

Uganda's Path to Energy Access – Is It Climate Friendly?

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Abstract

Only 18 percent of Ugandans have access to energy.¹ Compare this to 100 percent access in the similarly sized United Kingdom or 23 percent for their neighbors in Kenya.² Uganda does not have energy security, or “the uninterrupted availability of energy sources at an affordable price.”³ Climate concerns, such as droughts, floods, intense rainfall, or heat-waves,⁴ stress Uganda's developing electric grid and obstruct growth. Uganda's new energy infrastructure, recent oil discoveries, and unique climate initiatives make it an excellent case study to observe the balance between energy, climate, and national security concerns. Five questions may help reconcile tensions between security and climate: What are Uganda's energy security concerns? How have they dealt with these? Have these attempts succeeded? How do attempts look through a climate “lens?” Ultimately, this research offers a case study of Uganda's “policy package”⁵ for energy access, highlighting bright spots of local climate change innovation as well as shortfalls of government corruption and international meddling, concluding with three recommendations on how Uganda could best move their goal of energy access forward.

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Four Security Concerns

Uganda has four energy security concerns stemming from their most prominent energy sources: biomass, hydroelectricity, crude oil reserves, and solar power. First, biomass, including firewood, charcoal, and crop residues, makes up 93 percent of Uganda's energy profile,⁶ but this is economically undesired and environmentally detrimental. Second, recently discovered crude oil reserves⁷ are unchartered, environmentally harmful territory that invites foreign meddling but could replace petroleum imports (5 percent of Uganda's energy.)⁸ Third, hydroelectricity (the last 1.5

¹ World Bank 2015, “Data,” <http://data.worldbank.org/indicator>.

² Ibid.

³ “What is energy security?” (2015), <https://www.iea.org/topics/energysecurity/subtopics/whatisenergysecurity/>.

⁴ “Climate Change: Basic Information,” <http://www3.epa.gov/climatechange/basics/>.

⁵ B. Sovacool and H. Saunders, “Competing Policy Packages and the complexity of energy security,” *Elsevier*, February 13, 2014.

⁶ R. Tumwesigye, E. Pro-Biodiversity Conservationists in Uganda (PROBICO), “Key issues in Uganda's energy sector,” (London: International Institute for Environment and Development, 2011), 6.

⁷ US Energy Information Administration (EIA), *Uganda*, last updated August 2015,

<http://www.eia.gov/beta/international/country.cfm?iso=UGA>.

⁸ Tumwesigye, 6.

percent of Uganda's energy⁹) is inconsistent due to recent low water levels, and full megawatt (MW) capacity has not been installed but prices hinder investment.¹⁰ Fourth, solar energy potential is very high and could mitigate other concerns but remains largely untapped due to funding concerns.¹¹ What has been done, to date, regarding these problems?

Biomass

Overdependency on biomass is environmentally detrimental and could affect the availability of this resource longterm, damaging Uganda's gross domestic product (GDP) growth. Ninety-eight percent of Ugandans use biomass. This compares to similarly populated Peru where only 34 percent of people use biomass or Colombia, with crude oil reserve levels similar to Uganda, where only 14 percent of the population uses biomass.¹² Typically in the form of firewood, biomass is most often used for cooking with a three-stone fire method. Not only highly ineffective, this contributes to indoor air pollution.¹³ However, approximately 44 million tons are burned in Uganda each year, but sustainable annual supply is estimated to be only 26 million tons.¹⁴ Furthermore, with a 3 percent population growth rate, one of the highest in the world, annual use could rise to 135 tons unless action is taken.¹⁵ Forest area is declining steadily from 13.1 percent in 2011 to 11.7 percent in 2013.¹⁶ Uganda's recently discovered oil reserves are expected to stimulate economic growth, but this could accelerate industrial growth, which, ironically, would increase biomass demand until users could afford cleaner forms of energy.¹⁷ What else do these crude oil reserves imply?

