How to Build a MicroGrid in a Day

Craig Wooster

CEO Wooster Engineering
Project Manager
Stone Edge Farm Microgrid Project

Stone Edge Farm MicroGrid Project

SONOMA • CALIFORNIA

Stone Edge Farm Proprietors:

- **Mac & Leslie McQuown**
- After earning a mechanical engineering degree at Northwestern University, a Harvard M.B.A., and serving as an officer in the navy, Mac embarked on a career in banking and finance in New York. He joined Wells Fargo in San Francisco in 1964, where he and colleagues created the first stock index fund. He subsequently founded and built several entrepreneurial businesses.
- Mac began collecting wine in 1965. With his friend Dick Graff, the legendary winemaker, he co-founded the Chalone Wine Group in 1970, serving on its board for twenty-five years. In 1980 he co-founded Carmenet Winery and began an enduring friendship with Jeff Baker, now Stone Edge Farm's winemaker.
- Mac credits his wife, Leslie, with providing Stone Edge Farm's overarching aesthetic vision. Her eye for design informs the property's architecture and landscaping, with its outdoor rooms, inviting courtyards, and art pieces.

Winners of the 2017 GEELA Award for Sustainable Practices

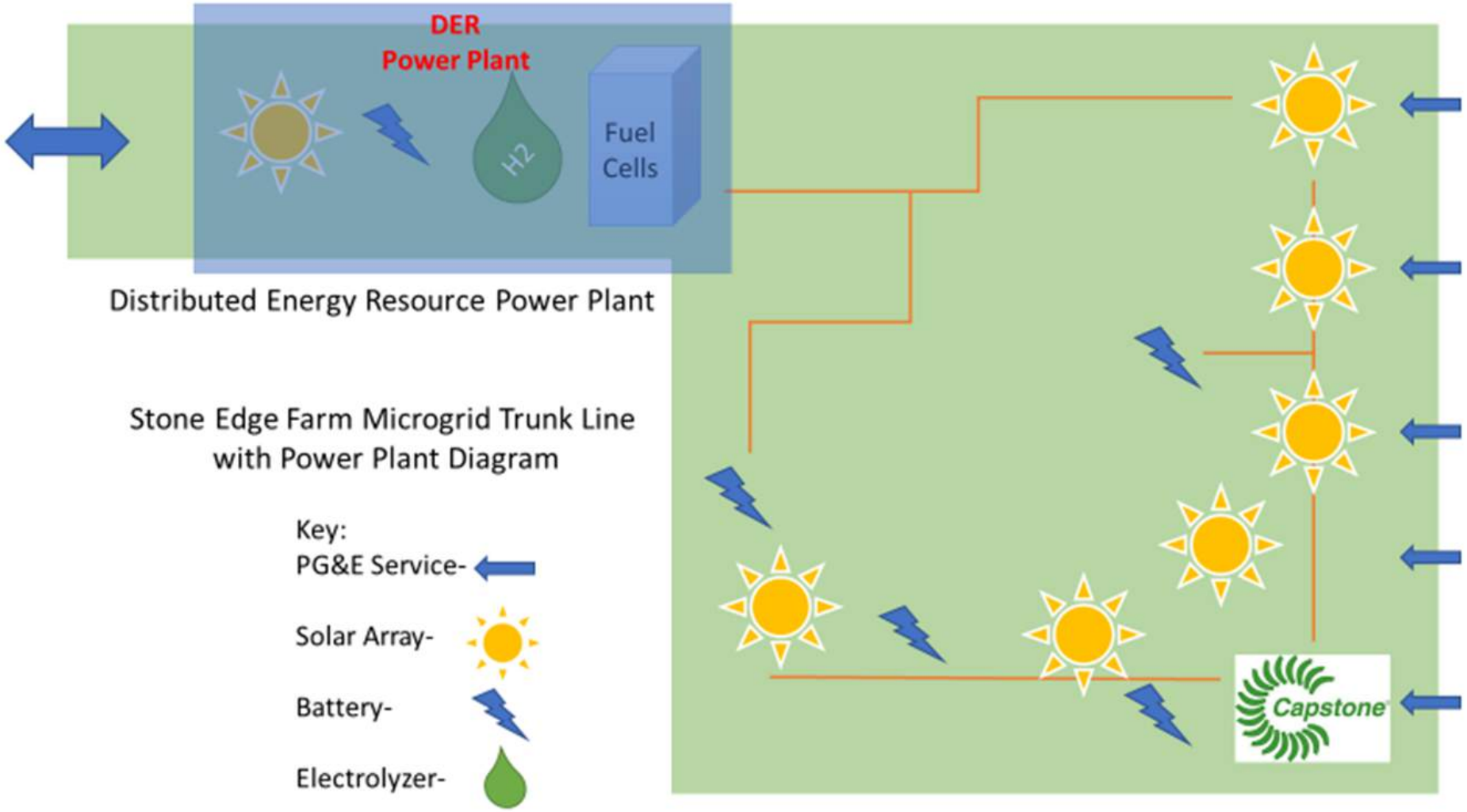
- The Governor's Environmental and Economic Leadership Award (GEELA) is California's highest environmental honor. The award honors individuals, organizations, and businesses that have demonstrated exceptional leadership and made notable, voluntary contributions in conserving California's precious resources, protecting and enhancing our environment, building public-private partnerships and strengthening the state's economy.

