Modelling the Eastern African Power Pool: An Opportunity for Regional Energy Security

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Introduction and Motivation

In an effort to address regional electricity access issues, the Eastern African Power Pool (EAPP) was formed with the aim of delivering reliable, affordable and secure electricity across East Africa from regional interconnections and proposed power plants [1]. The potential of regionally interconnected networks in meeting electricity needs in East Africa has been widely recognized in the literature. By trading surplus electricity across borders, interconnected networks can alleviate the power systems' limitations in meeting growing demand [2]. EAPP interconnections can potentially help alleviate pressures of national grids through the export of surplus electricity to neighboring countries, facilitate system flexibility and increase regional security.

Results

In this study, the impact of interconnections and supply projects were modelled to address the regional supply-demand disparity and electricity security East Africa from 2020 to 2050. Results present a series of supply increase is necessary to follow the growing pace of demand, with a total regional supply deficit of 116 TWh. Some countries meet national electricity access in 2030 but thereafter, a long-term supply plan alongside interconnection agreements is required to address the growing shortage. Coal grows to become the greatest energy source, but higher hydro mix countries like DRC and Ethiopia have greater export capacity than coal and gas-heavy countries Egypt and Kenya, which are consistently short on supply. The increasing regional dependency on coal may risk global efforts to transition to clean energy. Potential for shared investment opportunities can arise to minimize costs of increasing generation capacity and interconnection flow for the benefit of both importing and exporting countries.

References

[1] Eastern African Power Pool, n.a. The EAPP - Eastern Africa Power Pool.

[2] Valickova, P. & Elms, N., 2021. Potential gains from regional integration to reduce costs of electricity supply and access in Southern Africa, Energy for Sustainable Development. Elsevier,. 62, s. 82–100.

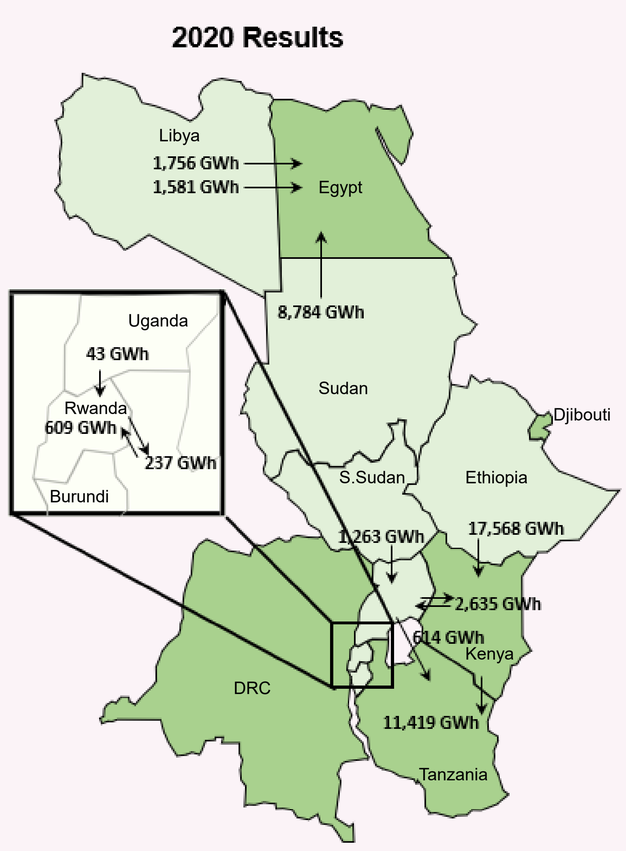
[3] IRENA, 2021. Planning and prospects for renewable power Eastern and Southern Africa

