

Lefu Maqelepo

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EDUCATION

PhD, Sustainability (Expected), Aug 2019 – July 2024

Rochester Institute of Technology, Rochester, NY, USA

Dissertation: Rural Electrification Subsidies: Quantification, Structure and Policy Implications

Committee: Dr. Nathan Williams , Dr. Jay Taneja , Dr. Eric Williams , Dr. Eric Hittinger

PhD, Engineering & Public Policy (Transferred) Jan 2019 - Aug 2019

Carnegie Mellon University, Pittsburgh, PA, USA

MS, Electrical & Computer Engineering Aug 2017 – Dec 2018

Carnegie Mellon University, Kigali, Rwanda

Independent Study: Implementation of Stochastic Techno-Economic Model (STEMM) in Python

Supervisor: Dr. Nathan Williams , Dr. Paulina Jaramillo

BEng, Mechanical Engineering Aug 2011 – May 2016

University of Botswana, Gaborone, Botswana

Capstone Project: Design, Fabrication and Testing of a Morama nut cracking machine

Supervisor: Dr. Robert Batane

SKILLS

Energy Models: OnSSET, STEMM, dGen, Homer, pvlib | **Programming Languages / Scripting:** Python, Java, C++, R, MATLAB, Bash, SQL | **Typesetting Document:** Latex, Microsoft suite | **ML stack:** Numpy, Pandas, Geopandas, Scikit-Learn, Stats-models | **Optimization:** Scipy, CVXPY, Pyomo, LINGO, Excel | **3D CAD Modeling:** Solidworks, AutoCAD | **Life Cycle Assessment:** Simapro | **Others:** QGIS, Git

EXPERIENCE

Graduate Research Assistant;

Golisano Institute of Sustainability, RIT, Rochester, NY, USA

Aug 2019 - Present

- Collaborate on and lead research projects focusing on energy justice in sub-Saharan Africa
- Developed a subsidy based modeling framework for determining decision boundary on electrification mode between grid extension and mini grids at a village community level
- Developed regression based and machine learning (ML) based computational models to evaluate grid electrification infrastructure cost for currently unelectrified communities
- Developed optimization based dispatch algorithms simulating hybrid PV-Battery-Diesel mini grid technical and economic performance fixed and flexible demand load types
- Identified areas most suited for mini grid electrification in Sierra Leone by applying graph algorithms to compute minimum spanning tree based MV distribution network for Cross Boundary
- Analyze energy use and money spend data from Cross Boundary supported mini grids to quantify elasticity of demand

Graduate III - Computer Science / Energy Analyst, Internship;

Distributed Systems & Storage Analysis group, NREL, Denver, CO, USA

Mar 2022 - Feb 2023

- Enhanced accessibility of dGen model by developing an alpha version of the GUI for dGen, an agent based distributed solar and wind adoption modeling tool
- Developed a methodology that utilizes statistical modeling and advanced optimization techniques to fuse data from different sources for dGen agents generation

- Collaborated with data engineering team to generate dGen agents for LA100 Equity Strategies project study

Software Engineering Consultant;

Onepower (Ltd) Lesotho, Maseru, Lesotho

Nov 2020 - Feb 2022

- Developed GUI based software tool (uGridPlan) for mini grid network visualization, editing and project development and tracking in python tkinter
- Developed a geospatial optimization based tool (uGridNet) that uses customer GPS locations, exclusion geometries and elevation data to design least cost mini grid power distribution network (MV backbone, LV lines and pole placement, cost) in python
- Built electricity demand prediction models using historical consumption and pricing data
- Developed a GUI based software tool that uses the underlying prediction models and unique attributes of a community and target tariff to produce synthetic 8760 load profile

Energy Modelling - Intern;

Green Design Institute, Carnegie Mellon University, Kigali, Rwanda

May 2018 – Aug 2018

- Expansion and implementation of Stochastic Techno-Economic Microgrid Model (STEMM) development in python
 - Development of physics based models that simulate technical performance of microgrid components
 - Development and incorporation of different algorithms for power system generation devices dispatch (heuristic, optimization, model predictive control)
 - Development and incorporation of smart metering capability into the model

Mechanical Engineer I;