Project Overview:

The Stone Edge Farm sits on a campus of 16 acres including 16 buildings and 7 PG&E electrical service meter entries. There are three 480 volt, 3 phase and four 240 volts, split phase services. There are 58 electrical service panels in the system. We have now internally connected the 7 metered services together within the walls as an island able electrical grid.

STONE EDGE FARM
MICROGRID PROJECT

SONOMA • CALIFORNIA



Distributed Energy Resource Power Plant

Stone Edge Farm Microgrid Trunk Line
with Power Plant Diagram

Key:
PG&E Service-
Solar Array-
Battery-
Electrolyzer-

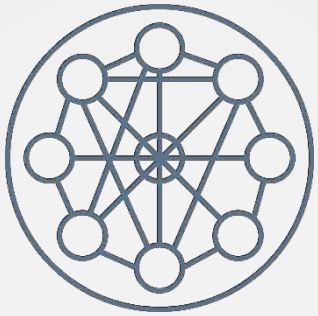
7 Solar Arrays- Enphase Energy M250 and S280 Microinverters
Capstone C65 Microturbine- Inverter Output
Tesla Industrial PowerPack- DynaPower Inverter
ESS Iron Flow Battery- Outback Grid Tie Battery Inverter
Aquion Energy Aqueous Battery Bank- Ideal Inverters
Simpli-Phi Batteries- Schneider Electric Inverter
Millennium Reign Triple Twin Hydrogen Electrolyzer
ReliOn Plug Power 2200X Hydrogen Fuel Cells- Outback Inverters

