FACTSHEET 9

Energy Efficiency

SESA
Smart Energy Solutions for Africa

Figure 1: **Solar Home Systems are more affordable when coupled with energy efficient light bulbs and fans** (Lumos, 2022)

About the Sustainable Energy Solutions Catalogue

The Sustainable Energy Solutions Catalogue provides an introduction to the solutions deployed during the SESA project. The catalogue targets energy practitioners, policy makers and civil society, especially at local level. In the catalogue, readers can find key facts about specific sustainable energy solutions (technologies, business models, impact areas), and learn about approaches and concepts that help ensure the viability and long-term success of sustainable energy in the African context.

AUTHORS:

Madeleine Raabe, Sophia Schneider, Kimberly Fahsold, María Yetano Roche (WI)

Contributors: Kent Davidsson (RISE), Augustine Kangni, Elisabeth Biber (Siemens Foundation), Abdulmutalib Yussuff (UNEP), Elena Turienzo López (TEC)

1 Introduction

Energy efficiency is considered the “first fuel” in clean energy transitions, meaning that it is the quickest and most cost-effective solution to achieving electricity access and decarbonisation goals. Energy efficiency simply means using less energy to perform the same task. This can lead to savings in energy costs and reduced environmental impacts, but also to improved reliability of supply, reduced peak demand, increases in productivity, health benefits and other social impacts (Fowlie and Meeks, 2021; Dagnachew et al., 2020). This factsheet presents different facets of energy efficiency technologies and business models in the context of the African energy transition. It also discusses the socio-economic impacts of energy efficiency and the potential for its scale up. Finally, it gives examples of energy efficiency solutions implemented in the African context.

2 The technology

A variety of energy efficiency technologies and applications exist. Two key examples of relevance to the African context are presented here in turn: off-grid solar electricity systems and buildings.

2.1 Energy efficiency for off-grid solar solutions

Energy efficiency is key to making off-grid solar solutions economically viable for the operators, and to lowering electricity costs for the users (Efficiency for Access, 2022). By using energy efficient supply systems (like more efficient PV panels or batteries) and energy use appliances (such as efficient lightbulbs), the overall size of the energy supply system can be reduced and with that the costs over the whole lifetime of the system. In other words, with energy efficient appliances, less solar energy supply is needed.

When productive use (PUE) appliances that are powered by off-grid solar energy are energy efficient, they can lead to greater cost savings or productivity gains, such as larger yields per unit of energy input. Such appliances include irrigation systems, cold storage or grain milling. For more details refer to the factsheet on Productive use of Solar Energy, in this catalogue.

Energy efficiency in off-grid solar solutions needs to be planned from the design stage. Several programmes are supporting the design and deployment of home, and productive-use appliances that are efficient and suited for use with off-grid solar standalone systems or mini-grids. These include the Efficiency for Access Design Challenge or the Low Energy Inclusive Appliances (LEIA) Programme (Efficiency for Access, 2023). The latter has supported testing and quality standards such as VeraSol's verified product database for five productive use technologies (solar water pumps, walk-in cold rooms, refrigerators, egg incubators, and electric pressure cookers), and the LEAP Solar Water Pump Test Method (based on Lighting Global and IEC quality standards).

Energy efficiency is also a key consideration during the construction or installation stages (e.g., the choice of positioning of the PV panel) and during the use phase (e.g., energy consumption behaviour, maintenance of the components). Smart meters, remote monitoring, and other Information and Communication (ICT) and Internet-of-Things (IoT) technologies, are essential to ensuring energy efficiency during the use phase, as the visualisations they provide help consumers and suppliers identify and address inefficient energy consumption patterns.

