Turning Saline Groundwater into Safe Drinking Water: Lamu County's Solar Desalination Solution

County:	**Lamu**		
Sector/s:	**Water & Energy**	**Sub-sector/Theme:**	**Water Security, Climate Resilience, Renewable Energy**
Keywords: (for search in the online platform)	**Lamu County, solar desalination, saline groundwater, reverse osmosis, water security, climate resilience, renewable energy, off-grid water systems, Lamu County, Kiunga, coastal water solutions, sustainable water supply**		
Target Audience:	**County Governments, policy makers, development partners, water sector practitioners, peacebuilding practitioners**		
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Introduction:

Kiunga is a remote coastal settlement located along Kenya's border with Somalia in Lamu County. The area has historically experienced severe water scarcity due to prolonged drought, limited freshwater sources, and the presence of naturally saline groundwater. Although underground water exists within the area, high salt concentration makes it unsafe for human consumption and unsuitable for domestic use. Conventional boreholes therefore failed to provide a sustainable solution to the area's water challenges.

The town has an estimated population of approximately 3,500 people, including host communities, internally displaced persons (IDPs) from the Boni Forest area, refugees, cross-border communities from Ras Kamboni in Somalia, students, traders, and security agencies stationed in the region. The lack of reliable clean water significantly affected households, schools, health facilities, and local economic activities. Women and children were often forced to walk for up to six hours daily in search of brackish and sometimes contaminated water, exposing them to safety risks and disrupting education and livelihoods.

Conventional water supply interventions such as shallow wells and water trucking proved unreliable, expensive, and unsustainable for the remote settlement. At the same time, increasing pressure on

the few available water points contributed to tensions among different user groups competing for access to water.

Faced with persistent water insecurity and the limitations of traditional approaches, Lamu County explored the use of solar-powered desalination technology to convert saline groundwater into safe drinking water. The initiative aimed to provide a sustainable, climate-resilient, and off-grid water supply solution suitable for remote coastal communities facing saline groundwater challenges.

Implementation of the practice (Solution Path):

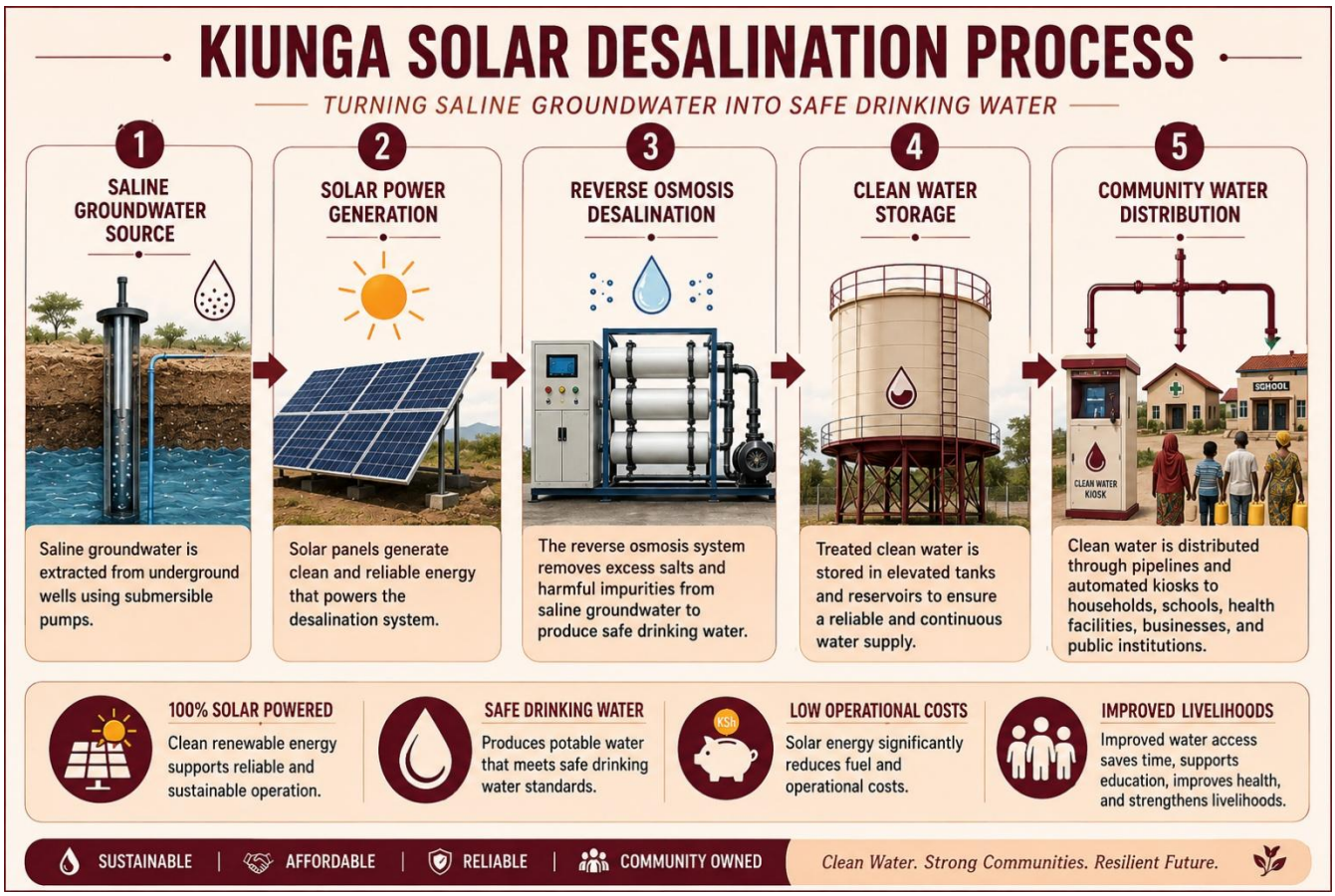
Figure 1The Kiunga Solar Desalination and Community Water Governance Initiative in Lamu County, featuring the solar panels that power the water supply system.

