Lefu Maqelepo (He/Him)

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RESEARCH INTERESTS

Energy Systems, Machine Learning, Optimization, Climate Change.

EDUCATION

Rochester Institute of Technology — Rochester, NY, USA
PhD, Sustainability (Expected); CGPA: 3.73/4.0 — Aug 2019 - Aug 2024
Dissertation: *Rural Electrification Subsidies: Quantification, Structure and Policy Implications*
Advisor(s): Professors Nathan Williams & Jay Taneja

Carnegie Mellon University — Pittsburgh, PA, USA
PhD, EPP (Transferred); GPA: 3.83/4.0 — Jan 2019 - Aug 2019
Advisor(s): Professor Nathan Williams

Carnegie Mellon University — Kigali, Rwanda
MS, Electrical & Computer Engineering, CGPA: 3.35/4.0 — Jul 2017 - Dec 2018
Independent Study: *Implementation of Stochastic Techno-Economic Microgrid Model (STEMM) in Python*
Advisor(s): Professor Nathan Williams

University of Botswana — Gaborone, Botswana
BEng Mechanical Engineering, GPA: 4.2/5.0 — Aug 2011 - May 2016
Capstone: *Design, fabrication and testing of a Morama nut cracking machine*
Advisor(s): Professor Robert Batane

TECHNICAL SKILLS

Programming: Python, Java, C/C++, R, Matlab, Bash, SQL, LaTeX.
Data / ML Stack: Numpy, Pandas, Geopandas, Scikit-Learn, Stats-models, Spark.
Optimization: Scipy, CVXPY, Pyomo, LINGO.
Energy Models: OnSSET, STEMM, dGen, Homer, pvlib.
CAD/CAM: Solidworks, AutoCAD, MasterCam, DesignBuilder
Web Development: HTML, CSS.
Applications: Vi/Vim, Eclipse, Visual Studio, Git.
Languages: Proficient: English, Sesotho, Setswana.

RELEVANT EXPERIENCE

Research Assistant — Rochester Institute of Technology
Rochester, NY — Aug 2019 - Aug 2024

- I collaborate on and lead research projects focused on energy access for SSA
- Developed a subsidy based computational model to match un-electrified communities with suitable electrification mode (between mini grids and grid extension)
- Developed methodology to estimate electrification infrastructure cost for currently un-electrified communities
- Developed optimization based dispatch algorithms for hybrid PV-Battery-Diesel mini grids under fixed and flexible loads
- Identified areas most suitable for mini grid and grid based electrification in Sierra Leone by applying graph algorithms to compute minimum spanning tree based distribution networks
- Analyzed electricity use and transactions data to quantify price elasticity of demand

Graduate III Intern Computer Science — National Renewable Energy Lab (NREL)
Golden, CO, USA (Remote) — Mar 2022 - Feb 2023

- Designed and developed a graphical user interface for dGen model, enhancing accessibility and usability to a wider audience

- Developed a data fusion methodology employing statistical modeling and optimization techniques to fuse data for dGen agents generation
- Collaborated with model engineering team to generate agents for LA100 Equity Strategies project

Consultant: Software Engineer Onepower
Maseru, Lesotho (Remote) Nov 2020 - Feb 2022

- Developed software tool (uGridPlan) for mini grid network visualization, editing and project development tracking in python tkinter
- Developed software tool (uGridNet) to design layout of distribution network (MV and LV) optimizing for cost
- Build electricity demand prediction models using historical consumption and price data
- Developed a GUI based software tool that uses underlying prediction models and unique community features nd a target tariff to produce synthetic 8760 load profile

Intern: Energy System Modeling Green Design Institute at CMU
Pittsburgh, PA, US (Remote) May 2018 - Aug 2018

- Ported the code-base of Stochastic Techno-Economic Microgrid Model (STEMM) from Analytica to Python
- Extended STEMM's capalities to support smart metering and model predictive control dispatch strategy

Mechanical Engineer I Onepower
Maseru Jul 2016 - Jul 2017

- PV tracker system control software development and fine tuning and hardware development
- Conducted pre-electrification surveys to collect data later used in demand estimation for mini grid components design
- Liaised with smart meter vendors to configure and field test meters to monitor performance

Intern: Mechanical Engineer Onepower
Maseru Feb 2015 - Jun 2015

- Components design and production of machining process program (G-Code) in Solidworks CAD software
- Installed electricity meters and weather stations at various schools and health clinics
- Collected and analyzed electricity usage and meteorologic data to establish correlations

Research Fellow: Sustainable Engineering University of Botswana
Maseru Feb 2015 - Jun 2015

- Collaborated on research focused on investigating mechanical strength of acetyled *agave sisalana* fibers.

TEACHING EXPERIENCE

Graduate Teaching Assistant Rochester Institute of Technology
Rochester, NY, USA Spring 2021, 2023

Course(s): Multicriteria Sustainable Systems, Sustainability in the Global South.

Graduate Teaching Assistant Carnegie Mellon University
Kigali, Rwanda Fall 2018

Course(s): Electric Power Systems.

JOURNAL PUBLICATIONS (peer-reviewed)

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

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.

CONFERENCE PROCEEDINGS (peer-reviewed)

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)*, Marrakesh, Morocco. November 2023.

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)*, Marakkesh, Morocco. November, 2023.

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)*, Kigali, Rwanda. September, 2022.

ARTICLES IN PRESS

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

Wamalwa, F., **Maqelepo, L.**, Williams, N., Falchetta, G.; Solar Irrigation Potential in Sub-Saharan Africa: A Crop-Specific Techno-Economic Analysis

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

CONFERENCE TALKS

Money and Power: The Impact of Tariff Structures on Electricity Consumption in Solar Microgrids in Africa, IEEE PES/IAS Power Africa, Kigali, Rwanda, August 2022.

INVITED TALKS

Implicit subsidies in grid-based electrification and what they mean for the DRE sector, Sustainable Energy for All, December, 2022.

Energy transitions and sustainable transformations in Africa, Physics World, environment and energy, November, 2022.

Rural Electrification Subsidies: Quantification, Policy Implications, RIT in Africa Research Colloquium, Rochester, NY, USA. April, 2021.

STUDENT MENTORING

Carnegie Mellon University
Tunmise Raji (Masters), now a PhD student at RIT.
Leandre Berwa (Masters), now Founder & CEO at Second Life Storage (SLS) Energy.
Chris Karera (Masters), now Lead Data Scientist at Odyssey Energy Solutions.
Janvier Muvunyi (Masters).

MEDIA COVERAGE

Stretching budgets by not stretching power lines: faster and cheaper electricity access through careful subsidy allocation in Africa. *SEforAll*, 2022.

CRWU senior lights family's night near African desert *The Daily, Case Western Reserve University*, 2024.

HONORS AND AWARDS

Mastercard Scholar, CMU
Recipient of a full scholarship to study Masters at Carnegie Mellon University in Kigali, Rwanda (2017).

Merit Award, University of Botswana
Recipient of academic excellence award in residence hall 405-415 for academic year 2011/12 (2012).

Excellence Award, Leribe district
Recipient of academic excellence award for being a top ten (rank 3rd nationwide) performer in the 2010 COSC examinations in Leribe district (2011).

Excellence Award, Sacred Heart High School
Recipient of excellence awards for being the top performer in Chemistry, Mathematics and Sesotho subjects at Sacred Heart High School (2010).

Certificate of Honour, Math Olympiad, Lesotho
Recipient of a certificate of honour for a high rank in the national Mathematics Olympiad taken at Cana High School (2008).