE interventions.	Statistics and knowledge	
Launch guidelines to map EE opportunities in industry. This action will assist in identifying and selecting EE opportunities for implementation.	Create a regional database for industrial energy consumption baselines from Member States in the region. Accurate and reliable energy consumption baselines will assist in tracking the impact of EE interventions in the region.	Establish comprehensive energy consumption baselines for the national industry using digital technologies. The data will assist in developing credible energy balances useful for assessing the impact of EE on energy consumption and on tracking CO ₂ emissions.
Establish a continental database of priority industrial sectors for EE interventions to assist in selecting industrial sectors for EE interventions.	Standards and monitoring	
Launch continental guidelines for energy management through EE practices. The guidelines will assist in promoting the incorporation of EE into energy management in industry.	Establish a regional clearinghouse of industrial EE opportunities to allow the quick identification of applicable EE opportunities by industry.	Establish EE opportunities in industry. This action will assist in identifying EE opportunities that exist in industry and prioritising them for implementation. The use of IIoT devices will improve the precision of this evaluation.
	Establish a regional database of priority industrial sectors for EE interventions. This action will ensure a high impact of EE interventions in the region.	Develop selection criteria of priority industrial sectors for EE interventions. This action will assist in selecting industrial sectors and enterprises with the highest potential to reduce energy consumption through EE interventions.

11 UNCTAD (2013). The state of industrial development in Africa: unexploited opportunities amidst growing challenges, Policy Brief n°27. https://unctad.org/system/files/official-document/presspb2013d1_en.pdf#Key%20points

Continental level	Regional level	National level
Statistics and knowledge	Standards and monitoring	
Launch continental energy information systems. This action will assist regions and countries in data capturing, processing and reporting of industry energy consumption.	Establish regional energy management standards. This action will promote the adoption of EE by industry in order to comply with the standards.	Implement energy management policies and standards for industry. This action will enable the formalisation of monitoring, evaluation, targeting and reporting of energy consumption by enterprises. This will unlock the energy saving potential through EE interventions.
Capacity building		
Establish continental training programmes for energy auditors, EE experts, energy managers and Measurement and Verification (M&V) experts. This action will assist in building capacity across all stages of implementation of EE in industry.	Establish regional EE awareness raising programmes for industry and its stakeholders. This action will assist in raising awareness of the benefits of EE in the region.	Implement awareness raising training on the benefits of EE in industry. The training will assist in raising awareness by highlighting the economic, environment and social benefits of EE.
Technology	Launch regional training programmes to develop human and institutional capacity to support EE in industry. The training for regional trainers and EE experts will support national training initiatives and enhance the transfer of EE skills.	Develop human and institutional capacity to support the implementation of EE in industry. This action will require collaboration with national training institutions to deliver training of energy auditors, industrial EE experts, energy managers and M&V experts who will assist in implementing and sustaining EE in industry.
Disseminate case studies from EE demonstration projects. This action will assist in raising awareness of the benefits of EE and inspire industry to implement EE interventions.		
Launch a continental database of industrial EE technologies. The database will allow industry to access updated information on new EE technologies that are benchmarked against international best practices.	Technology	
	Roll-out the implementation of regional EE demonstration projects in selected industrial sectors. This action will assist in sharing lessons learned and inspiring other industrial sectors in the region to implement EE interventions.	Implement EE demonstration projects in selected industrial sectors. This action will assist in raising awareness of EE and in building capacity in implementing EE interventions. It will also encourage the nationwide replication of EE interventions.
Market orientation		
Establish continental targets to reduce energy consumption through EE interventions. This action will assist in the development of EE programmes aimed at meeting the set targets.	Establish a regional database of industrial EE technologies. This action will assist in increasing the uptake of EE technologies in the region.	Develop a national database of industrial EE technologies. This action will assist industry in selecting and adopting appropriate EE technologies.
Finance and fiscal	Standards and monitoring	
Establish an information centre of available incentive schemes for EE projects in industry. The information will assist industry in considering such incentive schemes when planning to invest in EE projects.	Set regional industry targets to reduce energy consumption through EE interventions. This action will assist in mobilising resources for the implementation of EE interventions to meet the targets.	Set national industry targets to reduce energy consumption through EE interventions. This action will assist in developing EE implementation plans to meet the industry targets.

Continental level	Regional level	National level
Capacity building		
Establish a continental EE fund to support EE in industry. International Financial Institutions and Development Agencies will be invited to support the fund which will provide catalytic finance to unlock private sector investments in EE.	Establish financial instruments in the region for the implementation EE projects. The availability of several funding options will encourage industry to invest in EE projects. Establish a regional EE fund to support EE in industry. This action will assist industries in regional Member States to have more funding options for EE projects.	Establish financial incentives as enabling instruments for investing in EE projects. Financial support in the form of tax rebates, subsidies, grants or soft loans will accelerate the implementation of EE projects. Establish a national EE fund to support the implementation of EE projects. Industry will be able to access grants to support the implementation of EE projects.
Medium term: strengthening the EE framework		
Statistics and knowledge		
Establish a continental database of energy-intensive industries. This action will assist in the development of policies for mandatory energy management plans and the prioritisation of industrial sectors for EE programmes.	Establish national focal points to collect data on energy-intensive industries in the region. This action will assist in developing regional policies for mandatory energy management plans.	Review energy consumption baselines for the national industry. This action will assist in updating energy consumption data, identifying gaps and aligning with best practices.
Perform a continental review of industrial energy consumption baselines. This action will assist in analysing energy consumption trends and the impact of EE interventions.	Perform a regional review of industrial energy consumption baselines from Member States in the region. This action will assist in assessing the regional impact of EE interventions on industry energy consumption.	Standards and monitoring
Standards and monitoring		
Develop continental assessment tools to monitor the impact of EE interventions. This action will assist in the assessment of results achieved from EE interventions.	Establish digital monitoring tools to assess progress made in implementing EE in industry. This action will assist in reviewing progress and the impact of EE interventions in the region.	Develop national tools to monitor progress made in implementing EE interventions in industry. This action will assist in the assessment and monitoring of progress made in the implementation of EE projects.
Promote EE through the adoption of EnMS, ISO 50001 standard in African industry. This action will assist in sustaining EE in industry. This EnMS is closely linked to the Environmental Management System (EMS) ISO 14001, which deals with environmental protection. Both ISO 50001 and ISO 14001 are focused on safeguarding the environment.	Support the adoption of EnMS, ISO 50001 standard in the region. The support should include regional training of energy auditors, energy managers and EE experts in order to promote EE in the implementation of EnMS.	Support the adoption of EnMS, ISO 50001 standard by national industry. Promoting digital EnMS will provide enterprises with a platform to sustain EE practices through the implementation of ISO 50001.

Continental level	Regional level	National level
Standards and monitoring		
Create a coordination office within AFREC for EE activities in all industrial sectors. This action will enhance the smooth implementation of EE programmes in several industrial sectors. It will also allow the development of sector specific programmes, e.g. metal finishing industrial sector.	Establish a regional coordination body for EE activities in industrial sectors. This action will ensure the smooth implementation of EE interventions in the region.	Establish a national coordination body (national focal point) of EE activities in industrial sectors. This action will assist in preventing the duplication of roles and responsibilities, and ensure the sharing of knowledge, resources and experiences among various industrial sectors.
Capacity building		
Assess industry EE training programmes on the continent. This action will assist in updating the training programmes.	Review industrial EE training programmes in the region. This action will assist in assessing the impact of training provided on the implementation of EE interventions in industry.	Review national industrial EE training programmes. This action will assist in updating EE training programmes in line with new developments.
Launch a continental initiative for the registration and accreditation of EE training courses with the relevant authorities. This action will enhance the credibility of EE training courses.	Register and accredit selected regional EE training courses. This action will increase the demand for EE training in the region.	Register national industrial EE training courses with the National Skills and Qualifications Frameworks. This action will ensure the recognition of EE courses and increase the demand for the training courses.
Technology		
Develop continental generic guidelines for the implementation of industrial EE projects. This action will promote the adoption of EE and guide industry in the implementation of EE projects.	Establish generic guidelines for the implementation of industrial EE projects in the region. These guidelines will assist in accelerating the implementation of EE projects in the region.	Develop national generic guidelines for the implementation of industrial EE projects. This action will assist enterprises to implement EE projects.
Launch continental EE awards for regions that have excelled in implementing industrial EE projects. Awards will boost regional efforts to promote the adoption of EE in industry.	Launch regional EE awards for industrial sectors that have excelled in implementing EE projects. This action will assist in raising awareness of the benefits of EE and encourage other industrial sectors to implement EE projects.	Acknowledge enterprises that have achieved significant energy savings through implementation of EE projects. This action will assist in increasing competition among enterprises in implementing EE projects.
Finance and fiscal		
Set up continental funding mechanisms to support implementation of EE projects. Such funding mechanisms will support regional efforts to implement EE projects.	Establish regional EE funding mechanisms. The availability of funding mechanisms (grants, soft loans, climate finance, carbon credits, green credit lines) will boost implementation of EE projects in the region.	Establish funding mechanisms to support implementation of EE in industry. This action will ensure availability of funding for EE projects.

Continental level	Regional level	National level
Finance and fiscal		
Launch continental credit lines for the implementation of EE projects. This action will allow enterprises to access international financial products. International financial institutions and development agencies will be invited to support credit lines.	Establish regional financial credit lines for the implementation of EE projects. This action will allow any enterprise from the region to access the credit facility without national barriers. The terms of regional credits lines will take into consideration the regional economic dynamics.	Establish financial credit lines for the implementation of EE projects. Credits lines will provide a funding option for large EE projects. A conducive environment is required for the financial sector to offer credit lines to industry to implement EE projects.
Launch a continental fund to support ESCOs' activities. This action will allow ESCOs to access funding for their services in implementing EE projects.	Establish ESCOs for the implementation of EE projects. ESCOs will complement other available financial mechanisms to support the implementation of EE projects in the region.	Develop ESCOs for the implementation of EE projects. ESCOs will offer their services through a package, which includes a comprehensive energy audit service, financing mechanism, equipment procurement, installation and commissioning, operation monitoring and performance guarantees (energy performance contracting services). This will assist enterprises that do not have the expertise and resources needed to implement EE projects.
Long term: mainstreaming high EE solutions		
Standards and monitoring		
Launch continental standards for specific industrial EE equipment and technologies. This action will guide in the design and operation of specific industrial EE equipment and technologies.	Develop regional standards for specific industrial EE equipment and technologies. Studies should be conducted on existing standards to support the development of new standards incorporating EE.	Develop national standards for specific industrial EE equipment and technologies. Some existing equipment standards do not include EE requirements. Standards including EE are required for industrial EE equipment and technologies, such as boiler equipment, electric motors, fans, pumps, insulation systems, heating and cooling systems, Heating, Ventilation and Air Conditioning (HVAC) systems and industrial lighting.
Promote EE through the adoption of EnMS, ISO 50001 standard in African industry. This action will assist in sustaining EE in industry.	Support the adoption of EnMS, ISO 50001 standard in the region. The support should include regional training of energy auditors, energy managers and EE experts in order to promote EE in the implementation of EnMS.	Support the adoption of EnMS, ISO 50001 standard by national industry. Promoting digital EnMS will provide enterprises with a platform to sustain EE practices through the implementation of ISO 50001.
Establish a continental database of accredited energy professionals. This action will encourage energy practitioners to acquire registered and accredited qualifications.	Launch the regional certification and accreditation of energy professionals. This action will ensure credibility of energy professionals in supporting EE activities.	Establish certification and accreditation procedures for energy auditors, energy managers and M&V experts. Certification and accreditation of energy professionals will enhance industry confidence in implementing EE projects.

