

EFFICIENT ENERGY PATHWAYS: SMART MICROGRIDS FOR SUB-SAHARAN AFRICA

Rose-Margaret Ekeng-Itua^{1,2}, Juan Pablo Carvallo², Deborah Sunter², Prof. Daniel Kammen²

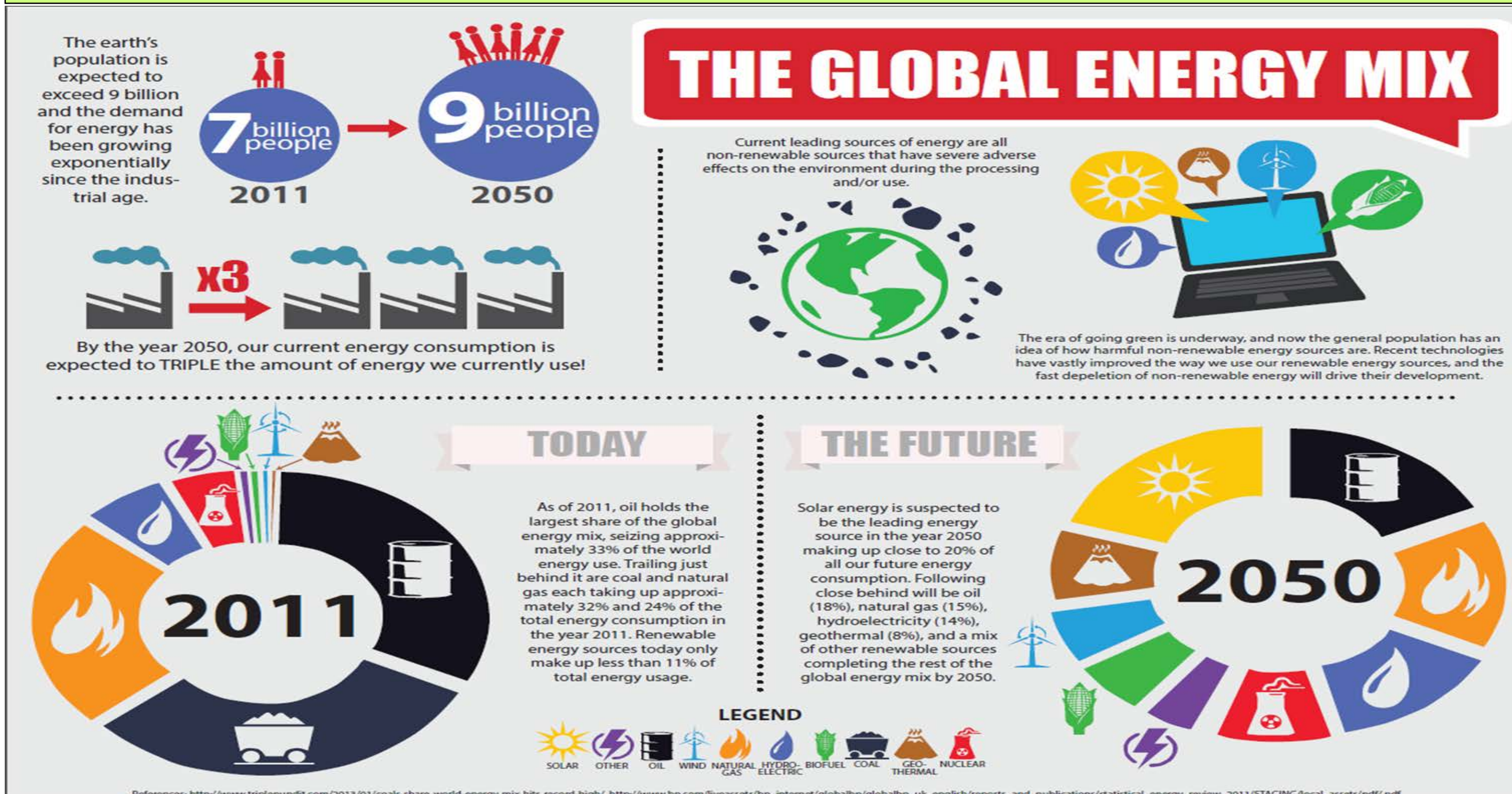
¹Engineering Department, Ohlone College; ²Renewable and Appropriate Energy Lab (RAEL), UC Berkeley

