Undergraduate Students: Mohamad Khazem, Andrew Shutt, Ariel Seminet, Mohamed Abdelrahman, Hanin Alhassan, Dongyang Li, Victor Chen, Arya Givehchin, Othman Alshikhli, Rahim Siddiq
Graduate Students: Alex McDonald and Oscar Heredero de Pablos

AEC Advanced Energy Community

UCI Samueli School of Engineering

Background

Advanced Energy Communities (AECs) in California assist in accelerating deployment of renewable energy resources from 27% at present to 33% by 2020.

These communities achieve net zero energy with onsite renewables and storage to improve grid reliability and resiliency. AEC best practices can be replicated and scaled to improve upon existing infrastructure.

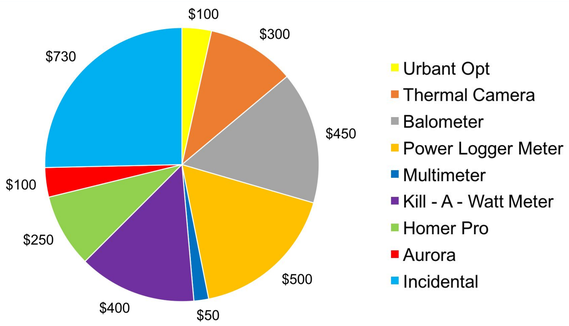
Goals & Objectives

The goal is to conduct a feasibility study of a solar powered microgrid within the low-income community of Oak View; a neighborhood in Huntington Beach, CA. This project will be scalable, and serves as a blueprint for future Advanced Energy Communities within CA. Our study will determine to what extent the community must be retrofitted in order to decrease its energy demand so that its needs may be supplied by the solar microgrid.

Requirements

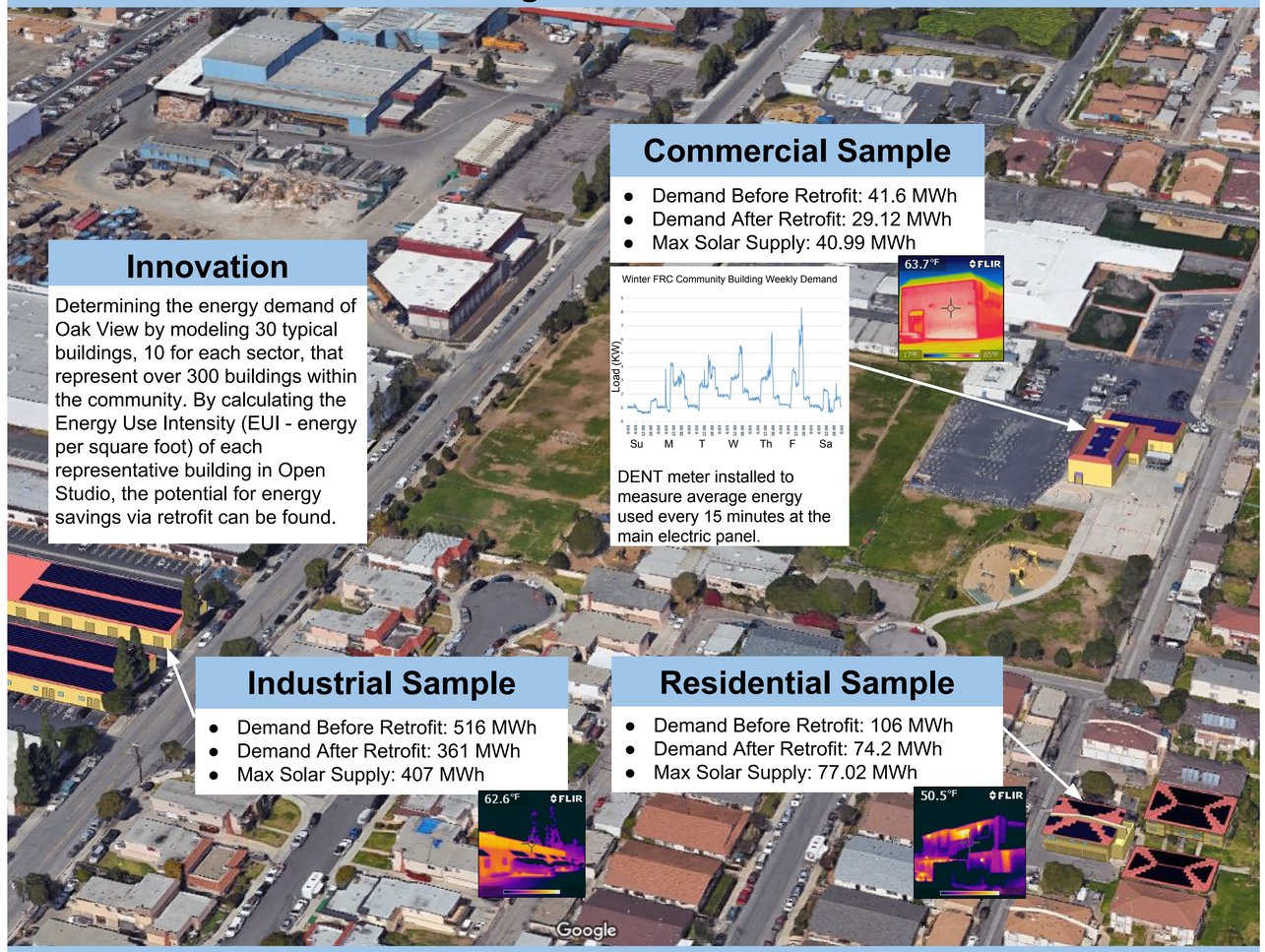
- Model the community with Open Studio and Energy Plus.
- Analyze the buildings with thermodynamic theories.
- Research retrofit techniques and best practices to inform building life cycle analysis.
- Develop a business model.
- Compare different scenarios:
  - Business as usual.
  - Minimize GHGs.
  - Optimize for cost.