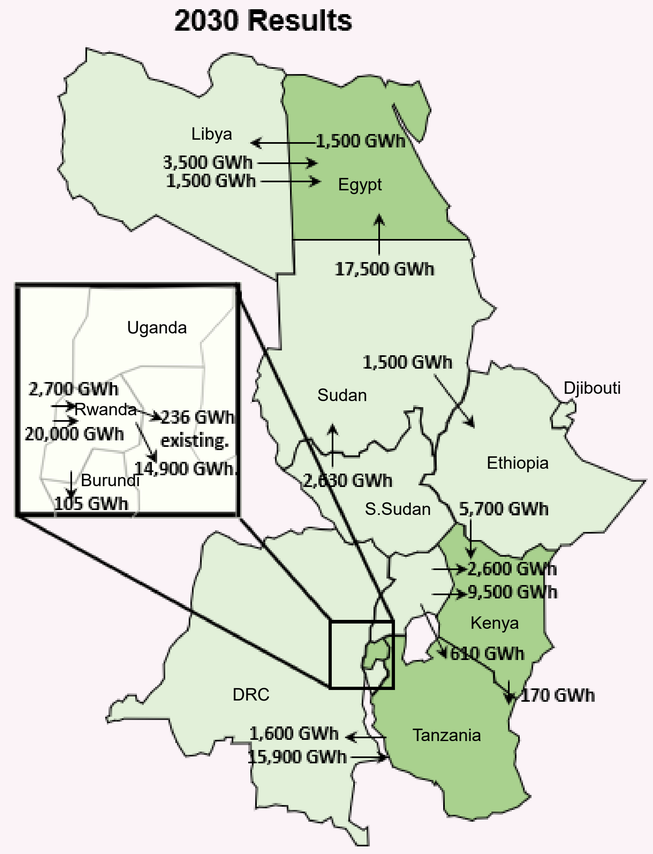
Methodology

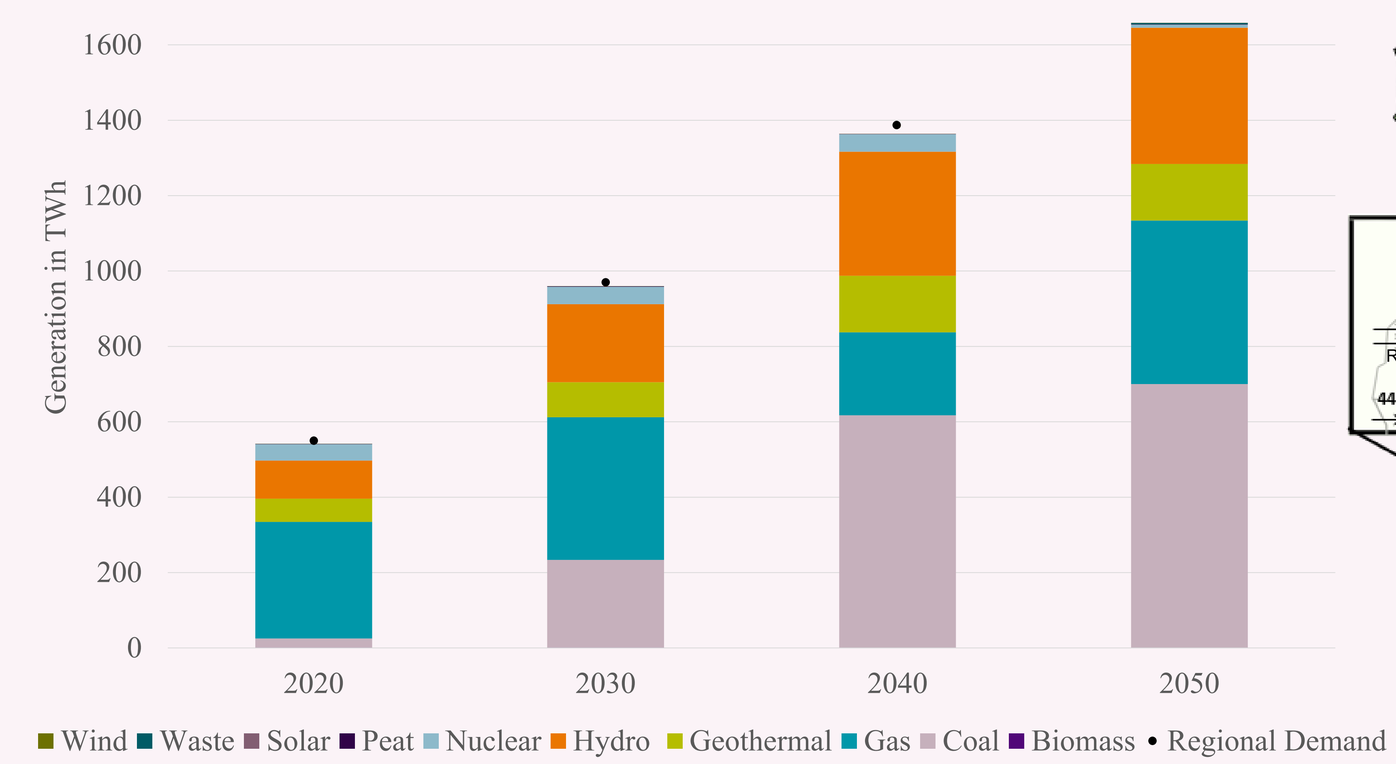
To model the planned power plants and interconnections under the EAPP proposed, PLEXOS Integrated Energy Model was utilized to simulate the electricity networks and power plants. The Long Term (LT) Plan optimization identifies the most efficient and cost-effective expansion strategies to meet the projected electricity access targets within the specified timeframe. To determine the necessary supply to meet total electricity access, the electricity demand is forecasted until 2050 with consideration to growth projections from data available from IRENA [3]. The capacity aims are extracted from national master plans and the EAPP, as presented in table below.

