# Planning Sustainable Energy Access in Tanzania using Energy Access Explorer (EAE)

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Much appreciation goes to the World Resources Institute (WRI) for providing access to the Energy Access Explorer platform, a data-driven, integrated, and inclusive approach for planning. WRI’s work has been instrumental in enabling stakeholders like the Tanzania Renewable Energy Association (TAREA) to explore innovative ways to support energy access and sustainable development in Tanzania.

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**Executive Summary**

Energy access remains a critical challenge in Tanzania, especially in rural areas where millions lack reliable electricity. Achieving universal access to sustainable energy is essential for improving health, education, livelihoods, and economic development. To address this challenge, the Energy Access Explorer (EAE)**,** developed by the World Resources Institute (WRI)**,** offers a powerful, data-driven platform that supports planning and decision-making for sustainable energy expansion.

The EAE integrates diverse spatial datasets, including population density, current electricity infrastructure, renewable energy resources, and locations of key public services, to identify underserved communities with high potential for electrification.

This case study utilized the EAE to evaluate sustainable energy access in Tanzania. These insights can support the national energy goals outlined in the National Clean Cooking Strategy 2024-2034, National Energy Efficiency Strategy 2024-2034, and Mission300 Action Plan that contribute to global efforts under Sustainable Development Goal 7. The EAE enables stakeholders, including policymakers, investors, and non-government organizations such as TAREA, to plan more effectively and equitably, accelerating Tanzania’s transition to sustainable and inclusive energy access.

## Key Findings

i. Some regions exhibit strong solar irradiance and low electrification rates, making them ideal for solar mini-grids and solar home systems. In remote areas, extending the national grid may be cost-prohibitive. EAE helps identify where decentralized solutions are more cost-effective.
ii. Many social institutions, such as health centers and schools in rural Tanzania, remain unelectrified. These are critical targets for energy access to improve service delivery and community well-being.
iii. The EAE's insights support Tanzania's National Clean Cooking Strategy 2024-2034, National Energy Efficiency Strategy 2024-2034, and Compact300 Action Plan by helping prioritize regions and technologies for energy expansion.
iv. Areas with agricultural activity, small businesses, and markets can benefit from reliable electricity for irrigation, processing, refrigeration, and digital services, enhancing rural economies.
v. Data-Driven Planning Enhances Equity. The tool facilitates transparent and inclusive planning, ensuring that energy investments reach marginalized communities often overlooked by traditional planning methods.

## Recommendations

i. Integrate EAE into National and Local Planning
Government ministries and energy agencies should embed EAE into the electrification planning process. Local governments can use it to prioritize energy investments in underserved areas.
ii. Prioritize Decentralized Renewable Energy (DRE) in Remote Areas.
Support the deployment of solar mini-grids and solar home systems in regions with low grid access and high renewable potential. Encourage public-private partnerships to scale DRE solutions.
iii. Support Productive Uses of Energy
Target energy interventions in areas with agricultural activity or economic hubs to power irrigation, storage, and processing will boost rural livelihoods and economic resilience.
iv. Enhance Data Collaboration and Training
Promote regular updates of geospatial data in EAE through collaboration with government agencies, utilities, and non-government organizations (NGO's). Organize training sessions for planners, NGOs, and developers to build capacity in using EAE effectively.
v. Mobilize Financing Based on Data-Driven Insights
Use EAE data to develop bankable projects and proposals for international donors, impact investors, and climate funds. Direct funding to areas with the highest energy poverty and development needs.

## 1. Introduction

### Purpose and Scope

The primary purpose of this case study is to apply the Energy Access Explorer, a spatial analysis tool developed by the World Resources Institute, to support the expansion of sustainable and inclusive energy access across Tanzania. The platform integrates various datasets to help policymakers, developers, and energy planners make data-driven decisions.