Continental level	Regional level	National level
<i>Capacity building</i>		
Launch a continental initiative for the registration and accreditation of EE training courses with the relevant authorities. This action will enhance the credibility of EE training courses.	Launch a regional registration and accreditation of selected EE training courses. This action will increase the demand for EE training in the region.	Launch a national registration and accreditation of industrial EE training courses with the National Skills and Qualifications Frameworks. This action will ensure the recognition of EE courses and increase the demand for the training courses.
<i>Technology</i>		
Establish a fund for R&D of EE technologies in Africa. This action will support regional research and the adaptation of internationally available EE technologies. Launch continental EE programmes in specific industrial sectors. The programmes will focus on priority industrial sectors on the continent that are high energy consumers and have potential for energy reduction through EE interventions.	Support R&D of manufacturing EE equipment and technologies in the region. This action will enhance the manufacturing capacity in the region. Roll-out the implementation of regional EE programmes in specific industrial sectors. This action will assist in focusing resources on industrial sectors that have a high energy consumption.	Develop the capacity for local manufacture of EE equipment and technologies. This action lowers investment costs of EE projects as most EE technologies are currently imported. The market, economic benefits, local skills, infrastructure capacity and regulatory framework will need to be assessed. Implement EE programmes in specific industrial sectors. These programmes aim to reduce energy consumption in industrial sectors that have a high energy consumption.
<i>Standards and monitoring</i>		
Review continental targets to reduce industrial energy consumption through EE interventions. This action will assist in the overall assessment of the regional EE programmes, their impact on reducing energy consumption and in setting new targets.	Review regional targets to reduce industrial energy consumption through EE interventions. This action will assist in setting new targets based on lessons learned from the implemented EE projects.	Review national targets to reduce industrial energy consumption through EE interventions. This action will assist in assessing the impact of implemented EE projects, benchmarking with the best industrial practices, and setting new national targets.
<i>Finance and fiscal</i>		
Launch a continental fund to support ESCOs' activities. This action will allow ESCOs to access funding for their services in implementing EE projects.	Establish ESCOs for the implementation of EE projects. ESCOs will complement other available financial mechanisms to support the implementation of EE projects in the region.	Develop ESCOs for the implementation of EE projects. ESCOs will offer their services through a package, which includes a comprehensive energy audit service, financing mechanism, equipment procurement, installation and commissioning, operation monitoring and performance guarantees (energy performance contracting services). This will assist enterprises that do not have the expertise and resources needed to implement EE projects.

11.2. ELECTRICITY SUPPLY INDUSTRY (CENTRALIZED GENERATION AND GRIDS)¹²

The traditional way of building electric power systems has been to build large centralised generation power plants, then connect them to transmission networks and therefrom either supply electricity to directly connected final customers or distribute and supply electricity to end-users through one-way distribution systems. In that old paradigm, generation (which is highly predictable) follows demand (which is fully stochastic) and electricity flows in one way. The network, which is mainly passive, delivers electricity to passive households. Communications are limited, as well as automation.

The rise of variable Renewable Energy Sources (RES), such as solar PV and wind power plants, has disrupted this reality. In that new paradigm, generation becomes a mix of traditional large remote centralised generation power plants, large variable RES connected to transmission network and Distributed Generation (DG) connected to distribution network. Generation (some of which is stochastic and dispersed) and demand (some of which is controllable) mutually interchange and electricity flows in both ways. Final customers participate more actively in the new electricity services and Demand Side Management (DSM) contributes to system operation. Two-way communications need to be available at all voltage levels and the central dispatching coexists with decentralised control. DES and EVs appear.

In the new paradigm, two main approaches in the evolution of the grids are noticeable¹³:

- Super Grid approach, which refers to a model for expanding and merging existing transmission systems able to allow large transfers of electricity over large distances; and
- Smart Grid approach, which is a distributed energy system that does not rely excessively on the capacity of transmission and distribution systems.

As the new paradigm is emerging (motivated by large-scale variable RES generation, small-scale DG, active final customers, market integration and market accessibility, improved operational security, etc.), the grids (both transmission and distribution, although only distribution ones are the subject herein) need to evolve to a smarter operational level and utilise ICT/digital technologies in order to effectively address this situation and improve at the same time the overall efficiency of the grids. The grids should evolve towards smarter electricity systems (Figure below).

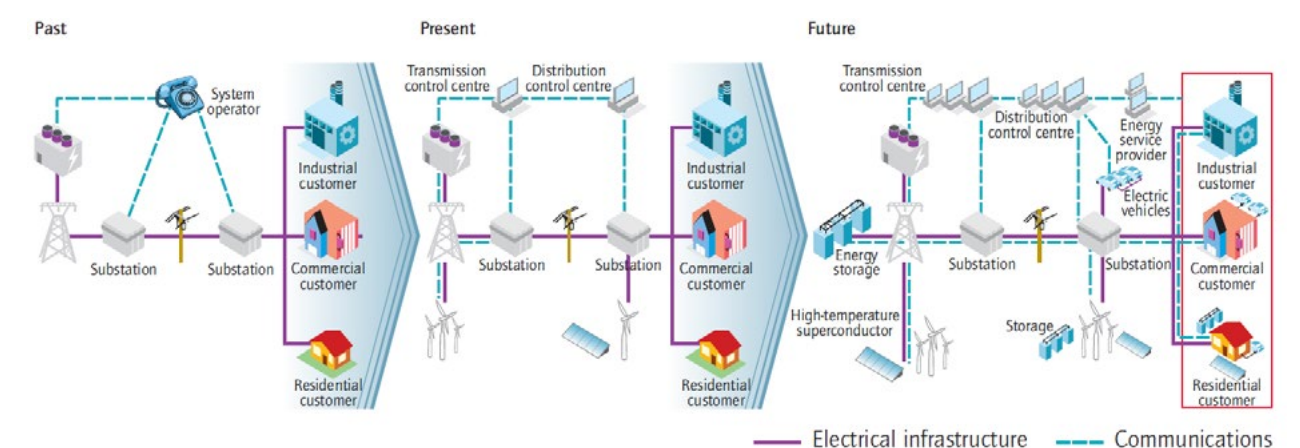


Figure 5: Evolution of Smarter Electricity Systems (Source: IEA, 2011¹⁴)

¹² EU GTAF (2021). Strategy and Roadmap for Smart Distribution Grids in Africa.

¹³ Blarke, M.B., Jenkins, B.M. (2013). Super Grid or Smart Grid: Competing strategies for large-scale integration of intermittent renewables?, Energy Policy, Volume 58, Pages 381-390, ISSN 0301-4215. <https://doi.org/10.1016/j.enpol.2013.03.039>.

¹⁴ IEA (2011). Technology Roadmap – Smart Grids. https://iea.blob.core.windows.net/assets/fe14d871-ebcb-47d3-8582-b3a6be3662ba/smart-grids_roadmap.pdf

Currently in Africa, the interconnections within and between Power Pools at the regional and continental levels in Africa are being planned for development under the Continental Power System Master Plan, which investigates transmission and centralised generation and takes into account all measures needed for their smart operation on par with current global smart grid developments. The evolution of the distribution grids to smart distribution grids was addressed in the “Strategy, Roadmap and Guidelines for Smart Distribution Grids - Digital complementarity of Continental Master Plan”. Finally, the grid losses, both at transmission and distribution levels was addressed in the “Continental Guidelines and Strategies for the Reduction of Technical Losses of Transmission and Distribution Lines and Smart Network Management”.

The roadmap presented below is broken down in three categories for easier implementation:

- 1. Centralized Generation: This work is new.
- 2. Transmission Grids: This work is based on the already adopted strategies.
- 3. Distribution Grids: This work is based on the already adopted strategies.



1. Centralized Generation

Table 14: Sectoral roadmap: Centralized generation

Continental level	Regional level	National level
- Short term-		
Capacity building	Standards and monitoring	
Develop policy guidelines for high-efficiency low-emission (HELE) technology adoption. Establish policies that incentivize the adoption of HELE technologies, including emission standards, carbon pricing, feed-in tariffs, and renewable portfolio standards.	Deploy digital transformation for maintenance. Employ digital tools such as artificial intelligence (AI), machine learning algorithms, and predictive modelling to anticipate equipment failures and optimize maintenance schedules, thereby improving EE. These are to be developed by the Power Pools.	Assess current power generation infrastructure. This includes an extensive evaluation of existing power generation assets considering their age, technology, fuel type, capacity, operational efficiency, and emission levels. Employ preventive maintenance of existing plants. Implement routine preventive maintenance practices for existing power generation facilities to enhance operational efficiency, increase plant availability, and extend the operational life.
Institutions and regulation	Deploy feasibility studies for HELE technologies. Conduct detailed feasibility studies to evaluate the potential for deploying HELE technologies within the existing energy infrastructure.	
Capacity building	Institutions and regulation	
Develop financial mechanisms for HELE technologies. Set up funding mechanisms, such as low-interest loans, grants, or public-private partnerships, to support the capital-intensive nature of HELE power plants led by AfDB.	Implement training programs for workforce. Develop comprehensive training programs for the local workforce on HELE technologies and advanced maintenance practices.	
- Medium term-		
Technology	Institutions and regulation	Institutions and regulation
Standardize processes and protocols. Standardize operation, maintenance, and repair processes and protocols for HELE power plants to maintain high levels of efficiency throughout their lifecycle.	Implement grid integration studies. Conduct studies on grid integration to understand how to efficiently and reliably integrate energy from HELE power plants into the existing grid infrastructure. Ensure alignment with Af-SEM and CMP activities.	Deploy pilot projects. Initiate pilot projects for HELE power plants, which provide an opportunity to gain practical insights, troubleshoot issues, and demonstrate the benefits of these technologies.

Continental level	Regional level	National level
	Technology	
	Establish regional monitoring and verification mechanisms. Implement robust monitoring and verification mechanisms to track the performance of HELE power plants, promoting transparency and accountability.	Implement Environmental Impact Assessments. Perform regular environmental impact assessments of HELE power plants to monitor their emissions and ecosystem impact, ensuring adherence to environmental regulations. Perform regular efficiency audits. Conduct regular efficiency audits of HELE power plants to identify opportunities for further improvement and to ensure that they operate at their highest potential efficiency.
	- Long term-	
Capacity building	Institutions and regulation	Institutions and regulation
Develop a strategy for the full decarbonization of the electricity supply in Africa. The use of fossil fuels needs to be minimized and a comprehensive roadmap needs to be developed to phase out all fossil fuel based power stations and replace them with renewable energy technologies. This activity needs to be aligned with AfSEM and the CMP in terms of planning.	Employ real-time monitoring at Power Pool level. All power plants participating the power pool market are offering real-time remote monitoring allowing further optimizations between the transmission grids and the centralized power production plants.	Implement advanced EnMS. Introduce Energy Management Systems (EnMS) to monitor and control the energy consumption of power plants continuously, leading to optimized energy use. Perform enhanced equipment upgrades. Plan and implement equipment upgrades based on efficiency audits, replacing outdated and inefficient components with advanced, energy-efficient alternatives.