The implementation of the Kiunga Solar Desalination initiative began after the County Government of Lamu identified persistent water scarcity as one of the major challenges affecting communities living in Kiunga and surrounding settlements. Assessments undertaken by the County established that although groundwater existed within the area, most of it was highly saline and therefore unsafe for human consumption. Existing water sources could not meet the growing demand from households, schools, health facilities, security agencies, and cross-border populations, while water trucking remained expensive, unreliable, and unsustainable for such a remote settlement.

At the same time, the County recognized that Kiunga had strong solar potential, making renewable energy a viable option for powering a long-term water solution. These findings informed the County's decision to explore solar-powered desalination technology as a sustainable intervention capable of converting saline groundwater into safe drinking water.

Implementation of the initiative commenced in January 2022 under the County programme titled *"Breaking the Wall of Peace Fragility in Disaster Zones"* in collaboration with the Water Sector Trust Fund at an estimated cost of approximately KES 48.9 million. The County coordinated the initiative through the Department of Public Service Management and the Directorate of Peace Building,

working closely with technical partners, local leadership, and community representatives during the planning and implementation phases.



Following the assessment phase, the County adopted a solar-powered desalination model using advanced brackish water reverse osmosis technology. The system was selected because reverse osmosis effectively removes high salt concentration, impurities, and contaminants from saline groundwater, making the water safe for human consumption. Unlike seawater desalination, the system utilizes locally available saline groundwater from underground wells, making the model more cost-effective and practical for remote inland coastal settlements.

The desalination system is powered by a 50kW off-grid solar photovoltaic system, eliminating dependence on fossil fuels, diesel generators, and unreliable electricity infrastructure. The use of solar energy significantly lowered operational costs while ensuring continuous water production within the remote settlement.

The infrastructure development phase involved installation of several interconnected components designed to support water abstraction, purification, storage, and distribution. Saline groundwater was abstracted from underground wells and directed into the reverse osmosis desalination system for treatment. Solar photovoltaic panels were installed to generate renewable energy required to operate pumps and the desalination equipment.

The plant currently produces approximately 5,000 litres of potable water per hour, translating to up to 120,000 litres of clean drinking water per day at full production capacity. The desalination process

successfully reduces Total Dissolved Solids (TDS) from hazardous and undrinkable levels to safe potable water standards suitable for domestic and institutional use. The system effectively transformed previously unusable brackish groundwater into "sweet water" for the local population.