Jorge Elizondo PhD

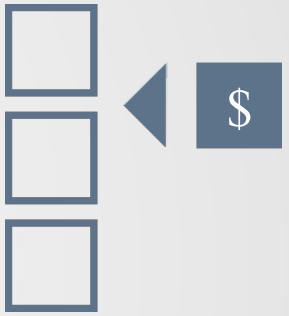
Microgrid Engineer
Heila Technologies

System integration is the primary barrier for Microgrid's adoption

Non-Standardized Ecosystem



Complex Systems

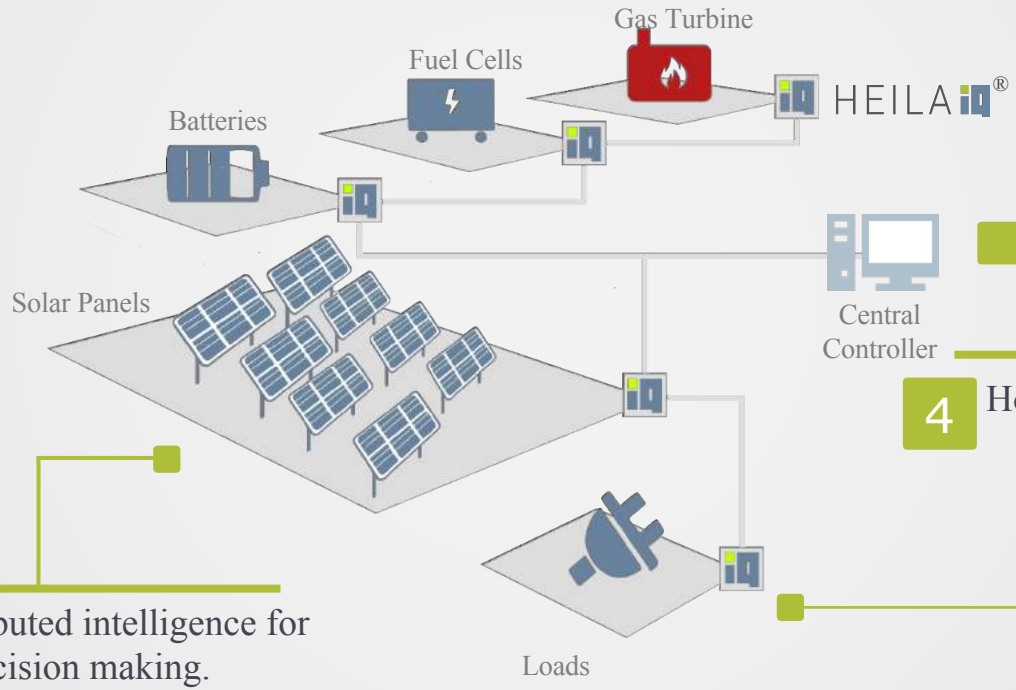


Rigid Structure

Customization increases deployment time and cost

Building-block approach for microgrid construction

1 Add/remove elements seamlessly by using a self-adaptable dispatch logic.



4 Homogenize the system for upper level controller.

2 Provide distributed intelligence for asset-level decision making.

3 Encapsulate the complexity behind replicable nodes used as building blocks.

HEILA iQ® a Building-block creator

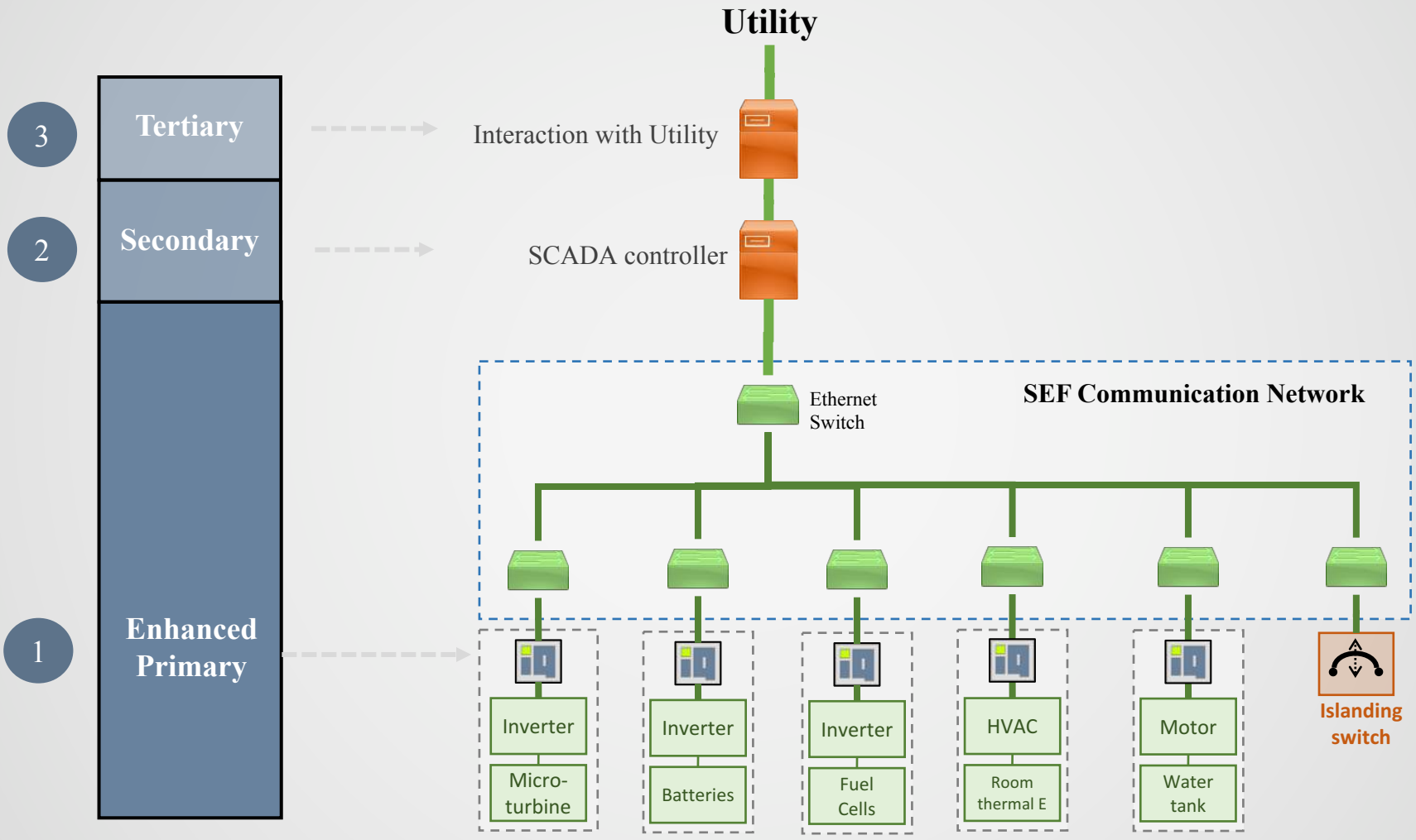
1. **Technology Agnostic**
   Compatible with most industry standard protocols and interfaces, and capable of interfacing with any vendor