2. Transmission grids

Table 15: Sectoral roadmap: Transmission grids

Continental level	Regional level	National level
- Short term-		
Institutions and regulation	Market orientation	Institutions and regulation
Develop Guidelines on tariff incentives for adopting loss reduction measures. AU Member States set the legal basis for tariffs that incentivise licensees to undertake loss reduction measures.	Develop a regional strategy for the minimization of grid losses.	Corporatize utilities. Functional unbundling of generation / transmission / distribution. Separate entities monitor the EE progress for each segment.

Continental level	Regional level	National level
Statistics and knowledge	Market orientation	Standards and monitoring
Develop innovative financing mechanisms for EE interventions. Development partners and IFIs, as well as commercial financing institutions, create innovative financing options within their EE windows that can fund transmission and distribution loss reduction and smart network management. Develop a continental grid energy losses system. Establishing transmission and distribution loss data collection/monitoring systems for analysing and reporting at the national, regional and continental levels, which are coordinated and reported at the continental level and anchored at AFREC	Deploy a losses reporting mechanism. RECs establish a voluntary reporting mechanism on transmission losses which is going to become mandatory in the future. Develop a Power Pool loss reduction strategy and roadmap. A loss reduction programme with targets/caps and timelines over a specified period.	Develop transmission energy/electricity balances. Perform mandatory periodic reporting of losses. Established entities at the corporate level report periodically on the electricity network losses to the ministries in charge of energy and the national regulatory authorities for buy in for budget allocation and migration towards set targets/caps.
	Standards and monitoring	Institutions and regulation
	Develop an enabling generation and/or avoided investment database. When the grid is updated this enables higher transmission capacity. The electricity utilities and grid operators present a database showing the benefit of grid projects in terms of enabled generation or avoided costs.	Ensure licence re-issue consider losses. The national regulatory authorities also base the reissue of licences on performances in terms of transmission and distribution loss reduction.
	Capacity building	Technology
	Deploy training programs for workforce. Training of the electricity utilities on application of technical measures and accessing various financing mechanisms offered by development partners and other sources of financing such as climate financing.	Install statistical metering. The electricity utilities install statistical metering in transmission grids to adequately track electricity flows. Standards and monitoring
		Ensure transmission licensees undertake and maintain asset base valuation.

Continental level	Regional level	National level
- Medium term-		
Finance and fiscal	Institutions and regulation	Standards and monitoring
Develop a revolving fund to finance EE interventions. The AUC creates a continental revolving fund/financing portfolio for EE, including transmission and distribution loss reduction, from contributions of AU Member States, augmented by development partners. ¹⁵	Make the development of loss reduction plans obligatory. Transmission licensees are obliged to develop transmission loss reduction plans.	Make monitoring and reporting of transmission grid losses obligatory. Established entities at the corporate level ensure that transmission loss determination is done, tracked and reported.
	Implement smart network management plans. Transmission licensees develop smart network management plans.	Institutions and regulation
		Link EE actions with approval for expansions. The national regulatory authorities link the approval of network expansion plans to considering transmission loss performance for operation and planning phases.
	Statistics and knowledge	Technology
	Report on loss reduction progress. Reporting of transmission loss reduction actions is crucial. Power Pools establish legally binding reporting on and enforcement of transmission and distribution loss reduction which applies to all operators with transmission licensees.	Deploy Supervisory Control And Data Acquisition (SCADA). The transmission system operators install adequate SCADA in transmission (SCADA/EMS).
		Standards and monitoring
		Make energy audits mandatory. The transmission system operators conduct/develop energy audits ¹⁶ .

¹⁵ A levy from electricity trading can also be raised as an input to such a fund which could be made available to Power Pools to upgrade efficiency of the continental transmission networks.

¹⁶ Including power quality audits and national assessment of distribution system transformers.

Continental level	Regional level	National level
- Long term -		
Market orientation	Technology	Institutions and regulation
Update CMP. Update of the CMP, also addressing EE topics.	Ensure planning is aligned with decrease of losses. Transmission licensees design high-voltage transmission networks (national and cross-border) with a focus on loss reduction opportunities and benchmarking on an agreed continental standard for losses.	Update tariff codes. The national regulatory authorities establish the adoption of tariff codes allowing transmission and distribution licensees costs of losses up to defined caps and offering tariffs to final customers that are conducive to energy-efficient consumption of electricity.
	Standards and monitoring	
	Make reporting on loss reduction progress obligatory. Power Pools establish legally binding reporting on and enforcement of transmission loss reduction imposed on transmission system operators.	

Table 16: Sectoral roadmap: Distribution grids

Continental level	Regional level	National level
- Short term-		
Finance and fiscal	Capacity building	Standards and monitoring
Develop innovative financing mechanisms. Policymakers and financial institutions accelerate the deployment of smart distribution grids by facilitating innovative financing options for thereto related projects.	Develop regional guidelines for smart distribution grids. Regional guidelines are developed to address the realities in each REC and kickstart the transition to smart grids.	Adopt smart metering standards. Distribution system operators and/or the electricity utilities apply smart metering standards adopted by AFSEC.

Continental level	Regional level	National level
Capacity building		Capacity building
Develop guidelines of cost-benefit analysis of smart grid projects. Definition of the methodology for cost-benefit analysis for smart distribution grids projects based on the principles and indicators defined.		Improve innovation and R&D capacity. Governments support building the R&D capacity of national centres, including in the field of smart distribution grids. They also support start-ups in the field of smart distribution grids.
Standards and monitoring		Standards and monitoring
Mainstream standardization. AU Member States support the establishment of an Official Journal of Appropriate Standards and Quality Infrastructure in Africa at the level of the AUC.		Implement data monitoring and reporting. Distribution system operators (as metering operators) and/or the electricity utilities avail reliable data to allow for the creation of new and better informed policies, as well as for an increase of the confidence of potential investors.
- Medium term-		
Institutions and regulation	Finance and fiscal	Institutions and regulation
Develop guidelines on the harmonization of smart grid frameworks across the continent. Organize a forum on smart grids. The AU encourages the exchange of R&D know-how and best practices, and proposes new solutions to overcome innovation barriers in the field of smart distribution grids.	Deploy regional financing mechanisms. RECs, governments and (national, international and/or development) financial institutions work together to support and develop grants and financial instruments (such as guarantees and project bonds) for the realisation of smart distribution grid projects that are positively assessed in the cost-benefit analysis. Standards and monitoring Adopt regional technical standards. Member States support the implementation of smart distribution grids on the basis of agreements on technical standards required.	Operationalize a taskforce on smart grids. Policymakers establish a national task force on smart distribution grids to guide development at the national level, and cooperate at the regional and continental levels. Facilitate smart grid investments. Legislators support smart distribution grids through investment/Public-Private Partnership laws and investment promotion agencies.

National level
Institutions and regulation
Develop conducive regulatory frameworks. Regulators develop a regulatory framework (and consider their harmonisation at the regional and continental levels), which reflects drivers, opportunities, challenges, priorities, and next steps for distribution system digitalisation and Distributed Energy Resources (DERs). Employ licensing requirements. Regulators focus, <i>inter alia</i> , on distribution licensing and monitoring of distribution licensees, adopting sustainable distribution tariff structures, and approving conducive distribution network rules/codes and plans.
Finance and fiscal
Digitalize the distribution system roadmap. Distribution system operators and/or the electricity utilities invest, operate, and strengthen their distribution systems, including by deploying technologies and solutions for smart distribution grids, i.e. distribution system digitalisation and DERs following a national roadmap. Support financing. Governments and (national, international and/or development) financial institutions create a leverage to attract further funding from the private sector and other public sector stakeholders. Governments support smart distribution grids R&D projects through national science foundations and other sources, and foster cooperation between R&D projects' developers.
Technology
Implement cybersecurity interventions. Distribution system operators (as metering operators) develop strategies and capabilities to guard their distribution networks against cyberattacks. Upgrade sub-stations. Distribution system operators equip all significant distribution substations with automation systems. Implement advanced distribution management system (ADMS) (control centre for distribution grid). Distribution system operators equip their distribution control centres with the systems which improve the information made available to operators, field and crew personnel, customer service representatives, management and, ultimately, to final customers. Deploy asset and maintenance management systems. Distribution system operators implement such systems to help maximise the value of the related distribution assets over their lifecycles, and help preparing future plans (long-term planning, mid-term optimisation, extension, refurbishment), and also the associated maintenance work. Employ power quality and power monitoring systems. Distribution system operators monitor the power quality levels given in standards, and use the results for final customer relationship or for reporting towards the regulator. Deploy advanced metering infrastructure (AMI). Distribution system operators install AMI which supports the deployment of smart meters and provides services to final customers, suppliers, and distribution system operators in the retail market.

Continental level	Regional level	National level
- Long term-		
Standards and monitoring		Institutions and regulation
Develop advanced standards. AU Member States require such open standards for smart distribution grids and smart meters which are capable to ensure interoperability, address key technological challenges, and enable successful integration of all system users, while providing high system reliability and quality of electricity supply.	Implement regional monitoring. The smart grid transition progress is monitored at the regional level.	Adopt licensing requirements. Regulators license as well as monitor and assess the performance of distribution licensees in relation to the development of smart distribution grids that promote distribution system digitalisation and DERs. Deploy advanced smart-metering based models. Regulators monitor the impact of the use of smart metering systems and dynamic electricity price contracts.
National level		
Technology		
Ensure data protection. Distribution system operators (as metering operators) protect data, including the personal data of consumers, in line with the rules on processing and free movement on data.		
Deploy automated sub-stations. Distribution system operators use such distribution sub-stations for automated operation of the medium-voltage/low-voltage transformer substation system.		
Ensure the mass deployment of low-voltage feeders. Distribution system operators include low-voltage feeders placed on the medium-voltage/low-voltage transformer substation in automated operation.		
Employ advanced asset and maintenance management systems. Distribution system operators implement the geographical information systems and all the elements needed to support asset managers regarding decision making in the operation of the electricity distribution infrastructure.		
Employ advanced power quality and power monitoring systems. Distribution system operators implement feeder automation systems which include fault detectors, pole or ground mounted medium-voltage switches, disconnectors and circuit breakers, without or with reclosing functionality (also called reclosers) between the high-voltage/medium-voltage substation (medium-voltage side included) and the medium-voltage/low-voltage substations.		

11.3.APPLIANCES AND DEVICES, INCLUDING CLEAN COOKING SOLUTIONS - MINIMUM ENERGY PERFORMANCE STANDARDS AND ENERGY LABELS

A MEPS is a threshold beyond which the most inefficient appliances are banned from the market. An energy label rates appliances from least efficient to most efficient, giving information to the consumer, as well as to the importers and retailers. In order to be efficient, these standards must be mandatory and reviewed periodically so as to take technical developments and changes in consumption patterns into account. Energy performance standards and labels are understood here in a broad sense encompassing off-grid appliances, clean cooking devices as well high efficiency cooking fuel production.

Extensive work has taken place in the past concerning MEPS and Energy Labels. More specifically, the following documents have been developed and adopted by the AU Summit:

1. Guidelines for MEPS Energy Labelling and Eco-Design at the Continental Level;
2. Market Surveillance Strategy and Action Plan;
3. Report on existing test laboratories, procedures and facilities;
4. Roadmap for Strategic Test Laboratories;
5. Strategy and Roadmap for Establishing a Market for Energy Efficient Appliances in Africa;
6. Guide for policy makers on developing Quality Assurance frameworks for off-grid appliances in Africa.