Examples of application in the African context 1

"ESCO-in-a-box" Kenya pilot

The idea:
- Support system incorporating all the processes and contract templates needed to deliver energy efficiency projects to SMEs, based on internationally established good practice
- ESCO-in-a-box is used by several local governments in the UK and is being piloted in Kenya, with the aim of growing a viable ESCO industry in Kenya to improve the rate of implementation of energy efficiency projects
- The target users are SMEs that traditionally lack the time and resources to implement energy efficiency upgrades

The impact:
- Energy and cost savings
- Job creation
- Capacity building for SMEs

For further information visit:
- https://enso-impact.co.uk/projects/esco-in-a-box
- https://epgroup.com/esco-in-a-box-a-decarbonisation-solution-for-smes


Unsplash / Riccardo Annandale

2.2 Energy efficiency in building design

Building design is crucial to increasing energy efficiency and realising energy savings while increasing comfort and affordability of operating and maintenance costs. Simple methods, such as the orientation of a building, the use of eaves to shade walls from the sun, façade greening, or the choice of materials with high thermal mass (which can mediate extremes of hot and cold temperatures), can greatly improve building energy efficiency. In addition, many bioclimatic design approaches exist that can reduce the need of energy for cooling and ventilation. These methods are found in traditional building designs and construction methods across all climatic regions in Africa and can be applied both to new buildings and to the refurbishment of old buildings (Guedes and Cantuaria, 2019).

Examples of application in the African context 2

African Energy Efficiency Program, African Union Member States

The idea:
- Integrated energy policy at the regional level
- Collaboration between the African Union's African Energy Commission (AFREC) and UNEP's United for Efficiency Programme (U4E)

The impact:
- Harmonisation of lighting and appliance standards and labelling across the African regions and in the African Union Members States
- Development and implementation of Minimum Energy Performance Standards (MEPS) at national level
- Fostering the attractiveness of energy efficient products to the final consumer
- Incentivising industry to develop, importers to import and retailers to sell energy efficient

For further information visit:
- https://united4efficiency.org
- https://au-afrec.org/energy-efficiency-programme

Dreamstime / David Herraez

3 Business and financing models

A growing number of businesses in Africa are developing energy efficient appliances and services. Business models for energy efficiency, just like business models for other sustainable energy solutions in Africa, need to address the challenge of affordability, in particular when they are geared towards low-income households, micro and small enterprises or smallholder farmers.

Approaches geared towards energy efficiency tend to be based on a general Energy-as-a-service (EaaS) business model. This allows customers to pay for energy services without the need to make upfront capital investments, which is the main barrier towards accessing energy efficient appliances and technologies. Different features can be integrated into an energy-efficiency oriented EaaS business model, such as the guarantee that a certain level of energy or cost saving will be met. This can be achieved, for example, through Energy Performance Contracting (EPC). An EPC model allows funding energy efficiency upgrades from the future savings made through energy efficiency. Under an EPC agreement, an Energy Service Company (ESCO) implements a project to deliver energy efficiency and uses the stream of income from the cost savings to repay the costs of the project, including the initial investment (EACREEE, 2020).

The companies EnSo and Energy Pro Ltd. are applying the innovative ESCO-in-a-box business model in Kenya. ESCO-in-a-box is an 'operating system' for energy services, aimed at unlocking the wide range of financial, environmental, and social benefits provided by energy efficiency upgrades for SMEs that traditionally lack the time and resources to implement energy efficient solutions (for more details see Examples section).

4 Socio-economic and sustainability impacts

The **direct benefits** of energy efficiency are the reduction of energy consumption and therefore of expenditure on energy bills. This can in turn boost productivity and affordability of mobility, lighting, heating and cooling, and other services. The subsequent savings free up resources for households, businesses and governments and makes economies less dependent on energy imports (IEA, 2019). The **indirect benefits** of energy efficiency are therefore broad, and promote economic and social development, health and wellbeing and energy access – among other strategic goals. Considering the multiple benefits of energy efficiency (Figure 2) is crucial to achieving political buy-in for it and for leveraging support for the investments required.