2. **Open-Source**
   Allow users to safely build new functionalities on top of its existing code.

3. **Multi-energy**
   Encapsulate the microgrid complexity behind sophisticated and robust algorithms by exploiting ***analogies***

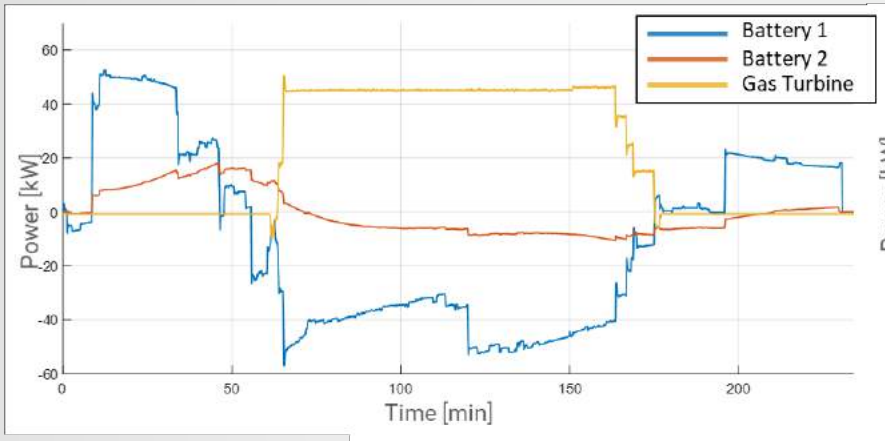
4. **“Selfish” operation**
   Each asset tries to maximize its own profits, inside a well-designed game-theoretical framework

