Privacy Preserving Cooperation among Microgrids for Efficient Load Management on the Grid

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URL: http://www.albany.edu/faculty/hong/projects/ppmc.html

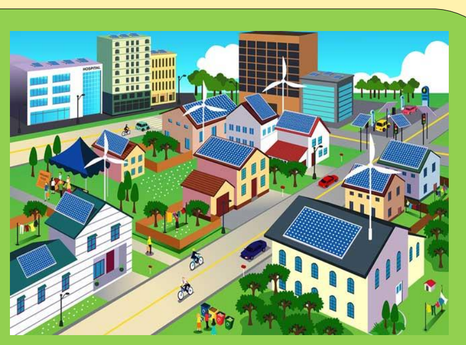
The objective of this project is to develop a series of privacy preserving techniques for distributed energy consumers and suppliers (which can be integrated as microgrids) to cooperatively advance their global and local load management without disclosing local data.

Novel Cooperative Load Management Applications:

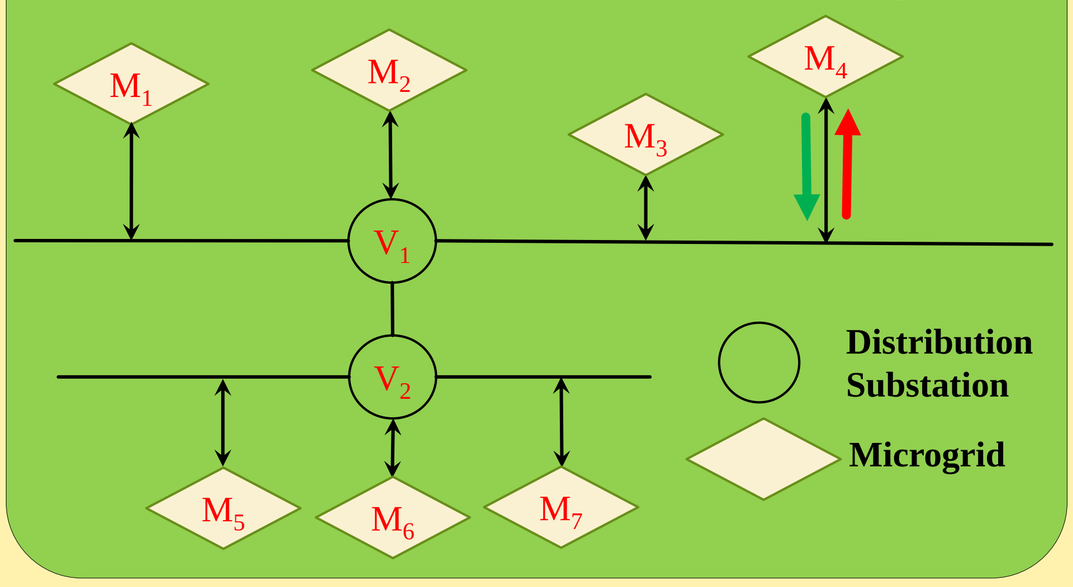
- Global and Local Load Balancing
- Load Leveling
- Energy Sharing with Distributed Power Supply
- Power Transmission Network Topology Design/Upgrade
- Zero Net Energy Community Discovery
- P2P Supply in Power Blackouts
- …

(Tacking the privacy concerns can *unlock the cooperation among microgrids* for better utility in above applications)

Commercial Microgrids



Residential Microgrids



Approach

Data Analytics & System Implementation

- Real Data Collection
- Collaborative Optimization
- Distributed Data Mining
- Data Integration
- Load Management Implementation

Privacy & Security

- Secure Communication Protocols for the Cooperative Models under SMC
- Privacy Notions for Data Sanitization in the Cooperation
- Formal Security/Privacy Proof

Privacy Preserving Energy Exchange

Microgrids privately share their local energy with min energy loss:

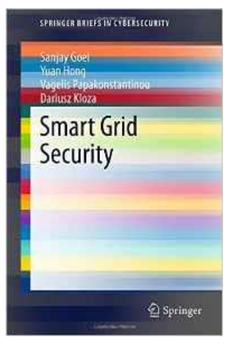
- Basic Microgrid Energy Exchange opTimization (MEET) Problem
- Relaxed MEET Problem
- Predictive MEET Problem

Yuan Hong, Sanjay Goel and Wen Ming Liu. An Efficient and Privacy Preserving Scheme for Energy Exchange among Smart Microgrids. *International Journal of Energy Research*, Vol. 40(3), pp. 313-331, 2016, Wiley.

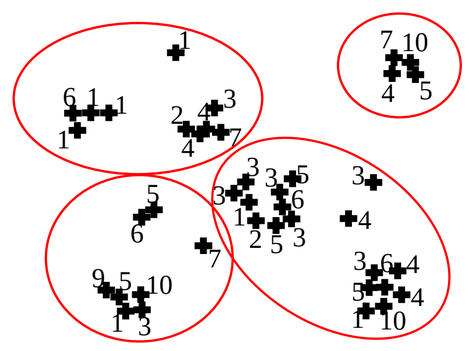
Smart Grid Security

A Springer book "Smart Grid Security" (which summarizes the most recent attacks and the state-of-the-art countermeasures in the Smart Grid Infrastructure) was published in 2015.

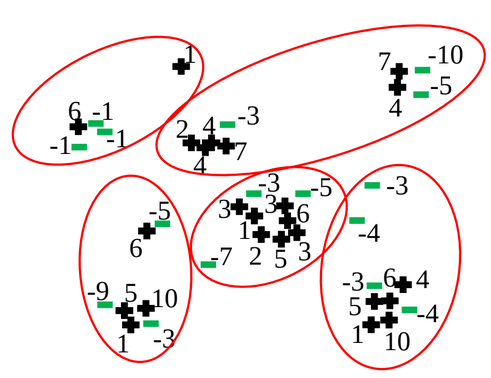
Sanjay Goel, Yuan Hong, Vagelis Papakonstantinou and Dariusz Kaloza, *Smart Grid Security*, Springer, London, ISBN 978-1-4471-6662-7, 2015.



Energy Community Discovery



Homogenous Energy Community



Mixed Energy Community

HEC: all the microgrids' net energy is exclusively positive or negative.

MEC: all the microgrids' net energy can be positive or negative.

Yuan Hong, Sanjay Goel, Haibing Lu and Shengbin Wang. Discovering Energy Communities for Microgrids on the Power Grid, *IEEE Transactions on Big Data*. (In Revisions for the Second Round Review).

Interested in meeting the PIs? Attach post-it note below!

National Science Foundation
WHERE DISCOVERIES BEGIN

NSF Secure and Trustworthy Cyberspace Principal Investigators' Meeting (SaTC PI Meeting '17), Jan. 9-11, 2017, Arlington, VA