**This analysis focuses on:**

i. Demonstrating how EAE can be used to build customized energy access scenarios to accelerate sustainable development.
ii. Identifying high-priority areas for decentralized renewable energy (DRE) solutions, including solar mini-grids and solar home systems.
iii. Highlighting unelectrified critical social infrastructure, such as health centres and schools.
iv. Supporting stakeholders, government, non-government organizations, private sector, and donors in decision-making and investment planning.

### Aim

To support the expansion of sustainable and data-driven energy access in Tanzania through the application of the Energy Access Explorer**,** enhancing the ability of stakeholders to plan, prioritize, and implement renewable energy solutions effectively.

### Objectives

i. Assess Renewable Energy Potential. Evaluate the availability of solar, wind, and hydro resources in various regions to inform technology selection.
ii. Facilitate Decentralized Energy Planning. Utilize spatial data to identify communities, institutions, and areas lacking reliable electricity access. Identify opportunities for mini-grids and solar home systems in off-grid and underserved regions.
iii. Target Social Infrastructure. Map unelectrified health centres and schools to prioritize for energy interventions.
iv. Inform Policy and Investment to promote Inclusive Development Provide evidence to support national energy plans, donor programs, and private sector investment strategies.

## 2. Methodology

This case study employed a geospatial analysis approach using the Energy Access Explorer to assess energy access gaps and identify opportunities for expanding sustainable energy solutions in Tanzania. The methodology consisted of the following key steps:

i. Platform Familiarization and Dataset Selection: Reviewed and selected relevant spatial datasets.

ii. Layer Integration and Mapping. Overlaid multiple datasets to visualize relationships between energy demand, infrastructure, and renewable energy supply potential, and identified geographic clusters of low electrification and high development need**.**

iii. Case Study Development: Built custom planning scenarios in EAE to evaluate:

### a) Priority areas for crops – Agriculture Analysis

**Demand Datasets**

| Dataset | Unit | Range | Selected Range | Importance |
|---|---|---|---|---|
| Crops | proximity in km | min: 0, max: 26000 | min: 100, max: 26000 | 3 |
| Population density | proximity in km | min: 0, max: 100000 | min: 0, max: 100000 | 3 |

**Supply Datasets**

| Dataset | Unit | Range | Selected Range | Importance |
|---|---|---|---|---|
| Global Horizontal Irradiation | proximity in km | min: 500, max: 2800 | min: 1000, max: 2800 | 3 |
| Distribution lines | proximity in km | min: 0, max: 700 | min: 2, max: 700 | 3 |

### b) Improved Cookstove Expansion – Biomass Use and Adoption

**Demand Datasets**

| Dataset | Unit | Range | Selected Range | Importance |
|---|---|---|---|---|
| Population density | proximity in km | min: 0, max: 100000 | min: 0, max: 100000 | 3 |
| Relative Wealth Index | proximity in km | min: -2, max: 2 | min: -2, max: 2 | 3 |

**Supply Datasets**

| Dataset | Unit | Range | Selected Range | Importance |
|---|---|---|---|---|
| Biomass | proximity in km | min: 0, max: 60000 | min: 20000, max: 60000 | 3 |

c) **Off-grid solar potential for social institutions like healthcare facilities and schools**

**Demand Datasets**

| Dataset | Unit | Range | Selected Range | |
|---|---|---|---|---|
| Healthcare Facilities | proximity in km | min: 0, max: 250 | min: 0, max: 5 | 3 |
| Population density | proximity in km | min: 0, max: 100000 | min: 0, max: 100000 | 3 |
| Schools | proximity in km | min: 0, max: 250 | min: 0, max: 5 | 3 |

**Supply Datasets**

| Dataset | Unit | Range | Selected Range | Importance |
|---|---|---|---|---|
| Global Horizonta Irradiation | proximity in km | min: 500, max: 2800 | min: 1000, max: 2800 | 3 |
| Distribution lines | proximity in km | min: 0, max: 700 | min: 2, max: 700 | 3 |

**Key Assumptions:**

i. Areas in Dodoma and Morogoro show high potential for solar-powered irrigation, agro-processing, and rural entrepreneurship.

ii. Many critical healthcare facilities and schools in the Southern Highlands of Tanzania, such as Lindi and Masasi, are far from the grid and can benefit from solar PV systems. Such locations need to be prioritized for renewable energy solutions

iii. Urban and peri-urban areas, like in Dar es Salaam, have growing charcoal demand; rural areas rely heavily on firewood. Areas with limited access to clean fuels but good road networks are ideal for ICS market development, such as Arusha, Mwanza, and Kilimanjaro.