2016 Context-Based Research Experiences for Community College Teachers (RET) Program

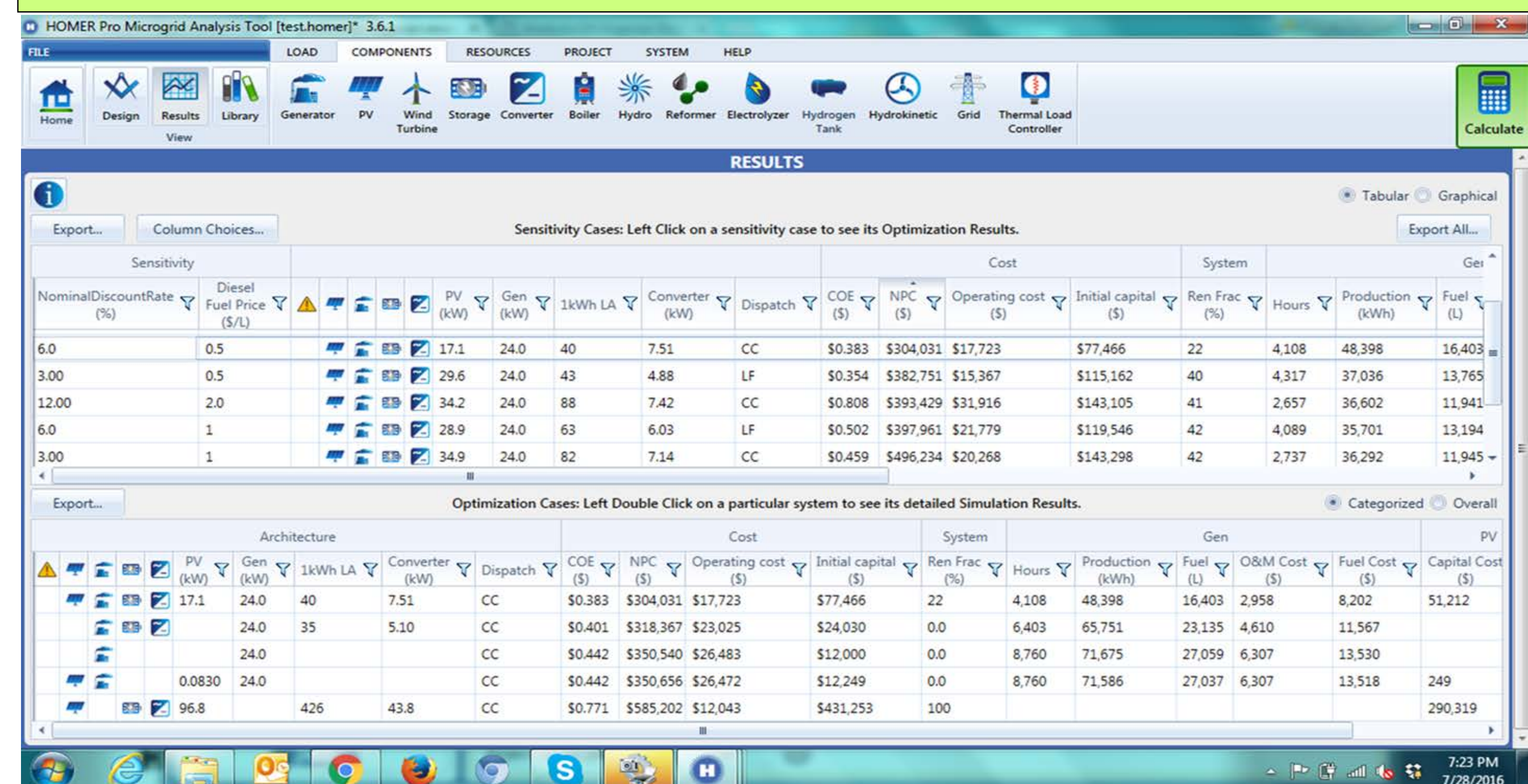
Abstract

1.6 billion people world wide have no access to electricity. In Sub-Saharan Africa (SSA), fewer than 10% of rural households have electricity connections. Access to grid electricity in Sub-Saharan Africa remains low; a problem generally ascribed to differences in settlement patterns. Mean Interhouse Distance (MID) and Penetration Rates (PR) are factors in population settlements that affect the cost of energy pathways. This research looks into the optimization of MID and PR in energy pathways through Smart Microgrids.

