RENEWABLE ENERGY SCENARIO REPORT

UGANDA’S ENERGY TRANSITION: TOWARDS 100% RENEWABLE ENERGY BY 2050
WWF Uganda, together with Multi-actor partnership (MAP) platform for 100% RE for all, commissioned a study “Towards 100% Renewable Energy by 2050”.

This study provides the possible transition pathways based on the current energy mix, energy plans and programs of the government of Uganda. These include: the business-as-usual (BAU) which considers national plans such as the Uganda vision 2040 with future developments of nuclear and peat energy; a high RE pathway (RE share of 80% with sustainable biomass limits), and a full RE pathway (100% RE with sustainable biomass limits), highlighting potential energy transitions by 2030, 2040, and 2050. These scenarios were developed considering the need for all Ugandans to access modern energy services, but also the need to ensure that energy demand is met by sustainable and renewable resources as opposed to non-renewable energy sources.

The findings of the study contribute to the development of a targeted “POLICY ROADMAP, FOR 100% RENEWABLE ENERGY FOR ALL BY 2050 FOR UGANDA”. The results are intended to inform decision-makers, including opinion leaders, academia, civil society, government officials and think tanks on possible transition pathways towards 100% RE in Uganda.
1. Growing energy demand and electrification, ongoing deforestation, and aimed decarbonisation to tackle climate change require the extension and transition to a reliable and sustainable energy system in Uganda.

2. Government plans to meet the rising demand with nuclear power are less cost-competitive compared to renewable energy-based extension plans. By 2050, transitioning to a fully renewable energy system (FullRE100) is projected to result in a 60% reduction in the Levelized Cost of Energy (LCOE) compared to the business-as-usual (BAU) plans. A high renewable energy system (HighRE80) could yield even greater savings, with a 72% LCOE reduction.

3. The findings indicate that to achieve a cost-effective and sustainable transition, the focus should be on substantial increases in PV and battery storage capacities. For a transition to high or full renewable energy, investments ranging from 74 GW in the HighRE80 to 130 GW in the FullRE100 in PV capacity and from 404 GWh to 525 GWh in battery storage capacity are recommended as techno-economical optimum.

4. A sensitivity analysis underpins the strong economic advantage of renewable energy-based transitions (HighRE80 and FullRE100) compared to a nuclear-based BAU scenario. Even when assuming that PV and battery storage prices are twice as high as the predicted 2050 prices, the renewable energy-based transitions still result in lower LCOE, with savings ranging from 27% to 43% compared to the BAU case. In reality, higher savings are expected.

5. The HighRE80 pathway achieves an 80% renewable share with a 20% fossil share, resulting in a 29% reduction in LCOE compared to the FullRE100 pathway. This approach reduces required PV and battery storage capacities by 43% and 23%, respectively. The small fossil share provides grid stability and energy security, allowing conventional energy sources to strategically balance renewable intermittency, eliminating the need for over-sizing the system to cover low generation/high demand periods.

6. The transition to a high or full renewable energy system requires substantial upfront investment costs, ranging from 245 to 393 billion USD, in contrast to the 132 billion USD in the BAU scenario. Nevertheless, these investments offer substantial long-term benefits, including potential annual cost savings of up to 80% due to reduced fuel costs. These savings may further increase in response to rising fuel prices.

7. Choosing a BAU pathway for energy expansion will lead to a 24% increase in annual emissions by 2050 compared to the 2019 energy system. In contrast, opting for a high or full renewable energy pathway has the potential to reduce emissions from 60% to 100% by 2050.

8. In the HighRE80 and FullRE100 pathways, it is essential to gradually replace conventional stoves with clean cooking technologies (such as electric and LPG stoves for HighRE80 and electric stoves for FullRE100) to ensure that Uganda’s biomass usage remains within sustainable limits. This transition is crucial in preventing deforestation and biodiversity loss.

9. Transitioning from combustion vehicles to electric vehicles is recommended for all pathways by 2030 due to high fuel oil prices. This recommendation holds true even at current fuel prices, but it becomes increasingly compelling with the anticipation of increasing fuel oil prices. In HighRE80 and FullRE100, envisioning solar-powered electric vehicles is especially promising for a sustainable and cost-effective solution for the future of the transport sector.
About the Study

The study was conducted in consultations and engagement with the Government of Uganda, Ministry of Energy and Mineral development and members of MAP platform formed under the project “Multi-Actor Partnerships (MAPs) for Implementing Nationally Determined Contributions with 100% Renewable Energy (RE) for All in the Global South”. Special thanks to all those who made a significant contribution to this work, especially, WWF Germany, World Future Council, Brot für die Welt, Reiner Lemoine Institute (RLI), Heden Engineering Solution Ltd and the German Federal Ministry for Economic Cooperation and Development (BMZ) – the primary donor.

About WWF Uganda

Since 1992, WWF Uganda Country Office (UCO) has been working with government, civil society, indigenous peoples, and local communities (IPLC) and more recently the private sector to protect and restore nature for the benefit of Uganda and its people, and the planet. Our 2050 vision is that Uganda achieves a just transition to a low carbon development pathway whilst protecting and restoring resilient forest landscapes, wildlife populations and freshwater ecosystems that support biodiversity and socioeconomic transformation.

Specifically, our Energy and Climate work is geared towards Supporting governments, private sector and local communities to move towards a low carbon and climate resilient future through reducing forest degradation, adopting nature-based solutions, and increasing access to inclusive energy solutions.