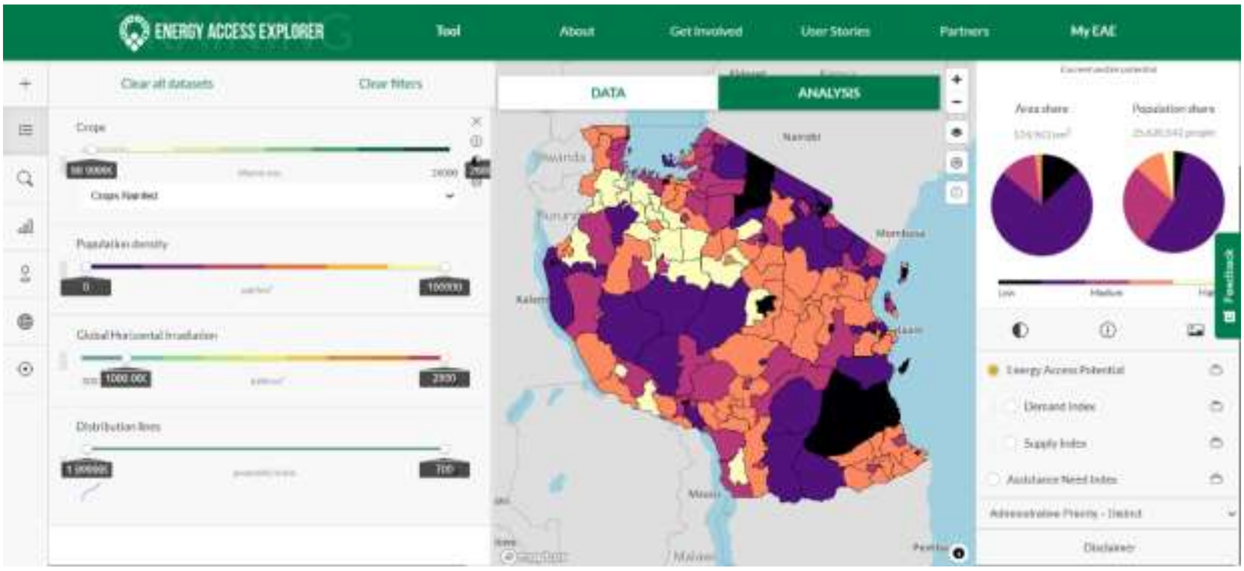
## 3. Results

### Scenario I. Agriculture Analysis

Identify regions where access to electricity can unlock economic development through productive use.

a) Agricultural activity, crop-oriented areas
b) Road infrastructure Access to Markets
c) Electrification status

