IMPROVED COOKSTOVES FOR LESOTHO

TECHNOLOGY DESCRIPTION

TECHNICAL DESCRIPTION

Improved cookstoves (ICS) have been specifically designed to address several environmental and health concerns. These stoves aim to reduce deforestation, lower greenhouse gas emissions from wood consumption and burning, and improve the overall quality of life by reducing health risks and the time spent collecting firewood. Various types of efficient stoves have been developed, each tailored to meet specific objectives and taking into consideration the cultural traditions of the communities that use them. The most common designs feature improved combustion chambers that reduce fuel usage and harmful emissions by increasing combustion efficiency and transferring heat to the cooking device more effectively. These cookstoves can operate on a variety of fuels, such as sustainably harvested wood, charcoal, and pellets, depending on the specific design.

High-performing biomass stoves are not currently widely manufactured in Lesotho. However, there are two organizations actively promoting and implementing their usage. The ACE 1 Ultra-Clean Biomass Cookstove, manufactured by African Clean Energy, and the SAVE80 Cookstoves, assembled locally by Solar Lights Ltd (Pty), are the most popular and highest efficiency cookstove available on the Lesotho market.

The SAVE80 Cookstoves are prefabricated by a German manufacturer and then assembled locally in Lesotho to create employment. According to the manufacturer, each stove saves around 2.5 to 2.8 t CO_2 per year, which is more than the emissions produced by a mid-size car driven 10,000 kilometres per year[1,2]. The SAVE80 sets reduce wood usage by 80%, with most of the wood sourced locally, compared to traditional open fires, leading to an 80% reduction in CO_2 emissions. The average CO_2 reduction per household (through daily use) for cooking and water boiling is approximately 2.8 t CO_2 annually. Over a 20-year lifespan, a SAVE80 Stove Cooking Set saves over 50 t CO_2.

ACE One Cookstoves, produced by African Clean Energy (ACE) in Lesotho, are clean cookstoves alternatives that can burn a wide range of solid biomass[3]. The gasifier technology of ACE-1 allows for more complete fuel combustion, resulting in lower emissions and reduced fuel consumption compared to traditional stoves. Users can cook with 50-85% less fuel compared to traditional cookstoves, leading to significant cost savings, lest time spent gathering fuel, and helping to mitigate deforestation in Lesotho. The ACE-1 burns biomass fuels without producing smoke, reducing CO_2 and fine particulate matter (PM2.5) emissions by up to 95% compared to an open fire. Conservatively calculated, one ACE1 clean cooking stove reduces **10 t CO_2 over 8 years.** These health benefits, along with fuel and time savings, help reduce gender inequalities, improve lives, and preserve forests.

CURRENT TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

Technology Readiness Level (TRL)[4]:

- Most designs for improved cookstoves, such as rocket stoves and improved biomass stoves, have progressed beyond the early TRL stages. Prototypes have been developed, tested in laboratories, and field-tested in various communities.
- Some improved cookstove models have reached TRL 7, where prototypes are demonstrated in an operational environment.
- Some improved cookstove models have reached TRL 9, where they are proven in operational environments at scale. Adoption in local communities, supported by NGOs and government programs, indicates high readiness levels.

[1] https://www.atmosfair.de/en/climate-protection-projects/energy_efficiency/lesotho/
[2] https://cdm.unfccc.int/Projects/DB/RWTUV1323354971.78/view?cp=2
[3] https://africancleanenergy.com/
[4] TRL scale measures technology maturity from basic research to commercial deployment, aiding R&D and funding decisions.