To support water storage and distribution, the County established a 15.093 km pipeline network, a 50m³ concrete sump tank, a 15-metre elevated steel storage tank for gravity-fed distribution, and localized community water kiosks. Water produced through the desalination plant is distributed through connected supply lines serving households, institutions, and public facilities within Kiunga and surrounding settlements.

Figure 2A concrete sump tank at the Kiunga Solar Desalination Plant used to support storage and regulated distribution of treated water to households and institutions

As part of expanding water access, the County extended the pipeline network to Ishakani village, the last settlement along the Kenya-Somalia border, significantly improving water availability in one of the most remote frontier areas of Lamu County.

Following installation, the desalination plant was commissioned to provide reliable clean water to households, schools, health facilities, businesses, security installations, and public institutions. Institutions currently benefiting from the project include Kiunga Primary School, Kiunga Secondary School, Ishakani Primary School, Kiunga Health Centre, Ishakani Dispensary, the Ward Administrator's Office, Fisheries Office, police and GSU camps, and local businesses operating within the settlement.

To support sustainable management of the system, day-to-day operations are managed through the Water Users Peace Committee (WUPC), a community-based management structure comprising representatives from host communities, refugee populations, youth leaders, elders, and women representatives, with women constituting approximately 30% of the committee membership.

The project operates through a social enterprise model under the Community Water Trust Fund. Water is sold at a nominal community-agreed rate, with revenues retained locally to support operations, operator payments, repairs, and maintenance of the system. Part of the revenue is also used to support local women's economic empowerment initiatives through small community-based financing mechanisms.

Figure 3 A group of women collecting water in containers during the designated hours at the community water point.

To ensure equitable access and accountability, the County facilitated community engagement forums involving host communities, internally displaced persons (IDPs), refugee representatives, youth groups, women groups, institutions, and security agencies. Through these consultations, stakeholders developed community-agreed water management arrangements to regulate usage and improve accountability around water distribution.

The County Government, through the Directorate of Peace Building under the Department of Public Service Management, continues to provide oversight and coordination for the initiative. The project is also integrated within the County Peace Policy and Disaster Risk Management frameworks established in 2022, strengthening sustainability and institutional support for the initiative.

Results of the practice:

The Kiunga Solar Desalination and Community Water Governance Initiative has significantly improved access to clean water and strengthened social cohesion in Kiunga and surrounding settlements.

- **Improved access to safe drinking water:** The Kiunga Solar Desalination initiative improved access to clean and reliable drinking water for approximately 3,500 residents in Kiunga and surrounding settlements, including host communities, internally displaced persons (IDPs), refugees, cross-border communities, students, traders, and security agencies. The project converted previously unusable saline groundwater into safe drinking water for domestic and institutional use.
- **Expansion of water supply coverage:** The County extended the water pipeline to Ishakani village, the last Kenyan settlement along the Somalia border, improving water access in one of the most remote areas of Lamu County.
- **Improved service delivery in institutions:** The desalination system currently supports water access in key institutions including: Kiunga Primary School, Kiunga Secondary School, Ishakani Primary School, Kiunga Health Centre, Ishakani Dispensary, Ward Administrator's Office, Fisheries Office, Police and GSU security camps and local businesses and households. Reliable water supply improved sanitation, hygiene, healthcare delivery, and learning conditions within these institutions.

- **Reduced burden on women and children:** Improved access to water reduced the time and distance previously spent by women and children searching for water, allowing more time for education, household activities, and livelihoods.
- **Climate-resilient and sustainable water solution:** The initiative demonstrated the viability of solar-powered desalination as a sustainable and cost-effective solution for coastal and arid areas with saline groundwater. The off-grid solar-powered system reduced dependence on diesel-powered systems and emergency water trucking.
- **Elimination of emergency water trucking:** The establishment of a permanent desalination and pipeline distribution system eliminated the County's reliance on expensive emergency water trucking during drought periods, generating significant savings in public emergency response expenditure.