Crude Oil Reserves

New crude discoveries have the potential to make Uganda an oil exporter. Currently, they import 22,000 barrels per day via trucks from Kenya, 20 percent of all their imports.¹⁸ In 2006 oil was discovered in Uganda and by 2014 appraisals proved oil reserves were 6.5 billion barrels.¹⁹ This made Uganda thirty-third for crude oil proved reserves and, of this, 2.5 billion are recoverable. "The largest onshore oil discovery in sub-Saharan Africa in 20 years"²⁰ has turned the heads of the United Kingdom, China, France, and Russia. After years of back and forth, Uganda chose Russia's Rostec (RT) Global Resources²¹ in February 2015 to build Uganda's first crude oil refinery in Hoima.

⁹ Ibid., 6.

¹⁰ Ibid.

¹¹ MEMD, "Rural Electrification Strategy and Plan Covering the Period 2013-2022," September 2012, 10.

¹² World Energy Outlook, "2015 Biomass database," <http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/>.

¹³ Tumwesigye, 30-31.

¹⁴ Ministry of Energy and Mineral Development (MEMD), *Biomass Energy Strategy (BEST) Uganda* (2013), 13.

¹⁵ Ibid.

¹⁶ World Bank 2015.

¹⁷ MEMD, *Biomass Energy Strategy (BEST) Uganda* (2013), 13.

¹⁸ The Observatory of Economic Complexity (OEC), "Uganda," <http://atlas.media.mit.edu/en/profile/country/uga/>.

¹⁹ EIA, *Uganda*, last updated August 2015.

²⁰ Tumwesigye, 25.

²¹ Reuters, "Uganda picks Russia's GT Global Resources to build refinery," February 17, 2015.

Doubts surrounded Russia as first choice linking them to previous arms exports to Uganda. The recent drops in crude oil prices in mid-2014 pushed back the production date,²² but the refinery is anticipated to have an initial 30,000 bpd output in 2018, intending to increase to 60,000 bpd.²³ Uganda planned to transport crude oil to this refinery by expanding neighbor Kenya's already established pipeline, benefitting them both,²⁴ but recent discussions with Tanzania made them pause on final decisions.²⁵ In fact, China National Offshore Oil Corporation (CNOOC) has already received a production license, but UK's offshore exploration company Tullow and France's oil and gas corporation Total are still waiting. First oil is expected late 2017 and early 2018.²⁶ Even in early stages, these reserves could help Uganda cut their \$3.1 billion negative trade balance almost in half by saving the \$1.15 billion from refined petroleum imports.²⁷ However, as previously noted, crude oil could exacerbate biomass pollution and deforestation. Fortunately, with Uganda's access to water and ample sunlight, hydropower and solar power prove viable alternatives to crude oil.

Hydroelectricity

Uganda's electricity demand is growing annually at 9 percent but large hydropower potential (2000 megawatt) has not been reached largely because of costs to businesses and consumers.²⁸ In fact, demand may outstrip supply by 2014 or 2015. More hydropower plants along the Victoria Nile River could close this gap while mitigating dependency on biomass.²⁹ At the end of 2014, total installed hydro capacity was at 855.7 MW, but unexploited large hydro is "well over 1300 MW."³⁰ Two large hydro plants located on Lake Victoria, Kiira and Nalubale, form the backbone of the electricity grid (230 MW) in Uganda. However, scholars anticipate rainfall here may drop 20 percent from present levels.³¹ Water constitutes 17 percent of the country,³² but climate change (especially changing rainfall and increasing droughts) make hydroelectricity less predictable. Nevertheless, Uganda continues to pursue hydro due to established infrastructure and institutional frameworks. They anticipate generating 1,500MW more through large hydro by 2020.³³ The largest hurdle for such expansion is the interplay between consumer and producer costs. In 2010 Uganda's tariffs were \$0.11 kilowatt hour (kWh).³⁴ Compare this with the 2010 average in South Asia: \$0.04.³⁵ Now Uganda's

²² EIA, *Uganda*, last updated August 2015.

²³ *Ibid.*

²⁴ Platts McGraw Hill Financial, "Uganda-Kenya Oil Pipeline Decision to Boost Region," August 14, 2015, <http://www.platts.com/latest-news/oil/london/analysis-uganda-kenya-oil-pipeline-decision-to-26178683>.