Commercial Readiness Index (CRI)[5]:

- Improved cookstoves in Lesotho are generally at CRI 3-4, showing market formation and initial customer acceptance. Some models are available for purchase, indicating commercial availability. In some areas, they are scaling up with growing demand, supported by international organizations like **atmosfair**. The distribution of Save80 efficient firewood stoves is helping reduce natural wood consumption in Lesotho. Full commercial maturity (CRI 6) may not be uniform across the country, but strong implementation programs can help achieve it[6]

CLIMATE RATIONALE OF THE TECHNOLOGY

Lesotho is confronted with major environmental and climate challenges, such as deforestation, soil degradation, and dependence on traditional biomass fuels for household cooking and heating, which have significant adverse effects on the environment, climate and public health in the nation.

On average each energy-efficient cookstove reduces CO_2 emissions by 2.85 tonnes annually compared to traditional open-fire cooking[7]. The average open fire will emit 1.9 kg CO_2 for every kilogram of wood burnt, and an extra 0.07 kg of black carbon (soot). This equates to an average of 28.5 kg CO_2 emitted by a single household per day (calculated at 15 kg of wood per day with an average of 4 people per household)[8].

Reduced GHG Emissions:

- Traditional three-stone fires and inefficient cookstoves lead to high levels of biomass combustion and related GHG emissions, such as CO_2 and CH_4. Switching to energy-efficient cookstoves can greatly decrease fuel usage and emissions, aiding in climate change mitigation.

Decreased Deforestation and Land Degradation:

- Reliance on fuelwood for cooking in Lesotho has caused deforestation and land degradation. Efficient cookstoves can help reduce fuel consumption, easing pressure on forests and preserving fragile ecosystems. Lesotho has lost a significant portion of its forests in the past 25 years due to high demand for firewood. Traditional cooking methods are inefficient and contribute to environmental degradation.

Improved Indoor Air Quality and Health:

- Traditional cooking methods create indoor air pollution, causing respiratory illnesses. Energy-efficient cookstoves can reduce this pollution and improve health.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

The technology aims to provide efficient cooking solutions to rural and peri-urban communities in Lesotho, reducing their reliance on traditional biomass fuels. By 2030, the goal is to disseminate 30,800 fuel-efficient stoves to households in these areas, with plans to expand to schools and clinics. This initiative will benefit rural community councils in all 10 districts, helping them transition away from harmful fuels like kerosene and firewood. The project is expected to create over 1,000 new jobs and promote socio-economic development while reducing the consumption of firewood and fossil fuels.

The timeline for implementing efficient cookstoves spans 6 years (2024-2030) to align with national policies and development priorities, aiming to achieve Lesotho's energy sector objectives in line with Sustainable Development Goal 7.

Preparation (6-12 months):

- Needs Assessment; Stakeholder Engagement; Capacity Building, Funding and Resources

[5] The CRI evaluates technology readiness for commercial success, analysing market potential, competition, and economic viability.
[6] https://www.atmosfair.de/en/climate-protection-projects/energy_efficiency/lesotho/
[7] https://www.green.earth/blog/cookstoves-for-carbon-reduction
[8] https://www.sunfire.co.za/solar-cooking-better/

Pilot Phase (6-12 months):

- Pilot Testing and Impact Assessment.

Expansion Phase (1-2 years):

- Scaling Up Production; Supply Chain Development; Community Outreach; Monitoring and Evaluation.

Full-scale Implementation (3-5 years):

- Nationwide Rollout; Subsidy and Financing Programs; Sustained Support; Policy and Regulation.

AMBITION FOR TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

The ambition for the future TRL and CRI of ICS technologies in Lesotho is to continue advancing them to the highest levels of maturity and commercialization.

Technology Readiness Level (TRL):

Current Status TRL 7-8: ICS technologies in Lesotho are generally demonstrated in operational environments and are being qualified through testing and demonstration.

Ambition for Technology Readiness Level (TRL): Achieve TRL 9

Maintain and advance improved cookstove technologies in Lesotho to highest TRL levels by ensuring widespread adoption, consistent quality, performance, and user satisfaction. Invest in research and development to optimize design, efficiency, and emissions performance, incorporating latest advancements and user feedback.