As is outlined in the adopted “Guidelines for MEPS Energy Labelling and Eco-Design at the Continental Level”, MEPS and labels are powerful instruments for EE:

- They must be mandatory, to be efficient, and reviewed periodically, to take in account the technical progress or the change of use habit;
- Between 10% to 25% of energy consumption can be saved thanks to MEPS and labels implementation, the electricity peak demand also decreases;
- The cost of implementation of MEPS and labels is low compared to energy production development and grid development, as they mainly consist of studies, information and training. Only the test laboratories require some investment costs, that can be shared on a regional basis.

According to the adopted “Guidelines for MEPS Energy Labelling and Eco-Design at the Continental Level”, the actions to be taken at the **continental level** in the implementation of the MEPS and labels of appliances are:

- Following the adoption and implementation of the MEPS and labels of appliances by AU member states, AUC will monitor the progress of the implementation of the MEPS and labels of the appliances, with the support of regional renewable energy and EE centres;
- AUC will update its recommendations on the implementation and extend the guidelines to other appliances and equipment;
- These activities need to be communicated to and taken into consideration when deploying any long-term modelling activity of the energy demand of Africa for full alignment (e.g., under the CMP).

The actions to be taken at the **regional level** are:

- The regional economic communities and the regional centres for renewable energy and EE will work to convene, help and support the member countries in the implementation of the MEPS and labels of appliances at the continental level;
- The support of the regional centres for renewable energy and EE will include a harmonized regional approach in the implementation and the establishment of regional appliance testing laboratories, including:
 - Support to establish a global view of the market and of the current use of the four pre-selected appliances;
 - Support for a harmonized regional approach (definition of the appliances, target values, control mechanisms, penalties, etc.), in order to create a more massive, homogeneous and controlled market;
 - Support for a coherent network of testing laboratories (localization, share of laboratories, rules of use and financing, etc.).

Finally, at the **national level**, the national roadmaps cover four major steps:

- Legislative actions;
- Control mechanisms and tools;
- Information and communications; Monitoring, follow-up and evaluation of impacts.

Three sets of products are included in the adopted guidelines:

- Set 1: fans, lighting and refrigerators and air conditioners;
- Set 2: motors and distribution transformers, water heaters, washing machines and televisions;
- Set 3: the other most common domestic appliances will be covered by MEPS and energy labels, such as dishwashers, electronic products (computers, monitors, etc.), electric cookers and electric ovens.

According to the “Roadmap for strategic test laboratories”, the number of test laboratories that can test appliances is limited (less than 15) and these laboratories are widely dispersed in Africa. There is, however, at least one such test laboratory in each geographical region of Africa. The few laboratories that can test such appliances are testing some but not all the appliances in the continental guidelines. While the appliances that can be tested vary by laboratory, most of these laboratories are capable of testing refrigerators/freezers, air conditioners, and lighting. These laboratories have been used for verification purposes, rather than product certification, except for South Africa, where laboratories certify some dryers and cookers that are locally manufactured.

Based on an analysis of the existing test laboratories, the existing gaps are as follows:

1. Minimal testing capacity generally for less than five appliances out of the 13 or so appliances listed in the continental guidelines
2. In general, there is no testing capability for off-grid appliances. However, there are a few cases

where solar PV panels, batteries, and sometimes solar lanterns and cookstoves can be tested. This lack is more evident in well-established laboratories.

3. There are disparities between the laboratories in terms of capacity for testing and the focus of testing. Established test laboratories are not necessarily testing similar appliances at this stage nor are they all following the Phase 1 list of appliances of the continental guidelines.
4. There is no inter-laboratory cooperation and associated harmonization of testing procedures for comparable test results, although the majority of laboratories have accreditation for IEC/ISO 17025 standards.
5. The turnaround timelines for testing are challenging and there is no guaranteed market to sustain the testing services in some countries.
6. Testing prices will differ depending on the laboratory and equipment used, including other charges such as transport, storage, and delivered service.

The test laboratory roadmap should address the need to build capacity according to groups of appliances similar to those in the continental guidelines.

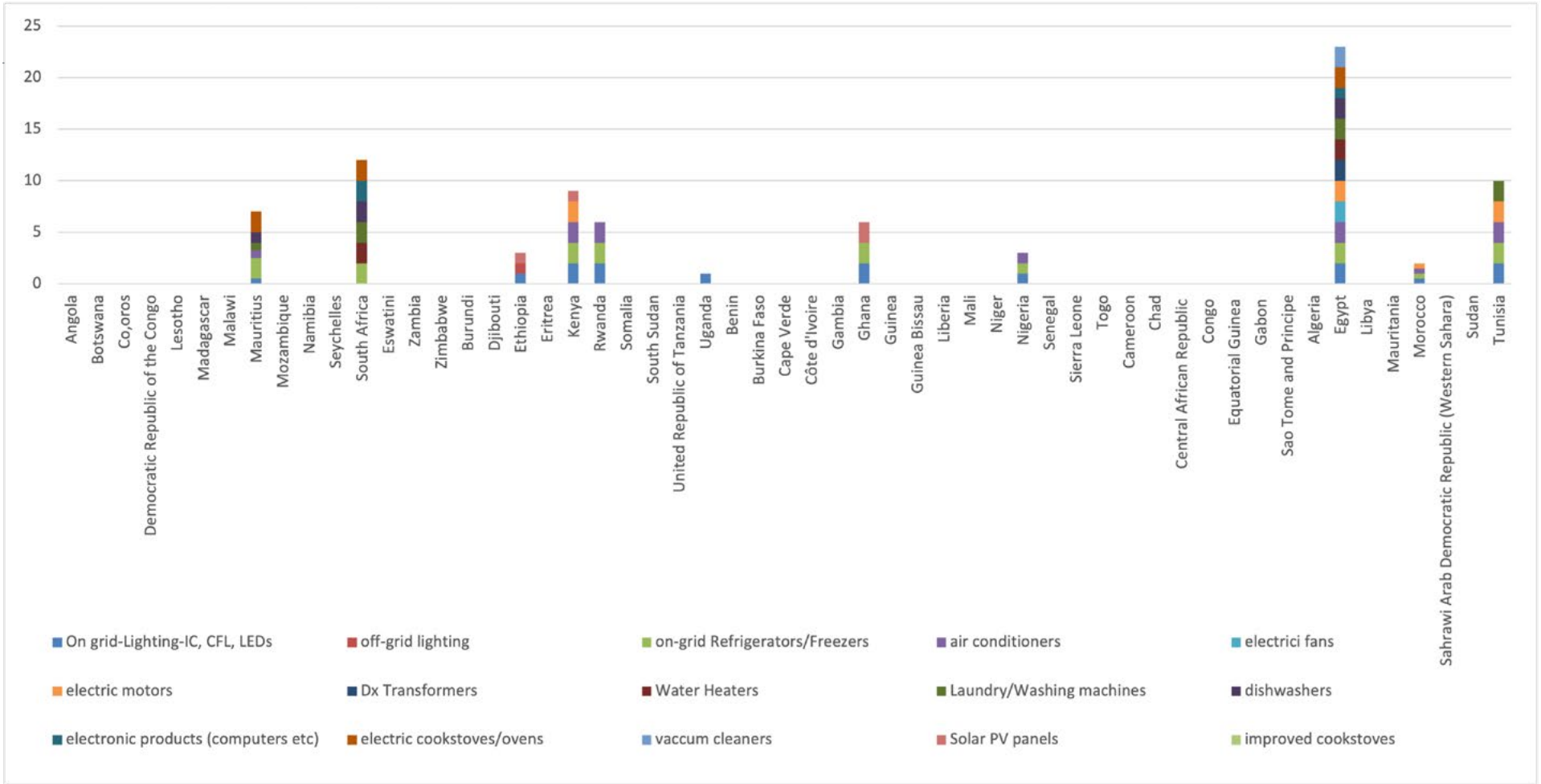
Based on the information made available and the analysis to date, the test laboratories presented in the figure below are proposed as candidates for upscaling activities per region and for the appliances, subject to further input from Regional Economic Communities.

Figure 6. Baseline testing capability of existing test laboratories in Africa. Source: GTAF 2020¹⁷



tion and monitoring of the Electricity Harmonization Regulatory Strategy and Action Plan

- **Multi-disciplinary collaboration** - Collaboration across a variety of stakeholder groups and effective communication and coordination systems between national, subnational, and local governments are essential



5. Last but not least, capacity building programs are essential to ensuring that there are enough trained local experts and practitioners, as well as enough skills and knowledge on all elements of energy-efficient buildings.

Regarding laboratory infrastructure, the **strategic goals** outlined in the afore mentioned roadmap document are:

1. There will be at least one accredited test laboratory recognized for testing appliances/equipment for MEPS and energy labelling in each continental region/REC.
2. Africa will be able to test compliance of all the appliances/equipment listed in the continental guidelines against the agreed MEPS.
3. The test laboratories supported under the current Roadmap will be able to support market surveillance in their regions within significant manufacturing zones, in reach of large imports arrival and trade routes.
4. There will be harmonized testing across test laboratories to ensure comparable results and allow mutual recognition agreements across the continent.
5. The private sector will be encouraged to participate, as importers and manufacturers, to create the needed market demand for the strategic test laboratories.

The **main steps in order to realize this** are:

1. Policy to be adopted for testing;
2. Accreditation and standardization/harmonization of testing;
3. Building actual testing infrastructure at strategic laboratories and related capacity for testing;
4. Business plan and financing models for the test laboratories;
5. Creation of awareness and communication among the potential customers.

A common testing policy for the selected Strategic Test Laboratories (STLs) is required, including proficiency testing to ensure uniformity of testing. The testing policy will ensure traceability of testing results and calibration of the STLs. All the STLs are to be accredited for EE scope for each appliance they will be testing and should adopt similar standard specifications for testing.

Finally, a “Strategy for Establishing a Market for Energy-Efficient Appliances in Africa” has been developed. The **vision** of the Strategy is to “have a single energy-efficient appliance/equipment market operating under AfCFTA by 2030 in order to develop competitive and sustainable economies supported in parallel by a dynamic industrial sector that generate employment, reduce poverty and foster social inclusion”. Its **mission** is “trade liberalization and harmonization of the regional appliance and equipment standards and enforcement systems”.

The vision has four strategic goals:

1. Increased volume of intra Africa trade of energy-efficient appliances/equipment;
2. Increased industrialization on energy-efficient appliances/ equipment in Africa;
3. Tariff liberalization and elimination of other barriers to intra-African trade in energy-efficient appliances/equipment across Africa;
4. Significant reduction in electricity peak demand on the continent attributed to the energy-efficient appliance/equipment market.

In order to develop a roadmap of actions towards the achievement of the Strategic goals, seven Strategic Pillars have been identified:

1. Harmonization of standards and labelling requirements;
2. Market surveillance;
3. Continental product registration database;
4. Mechanisms to share market intelligence, resources and best practices for market surveillance authorities;
5. Liberalization of tariffs and other barriers to import of energy-efficient appliances (including the implementation of the Annex on Technical Barriers to Trade);
6. Harmonized preferential rules of origin;
7. Capacity building.

The outline of the Roadmap is presented in the table below.