Energy efficiency has the potential to deliver sustainable high-quality **employment** in Africa. The Africa Energy Outlook projects that 1.3 million jobs will be created by 2030 in the clean energy sector, of which 20% are related to energy efficiency (IEA, 2022a). Areas of particularly high potential for job creation include the retrofitting of buildings to increase their efficiency, the application of energy efficiency measures in industry consistent with ISO 50001 Energy Management System standards, and the manufacturing or assembling of efficient appliances. Most of the jobs will require specialized training and education (IEA, 2022a).

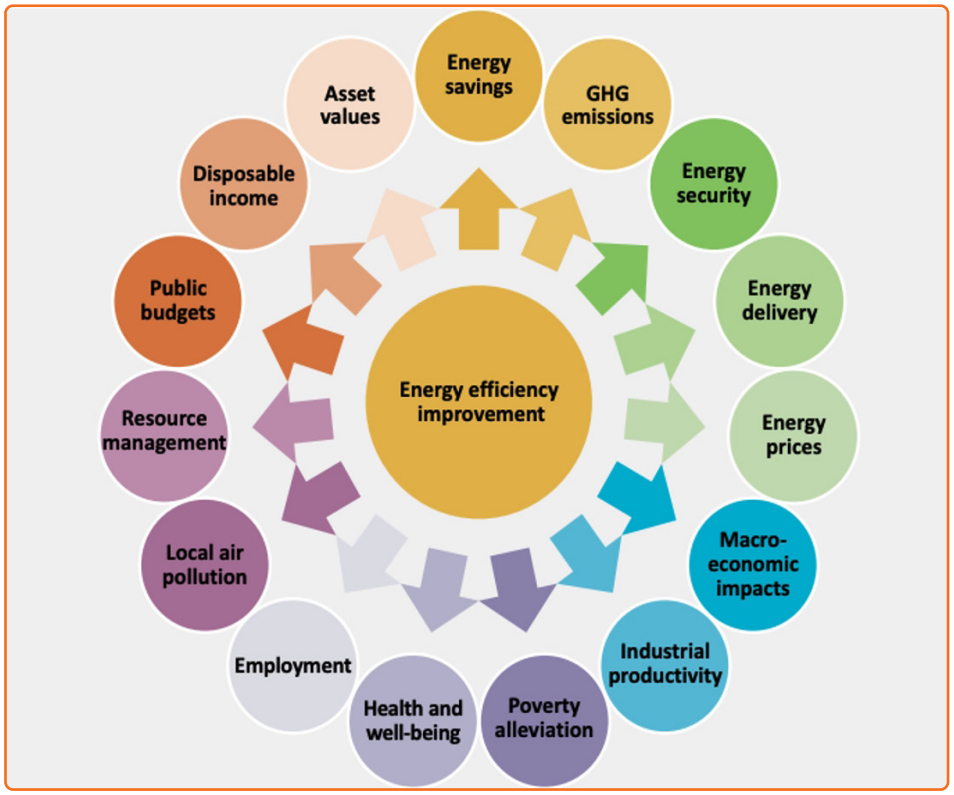

Figure 2: **The multiple benefits of energy efficiency** (IEA 2015)

5 Scaling-up

Energy efficiency policies and programmes exist across Africa but will require significant acceleration in order to keep up with growing energy demand. Moreover, resources need to be in place for the effective implementation of policies.

The required policy mix includes a combination of regulation, incentives and information. Regulation, for instance, is crucial to exclude worst-performing equipment from the market by **introducing stringent minimum energy performance standards (MEPS) and mandatory comparative labels** (IEA, 2022b) (See tools section for more details). Regulation is also necessary to put a stop to the dumping of inefficient second-hand appliances from the global north on the African market (for more details, see also E-waste Factsheet in this catalogue). Restrictions on the import of inefficient appliances are not only beneficial for increasing energy efficiency, but they also have the potential to encourage local manufacturing or assembly (IEA, 2022b).