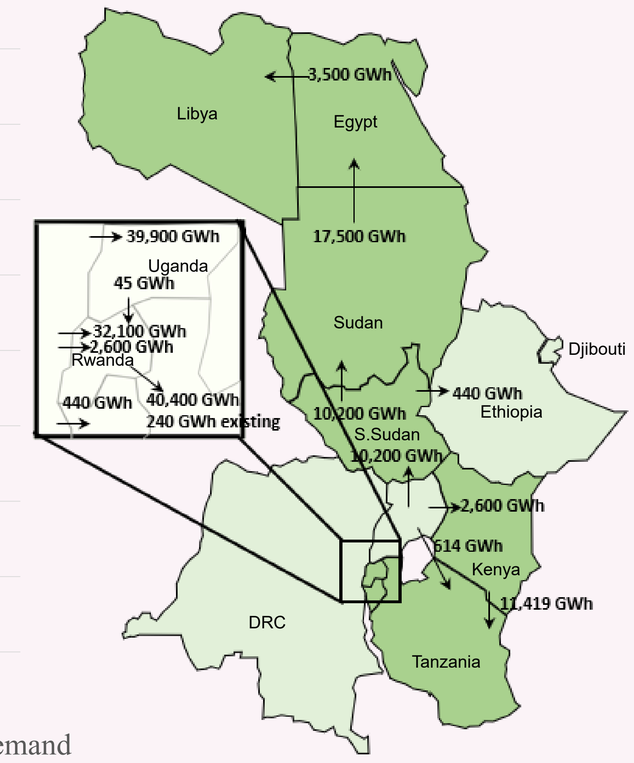
Capacity Aims (Data Source: EAPP [1])

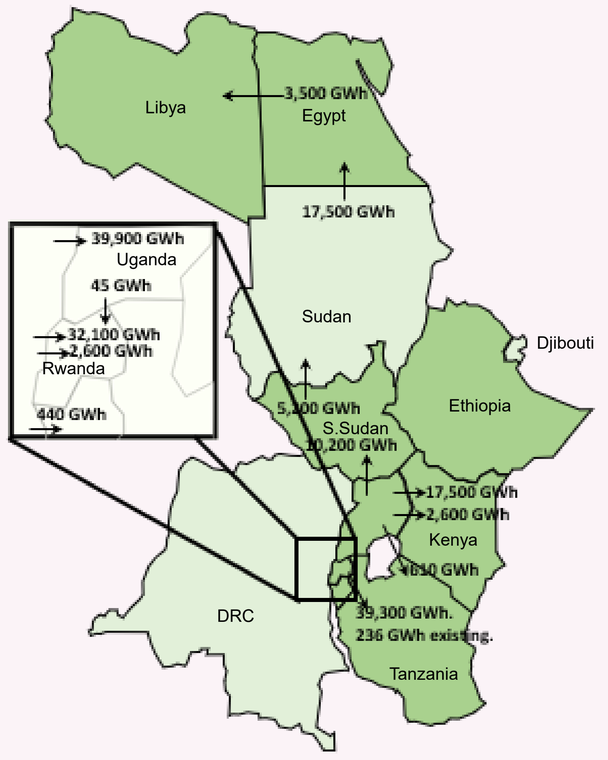
Country	Capacity Aims
DRC	Hydro: gradual increase to 42 GW by 2050.
Egypt	Natural gas, coal, Nuclear: 24.2 GW, 7 GW, 1.65 GW by 2020 respectively; 9.6 GW, 6 GW, 3.3 GW by 2030 respectively.
Ethiopia	Hydro power: 9 GW by 2030. Wind: 900 MW by 2016. solar: 300 MW by 2030. Geothermal: 5 GW by 2037.
Kenya	Nuclear: 5 GW by 2030. Geothermal: 5 GW by 2037. Coal and LNG 2 GW & 1 GW by 2020.
Libya	Natural gas and oil: 23.6 GW.
S.Sudan	Hydro: 40 MW, 300 MW by 2020 and 2025 respectively. Diesel: 336 MW by 2020. Additional 11 MW by 2025.
Sudan	3.3 GW by 2030.
Tanzania	Hydro, gas, coal: 3.3 GW, 1 GW; 3.8 GW by 2035 respectively.
Uganda	Hydro power: 2.4 GW by 2030.











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