Table 17. Outline of the roadmap (Source: Strategy for Establishing a Market for Energy-Efficient Appliances in Africa)

Activity per pillar	Actions	Timeframe (Short Term- 2-3 years Medium Term 4-6 years Long term 7-10 years)
1.1	Developing and adopting reputable standards and labels for appliances/equipment for energy/electricity using appliances/equipment	Short term - ongoing for the rest of appliances
1.2	Harmonization of regional MEPS and making MEPS and energy labels mandatory	Short term - ongoing
1.3	Harmonization of mandatory MEPS at the continental level	Short term - medium term
2.1	Market surveillance authorities well established for MEPS/energy labels	Short Term - medium term
2.2	Market surveillance strategies established	Short term
2.3	Market surveillance mutual agreement protocols established	Short term - medium term
2.4	Establishment of testing capability for appliances and equipment	Medium term - ongoing
2.5	Cross-border committees well established	Short term - ongoing
3.1	Design of the continental product database	Short term
3.2	Development of the platform	Short term
3.3	Deployment of functionalities	Short to medium term
4.1	Well informed stakeholders in the appliance/equipment value chain	Short term - ongoing
4.2	Cross-border information sharing	Short term - ongoing
4.3	Continental information platform for monitoring market transformation	Medium - ongoing
5.1	Tariff liberalization in accordance with Articles 7 and 8 of the Protocol on Trade in Goods	10 years
5.2	Elimination of all non-conforming Non-tariff measures (NTMs)	Upon entry into force of the AfCFTA
5.3	Implementation, monitoring and evaluation of liberalization commitments and obligations	Ongoing
5.4	Import licensing	Short term (six months)
5.5	Pre-shipment inspection	Short term (six months)
5.6	Trade-related investment measures	Short term (six months)
5.7	Cooperation activities related to the implementation of the Annex on Technical Barriers to Trade	Ongoing
5.8	Transparency (Art. 11 of the Annex on Technical Barriers to Trade / WTO)	Ongoing
5.9	Amendment of Art. 11 of the Annex on Technical Barriers to Trade / WTO	Long term
5.10	Policy debate on harmonization of MEPS and energy labelling Amendment of Art. 13 (Establishment and functions of the Sub-Committee for Technical Barriers to Trade)	Long term
5.11	Review of state parties' EE policies Amendment of Art. 13 (Establishment and functions of the Sub-Committee for Technical Barriers to Trade)	Long term
6.1	AfCFTA implementation monitoring	Short term - ongoing
6.2	Volume of trade monitoring and preferences utilization rates	Medium term - ongoing
6.3	Periodic review of AfCFTA rules of origin	Medium term
6.4	Monitoring tariff regimes	Medium term - ongoing

Activity per pillar	Actions	Timeframe (Short Term- 2-3 years Medium Term 4-6 years Long term 7-10 years)
7.1	Market surveillance establishment	Short term
7.2	Volume of trade monitoring	Short term
7.3	Harmonization of mandatory MEPS at the continental level	Short term
7.4	Monitoring tax and tariff regimes	Short term
7.5	Rules on border controls	Short term to medium term
7.6	Legal and regulatory activities related to the MEPS, labels and eco-design	Short term to medium term
7.7	Harmonization of standards and administrative requirements to lower technical barriers to trade	Short term to medium term
7.8	Market building	Medium to long term
7.9	Harmonized testing MEPS methodology	Medium to long term
7.10	Plan development for dialogue / information sharing	Medium to long term



11.4. BUILDINGS

When the manufacturing of the materials required in their construction is taken into consideration, buildings account for about 37% of the world’s energy consumption and energy-related CO2 emissions¹⁸.

The global economy should strive to attain net zero CO2 emissions by 2050 to reach the Paris Agreement’s target of keeping global temperature increase to far below 2°C. The Net Zero by 2050 report from the IEA (2021) presents a working example of “a cost-effective and economically productive pathway, resulting in a clean, dynamic, and resilient energy economy, dominated by renewables like solar and wind instead of fossil fuels”¹⁹. This path describes how to achieve a net zero energy system by 2050 while assuring reliable and inexpensive energy sources, ensuring everyone has access to energy, and promoting vigorous economic growth in all areas.

The global economy’s decarbonization depends in large part on the building sector. Despite the sector’s activity more than doubling due to expanding floor space, extending access to energy services, and raising living standards, there are few interventions to make it energy-efficient. This can be made feasible by the shift to zero-carbon-ready buildings, which are extremely energy-efficient structures that are climate responsive. By 2050, buildings-related emissions can be reduced by 70% thanks to EE upgrades and electrification, with the remaining 30% coming from a change in behaviour and on-site renewable energy sources.

In order to achieve buildings with net zero carbon emissions, this roadmap aims to identify potential energy-efficient and low-carbon actions and activities that AU member states should explore for implementation by 2060 and beyond. The roadmap acknowledges that different AU member states have different national circumstances, targets, and priorities in relation to energy-efficient buildings, and that each will be establishing its own particular path and pace for improvements in the buildings sector²⁰.

The roadmap is sub-divided into three major steps:

- Step one: Strengthen and adopt compliance with mandatory building energy codes.
- Step two: Boost market demand for energy-efficient buildings.
- Step three: Boost capacity for delivery of energy-efficient buildings.

Several guiding ideas should be kept in mind while you work with this Roadmap²¹:

- **Flexibility** - This Roadmap is meant to be a guide rather than a prescription. The AU member states have the chance to set up an efficient implementation plan based on the roadmap thanks to their in-depth understanding of the unique local situation.
- **Holistic approach** - The construction industry is complicated and dispersed. This roadmap advises keeping a comprehensive perspective of the industry.
- **Strategy** - The roadmap’s actions for strategic planning are likely to have a greater impact if they are incorporated into either freshly created strategic plans or current policy processes.

18 Olweny (2013). Environmental sustainable design and energy efficiency in architecture education in East Africa. Researchgate.net

19 IEA (2021). Net Zero by 2050. https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroBy2050-ARoadmapfortheGlobalEnergySector_CORR.pdf

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21 IEA (nd). Roadmap for Energy Efficient Buildings and Construction in ASEAN. <https://iea.blob.core.windows.net/assets/5255ea58-1fa7-4fb4-bca0-b32923e9184a/RoadmapforEnergy-EfficientBuildingsandConstructioninASEAN.pdf>

Table 18: Sectoral roadmap: Buildings

Continental level	Regional level	National level
Short term - Stage 1: Strengthen adoption of mandatory energy building codes		
Capacity building		
Launch EE awareness raising initiatives for the continent. This activity will strengthen regional and national initiatives by providing updated information on the benefits of EE. Launch an education sector Steering Committee for curriculum reviews in institutions of higher learning. This activity will assist in the coordination of regional initiatives and the harmonization of EE integration in education. It will also assist in benchmarking of curricula against international best practices.	Develop capacity building programmes for policy makers and regional knowledge sharing. These programmes will allow knowledge exchanges and regional learning to understand which policies work best and provide regional benchmarks. Support curriculum review for institutions of higher learning to include EE in buildings. This activity will allow knowledge exchanges and regional learning to understand which pedagogies work best and provide regional benchmarks.	Develop capacity building programmes for policy makers. These programmes will equip policy makers with the necessary tools to develop policies for EE. Support curriculum review for institutions of higher learning to include EE in buildings. This activity will equip future architects, engineers and building professionals with capacity in EE in buildings.
Institutions and regulation		Standards and monitoring
Establish a Steering Committee for the development of EE policies in buildings. This activity will assist in the coordination of regional initiatives and the harmonization of EE policies. It will also assist in benchmarking the EE policies against international best practices.	Establish regional coordination structures for EE in buildings policies. This activity will facilitate the sharing of information, coordination of EE initiatives and harmonization of regional policies.	Develop minimum energy and thermal performance requirements. Respective ministries establish mandatory EE codes covering all building types, new and existing buildings.
Statistics and knowledge		
Establish a digital continental database with all national energy consumption baselines for buildings. This activity will assist in understanding energy consumption trends and in setting reduction targets through EE interventions.	Create a digital regional database for building energy consumption baselines from Regional Member States. Accurate and reliable energy consumption baselines will assist in tracking the impact of EE interventions in the region.	Conduct comprehensive national building energy audits to establish energy consumption baselines for building sectors. The data will assist in developing building codes, setting targets, assessing the impact of EE on energy consumption and on tracking CO ₂ emissions.

Continental level	Regional level	National level
Statistics and knowledge		
Establish a continental database of priority sectors for EE interventions. This activity will assist in the selection of industrial sectors for EE interventions.	Establish a regional database of priority sectors for EE interventions. This activity will ensure a high impact of EE interventions in the region.	Establish priority sectors for EE interventions. From data collected through building energy audits, priority areas will be established.
Technology		
Launch a digitalised continental database of low-embodied-carbon technologies. The database will give access to updated information on new EE technologies that are benchmarked against international best practices.	Establish a digitalised regional database of low-embodied-carbon technologies. This activity will assist in increasing the uptake of EE technologies in the region.	Develop a national database of low-embodied-carbon technologies. This activity will assist the building sector in the selection and adoption of appropriate EE technologies.
Develop continental guidelines for the implementation of EE in buildings. This activity will promote the adoption of EE and guide the industry in the implementation of EE projects.	Establish comprehensive regional guidelines for energy performance in buildings in the region. These guidelines will assist in accelerating the implementation of EE projects in the region.	Develop comprehensive national guidelines for energy performance in buildings. This activity will be done according to various climatic zones and will assist in implementing EE projects.
Establish a fund for R&D of EE technologies in Africa. This activity will support regional research and adaptation of internationally available EE technologies.	Support R&D of manufacturing EE equipment and technologies in the region. This activity will enhance the manufacturing capacity in the region.	Develop the capacity for local manufacture of EE equipment and technologies. This activity will lower investment costs of EE projects as most EE technologies are currently imported. The market, economic benefits, local skills, infrastructure capacity and regulatory framework will need to be assessed.
Medium term - Stage 2: Boost market demand for energy-efficient buildings		
Market orientation		
Establish continental targets to reduce energy consumption through EE interventions. This will assist in the development of EE programmes aimed at meeting the set targets.	Set regional targets to reduce energy consumption through EE interventions. This activity will assist in mobilizing resources for the implementation of EE interventions to meet the targets.	Set national building targets to reduce energy consumption through EE interventions. This will assist in developing EE implementation plans to meet the targets.

Continental level	Regional level	National level
Standards and monitoring		
Develop a continental initiative for coordination structures for product standards. This activity will facilitate the sharing of information, coordination of EE initiatives and harmonization of building products on the continent.	Establish regional coordination structures for product standards. This activity will facilitate the sharing of information, coordination of EE initiatives and harmonization of building products in the region.	Develop building product standards. This initiative will develop mandatory MEPS for all types of appliances and building systems and building automation and control systems that are regularly updated.
Institutions and regulation	Develop procurement regulations. This activity will contribute to harmonise mandatory requirements at regional level for public procurement to use low-carbon materials and EE design and equipment.	Develop procurement regulations. This activity will contribute to develop mandatory requirements for public procurement to use low-carbon materials and EE design and equipment.
Develop a Steering Committee for the development of procurement regulations. This activity will contribute to develop mandatory requirements for public procurement to use low-carbon materials and EE design and equipment.	Institutions and regulation	
Create a continental compliance body. These bodies will enforce the national building codes and ensure compliance in the building sector.	Create regional compliance bodies. These bodies will enforce the national building codes and ensure compliance in the building sector.	Create national compliance bodies. These bodies will enforce the national building codes and ensure compliance in the building sector.
Standards and monitoring		
Launch continental standards for buildings. These standards will guide in the design and operation of specific industrial EE equipment and technologies.	Develop regional standards for buildings. This activity will initiate studies on existing standards to support the development of new standards incorporating EE.	Develop national building certification systems. This activity will develop certification of building energy performance for new and existing buildings with requirements for thermal comfort, material efficiency and use of low-embodied-carbon materials for corresponding climatic zones.
Launch continental digital tools. This initiative will launch integrated design tools and database management at a continental level to keep track of EE implementation in buildings.	Develop regional digital tools and database. This activity will develop integrated design tools and database management at a regional level to keep track of EE implementation in buildings.	Develop digital tools and data. This activity will develop integrated design tools to assess energy performance in building construction and renovation and building management systems.