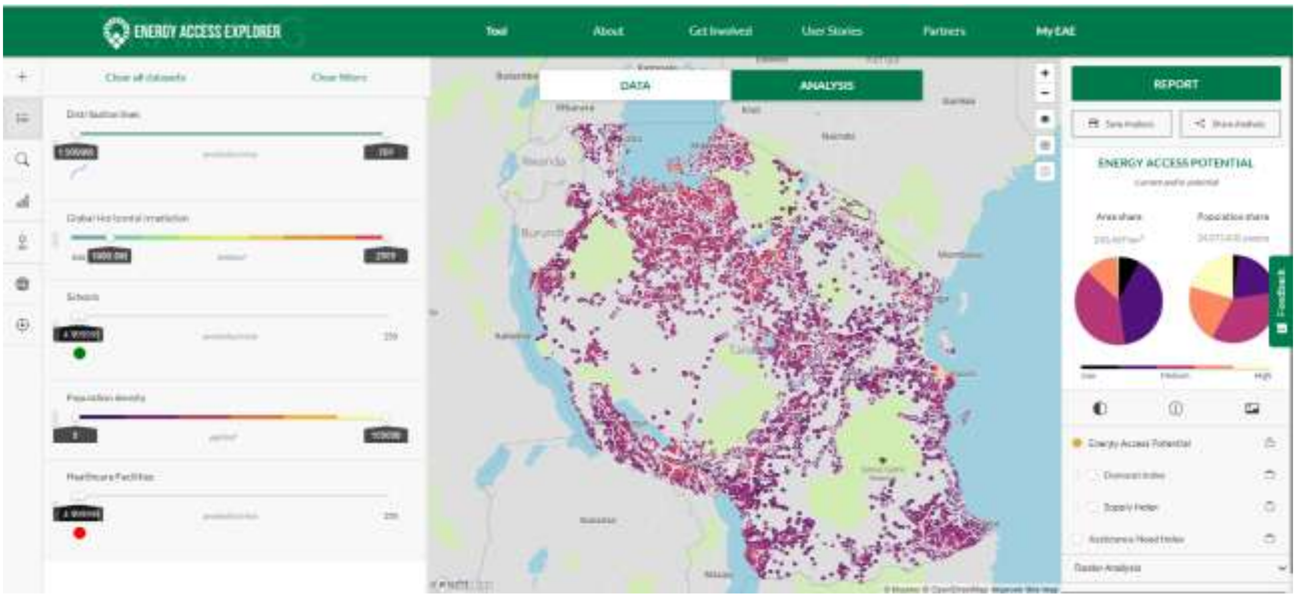
Areas in Dodoma and Morogoro show high potential for solar-powered irrigation, agro-processing, and rural entrepreneurship. High Priority Locations for the Energy Interventions are Morogoro, Dodoma, Geita, and Tarime, whereby the Demand index info is high and the Supply Index info is Medium




### Scenario II. Electrification of Social Institutions

Identify unelectrified healthcare facilities and schools that are priorities for decentralized energy solutions

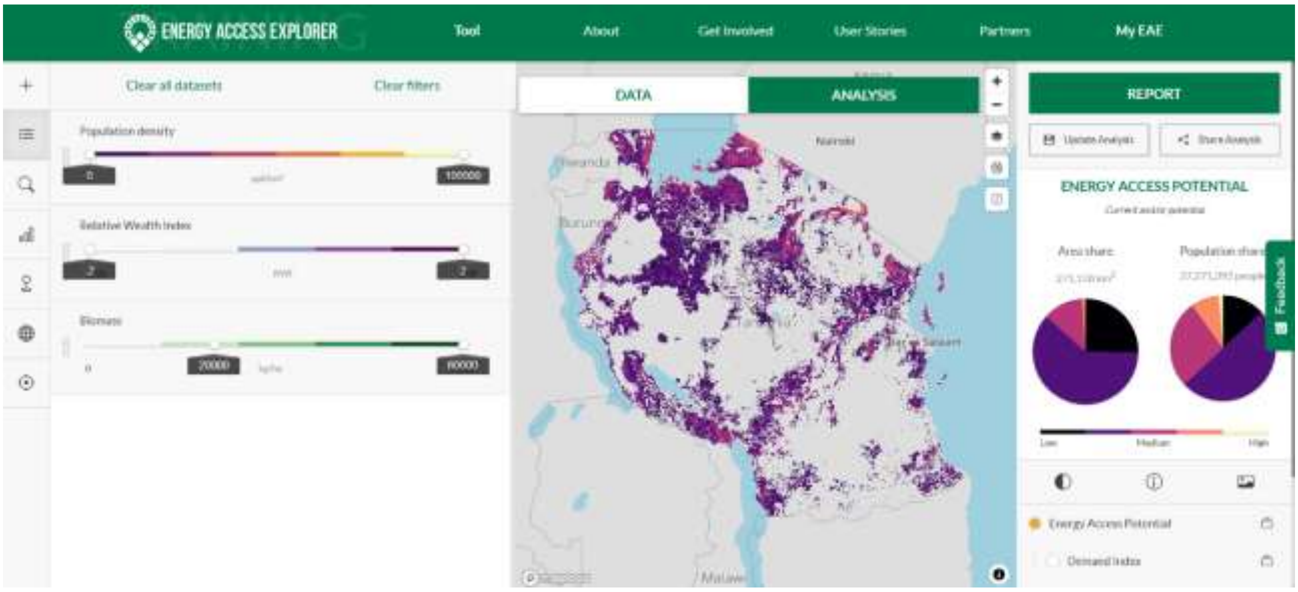
Many critical facilities are far from the grid and can benefit from solar PV systems. High Priority Locations for the Energy Interventions are Dar es Salaam, Lindi, Masasi, and Geita, where the Demand index info is high and the Supply Index info is Medium