²⁵ Frederic Musisi, "Uganda: Oil Cash—How Long Shall We Wait?," *All Africa*. November 17, 2015, <http://allafrica.com/stories/201511171701.html>.

²⁶ *Ibid.*

²⁷ OEC, "Uganda," <http://atlas.media.mit.edu/en/profile/country/uga/>.

²⁸ The Republic of Uganda, "Scaling-up Renewable Energy Program Investment Plan (SREP)," October 2015, 7.

²⁹ Electricity Regulatory Authority (ERA), "Developments and Investment Opportunities in Renewable Energy Resources in Uganda," June 2013, 14.

³⁰ *Ibid.*

³¹ Ministry of Water & Environment, *Uganda's Intended Nationally Determined Contribution (INDC)* October 2015, 4.

³² CIA World Factbook, last updated November 19, 2015, <https://www.cia.gov/library/publications/the-world-factbook/geos/ug.html>.

³³ The Republic of Uganda, "SREP," October 2015, 10.

³⁴ Electricity Regulatory Authority (ERA), Domestic Tariff, <http://www.era.or.ug/>.

tariffs sit at \$0.20/kWh after a recent raise of 2.5 percent; measures were put into place capping increases to 2.5 percent per quarter, otherwise this might have been 8.2 percent.³⁶ A cushion to consumers was removed in 2012 and justified because it saved millions to invest in another hydro plant.³⁷ Since tariffs are increased to balance the shilling depreciation, exports, particularly crude oil, could mitigate this problem. Ironically, crude reserves have potential to reduce imports, stabilize economy, and thus bolster Uganda's renewable energy sector (more on this in *Recommendations*). Uganda is also attempting to combat consumer/producer financing barriers through a multilateral initiative called "GET FiT," which is a way to fast-track renewable businesses like hydro and solar.³⁸ What does Uganda's solar power look like?

Solar Power

GET FiT stakeholders have recognized the high solar potential in Uganda and its ability to reduce dependence on biomass and fossil fuels. Largely due to location near the equator, average solar radiation in Uganda is 5.1 kilowatt hours per square meter per day (kWh/m²/day.)³⁹ This means each day, every square meter in Uganda could power five 100-watt light bulbs for 10 hours.⁴⁰ Previous attempts have failed to exploit this outstanding potential. Uganda aimed to install 80,000 photovoltaik (PV) solar systems from 2001-2012, but only 7,000 were installed.⁴¹ The Ministry of Energy and Mineral Development (MEMD) listed main causes: failure to educate rural population, lack of marketing, high cost, and lack of incentive to enter rural markets.⁴² More broadly, the Government of Uganda (GoU) believes they skipped a step by investing in an underdeveloped private sector unable to take necessary risk. GoU is now stepping in to bolster solar production and consumption with "GET FiT."

Launched in 2013, this initiative is spearheaded by Uganda's ERA, GoU, and German Development Bank (KfW) with sponsorship from Norway, Germany, the UK, and the EU.⁴³ Anticipated to expand through East Africa, phase one is in Uganda until 2018. It targets small renewable energy projects (1-20 MW each) by offering a results-based payment to companies on top of tariffs.⁴⁴ This ensures consumers are not burdened with even higher tariffs and eases risk of producer investment. GET FiT aims to commission a total installed capacity of 170 MW with 20 MW specified for solar PV.⁴⁵ In 2014, four solar PV companies were approved, marking a milestone in Uganda.⁴⁶

³⁵ African Development Bank (AFDB), "The High Cost of Electricity Generation in Africa," February 13, 2013, <http://www.afdb.org/en/blogs/afdb-championing-inclusive-growth-across-africa/post/the-high-cost-of-electricity-generation-in-africa-11496/>.

³⁶ ESI Africa, "ERA-2.5% Tariff Hike for Uganda," July 17, 2015, <http://www.esi-africa.com/electricity-regulatory-authority-ugandan-power-consumers-get-2-5-tariff-increase/>.

³⁷ Reuters, "Uganda removes power subsidies, to expand generation," January 12, 2012, <http://uk.reuters.com/article/uganda-electricity-subsidy-idUKL6E8CC2D120120112>.