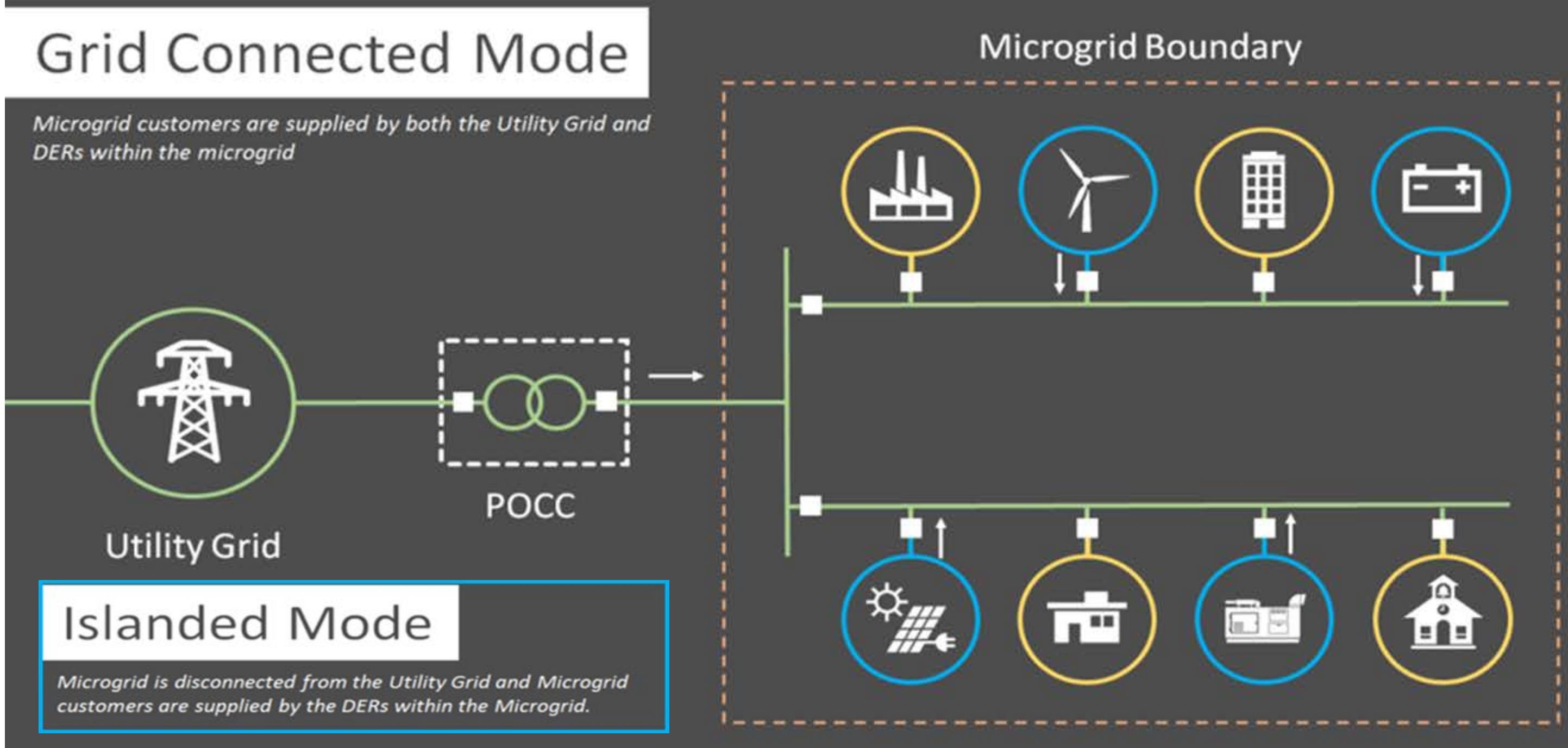
Research Rationale



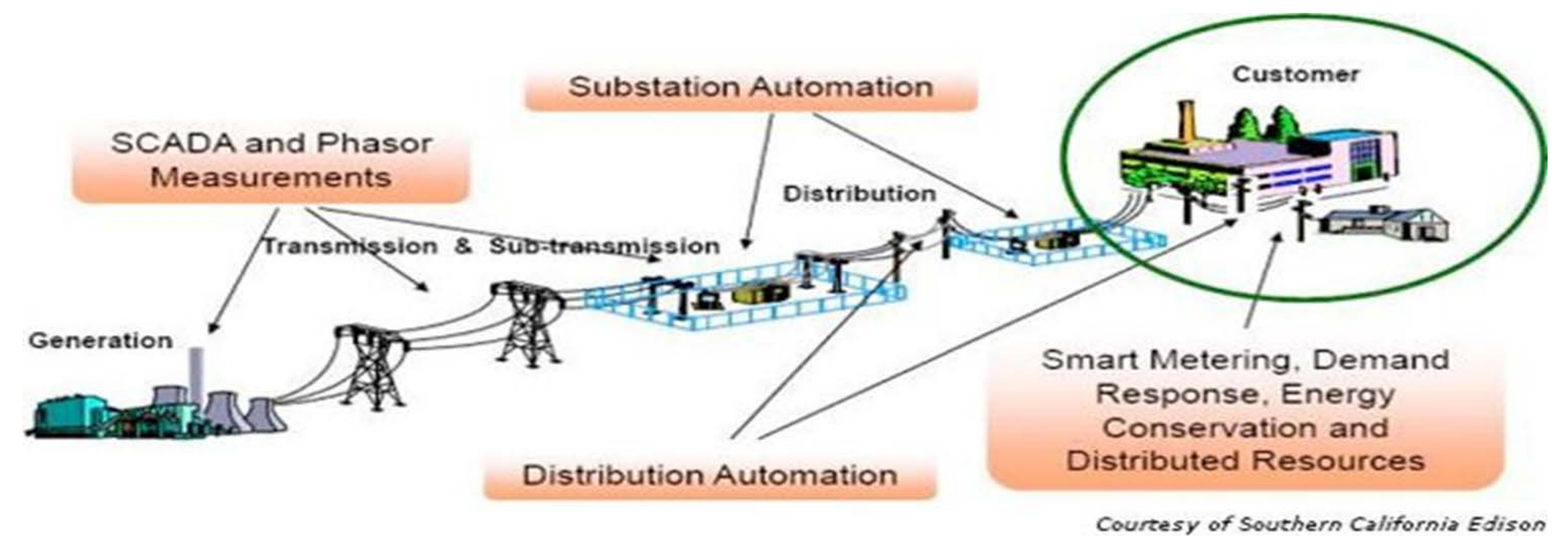
HOMER: Microgrid Optimization Results



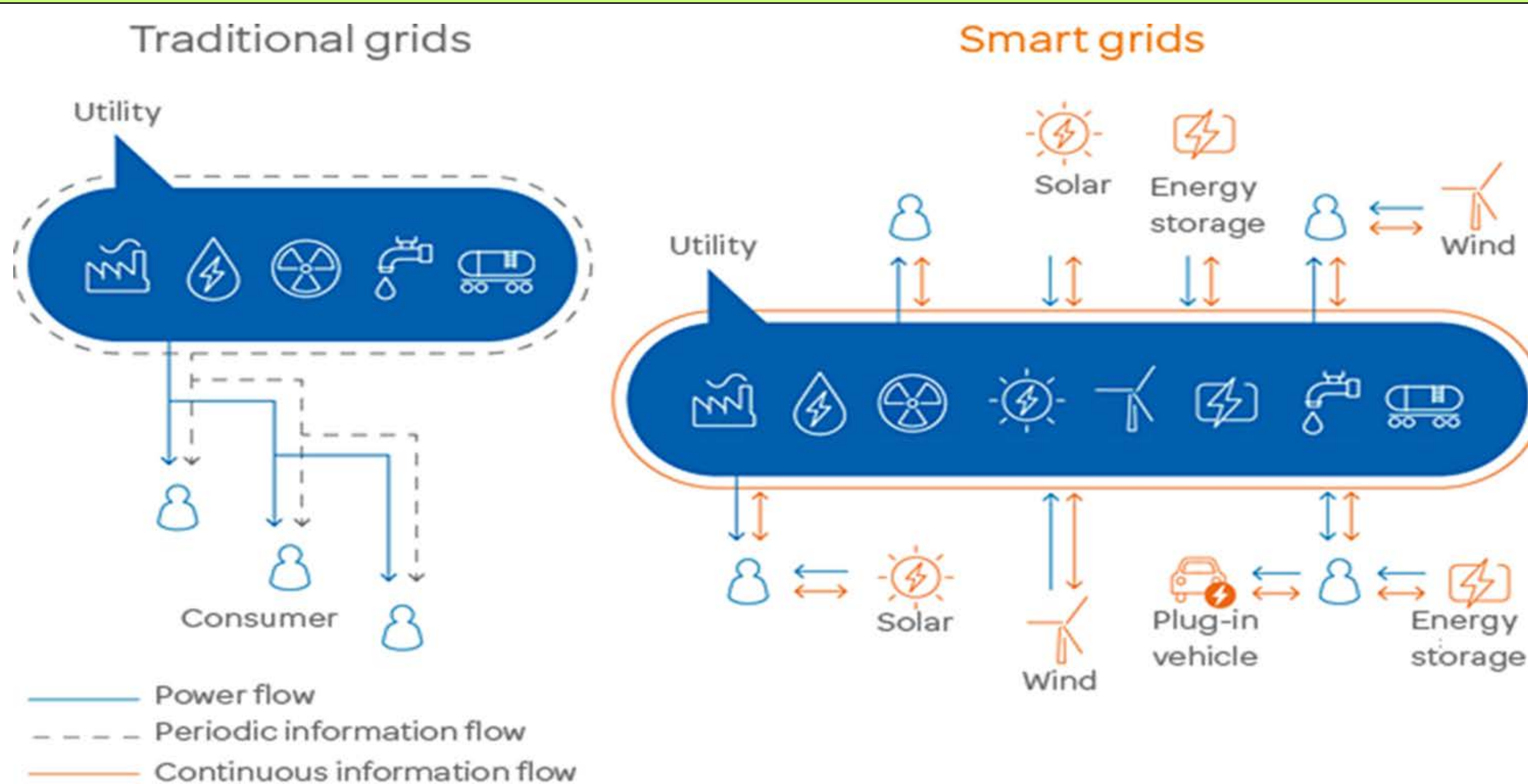
Microgrids



Impact of Smart Devices on MID and PR



Smart Grids vs. Traditional Grids



"Smart grids are electricity networks that can efficiently integrate the behavior and actions of all users connected to it in order to ensure an economically efficient, sustainable power system with low losses and high quality and security of supply and safety" – The European Smart Grid Taskforce

Conclusion

- There is a correlation between Spatial Patterns of Population Settlements and Cost of Energy Pathways.