**Scenario III. Expansion of Improved Cookstove Biomass Adoption**

Identify geographic areas where the deployment of improved biomass cookstoves would have the greatest impact on reducing indoor air pollution, enhancing energy efficiency, and conserving natural resources. Key Spatial Layers Used: Population density (to estimate stove demand) and Market access/road infrastructure (for stove distribution feasibility).

Urban and peri-urban areas have growing charcoal demand; rural areas rely heavily on firewood. Areas with limited access to clean fuels but good road networks are ideal for ICS market development. High Priority Locations for the Energy Interventions are Arusha, Mwanza, Kilimanjaro, and Mara, where the Demand index info is high and the Supply Index info is High




## 4. Discussion

One of the key insights from the analysis is the clear disparity in energy access across regions, particularly in central and western Tanzania, where grid expansion is limited and socio-economic indicators signal high development needs. In such areas, the EAE has proven especially useful for identifying locations best served by decentralized renewable energy (DRE) solutions such as solar mini-grids and solar home systems.

The integration of social infrastructure mapping revealed that many schools, health clinics, and water points remain unelectrified, especially in remote communities. This finding reinforces the need for targeted, off-grid interventions that prioritize basic services, aligning with both SDG 7 (clean energy) and SDG 3 and 4 (health and education).

Furthermore, the inclusion of a biomass cookstove scenario broadens the planning lens beyond electricity access. It highlights the urgent need to address cooking energy, often overlooked in electrification strategies, especially in regions where biomass dependency exacerbates environmental degradation and public health risks.

The scenario-building feature of EAE also opens up possibilities for customized planning based on specific development goals (e.g., economic growth, climate resilience, or women's empowerment). However, the discussion also acknowledges some limitations: the platform does not model real-time cost or grid rollout timelines, and the analysis relies on the availability and accuracy of open-source spatial data.

## 5. Conclusion

i. Data-Driven Planning Enhances Impact
The use of spatial data through EAE allows for evidence-based prioritization, helping planners identify where energy investments can deliver the greatest social and economic returns.

ii. Decentralized Solutions Are Key for Remote Areas
In many regions, particularly in western and central Tanzania, grid extension is not cost-effective in the short term. Decentralized renewable energy systems, especially solar mini-grids and home systems, are better suited for these communities.

iii. Collaboration Builds Capacity and Buy-in
Working with local stakeholders, including government agencies, NGOs, and energy developers, enhanced platform adoption and ensured the findings reflect local priorities and realities.

iv. Scenario Building Is a Powerful Policy Tool
The ability to create and visualize custom scenarios in EAE empowers users to align energy planning with diverse objectives, such as climate resilience, education, or rural development.

v. Data Gaps Limit Precision
The quality of outputs depends on the availability and accuracy of spatial data. Regular data updates and improved local data collection systems are needed to refine future analyses.

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