³⁸ GET FiT Uganda, "2014 Annual Report," www.getfit-uganda.org.

³⁹ ERA, "Developments and Investment Opportunities in Renewable Energy Resources in Uganda," June 2013, 22.

⁴⁰ Duke Energy, "So what is a Killowatt-Hour?," <https://www.duke-energy.com/pdfs/MyHER%20What%20is%20a%20Killowatt-Hour%20Energy%20Chart.pdf>.

⁴¹ MEMD, "Rural Electrification Strategy and Plan Covering the Period 2013-2022," September 2012, 10.

⁴² Ibid.

⁴³ GET FiT Uganda, "2014 Annual Report," www.getfit-uganda.org, 13.

⁴⁴ Ibid.

⁴⁵ Ibid.

⁴⁶ Ibid., 1-3.

Although meeting their goals, one problem is the depreciation of the euro to the dollar. Nevertheless, these investments may help diversify Uganda's energy profile and increase access. Collectively, though, has Uganda managed to increase access thus far?

Successful or Not?

Uganda has largely failed to achieve energy access and one of the greatest obstacles is their institutional corruption, which discourages investment. Two metrics can help analyze the success of Uganda's attempts: percentage of access and government corruption score. Although urban access is 55 percent, rural access still hovers at 7 percent.⁴⁷ As previously mentioned, from 2001-2010, the Ugandan Ministry of Energy and Mineral Development (MEMD) anticipated rural electricity access would grow from 1 percent to 10 percent but it only grew to 5 percent.⁴⁸ This was an increase, but since the current level is barely above the 2010 estimate it is appropriate to say the Uganda government has largely failed its rural population.

Government's role in policy, partnerships, and budget are crucial for energy security and climate change mitigation. Donors, investors, and business partners may not trust Uganda, however, since the government of Uganda is slightly more corrupt than Russia with a country score of 26/100 (where 100 is least corrupt); of 175 countries, they rank 142.⁴⁹ In 2012, Uganda topped East Africa for corruption, but their individual country score (of 100) has declined since 2012 from 29 to 26.⁵⁰ This score measures perceived levels of corruption in the public sector. An unfortunate, more recent example of corruption was in August 2012 when 12 million Euros in aid were channeled through the Office of the Auditor General to officials' private bank accounts.⁵¹ On the other hand, Uganda's score on the Open Budget Index rose from 55 in 2010 to 65 in 2012, showing improvements in budget transparency. Nevertheless, reporting more comprehensively (particularly on expenditures, outstanding debts, and macroeconomic forecasts) would greatly enhance this score.⁵² One glimmer of hope shines through the liberalization of Uganda's power sector; it is one of the most liberalized in Africa.⁵³ But how does Uganda compare to Africa on climate matters?

A Climate "Lens"

Uganda's international climate commitments are consistent with its actions, but must be presented in absolute terms since they have no point to reference for comparison. As a signatory to the UN Framework Convention on Climate Change (UNFCCC), Uganda submitted an Intended Nationally Determined Contribution (INDC) in light of the UN Conference of Parties (COP) 21 to discuss climate change globally. Uganda states they have one of the lowest greenhouse gas emissions per capita (at 1.39 tons) whereas the global average is 7.99 tons of carbon dioxide.⁵⁴ Their business-as-usual scenario

⁴⁷ EIA, *Uganda*, last updated August 2015.

⁴⁸ MEMD, "Rural Electrification Strategy and Plan Covering the Period 2013-2022," September 2012, 10.

⁴⁹ Transparency International (TI), Uganda, 2014. https://www.transparency.org/country/#UGA_DataResearch.

⁵⁰ TI, "Uganda tops East African in Corruption," August 30, 2012,

https://www.transparency.org/news/pressrelease/uganda_tops_east_africa_in_corruption.

⁵¹ U4 Expert Answer, "Uganda: overview of corruption and anti-corruption," www.u4., no, 4.

⁵² Ibid.

⁵³ GET FiT Uganda, "2014 Annual Report," www.getfit-uganda.org, 12.