- Information Communications Technology could have an impact on Mean Interhouse Distance (MID) and Penetration Rate (PR) and as such the cost and efficiency of Energy Pathways in SSA.

Future Work

- Develop an algorithm/modeling tool for Smart Grid Optimization.

References

- Zvoleff, Alex, et al. "The impact of geography on energy infrastructure costs." Energy Policy 37.10 (2009): 4066-4078.
- Ricci, A., et al. "Power-grid load balancing by using smart home appliances." 2008 Digest of Technical Papers-International Conference on Consumer Electronics. IEEE, 2008.
- Panajotovic, Boban, Milan Jankovic, and Borislav Odadzic. "ICT and smart grid." Telecommunication in Modern Satellite Cable and Broadcasting Services (TELSIKS), 2011 10th International Conference on. Vol. 1. IEEE, 2011.
- Shaaban, M. & Petinrin, J. Renewable energy potentials in Nigeria: Meeting rural energy needs. Renewable and Sustainable Energy Reviews 29, 72-84 (2014).

Support Information

This work was funded by the National Science Foundation under Award EEC-1405547, and made use of resources in the Center for Energy Efficient Electronics Science (E³S) supported by the National Science Foundation (Award 0939514).

Contact Information
Rose-Margaret Ekeng-Itua
ritua@ohlone.edu.