SEF capabilities allowed by its Control Architecture

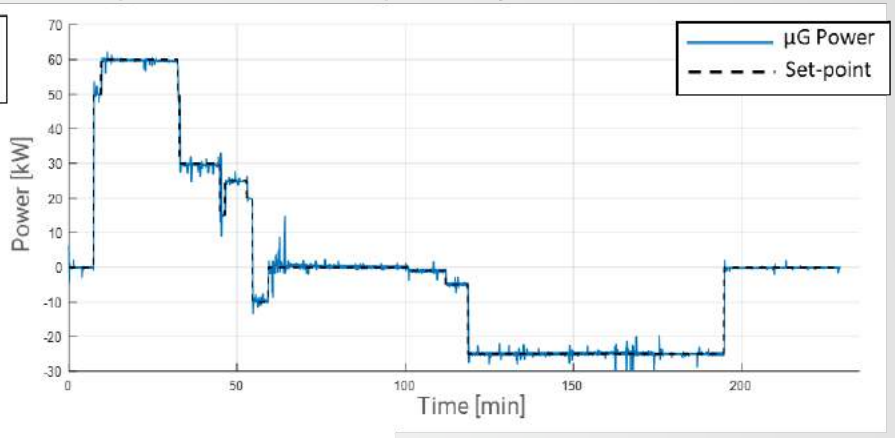


Use Case 1: Interaction with grid

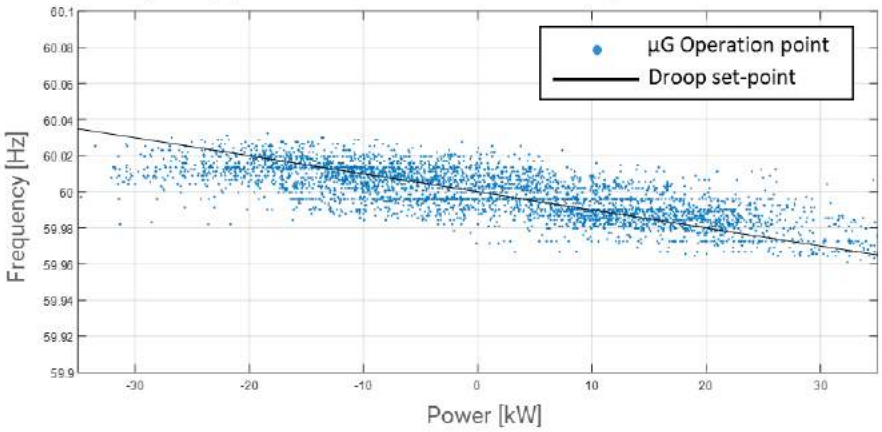
Game theory: assets make their own decisions



Microgrid react as a single entity.