⁵⁴ GoU, *Uganda's Intended Nationally Determined Contribution (INDC)*, October 2015, 4.

estimates carbon dioxide emissions will be 77.3 million tons by 2030. It is interesting to note how frequently Uganda's INDC stresses funding, in light of discussion on governmental corruption and misallocation of funds. Seventy percent of required financial resources are expected to come from international sources. Tangible emissions reduction plans include: tree planting, reforestation programs, biodiversity conservation, and increasing hydropower. Consistent with current efforts, they mention promoting solar energy. They elaborate stating that they aim to have 3,200 MW renewable by 2030 up from 729 MW in 2013. They also intend to focus on the previously mentioned issue of deforestation increasing coverage from 14 percent in 2013 to 21 percent in 2030.

Another interesting note on Uganda and climate: Climatescope ranked Uganda ninth of fifty-five countries and third among African nations. This is a global survey on a country's ability to "attract capital for low-carbon energy sources."⁵⁵ This measures enabling framework, financing and investment, value chains, and greenhouse gas management. Although very new, this survey highlights Uganda's promise for future renewable development. Nevertheless, it has a long way to go. How can Uganda reconcile energy access security in a climate-conscious way?

Recommendations

Considering their four security concerns, Uganda should consider the following three things moving forward: (i) technological innovations such as improved cookstoves; (ii) decentralized small-scale initiatives, such as solar; and (iii) oil-to-cash transfers when Uganda gets "first oil."

First, improved cookstoves could help transition 93 percent of the population dependent on biomass to a more effective technology and mitigate pollution. "Improved cookstoves" have a higher combustion efficiency (at least 40 percent when compared to traditional methods) and also rely on better fuel sources.⁵⁶ Since transitioning 93 percent of Ugandans to the national grid or renewable sources of energy is both impractical and currently unfeasible this could compliment INDC efforts of reforestation.

Second, since rural access rate is still so low, Uganda should continue to pursue their GET FIT program of PV solar companies. Moreover, they should increasingly focus on *decentralized* solar capabilities. They can follow the example of the mayor of Kasese; his aim is to get his district 100 percent renewable by 2020.⁵⁷ After tax breaks for all renewable energy, business in their green economy jumped from five to fifty-five, jobs for locals are increasing, and currently renewables provide 26.8 percent of their district's energy. Not only is greenhouse gas emission being reduced, but people save time from collecting firewood to study. This may be a case study for the whole country to follow.

Lastly, should Uganda's development in pipeline and refinery continue, Uganda should consider what has been coined "oil-to-cash transfers."⁵⁸ This concept is one founded on the accountability of a government to a people that it taxes.⁵⁹ Uganda's oil rents could provide up to 15 percent of the GDP. This would be a huge influx of money

⁵⁵ Climatescope, Uganda, <http://global-climatescope.org/en/country/uganda/#/details>.

⁵⁶ Energising Development, "Progress Report 2014."

⁵⁷ Godfrey B. Kime, "Ugandan mayor: my district will be 100% renewable b 2020," *The Guardian*, October 20, 2015, <http://www.theguardian.com/global-development-professionals-network/2015/oct/20/ugandan-mayor-my-district-will-be-100-renewable-by-2020>.

⁵⁸ Gelb A. and S. Majerowicz, "Oil for Uganda—or Ugandans? Can Cash Transfer Prevent the Resource Curse?," Center for Global Development, July 2011.

⁵⁹ *Ibid.*

to Uganda’s energy sector and overall economy. The proposal is to redistribute the wealth from oil revenues to the citizens in their bank accounts. Then the government could tax this revenue, thus the government is not able to hoard income, but it does receive money to continue services. Moreover, this tax money and money received from exporting oil could boost the Ugandan Shilling enough to stimulate more consumption of hydroelectric power. However, as previously mentioned, Uganda would need to be wary of the increase of biomass use as a result of oil revenues.

Conclusion

Uganda has a complex mix of biomass, oil, hydro, and solar power. While the country has yet to be successful in reaching full energy access, its capacity is incrementally increasing. Examples like the improved cookstoves and the district of Kasese show that local climate change innovation and decentralization is one of their best next steps. Through clear examples of energy development they can hopefully mitigate the effects of a corrupt government on investment possibilities.

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