

NoorNation

Decentralized Solar-Water Systems for Climate Resilience in African Agricultural Communities

Submitted to: UNFCCC Secretariat

Submitted by: NoorNation

1. Context and Climate Challenge

Agricultural and rural communities in Egypt and across Sub-Saharan Africa face increasing vulnerability to water scarcity and energy insecurity, exacerbated by climate change. Diesel-powered irrigation systems dominate agricultural practices, leading to high emissions and substantial fuel costs. In many regions, the lack of reliable access to electricity and clean water infrastructure continues to hinder development and climate adaptation.

Problem Summary:

- Water Scarcity: 40% of Egypt's rural population faces saline groundwater contamination (UNICEF, 2022).
- Energy Poverty: 600 million Africans lack access to electricity; 75% rely on diesel generators for agriculture (IEA, 2023).
- Economic Burden: Farmers spend approximately \$18,000 per year on diesel fuel and water trucking (NoorNation field analysis, 2023).

Policy Alignment:

- Egypt's Nationally Determined Contributions (NDCs): 42% renewable energy target by 2030; 50% emissions reduction in agriculture.
- UNFCCC Global Goal on Adaptation: Priority areas include water security and rural resilience.

2. Adaptation Initiative: NoorNation's LifeBox Deployment

NoorNation, an impact-driven renewable energy company operating in Egypt and Rwanda, has developed and deployed LifeBox — a decentralized, solar-powered containerized solution that integrates clean energy generation with water pumping and desalination without reliance on batteries. LifeBox is scalable, remotely monitored, and designed for off-grid agricultural areas.

Deployments include remote regions such as the Bahariya Oasis in Egypt and borehole-fed agricultural sites in Sharjah, UAE, with pilot expansion underway in Rwanda. LifeBox supports multiple use cases, including solar irrigation, desalination for crop and livestock use, and distributed electricity access.

Technical Specifications:

- Solar Capacity: 5–200 kWp (bifacial N-type panels with a 30-year lifespan)
- Water Output: 10–1,000 m³/day desalination (tolerating up to 45,000 ppm salinity)
- IoT System: Remote monitoring of energy production, water output, and CO₂ emissions savings
- Cost: \$25,000–\$200,000/unit (approximately 15% lower cost than imported alternatives through local manufacturing and design optimization)

Innovations:

- Dual Utility: Simultaneous clean energy generation and water treatment
- Land Efficiency: Up to 70% less land usage compared to conventional solar farm layouts
- Batteryless Operation: Lower operational costs and reduced maintenance requirements
- IoT Remote Monitoring and Control: Enables efficient operation, maintenance, and control of the system

3. Outcomes and Measurable Impacts

Since its initial deployment in 2022, NoorNation's LifeBox has achieved the following results:

- 4 GWh of solar energy generated
- 7.5 million liters of desalinated or purified water produced
- Over 3,100 tons of CO₂e emissions avoided
- More than 2,200 acres irrigated sustainably
- Approximately \$560,000 USD in cost savings for end users compared to diesel operations
- Improved livelihoods, directly benefiting over 1,200 individuals

Field feedback also indicates enhancements in productivity, energy independence, and operational predictability due to the IoT-enabled control systems.

4. Lessons Learned and Replicability

Key challenges encountered during implementation included variable terrain conditions, upfront cost barriers, and limited digital infrastructure for monitoring. Solutions adopted included:

- Local fabrication of mounting structures
- Provision of installment payment options through microfinance institutions
- Deployment of GSM/Cloud-based remote dashboards for system management

The modular and pre-assembled nature of LifeBox facilitated rapid deployment across different terrains, while continuous data feedback enabled system optimization and preventative maintenance.

This case study demonstrates how integrated water-energy solutions can enhance climate resilience and can be scaled to similarly vulnerable regions worldwide.

5. Alignment with UNFCCC Priorities and SDGs

This initiative directly contributes to the following Sustainable Development Goals (SDGs):

- SDG 6 (Clean Water and Sanitation): Provision of safe desalinated water
- SDG 7 (Affordable and Clean Energy): Delivery of decentralized solar energy access
- SDG 13 (Climate Action): Emissions reduction through diesel displacement

It supports the implementation of Egypt's NDCs by providing clean technologies for water and energy use in agriculture, aligning with both mitigation and adaptation goals.

6. Contact for Further Information

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*This submission is provided in response to the UNFCCC's ongoing efforts to gather case studies that illustrate practical, scalable solutions for climate adaptation and innovation. NoorNation welcomes any opportunity for further dialogue or engagement to expand this work.