ENERGY-EFFICIENT LIGHTING AND APPLIANCES FOR LESOTHO

TECHNICAL DESCRIPTION

Energy efficiency is a cornerstone of any effort to achieve climate, energy and development goals. This initiative focuses on the implementation of energy efficiency and management tools to enhance energy usage in commercial services and households. In commercial services, the emphasis is on using energy-efficient appliances. In households and institutions, the focus is more on adopting energy-efficient lighting technologies. These measures are designed to reduce electricity demand, avoid premature investments in energy supply, lower GHG emissions and air pollution, increase energy access and services, reduce dependence on fossil fuels, improve grid reliability, and accelerate the benefits of renewable energy. Energy-efficient appliances consume less energy than traditional ones, reducing utility bills and overall energy consumption. They feature energy-saving technologies for improved efficiency and performance. These appliances are designed to minimize energy waste during operation and are labeled with energy efficiency ratings like ENERGY STAR or EU energy labels. They offer benefits such as cost savings and reduced environmental impact. Improving energy efficiency in households is crucial for reducing energy consumption and carbon emissions, leading to lower energy bills and a healthier environment.

Lesotho's energy demand is growing steadily, with consequences for the economy and the environment. Without energy efficiency measures, massive investments in new energy generation capacity are needed and deforestation will continue unabated. In order to achieve SDG 7, which aims to ensure access to affordable, reliable, sustainable and modern energy for all, energy efficiency (EE) can be a powerful lever in terms of cost (cheaper in terms of demand and supply through avoided investments in infrastructure), time (faster), scale (cross-sectoral), and greenhouse gas (GHG) emissions (significantly reduced).

Lighting Technology:

- LED (Light-Emitting Diode) lighting has become the most energy-efficient and cost-effective option for lighting in Lesotho. LED bulbs use up to 80% less energy than traditional incandescent bulbs and have a much longer lifespan of 25,000-50,000 hours.
- Solar LED lanterns are modular and easily deployable, making them a scalable solution for reaching remote rural areas in Lesotho.

An LED is a semiconductor that emits light when an electric current passes through it, offering benefits such as longevity, brightness, and lower electrical cost compared to CFLs and incandescent bulbs For example, an LED bulb can last 15 years if used 24/7. LEDs emit 72 lumens per watt, making them more efficient than incandescent bulbs (15 lumens per watt) and CFLs (60 lumens per watt). To achieve a brightness of 800 lumens, an incandescent bulb needs 60 watts, a CFL needs 14 watts, and an LED only needs 10 watts. ENERGY STAR-rated LEDs use up to 75% less energy.

Appliance Technology:

- High-efficiency refrigerators and freezers that meet strict energy standards are increasingly accessible in Lesotho, using 25-50% less energy than traditional models. Energy-efficient washing machines are also gaining popularity, particularly in urban areas. Solar water heaters are being embraced in Lesotho to reduce energy consumption for hot water, leveraging the country's abundant sunshine.

CURRENT TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX[1]

Lighting Technology:

- **LED Lighting and Compact Fluorescent Lamps (CFLs): TRL 9, CRI 5:** LED bulbs and fixtures are widely commercially available and commonly used throughout Lesotho, both in urban and rural areas. The technology is mature and well-established. CFLs have been available in Lesotho for many years and are a mainstream lighting option, especially for residential and commercial applications.
- **Solar-powered LED Lamps/Lanterns: TRL 8, CRI 4:** These are widely available and used, especially in off-grid rural areas, but may still face some affordability barriers for the lowest-income households.

[1] CRI is a tool that evaluates the commercial readiness of a technology by assessing six indicators. It is commonly used alongside the TRL method, which focuses on the technology's technical maturity.