Onepower (Ltd) Lesotho, Maseru, Lesotho

Jul 2016 – Jun 2017

- Conducted pre-electrification surveys and modeled load requirements based off surveys
- Liaised with smart meter vendors to configure and field test meters (connectivity, loading units, remote monitoring)
- PV Tracker software development and fine tuning
- PV tracker system hardware development and modification
- Balance of system components circuit design and wiring
- Developed and led hardware manufacturing operations and manufacturing processes workflow

Mechanical Engineer - Internship;

Solar Turbine Group / Onepower (Ltd) Lesotho

Feb 2015 – Jun 2015

- Designed components/parts in SolidWorks CAD software
- Produced G-code and machined components on a 3-axis CNC milling machine
- Machined components on lathe machine
- Installed electricity meters & weather stations to collect energy use and weather data

Research Fellow - Sustainable Engineering;

University of Botswana, Gaborone, Botswana

May 2014 - Jun 2014

- Conducted research focused on understanding mechanical strength *agave sisalana* aloe fibers

Mechanical Engineer - Internship;

Barloworld Equipment Botswana

Jun 2013 – Jul 2013

- Maintenance of, rebuilding, servicing, and pre-sales testing of heavy-duty Caterpillar machinery

TEACHING

Teaching Assistant (2023), Sustainability in the Global South, *Department of Sustainability, RIT*

Teaching Assistant (2018), Power System Operations (18-863-K3 mini) and Power System Expansion (18-864-R4 mini), Dept. of ECE, CMU

PUBLICATIONS

Peer Reviewed Journal Articles

1. **Maqelepo, L.**, Williams, N. and Taneja, J., 2022. Rural electrification subsidy estimation: a spatial model development and case study. *Environmental Research: Infrastructure and Sustainability*, 2(4), p.045009
2. Wamalwa, F., **Maqelepo, L.**, & Williams, N. (2023). Unlocking the nexus potential: A techno-economic analysis of joint deployment of minigrids with smallholder irrigation. *Energy for Sustainable Development*, 77, 101345.

Peer Reviewed Conference Proceedings

1. **Maqelepo, L.**, Wamalwa, F., Raji, T., & Williams, N. J. (2023, November). Thinking Beyond The Connection: Mapping Electricity Tariffs Affordability in Sub-Saharan Africa. In *2023 IEEE PES/IAS PowerAfrica* (pp. 1-5). IEEE.
2. Raji, T., Wamalwa, F., **Maqelepo, L.**, & Williams, N. J. (2023, November). Assessing the Feasibility of Behind-the-Meter Battery Storage Systems for Tariff Arbitrage in Uganda. In *2023 IEEE PES/IAS PowerAfrica* (pp. 1-5). IEEE.
3. Raji, T., **Maqelepo, L.**, Williams, N.J. and Bett, A., 2022, August. Money and Power: The Impact of Tariff Structures on Electricity Consumption in Solar Microgrids in Africa. In *2022 IEEE PES/IAS PowerAfrica* (pp. 1-5). IEEE

Articles in Press

1. **Maqelepo, L.**, Wamalwa, F., Williams, N., Taneja, J.; Two Sides of a Coin: Assessing Trade-offs Between Reliability and Profit in Mini Grids and the Policy Implications for Subsidies
2. Wamalwa, F., **Maqelepo, L.**, Williams, N., Falchetta, G.; Solar Irrigation Potential in Sub-Saharan Africa: A Crop-Specific Techno-Economic Analysis
3. Maqelepo, L., Raji, T., Williams, N. J.,; Precious Photons: A Geospatial Benchmarking of the Value of Sun tracking in Solar PV Systems in Sub-Saharan Africa

Speaking:

1. Webinar; Implicit subsidies in grid based electrification and what they mean for the DRE sector, December 2022, <https://www.seforall.org/events/implicit-subsidies-in-grid-based-electrification-and-what-they-mean-for-the-dre-sector>
2. Webinar; Energy transitions and sustainable transformations in Africa, November 2022 <https://physicsworld.com/a/energy-transitions-and-sustainable-transformations-in-africa>
3. Webinar; RIT in Africa Research Colloquium, April 2022, <https://www.rit.edu/academicaffairs/global/rit-africa-research-colloquium>

In the News/Blog:

1. <https://www.seforall.org/news/stretching-budgets-by-not-stretching-power-lines-faster-and-cheaper-electricity-access-through>
2. <https://thedaily.case.edu/cwru-senior-lights-familys-night-near-african-desert/>