Continental level	Regional level	National level
<i>Capacity building</i>		
Develop continental continuous professional development (CPDs) with continental professional bodies. These CPDs will provide regular training sessions for architects, engineers and building professionals through the continental professional bodies such as the African Union of Architects to mainstream EE in building practices. Launch EE awareness raising initiatives for the continent. This activity will strengthen regional and national initiatives by providing updated information on benefits of EE.	Develop regional CPDs with regional professional bodies. These CPDs will provide regular training sessions for architects, engineers and building professionals through their regional professional bodies such as the East Africa Institute of Architects to mainstream EE in building practices. Establish regional EE awareness raising programmes for national governments. This activity will assist in raising awareness of the benefits of EE in the region.	Develop national CPDs with National professional bodies. These CPDs will provide regular training sessions for architects, engineers and building professionals through their professional bodies to mainstream EE in building practices. Implement awareness raising campaigns on EE in buildings. This activity will assist in raising awareness among consumers and drive market demand for more efficient buildings.
<i>Technology</i>		
Support continental dissemination of case studies from EE demonstration projects. This activity will assist in raising awareness on the benefits of EE and drive market demand for energy-efficient buildings. Launch continental EE awards for regions that have excelled in implementing industrial EE projects. Awards will boost regional efforts to promote the adoption of EE.	Implement regional demonstration/pilot projects. This activity will assist in sharing lessons learned and inspiring other industrial sectors in the region to implement EE. Launch regional EE awards for buildings that have excelled in implementing EE. This initiative will assist in increasing competition in the building sector and provide incentives for energy-efficient building practices.	Implement EE demonstration/pilot projects (by national governments). This activity will assist in raising awareness on EE and in building capacity in implementing EE interventions, drive market demand and encourage nationwide replication of EE interventions. Support recognition of developers and projects that have achieved significant energy savings through implementation of EE projects. This activity will assist in increasing competition in the building sector and provide incentives for energy-efficient building practices.
<i>Finance and fiscal</i>		
Set up continental funding mechanisms to support the implementation of EE projects. Such funding mechanisms will support regional efforts to implement EE projects.	Establish regional EE funding mechanisms. The availability of funding mechanisms (grants, soft loans, climate finance, carbon credits, green credit lines) will boost the implementation of EE projects in the region.	Establish funding mechanisms to support the implementation of EE in buildings. This activity will ensure the availability of funding for EE projects.

Continental level	Regional level	National level
<i>Finance and fiscal</i>		
Launch continental credit lines for EE buildings. This activity will allow enterprises to access international financial products. International financial institutions and development agencies will be invited to support credit lines.	Establish regional financial credit lines for the implementation of EE in buildings. This activity will allow any enterprise from the region to access the credit facility without national barriers. The terms of regional credits lines will take into consideration the regional economic dynamics.	Establish financial credit lines for the implementation of EE projects. Credits lines will provide a funding option for large EE projects. A conducive environment is required for the financial sector to offer credit lines to implement EE projects.
<i>Long term - Stage 3: Boost capacity for delivery of energy-efficient buildings</i>		
<i>Standards and monitoring</i>		
Develop continental initiative on the regulation of materials. This activity will develop mandatory protocols for low-embodied-energy materials, buildings' deconstruction, plans and systems for the collection and reuse/recycling of construction and demolition waste. Develop continental framework regulations. This activity will develop regional knowledge sharing on best practices on regulation that supports decentralized energy production and development of feed-in tariffs and integration of renewables into urban and regional planning.	Develop regional regulation on materials. This activity will develop mandatory protocols for low-embodied-energy materials, buildings' deconstruction, plans and systems for the collection and reuse/recycling of construction and demolition waste. Develop regional framework regulations. This activity will develop regional knowledge sharing on best practices on regulation that supports decentralized energy production and development of feed-in tariffs and integration of renewables into urban and regional planning.	Develop national regulation on materials. This activity will develop mandatory protocols for low-embodied-energy materials, buildings' deconstruction, plans and systems for the collection and reuse/recycling of construction and demolition waste. Develop national framework regulations. This activity will develop regulation that supports decentralized energy production and development of feed-in tariffs, peer-to-peer trading of renewable energy and mandatory requirements for integration of renewables into urban planning.
<i>Statistics and knowledge</i>		
Launch a continental fund to support ESCOs' activities. This activity will allow ESCOs to access funding for their services in implementing EE projects.	Establish ESCOs for the implementation of EE projects. ESCOs will complement other available financial mechanism to support the implementation of EE projects in the region.	Develop ESCOs for the implementation of EE projects. ESCOs will offer their services through a package, which includes comprehensive building energy audits, retrofits for existing buildings and building performance certification. This activity will assist enterprises that do not have the expertise and resources needed to implement EE projects.

Continental level	Regional level	National level
Technology		
Establish a fund for R&D of low-embodied-carbon materials and technologies in Africa. This activity will support regional research and the adaptation of internationally available EE technologies.	Support R&D of manufacturing of low-embodied-carbon materials and technologies in the region. This activity will enhance the manufacturing capacity in the region.	Develop the capacity for local manufacture of low-carbon building materials and technologies. This activity will lower investment costs of EE projects as most EE technologies are currently imported.
Standards and monitoring		
Launch continental rating labels. This activity will develop mandatory rating labels for new and existing buildings based on energy performance including materials and systems. To be shared by stakeholders across the continent, and streamline the monitoring process, the continental labels should be digitalised. Launch continental standards for building services and technologies. This activity will guide in the design and operation of building services and technologies.	Launch regional rating labels. This activity will develop mandatory rating labels for new and existing buildings based on energy performance including materials and systems. Digital labels will be proposed to promote coordination, information sharing, and transparency. Develop regional standards for building services and technologies. This activity will initiate studies on existing standards to support the development of new standards incorporating EE.	Develop rating labels. This activity will develop mandatory rating labels for new and existing buildings based on energy performance including materials and systems. Develop national standards for specific building services and technologies. Some existing equipment standards do not include EE requirements. Standards including EE are required for equipment and technologies, such as and building automation and control systems, fans, pumps, insulation systems, heating and cooling systems, HVAC systems and lighting.
Capacity building		
Launch a continental initiative for the registration and accreditation of EE training courses with the relevant authorities. This activity will enhance the credibility of EE training courses.	Launch registration and accreditation of selected regional EE training courses. This activity will increase the demand for EE training in the region.	Launch registration and accreditation systems for building professionals on EE in buildings. This activity will ensure the recognition of EE courses and increase the demand for the training courses.

11.5.TRANSPORTATION

Transport systems encompass the regulation, network, infrastructures and stock of vehicles contributing to the organisation of the mobility services for passengers and goods. They ensure connectivity between production and consumption centres and enable access to a wide range of services, activities, and opportunities. From a mobility point of view, an inefficient transport system is characterized by limited or slow access to goods, jobs, or amenities with strong social and geographical inequities implications. From an EE point of view, the ambition is to maximise the level of provided transport services per unit of energy consumed. By stressing energy productivity improvement in transportation, AfEES promotes actions leading to EE in, mobility wise, inclusive and efficient transport systems. It will help generalise, upscale and coordinate existing efforts to boost EE in the transportation sector.

Some of the mobility challenges that the transport sector in Africa faces are: low motorization rates, an important informal collective transport system, congested and fast-growing urban areas, a high-level of casualties due to poor infrastructures, and accessibility issues in rural areas. For good transport, facilitating trades at local, national, regional and continental levels is a requirement for economic development. Continental challenges include enhancing and modernising the logistic flows of goods by developing strategic trade corridors. This development must be supported by massive investments in Africa’s infrastructure for improved road networks, as well as strong railway, maritime ports and airports systems.

In terms of energy demand, the African transport sector account for 70% of all oil products consumed on the continent and this demand increased at an average annual rate of 5.3% between 2008 and 2018.²² A growing population and an average motorization rate which starts from a very low level are the two main drivers for the anticipated strong increase of the number of vehicles on Africa’s roads in the coming decades. However, the stock of vehicles in Africa is characterized by a low energy performance with a high proportion of imported second-hand vehicles, and an overall average age of the rolling stock of cars of 15 to 20 years.²³

In order to realise the continental EE ambition of AfEES, the roadmap of the transport sector outlines a set of actions that can be adopted by AU Members States, by regional institutions, or at the continental level. Its principle is consistent with the enable, avoid, shift, improve paradigms that have been promoted for transport policies and expressed for Africa by the SSATP.

Key recommendations of the roadmap include:

1. The need for more detailed and accurate statistical data to understand the type and amount of mobility service produced. This is a long run but essential task to be able to quantitatively assess the EE of the transport system.
2. The importance of age limitation regulation and policy to improve the technical efficiency of the rolling stock.
3. Clear regulatory process to define benchmark and standards for both people and goods mobility.
4. A modernized mass transport system with higher performance and efficiency of formal and informal public transport that are essential for a large share of the population.
5. The need to integrate EE and urban planning.
6. The importance of modal shift infrastructures to facilitate the shift to less energy intensive transport modes.
7. Due to the inertia and capital-intensive nature of the decisions that have to be made for the infrastructure, there is a need for debated, collaborative and shared views to allow timely investments.
8. The importance of demonstration projects to create a learning by doing process, structure the local stakeholder network, and move effectively from plans to implemented projects.

22 AFREC (nd). Energy Balances. <https://au-afrec.org/fr/>

23 UNECE (2022). Safer and Cleaner Used Vehicles for Africa. <https://unece.org/sites/default/files/2023-05/Safer%20and%20Cleaner%20Used%20Vehicles%20for%20Africa%20%28Final%29.pdf>

9. Policies aiming at fiscal supports, charging infrastructures deployment, and pilot fleets, are needed to prepare the transport sector for an increased adoption of electrified mobility solutions.
10. The importance of digital technologies in transport for improved vehicles’ performances and more efficient mobility organization. Digitalization will support data collection, public transport design, shared mobility, efficient logistic chains, routes optimization and smart electrification.
11. Dedicated work groups for good mobility to integrate EE in the conception of regional integration policies and for the expected increase in trades with the African Continental Free Trade Area (Af-CFTA).
12. The need to promote trains as energy efficient transport solution and support the electrification of railways and the definition of harmonized standards across the continent as part of Africa’s regional and continental integration.
13. The need to promote clean and energy efficient solutions for the maritime and aviation sectors via continental guidelines and regional pilot projects.
14. Prepare professionals and policy makers in the transport sector to integrate EE in their decision processes by setting new capacity building activities.