6 Climate-proofing

Climate proofing is a term that refers to the process of mainstreaming climate change into mitigation and adaptation strategies and programmes (Climate Policy Info Hub, 2022). The goal of climate proofing is to ensure that climate-related risks and opportunities are integrated into the design, operation, and management of products and infrastructure. In order to do this, solutions have to be screened for climate risks, vulnerabilities and opportunities in the early design stage.

Energy efficiency can reduce vulnerability to climate change, especially in rural populations (IPCC, 2022). Some of the key links between energy efficiency and climate proofing are:

- Solar photovoltaic systems can potentially suffer efficiency reductions in case of changes in average temperature or radiation. Climate proofing PV systems requires selecting more resilient modules that are appropriate for the expected changes in climatic conditions in the location.
- Depending on the selected location, energy infrastructure can be at a high risk of exposure to extreme events that cause physical damage, such as floods or forest fires. Energy efficiency can lower this risk by reducing the need for energy infrastructure, as energy efficient buildings and appliances require less energy supply infrastructure. To minimise exposure to these hazards, the siting of infrastructure should take future climate projections into account. This should preferably be done in the design phase.


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7 Relevant tools and capacity building materials

"The value of urgent action on energy efficiency" Policy Toolkit

To support stronger action on efficiency the IEA has designed a policy toolkit for governments, launched at the IEA's 7th Annual Global Conference on Energy Efficiency in 2022. The toolkit provides a practical approach to accelerate action on energy efficiency by guiding governments in the design of effective policy measures, the support of policy decisions and the delivery of policy actions.

➔ www.iea.org/reports/the-value-of-urgent-action-on-energy-efficiency/policy-toolkit

Energy efficiency in Cold Water Supply Systems Tool

Replacement of old and inefficient water ground pumps in municipal cold-water systems is recognised as a "low hanging fruit" to increase energy efficiency within a short 2 to 5 years payback period. This online tool requires minimal data on cold-water consumption in municipalities and presents potential energy savings, emission savings, investment volume and a simple payback period.

➔ https://c2e2.unepccc.org/kms_object/energy-efficiency-in-cold-water-supply-systems-tool

Energy Efficiency Indicators: Fundamentals on Statistics

The lack of data for developing proper indicators to measure energy efficiency often prevents countries from transforming declarations into actions. The main objectives of this manual are to identify the main sectoral indicators and the data needed to develop these indicators; and to make surveying, metering and modelling practices existing all around the world available to all.

➔ www.iea.org/reports/energy-efficiency-indicators-fundamentals-on-statistics

ECOWAS Energy Efficiency Technical Assistance Facility

Energy audits are a reliable tool to enable energy efficiency. The ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) and the National Renewable Energy Laboratory (NREL) have partnered to promote the energy audit market, and deliver technical assistance to businesses providing energy audit services in the ECOWAS Region.

➔ www.ecreee.org/page/ecowas-energy-efficiency-technical-assistance-facility

Efficiency for Access Impact Assessment Framework

The framework merges evidence on the impacts of four high-performing appliances: fans, refrigerators, solar water pumps, and TVs, and provides a set of formulas that help quantify these impacts. The framework and formulas help to facilitate the financing, planning, measuring, and reporting of these impacts. Efficiency for Access is publishing a number of outputs based on this study, to help identify the impacts of high-performing appliances further.

➔ https://efficiencyforaccess.org/publications/impact-assessment-framework

CLASP tools: Efficient appliances for people and the planet

In the CLASP database tools can be found that provide essential data and information on appliance energy performance and quality. This includes the analysis of impacts of efficiency policy options, a comparison tool for off-grid energy solution appliances, a policy resource hub, an overview on policy compliance and an open-source testing tool to measure the power and performance of computers.

➔ www.clasp.ngo/tools

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SESA
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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101037141. This material reflects only the views of the Consortium, and the EC cannot be held responsible for any use that may be made of the information in it.

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