Appliance Technology:

- **Energy-Efficient Refrigerators/Freezers: TRL 9, CRI 4:** High-efficiency refrigeration appliances meeting energy performance standards can be purchased in major urban centres, but availability and affordability remain challenges in more remote areas.
- **Energy-Efficient Washing Machines: TRL 8, CRI 4:** These are becoming common in Lesotho, especially in major urban centres, but still have limited penetration compared to traditional washing machine models.
- **Solar Water Heaters: TRL 8, CRI 4:** Solar water heater systems are gaining traction in Lesotho, particularly for residential use, but face barriers related to upfront cost and installation complexity compared to conventional electric. Some advanced appliance technologies like heat pump clothes dryers or super-efficient HVAC systems may be at a TRL 7-8, still undergoing demonstration and early commercial rollout, have a CRI of 4-5, showing they are commercially available and beginning to gain meaningful market share.

CLIMATE RATIONALE OF THE TECHNOLOGY

- **Reduction of Candle and Kerosene Use**: Solar LED lanterns replace traditional kerosene lamps, which emit significant GHG gases and pollutants. The use of solar lanterns eliminates the need for kerosene, leading to a substantial decrease in CO_2 emissions associated with fossil fuel combustion. Kerosene lamps are a major source of indoor air pollution and GHG emissions, and their replacement with solar technology directly mitigates these emissions
- **Clean Energy Source**: Solar lanterns harness renewable energy from the sun, providing a sustainable and clean alternative to fossil fuels. This shift not only reduces GHG emissions but also enhances energy security for rural households that lack access to the national grid
- **Environmental and Resource Conservation**: By adopting energy-efficient lighting and appliances, Lesotho can reduce the need for additional fossil fuel-based power plants in the future as electricity demand increases.
- **Reduced strain on hydroelectric resources**: Efficient use of electricity helps conserve Lesotho's water resources used for hydropower generation.
- **Increased grid capacity**: By reducing the overall energy demand, energy-efficient technologies can help Lesotho's grid accommodate more consumers without the need for additional power generation infrastructure
- **Adaptation to Climate Change:** Lesotho is vulnerable to climate change impacts, such as droughts affecting hydropower generation. Using energy-efficient technologies can help enhance resilience to such shocks.
- **Alignment with National Climate Strategies and Broader Sustainability Co-Benefits:** Lesotho's NDC focuses on energy efficiency as a key climate change strategy.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

Lighting: Nationwide rollout of LED bulb distribution and replacement programs, targeting residential, commercial, and public sector buildings; Potential to achieve near-complete LED adoption across Lesotho within 5-7 years with concerted policy support and consumer awareness campaigns.

Appliances: Phased approach to promote energy efficient major household appliances like refrigerators, washing machines, and air conditioners; Focus on driving market transformation through minimum energy performance standards, labelling programs, and consumer incentives; Potential to achieve 50-70% efficient appliance market share within 7-10 years.

Timeline:

- **Short-term** goals include establishing national energy efficiency standards, introducing consumer rebates, and launching public awareness campaigns.
- **Medium-term** goals involve expanding energy efficiency standards, scaling up bulk procurement programs, and providing financing mechanisms.
- **Long-term** goals aim for widespread adoption of LED lighting and energy-efficient appliances, integrating them into national climate change strategies and exploring smart grid technologies.

AMBITION FOR TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

Lighting Technology:

- **LED Lighting Compact Fluorescent Lamps (CFLs): TRL 9, CRI 5 (Current):** Maintain the high TRL and CRI as LED bulbs and fixtures become the dominant lighting solution nationwide. Gradually phase out CFLs in favour of more efficient LED alternatives over the next 5-10 years.
- **Solar-powered LED Lamps/Lanterns: TRL 9, CRI 5:** Achieve widespread availability and affordability, especially in remote, off-grid areas, within the next 5-7 years.

Appliance Technology:

- **Energy-Efficient Refrigerators/Freezers: TRL 9, CRI 5:** Ensure that high-efficiency refrigeration appliances meeting stringent energy performance standards become the norm in both urban and rural markets within the next 7-10 years.
- **Energy-Efficient Washing Machines: TRL 9, CRI 5:** Increase the market share of energy-efficient washing machines to at least 70% of total sales within the next 7-10 years.
- **Solar Water Heaters: TRL 9, CRI 5:** Achieve a significant increase in the adoption of solar water heaters, particularly in the residential and commercial sectors, with a CRI of 5 within the next 10-15 years.