Depending on the level of comprehensiveness reached by existing EE policies for the transport sector, the actions described in the roadmap can be timed in three stages with specific focus:

1. Standards and accurate data sources on energy usages for mobility services. Readily applicable in the short-term.
2. Infrastructures and coordinated plans to strengthen the transport EE framework. Applicable as a second stage in the medium-term.
3. Mainstreaming transport solutions with a high level of efficiency and capturing manufacturing opportunities: will provide effects in the longer-term after reliable regulatory frameworks and standards, as well as adequate infrastructures have been established.

Table 19: Sectoral roadmap: Transport

Continental level	Regional level	National level
Short term: Standards and accurate data sources on energy usages for mobility services		
Capacity building	Institutions and regulation	
Develop and implement continental capacity building programs on data collection focusing on mobility services and energy consumption per transport mode. This action will develop coordinated EE capacity building activities at the continental level. A specific focus will be on the assessment of the demand for mobility services and consumption per transport mode. and the trainings will be performed in all regions for effective impact.	Adopt coordinated regional policies limiting the age of imported vehicles. Implementing this action will provide a more consistent improvement of the car fleet and mitigate the risk of vehicle imports from neighbouring countries with less stringent targets. It will also support the exchange of best practices.	Implement national policies aimed at limiting the age of imported vehicles. This action will develop the supporting regulatory frameworks at country level to gradually reduce the age of imported vehicles with an explicit timeline for implementation.
Finance and fiscal	Standards and monitoring	Establish a working group dedicated to urban mobility and EE. The proposed short-term focus of the working group is transport EE in the main urban centre in each country. It will provide factual knowledge of the link between urban planning and mobility flows, will identify opportunities to promote modal shift, and increase the awareness of the population.
Establish financing mechanisms at the continental level to support EE investment in public transport. This action will aim at identifying the appropriate mechanisms and mobilizing finances for projects (infrastructures, traffic conditions improvement, technologies) with a demonstrated benefit in terms of EE.	Adopt regionally harmonized fuel efficiency standards for new light duty vehicles. Harmonised standards will be developed at regional level to increase the effectiveness of EE standards and avoid the risk of imports through countries will less ambitious EE goals.	
	Statistics and knowledge	Standards and monitoring
	Develop regional transport EE database. This database will provide accurate information on EE at the regional level. It will support the diffusion of best practices, and provide default statistics for countries where data collection remains difficult.	Implement minimum fuel efficiency standards for new light duty vehicles. These standards will provide the technical basis for a better knowledge of the fuel economy of the new light duty vehicles entering the market.
	Technology	
	Perform EE assessment of regional priority projects for integrated logistic platforms. This action will support flagship projects of regional relevance that concretely demonstrate EE gains for the mobility of goods and that are anchored on the strategic trade corridors.	Implement minimum fuel efficiency standards for new heavy-duty vehicles. Metrics and standards for heavy duty vehicles are more complex to define. Learning from international experiences, this action will define the technical basis for the specification of such standards for good mobility in African countries.

National level
<i>Statistics and knowledge</i>
Perform fuel efficiency survey for formal and informal public transport. The survey will increase the understanding of the energy consumption impact per unit of mobility services provided by collective transport options.
Perform fuel efficiency survey for heavy duty vehicles. Fuel efficiency surveys will be conducted to improve the understanding of the energy consumption impact per ton of goods of the existing stock of vehicles.
<i>Standards and monitoring</i>
Implement fuel efficiency measurement labs. These labs will be instrumental to ensure compliance with all efficiency standard.
<i>Capacity building</i>
Launch capacity building programmes on data collection focusing on mobility services and energy consumption per transport mode. This action will increase the quality and reliability of energy balances. It will also help create a shift from an energy only perspective to an efficient mobility service provision approach.
<i>Technology</i>
Develop national bus rapid transit and mass transport programs. This activity will support the adoption and generalization of bus rapid transit or light rail systems that have proven effective in several cities.
Launch national electromobility pilot projects. This activity will support demonstration projects for car fleets, public transport and three-wheelers. It will enable concrete installation of charging infrastructure needs and create first practical experiences. The program will identify successful projects that can be replicated.
Implement efficient logistics platforms flagship projects. This measure will focus on implementing a few demonstration projects for fuel efficient transport and modal shift on major good mobility corridors.
<i>Finance and fiscal</i>
Establish financial mechanisms for EE investment in collective transport and commercial vehicles. The financial mechanisms will contribute to facilitated access to capital at national level via loans, subsidies or tax rebates as well as via innovative blended finance measures.
<i>Capacity building</i>
Deploy transport EE awareness campaigns. The awareness campaigns will increase the general understanding of the benefit of efficient vehicle technologies in terms of fuel savings, costs, health and emissions. It will cover savings from technological improvement as well as savings from drivers’ behaviour.
<i>Institutions and regulation</i>
Adopt national policies dedicated to road asset management. This action will include the definition of a legal framework for mandatory development and maintenance of the road network. It will also include polices dedicated to congestion reduction, and maintenance of all transport infrastructures.

Continental level	Regional level	National level
<i>Medium term: Infrastructures and coordinated plans to strengthen the transport EE framework</i>		
<i>Standards and monitoring</i>	<i>Capacity building</i>	<i>Institutions and regulation</i>
Develop continental benchmark of energy usages in formal and informal collective transport. This initiative will benchmark activity levels and EE in formal and informal public transport.	Develop regional training programs for energy-efficient transport systems. The coordination will improve the capacity building process by mutualising the information on national training activities and launching regional training programs. It will target fleet managers, transport professionals or institutional stakeholders.	Reinforce the urban mobility and EE working group. As the increasing urbanization rate and population growth will also affect mobility demand in other important urban centres, this phase will generalize the urban planning and mobility flows analysis to the main urban centres in each country.
<i>Finance and fiscal</i>		<i>Standards and monitoring</i>
Develop continental guidelines for energy statistics and reporting for the maritime transport sector. This action will develop continental guidelines for the collection of energy use data and for EE index calculation in the maritime transport sector for Africa.	Develop regional guidelines for Public Private Partnerships on EE investment for transport. This action will develop harmonised guidelines at the regional level to support the collaboration between public and private capital to finance EE projects. Identifying the relevant models to share the benefits and cost of the actions.	Update fuel efficiency standards for imported and new light duty vehicles. This update will target a 1.5% to 2% annual improvement rate of the average fuel efficiency of light duty vehicles. This update will affect both the age of imported vehicles and the minimum efficiency of the new light duty vehicles entering the market.
Develop continental guidelines for energy statistics and reporting for aviation. This action will develop continental guidelines for the collection of energy use data and for EE index calculation in the air transport sector for Africa.	<i>Standards and monitoring</i>	Update fuel efficiency standards for new heavy and light duty vehicles. This update will aim at anrage fuel efficiency.
Develop harmonized railway electrification policies at regional level. This activity will support electrification policies by defining harmonized railway electrification plan and technical regulation at regional level.		
National level		
<i>Technology</i>		
Elaborate a national electromobility plan. Electromobility requires a coordinated development of the power grid, the deployment of a network of charging infrastructures, and the adoption of electrified vehicles by end-users. The plan will provide transport and non-transport stakeholders involved in the electrified mobility value chain with visibility on the expected contribution of electrified mobility. It will in particular assess power grid implications of the development of electrified mobility solutions (peak power demand, grid reinforcement and total demand increase).		
Implement digital solution for energy-efficient transport flagship projects. This measure will support the implementation of a couple of projects demonstrating the contribution that digital solutions can make to an energy-efficient transport system.		

Finance and fiscal		
Implement national fiscal and financial measures for all energy-efficient vehicles. This measure will contribute to the design of the applicable financial and fiscal measures that best address the specificities of individual countries. It will cover all vehicle categories and their enabling infrastructure (investment in charging stations or in multimodal platforms).		
Standards and monitoring		
Implement national fiscal and financial measures for all energy-efficient vehicles. This action will map the contribution of demand side measures for mobility as a key component of an energy efficient transport system.		
Long term: Mainstreaming transport solutions with a high level of efficiency and capturing manufacturing opportunities		
Continental level	Regional level	National level
Long term: Mainstreaming transport solutions with a high level of efficiency and capturing manufacturing opportunities		
Standards and monitoring	Technology	Technology
Develop a continental energy productivity plan for freight transport in Africa: regional flows of goods, railway network and maritime routes. This activity will develop energy productivity improvement plan for goods transport that will cover road, rail, maritime and aviation sectors. It will, in particular, align the EE strategy for the transport sector with the development of the AfCFTA.	Implement regional flagship project for EE and sustainability in the maritime transport sector. The flagship projects will concretely showcase scalable initiatives in the maritime transport sector in Africa. This will create new knowledge and help identify implementation barriers and successful approaches. Implement regional flagship project for EE and sustainability in the air transport sector. The flagship projects will concretely showcase scalable initiatives in air transport in Africa. This will create new knowledge and help identify implementation barriers and successful approaches.	Continuously update implemented actions. Most transport EE actions described at the national level can readily be initiated in the short to medium term. For the long-term, this generic action ensure that measures are continuously updated or replicated. It has the same applicable colour code as the relevant short or medium-term activity.

11.6.AGRICULTURE

Agriculture, a cornerstone of Africa’s economy and food security, encompasses a vast range of activities, including open field farming, greenhouse cultivation, animal farming, fisheries, and operations within agricultural buildings. As Africa grapples with the impacts of climate change and population growth, a comprehensive EE strategy for agriculture, aligned with self-sufficient farming principles and climate action, becomes crucial. At the same time, AfEES aims to address the agricultural sector’s energy demands in a manner that comprehensively considers the interconnected and mutually dependent nature of water, energy, and food systems (WEF). The agriculture sector is intrinsically linked to the WEF nexus due to its dependency on energy for operations such as irrigation, harvesting, and post-harvest processing, among others. An improvement in EE inherently reverberates through the nexus, enabling optimized water usage and food production. By aligning AfEES with the WEF nexus, a robust framework is created that addresses multiple SDGs beyond energy, including clean water and sanitation, zero hunger, and climate action.

The main pillars of AfEES for the agricultural sector include:

- Precision Irrigation:** Transitioning from traditional to precision irrigation methods can save significant amounts of water and energy. The use of sensor-driven drip irrigation systems, controlled by AI algorithms, can target water delivery to where it’s most needed, minimizing waste. Additionally, solar-powered pumping systems can offer reliable irrigation power without dependence on fossil fuels, aligning with self-sufficiency principles.
- Sustainable and Efficient Agricultural Practices:** Implementing Conservation Agriculture (CA) practices, such as minimal soil disturbance, permanent soil cover, and diverse crop rotations, can lower energy use in tillage and soil management and allow farmers without access to agricultural equipment (e.g., tractors) to improve their yields. Precision farming technologies, utilizing IoT devices for real-time monitoring and control, allow for targeted application of fertilizers and pesticides, minimizing indirect energy consumption and environmental impacts. The hardware cost for these applications can be minimal and require at a first step only a smart phone with access to the internet.
- Fertilizer and Pesticide Efficiency:** As African economies grow, the use of fertilizers and pesticides is expected to increase. To keep this in check, integrated nutrient management and integrated pest management strategies should be promoted. These strategies entail precise application, optimizing timing and placement, and promoting biological control methods, reducing the overall need for these inputs. For self-sufficient farming, on-site composting and vermiculture can turn farm waste into nutrient-rich natural fertilizers, cutting down the need for synthetic ones.
- Greenhouse Energy Management:** Greenhouses can be optimized for energy use through passive solar designs, thermal screens, and efficient ventilation systems. Integration of renewable energy technologies, such as solar PV panels and geothermal heating/cooling, can make greenhouses largely energy-independent. Automation, guided by AI-based environmental monitoring, can further enhance EE in heating, cooling, lighting, and irrigation.
- Animal Farming Efficiency:** Optimizing feed mixtures and enhancing animal health management can reduce energy consumption associated with feed production and livestock rearing. Self-sufficient farming principles can be applied through on-site production of feed crops and use of animal waste. Anaerobic digestion of manure can generate biogas, a renewable energy source that simultaneously tackles methane emissions, a potent GHG.
- EE in Fisheries:** In the fishing industry, energy is consumed during fishing operations, aquaculture, and processing. Energy-efficient fishing gear, LED light lures, and optimal routing for fishing vessels can lower energy use. In aquaculture, energy-efficient aeration systems, recirculating aquaculture systems (RAS), and precision feeding can reduce energy demand significantly.
- Efficiency in Agricultural Buildings:** Energy is extensively used in agricultural buildings for

space heating/cooling, lighting, and operating machinery. Insulation improvements, energy-efficient appliances, LED lighting, and integration of renewable energy systems can contribute to substantial energy savings. Additionally, bioclimatic architectural designs that maximize natural light and ventilation can reduce dependence on mechanical systems.

