# **Energy Policy and Systems Modeling**

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Microgrid Institute, http://www.microgridinstitute.org/about-microgrids.html

#### **Proposed Cleveland Microgrid Annual Generation by Source**





Kristian Jokinen and Bryan Lee. "SARTA Microgrid Feasibility Study" 2020.

https://www.midwesthydrogen.org/site/assets/files/1413/sarta\_microgrid\_feasibility\_study\_final\_report-3.pdf

### **Digital Twin Development**

- Digital twins are virtual representations of physical microgrids and distributed energy systems
- More dynamic, adaptive, and interactive
  - $\odot$  Design of interconnected microgrids (Integrated Community Energy Systems)
- Physics-based models
- Potential to incorporate real-time energy data
- Allows for controller testing
- Opportunity for integration of economic data



#### **Opportunities for Student Projects**

- Development of a digital twin for
  - $\odot$  CSU campus microgrid
  - $\odot$  SARTA microgrid



## **Thank You!**

**Questions?** 





#### **Generation Resources Considered**

- CHP Power
  - o Baseload generated regardless of CHP steam demand
  - $\circ \ \ \, \text{Intermediate} \text{variably generated depending on CHP steam demand}$
- Grid Power
  - $\circ$  Contracted Traditional purchased power on the PJM grid using long term contracts
  - Contracted Renewable purchased renewable power on the PJM grid using long term contracts including Power Purchase Agreements (PPAs)
  - $\,\circ\,$  LMP spot power purchased at Location Marginal Pricing (LMP) on the PJM grid
- Solar from solar PV installations within the microgrid
- Terrestrial Wind from small turbine installations within the microgrid
- Customer Generators power provided from diesel generators in place at microgrid customer locations for which the microgrid operator pays the customer for capacity, usage, and the ability to dispatch during extremely high LMP pricing events or emergencies
- Customer Demand Reduction capacity provided by the microgrid operator either automatically or through a manual process reducing the load at a customer site based on LMP pricing or during emergencies



hmed, Ali H.; Thomas, Andrew R.; and Henning, Mark, "Techno-Economic Feasibility Analysis of a Microgrid in Downtown Cleveland, Ohio" 018). All Maxine Goodman Levin School of Urban Affairs Publications. 0 1 2 3 1559. https://engagedscholarship.csuohio.edu/urban\_facpub/: