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Microgrid expansion planning and policy making in the electricity market

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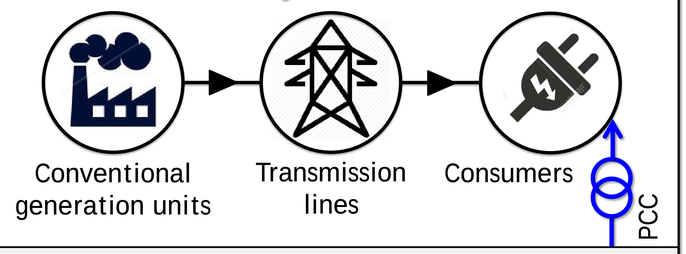
Introduction

Electric Power Systems

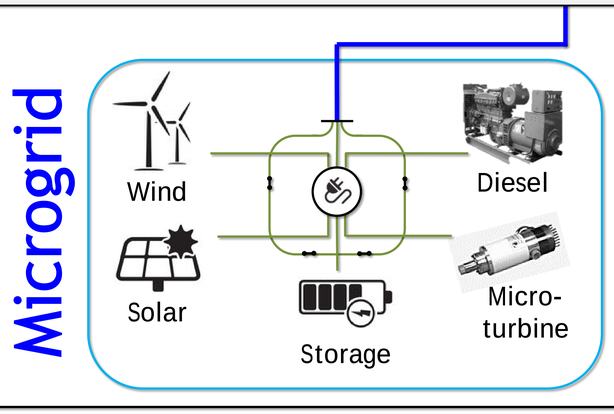


250,000 People without power in Texas During Harvey

16% People are living in the dark.

10% Power outage duration

31% Electricity greenhouse gas emission



Motivation

Model presents correct price signals to MG, generation units, and transmission lines' investors according to:

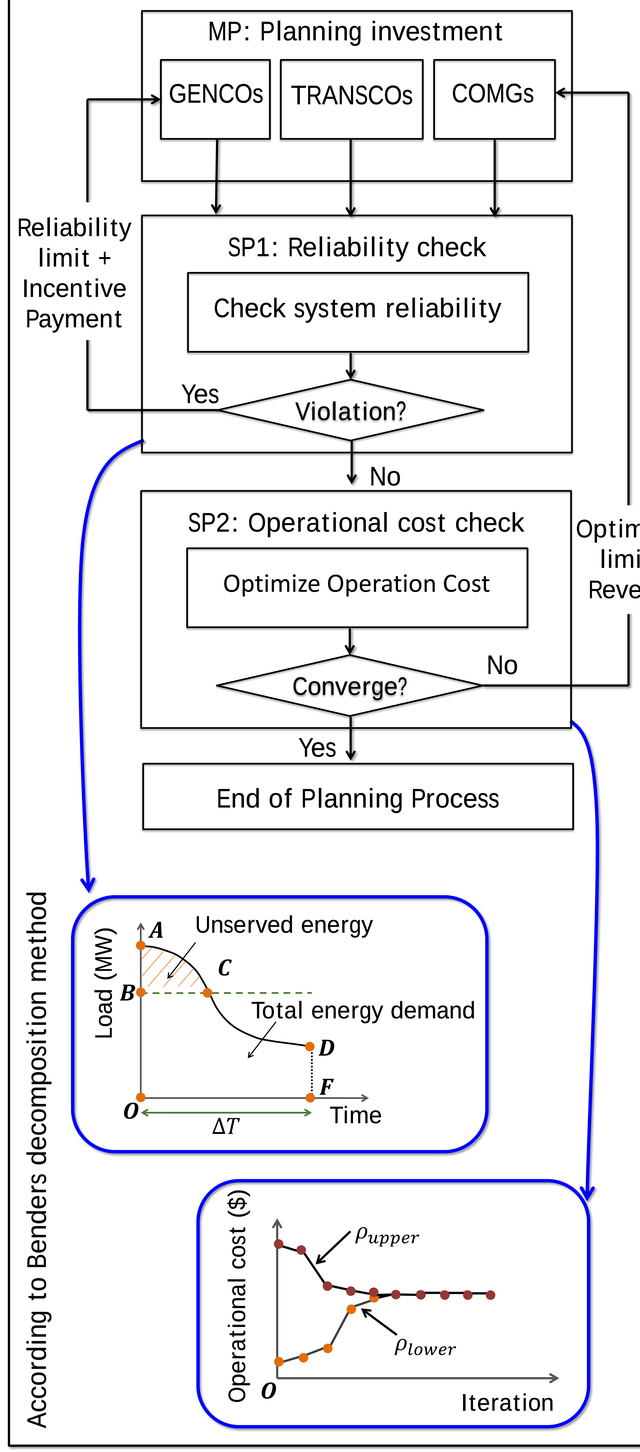
1- Reliability enhancement

2- Operational cost reduction

3- Rural electrification

4- Emission reduction

Method



Result and Conclusion

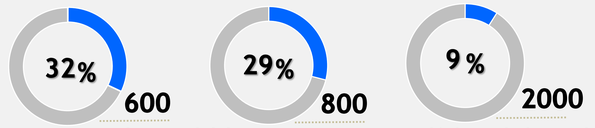
Having Microgrid in the power system can result in:

- Lower unserved energy
- Lower operation cost
- Rural electrification

38% ↓ Unserved energy (MWh)

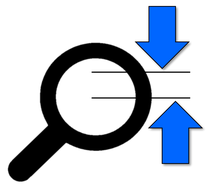
21% ↓ Operation cost ($)

11% ↑ Rural electrification



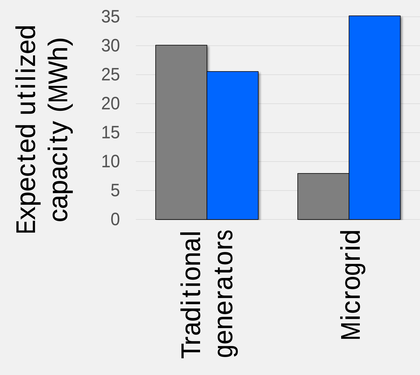
MGs with higher investment cost can enhance reliability & rural electrification.

Our applied solution approach converges faster with smaller gap.



2.67×10^{-7} Negligible gap at iteration **6**

90 % CPU time reduction



Adding emission policy and limitation results in higher penetration of MG, which it causes a more reliable network with lower operation cost, even though the investment cost of microgrid is huge.

References

[1] **A. Khayatian**, M. Barati, and G.J. Lim (2017) "Integrated Resource Planning in Electricity Market under Uncertainty," accepted in IEEE Transaction on Power Systems journal.

[2] **A. Khayatian**, M. Barati, and G.J. Lim (2016) "Market-based and Resilient Coordinated Microgrid Planning under Uncertainty," Transmission and Distribution Conference and Exposition (T&D), IEEE/PES.