- 8. Machinery and Fuel Efficiency:** Transitioning to electric machinery, charged by on-site renewable energy sources, and promoting biofuels made from agricultural residues can reduce reliance on fossil fuels. Regular machinery maintenance can enhance fuel efficiency, prolong machinery life, and reduce overall energy demand.
- 9. Energy-Efficient Post-Harvest Appliances:** Transitioning to energy-efficient appliances for post-harvest processes, such as solar-powered cold storage and drying units, can drastically cut energy use. Energy recovery systems in processing plants can further enhance overall EE.
- 10. Renewable Energy Integration:** Integration of renewable energy technologies like solar PV, wind turbines, and biogas digesters can reduce the agricultural sector's carbon footprint and increase self-sufficiency. Energy storage systems can ensure a steady supply of power, even in periods of low production.
- 11. Climate-Responsive Policy Environment:** Policymakers should align EE strategies with climate action plans, facilitating access to climate financing opportunities. Policy incentives and EE standards can foster innovation and drive investment in the sector.
- 12. Capacity Building and Partnerships:** Tailored training programs can enhance farmers' capacity to implement energy-efficient practices and transition towards self-sufficient farming. Strategic partnerships with international organizations, research institutions, and the private sector can facilitate technology transfer, share best practices, and improve access to financing.



Table 20: Sectoral roadmap: Agriculture

Continental level	Regional level	National level
Short Term		
Institutions and regulation	Capacity building	Technology
Form an EE in agriculture working group (by AFREC and AUDA-NEPAD (CAADP)). This group will foster an integrated approach to EE, supporting policy harmonization and providing technical assistance across the continent, acknowledging the cross-sectoral aspects and the numerous relevant stakeholders for this activity..	Implement regional training programs for EE in agriculture. In collaboration with regional universities and research institutions, these programs will provide specialized training on energy-efficient farming techniques and technologies.	Implement national programs for EE in agricultural machinery. These programs will provide incentives for the adoption of energy-efficient machinery and will promote maintenance practices that enhance EE.
Institutions and regulation	Technology	Standards and monitoring
Launch a pan-African initiative for energy audits in agriculture under CAADP. This initiative will benchmark energy usage and efficiency in agricultural practices, creating a continental database to identify best practices and areas for improvement.	Create a regional clean energy for irrigation initiative. Focused on regions with significant irrigation needs, this initiative will promote renewable energy technologies for energy-efficient irrigation.	Establish national standards for EE in irrigation. Developed in collaboration with national standardization bodies, these standards will guide the design and operation of energy-efficient irrigation systems.
Capacity building	Launch regional programs for precision agriculture. These programs will promote the adoption of precision agriculture technologies and practices, enhancing productivity and EE.	Technology
Create a continental digital literacy program in agriculture. This program will enhance the ability of farmers to adopt digital tools for energy-efficient farming, leveraging existing continental initiatives for ICT in agriculture.		Launch national programs for the adoption of solar-powered irrigation systems. These programs will promote the use of solar energy in irrigation, enhancing EE and reducing reliance on fossil fuels.
Technology	Standards and monitoring	Capacity building
Develop a continental initiative for GHG emissions reduction in agriculture. This initiative will focus on practices and technologies that mitigate emissions, promoting climate-smart farming and contributing to Africa's obligations under international climate agreements.	Establish regional standards for EE in agricultural buildings. Developed in collaboration with regional standardization bodies, these standards will promote EE in the design and operation of agricultural buildings.	Create a national digital extension service for EE in agriculture. This service will provide farmers with tailored advice on energy-efficient farming practices, leveraging digital tools to reach a wide audience.

Continental level	Regional level	National level
	Institutions and regulation	
	Form regional coordination structures for EE in agriculture under existing institutions. These structures will facilitate coordination between Ministries of Agriculture and Energy at the regional level, supporting the harmonization of policies and programs.	Establish national policies for sustainable fertilizer and pesticide use. These policies will promote the efficient use of fertilizers and pesticides, reducing energy usage in their production and application.
National level		
Technology		
Launch national programs for the adoption of energy-efficient post-harvest technologies. These programs will promote the adoption of energy-efficient technologies in post-harvest processes, reducing energy wastage.		
Institutions and regulation		
Implement national policies for the integration of renewable energy in farming operations. These policies will incentivize the adoption of renewable energy technologies in farming, promoting energy self-sufficiency.		
Create national coordination structures for EE in agriculture. These structures will ensure coordination between Ministries of Agriculture and Energy at the national level, aligning policies and programs for EE in agriculture.		
Establish national programs and policies for biogas production from animal waste. These programs will promote the production of biogas from animal waste, providing a renewable energy source and reducing GHG emissions.		
Capacity building		
Launch national capacity building programs in EE for agriculture. These programs will equip farmers with the skills and knowledge to implement energy-efficient farming practices, enhancing productivity and reducing energy wastage.		

Meduim term		
Institutions and regulation	Technology	Institutions and regulation
Establish a continental green certification scheme for energy-efficient farms. This activity will recognize and reward agricultural enterprises that demonstrate superior energy performance.	Launch regional initiatives for circular economy in agriculture. These initiatives will promote practices such as the use of agricultural waste for energy generation and composting.	Implement national green certification schemes for energy-efficient farms. These schemes will recognize and reward agricultural enterprises that demonstrate superior energy performance at the national level.
Technology	Capacity building	
Launch the continental mechanism for knowledge sharing in energy-efficient farming. This platform will facilitate the sharing of experiences and lessons learned across the continent.	Establish regional hubs for innovation in energy-efficient farming. These hubs will foster R&D in energy-efficient farming technologies and practices.	Establish national standards for renewable energy in agriculture. These standards will guide the design and operation of renewable energy systems in farming operations.
Standards and monitoring	Technology	
Develop an African standard for EE in agricultural machinery. This initiative will guide the production and import of energy-efficient agricultural machinery in Africa.	Roll-out regional programs for AI in precision farming. Building on the continental initiative, these programs will promote the use of AI technologies in precision farming within specific regions.	Roll-out national programs for AI in precision farming. Building on the regional and continental initiatives, these programs will promote the use of AI technologies in precision farming at the national level.
Technology	Capacity building	Institutions and regulation
Launch a continental initiative for AI in precision farming. This initiative will promote the use of AI and machine learning technologies in precision farming for enhanced EE.	Launch regional mechanisms for knowledge sharing in energy-efficient farming. These mechanisms will facilitate the sharing of experiences and lessons learned within specific regions.	Develop national policies for carbon sequestration in agriculture. These policies will promote practices that enhance the absorption of carbon dioxide by agricultural land, contributing to climate action at the national level.
Finance and fiscal	Market orientation	Technology
Establish an African fund for renewable energy in agriculture. This fund will provide financial support for the adoption of renewable energy technologies in agriculture across Africa.	Establish regional strategies for carbon sequestration in agriculture. These strategies will promote practices that enhance the absorption of carbon dioxide by agricultural land, contributing to climate action. They can also allow farmers to have a new income stream by selling carbon credit certificates.	Implement national initiatives for circular economy in agriculture. These initiatives will promote practices such as the use of agricultural waste for energy generation and composting at the national level.

<i>Long Term</i>		
<i>Technology</i>		
Establish a continental mechanism for carbon trading in agriculture. This mechanism will enable the trading of carbon credits generated by agricultural enterprises, incentivizing carbon sequestration. Launch a continental initiative for net-zero agriculture. This initiative will promote practices and technologies that enable net-zero emissions from the agricultural sector. Launch a continental initiative for energy self-sufficient farming. This initiative will promote practices and technologies that enable farms to generate their own energy.	Launch regional programs for net-zero agriculture. Building on the continental initiative, these programs will promote practices and technologies that enable net-zero emissions from the agricultural sector within specific regions.	Implement national programs for net-zero agriculture. These programs will promote practices and technologies that enable net-zero emissions from the agricultural sector at the national level.
	Roll-out regional mechanisms for technology transfer in energy-efficient farming. These mechanisms will facilitate the transfer of technologies that enhance EE in farming within specific regions.	Establish national mechanisms for carbon trading in agriculture. These mechanisms will enable the trading of carbon credits generated by agricultural enterprises, incentivizing carbon sequestration at the national level.
<i>Standards and monitoring</i>		
	Establish regional standards for EE in greenhouses. These standards will guide the design and operation of energy-efficient greenhouses within specific regions.	Implement national standards for EE in greenhouses. These standards will guide the design and operation of energy-efficient greenhouses at the national level.
<i>Institutions and regulation</i>		<i>Capacity building</i>
Develop an African standard for EE in greenhouses. The outcome of this activity will guide the design and operation of energy-efficient greenhouses across the continent.	Develop regional policies for carbon trading in agriculture. These policies will enable the trading of carbon credits generated by agricultural enterprises within specific regions, incentivizing carbon sequestration.	Launch national mechanisms for technology transfer in energy-efficient farming. These mechanisms will facilitate the transfer of technologies that enhance EE in farming at the national level.
<i>Capacity building</i>	<i>Market orientation</i>	
Establish a continental mechanism for technology transfer in energy-efficient farming. This mechanism will facilitate the transfer of technologies that enhance EE in farming.	Establish regional strategies for energy self-sufficient farming. These strategies will promote practices and technologies that enable farms to generate their own energy within specific regions.	Roll-out national strategies for energy self-sufficient farming. These strategies will promote practices and technologies that enable farms to generate their own energy at the national level.



ABOUT THE AFRICAN ENERGY COMMISSION (AFREC)
The African Energy Commission (AFREC), a specialised agency of the African Union, leads the coordination and development of Africa's energy sector. AFREC supports Member States with policy harmonisation, data systems, capacity development, and integrated planning to advance sustainable development across the continent.

ABOUT AFEES
The African Energy Efficiency Strategy and Roadmap (AfEES) provides a unified framework for accelerating energy efficiency across all sectors. It outlines strategic objectives, sectoral roadmaps, and an action plan that strengthens energy productivity, supports climate resilience, and contributes to the aspirations of Agenda 2063.

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