Budget



Phase I: Two year feasibility study with $1.9M from CEC EPIC grant; senior design rolled into phase I with a complementary budget of $1,280 for incidentals.
Phase II: Construction of AEC with $8M CEC EPIC grant plus $8M cost share following completion of phase I.

Design and Innovation



Innovation

Determining the energy demand of Oak View by modeling 30 typical buildings, 10 for each sector, that represent over 300 buildings within the community. By calculating the Energy Use Intensity (EUI - energy per square foot) of each representative building in Open Studio, the potential for energy savings via retrofit can be found.

Commercial Sample

- Demand Before Retrofit: 41.6 MWh
- Demand After Retrofit: 29.12 MWh
- Max Solar Supply: 40.99 MWh

DENT meter installed to measure average energy used every 15 minutes at the main electric panel.

Industrial Sample

- Demand Before Retrofit: 516 MWh
- Demand After Retrofit: 361 MWh
- Max Solar Supply: 407 MWh

Residential Sample

- Demand Before Retrofit: 106 MWh
- Demand After Retrofit: 74.2 MWh
- Max Solar Supply: 77.02 MWh

Timeline

FALL — Past Work

- **Oct. 14th:** Rough geometry of model developed.
- **Oct. 21st:** Draft of energy improvements suggestions.
- **Oct 28th:** Commissioning of FRC Building completed.
- **Nov 11th:** Finish modeling suggestions, cost comparison, thermodynamic properties.

WINTER — Current Status

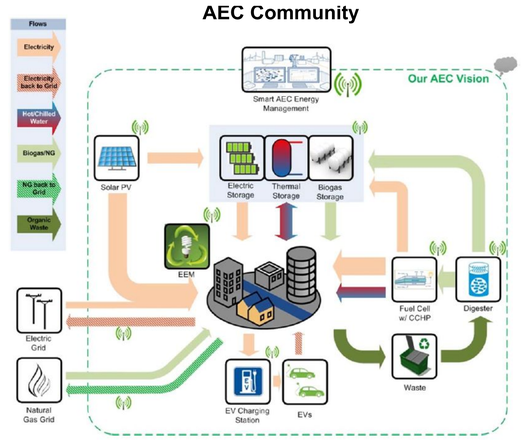
- **Jan 17th:** Software, Thermodynamics, and Economics analysis reviewed.
- **Jan 24th:** Finalize Community Building Model.
- **Feb 7th:** Geometry of 25-30 building types finished.
- **Feb 13th:** Finish data analysis and creating figures.

SPRING — Next Steps

- **March 29th:** Finish last minute modeling.
- **June 5th:** Produce community analysis in cooperation with AEC community energy demand.

The Bigger Picture

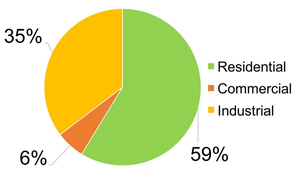
The proposed work will combine regulatory streamlining strategies with a real-world development example to produce an Advanced Energy Community (AEC), and a case study that describes the actions, challenges and lessons learned from the project. Within our AEC, more solar energy is generated by the community than needed. Waste is processed within the community when feasible, and turned into energy. Extra electricity and natural gas flow back into the grid.



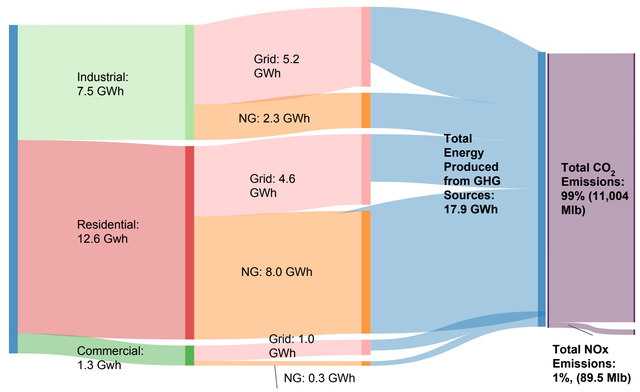
Estimate

Energy Consumption By Sector

- Estimated energy supply from solar panels: 15.7 GWh per year. This is achieved by installing solar panels on all NSEW sides of the roof.
- Estimated energy demand before retrofit: 21.4 GWh per year.
- Estimated energy demand after retrofit: 15.0 GWh per year.



Oak View Annual Emissions Flow Chart



Contact Information:
Mohamad Khazem - mkhazem@uci.edu