Commercial Readiness Index (CRI):

Current Status: CRI 3-4: Early stages of commercialization with market formation and initial customer acceptance

Ambition for Commercial Readiness Index (CRI): Achieve 5 -7

The ambition is to elevate the commercial readiness of improved cookstoves in Lesotho to the highest CRI levels:

- **CRI 5 (Commercial Scale-up): Sustain** and expand the well-established cookstove supply chains, distribution networks, and after-sales support services in Lesotho; **Ensure** a diverse and competitive market with multiple manufacturers, retailers, and financing options available to consumers.
- **CRI 6 (Bankable): Develop** robust financing mechanisms, including consumer credit, microfinance, and results-based funding, to improve the affordability and accessibility of improved cookstoves; **Attract** increased private sector investment and participation in the cookstove market in Lesotho.
- **CRI 7 (Market Competition): Foster** an environment of healthy competition among cookstove providers, leading to continuous innovation, cost reductions, and improved customer experiences; **Ensure** that the cookstove market in Lesotho is self-sustaining and able to thrive without significant external support.

EXPECTED IMPACTS OF THE TECHNOLOGY

- **Environmental Impacts**: Reduced biomass fuel consumption and GHG emissions, aiding climate change mitigation. Less deforestation and land degradation from lower fuelwood demand. Better local air quality and reduce d indoor air pollution. Preserved biodiversity and ecosystem services from forests.
- **Health Impacts:** Improved respiratory health, especially for women and children, due to decreased household air pollution exposure; Decreased burn injuries and other cookstove-related accidents.
- **Socioeconomic Impacts**: Lower fuel expenses could result in increased disposable income for households, enabling them to invest in education and healthcare. The cookstove value chain has the potential to generate new employment opportunities in Lesotho. The time saved on gathering fuel and cooking can be utilized for educational pursuits, leisure activities and family bonding.
- **Gender Impacts:** Benefits for women and girls include a decrease in the amount of household chores, enhanced safety, and the opportunity for greater involvement in decision-making and leadership positions concerning energy access and resource management.

- **Broader Development Impacts**: Contributes to Lesotho's SDGs, including clean energy access (SDG 7), poverty reduction (SDG 1), improved health (SDG 3) and climate action (SDG 13). Synergies with other initiatives like rural electrification and agricultural productivity. Enhances community resilience to climate-related challenges.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

- **National Energy Policy (2015-2025)** promotes cleaner cooking technologies to reduce reliance on traditional fuels.
- **Draft Renewable Energy Policy (2013)** supports improved cookstoves to cut emissions.
- **Climate Change Policy (2017-2027)** and **Revised Nationally Determined Contribution (2024)** include cookstoves to meet climate targets.
- **National Forestry Policy (2008)** recognizes efficient cookstoves to reduce deforestation.
- Lesotho is part of the **SE4ALL initiative** for universal access to modern energy services by 2030, including improved cookstoves.

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

- Financial incentives and subsidies to offset upfront costs for technology deployment.
- Institutional development in biomass sector for coordination among stakeholders.
- Skills development for improved cookstoves workforce capacity.
- Improved cookstove standards; Innovation and technology for local production of cookstove components.

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

Cookstove Subsidies and Incentives: Estimated cost range: $20 - $50 per cookstove, depending on the level of subsidy and target beneficiaries.
Cookstove Distribution and Supply Chain: Estimated cost range: $5 - $15 per cookstove for distribution and supply chain infrastructure.
Awareness and Behaviour Change Campaigns: Estimated cost range: $2 - $5 per household reached for awareness and behaviour change activities.
Research, Development, and Testing: Estimated cost range: $0.5 - $2 million for initial setup and operations.
Monitoring, Evaluation, and Impact Assessment: Estimated cost range: $0.5 - $1 million per year for monitoring and evaluation activities.
Institutional Capacity Building: Estimated cost range: $0.5 - $1 million for initial capacity building efforts.

USEFUL INFORMATION

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LINKS TO TNA REPORTS

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