Figure 4Ambassador Mary M. Mutuku receiving the 2026 Water Transversality Global Award on behalf of Lamu County

- **Strengthened community cooperation:** The community-agreed water management system improved equitable access to water and strengthened cooperation among host communities, refugees, internally displaced persons, and security agencies. This contributed to reduced tensions related to water scarcity.
- **International recognition:** The initiative received international recognition under the Water Transversality Global Awards 2026, where it was selected as the **Best Community Impact Project Award** winner for its contribution to water security, climate resilience, and community impact.

Lessons Learned:

- **Solar-powered micro-grids reduce operational costs:** The Kiunga desalination plant demonstrated that integrating desalination systems with solar-powered micro-grids significantly lowers operational costs in remote and off-grid settlements. The 50kW solar photovoltaic system eliminated dependence on diesel-powered generators and supported affordable water production.
- **Built-in technical redundancy improves reliability:** The use of parallel pumping systems ensured continuous water production even during maintenance or equipment failure, reducing the risk of complete system shutdowns in the remote settlement.
- **Long-term sustainability requires local ownership:** The project demonstrated that community-managed operational models are critical for sustainability of remote water infrastructure. Through the Water Users Peace Committee (WUPC) and the Community Water Trust Fund, locally generated revenues support operations, maintenance, and repairs while strengthening local ownership and accountability.

- **Equitable water governance strengthens social stability:** Community-agreed water management arrangements improved accountability, regulated access to water, and reduced tensions associated with water scarcity among host communities, refugees, institutions, and security agencies.
- **Modular clean technology enables scalable solutions:** The initiative demonstrated that modular solar-powered desalination systems can be deployed in remote coastal and arid areas without extensive conventional infrastructure, providing a practical and replicable solution for saline groundwater regions.

Recommendations:

- Coastal and arid Counties facing persistent water scarcity should consider solar-powered desalination as a sustainable and climate-resilient solution for converting saline groundwater into safe drinking water.
- **Groundwater assessments should guide water investments:** It is important to undertake groundwater quality and salinity assessments before investing in conventional boreholes and water supply systems.
- **Water projects should integrate storage and distribution systems:** Desalination projects should include adequate storage facilities, pipeline networks, elevated tanks, and community distribution points to ensure reliable water access.
- **Renewable energy should be integrated into remote water systems:** Solar-powered systems reduce operational costs, fuel dependency, and carbon emissions while improving reliability in remote and off-grid settlements.
- **strengthen local technical capacity for operation and maintenance:** Sustainability of desalination systems depends on local operational capacity. Counties implementing desalination projects should invest in training local operators and technicians on operation, maintenance, troubleshooting, and management of reverse osmosis systems to reduce dependence on external technical support.
- **Community-managed operational models should be prioritized**
- Community-managed governance structures and locally retained revenue systems strengthen accountability, ownership, and sustainability of water infrastructure projects. Counties should establish community-based management systems to support operation, maintenance, and equitable access to water resources.
- **Water projects in fragile areas should integrate inclusive governance approaches:** There is need to promote community participation and locally agreed water management arrangements to improve accountability and reduce tensions associated with water scarcity.

Further Reading:

- https://eastleighvoice.co.ke/coast/310339/lamu-county-wins-global-award-for-innovative-water-project-that-promotes-peace?amp=1
- https://www.the-star.co.ke/climate-change/2026-03-10-lamus-solar-desalination-project-wins-global-award
- Lamu County Disaster Management Act, 2022, Lamu County Gazette Supplement No. 12 (2022). https://slo-countybills.go.ke/api/v1/bill/pdf/U8EF6P4GPS_1_Disaster%20Management%20Act,%202022.pdf

Photo Gallery

Figure 5Residents at the water collection point during its commissioning

Figure 6Community members collecting water at the point

Figure 7Interior of the solar desalination system, including batteries and operational components

Figure 8Interior of the solar desalination system, including operational components

Figure 9One of the community dialogues sessions involving women to discuss the growing tensions around water scarcity and jointly explore possible solutions

Figure 10Cross-border forum to discuss the growing tensions around water scarcity and jointly explore possible solutions

Figure 11A photo of Kiunga Solar desalination plant

Figure 12One of the tanks used for water storage