EXPECTED IMPACTS OF THE TECHNOLOGY

- **Energy Savings and Emissions Reduction**: Reduced electricity consumption by 20-30% in residential and commercial sectors, leading to indirect GHG emission reductions from electricity imports and supporting Lesotho's climate change mitigation goals.
- **Electricity Supply and Grid Stability:** Reduced peak electricity demand, avoiding blackouts; Delayed grid investments and improved resilience; enhanced energy security for homes and businesses.
- **Energy Access and Affordability:** Improved access to affordable energy services in rural areas, reducing household expenses and improving health and quality of life, especially for women and children.
- **Economic Benefits:** Creation of new green jobs in energy-efficient products; Potential for local enterprise development and small-medium business growth; increased competitiveness of Lesotho's industries through lower energy costs.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

- **National Energy Policy (2015-2025):** Articulates the goal of promoting energy efficient practices and equipment in all sectors of the economy under Policy Statement 5: Energy Efficiency in Electricity.
- **Sustainable Energy for All (SE4ALL) Action Agenda (2016):** Establishes goals to increase access to modern, efficient, and clean energy technologies, includes plans to develop LED lighting and appliance efficiency programs.
- **Revised Nationally Determined Contribution (2024):** Identifies energy efficiency as a key mitigation strategy, Highlights the need for policies, regulations, and awareness campaigns to drive the adoption of energy-efficient technologies.
- **Sustainable Energy Strategy (2018-2022):** Outlines plans to promote energy efficient lighting and appliances through targeted incentives and awareness campaigns, Emphasizes the need to establish energy efficiency standards and labeling
- **Energy Efficient Lighting and Appliances in EAC and SADC (2019 – 2024)**: The EELA project supports the development of energy efficient lighting and appliances markets in East and Southern Africa.
- **Energy Efficiency Builders Manual 2023**: Lesotho's Ministry of Local Government, with the Department of Energy and other partners, has created an Energy Efficiency Builder's Manual for energy efficient buildings. It promotes energy efficient lighting and alternative energy sources like solar systems**.**

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

- Developing detailed regulations for energy efficiency in Lesotho's Energy Policy 2015-2025, including Mandatory Minimum Energy Performance Standards. Regularly review and enforce compliance.
- Introducing tax incentives and establish a national Energy Efficiency Fund for financing energy-efficient products. Collaborating with financial institutions for specialized financing.
- Strengthening the Department of Energy's capacity to oversee energy efficiency policies. Establishing an Energy Efficiency Unit and offer training for local businesses.
- Launching a public awareness campaign work with community leaders and media, and include energy efficiency education in schools.
- Promoting bulk procurement programs, support local manufacturing, and encourage energy service companies for commercial clients.
- Establishing a monitoring and evaluation framework, update standards and incentives, and promote research and development.
- Requiring energy-efficient lighting and appliances in government buildings, infrastructure, and social housing.

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

- Developing and implementing MEPS and labelling standards, ensuring adherence and monitoring programmes
- Establishing an Energy Efficiency Fund
- Providing tax incentives and subsidies
- Establishing a dedicated Energy Efficiency Unit
- Launching a national awareness campaign
- Implementing bulk procurement and distribution programs
- Supporting local manufacturing and assembly
- Establishing a monitoring and evaluation framework

The projected cost for developing and implementing policies to promote the adoption of LED technology is approximately USD 367,500. This figure is expected to rise to USD 500,000 if basic energy-efficient appliances such as refrigerators, freezers, washing machines, televisions, and solar water heaters are included.

Potential Funding Sources:

- **Government of Lesotho (GOL):** Funding through national budgets or specific climate and energy efficiency allocations.
- **International Grants:** Seek grants from international organizations focused on energy efficiency and climate change.
- **Private Sector Contributions**: Partnerships with companies involved in the manufacturing and distribution of energy-efficient technologies.

USEFUL INFORMATION

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Links to TNA reports

https://tech-action.unepccc.org/country/lesotho/