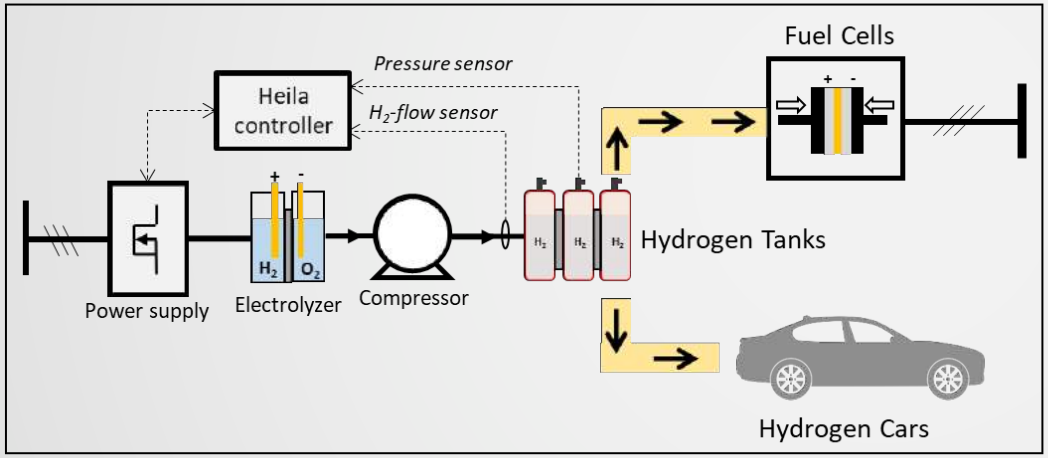


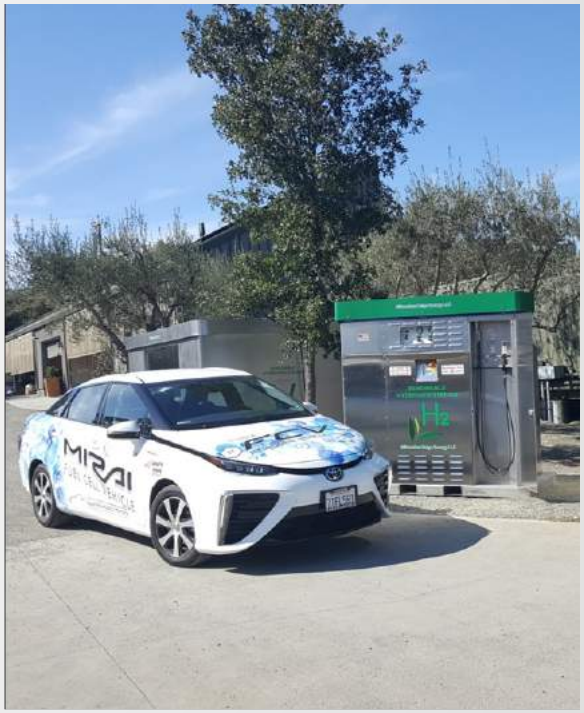
Frequency support with the entire microgrid



Use Case 2: Hydrogen Production

Simplified Hydrogen System

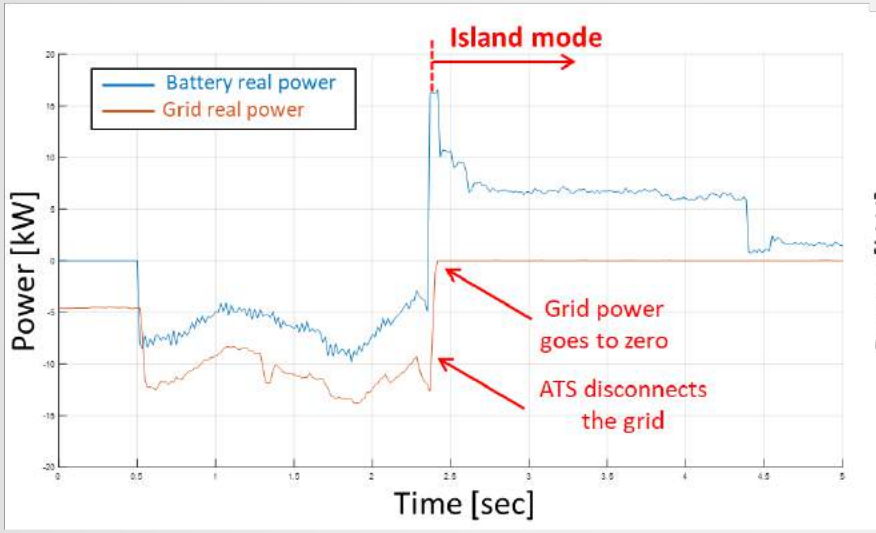


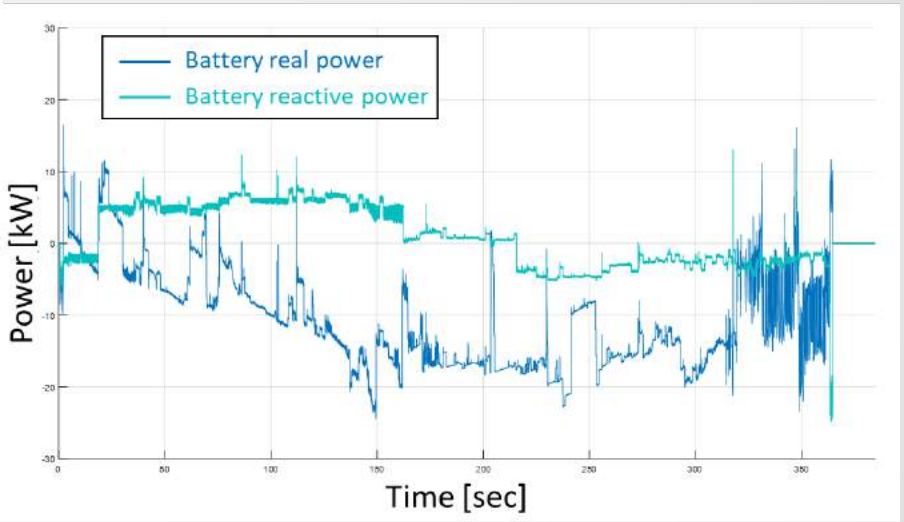


Car fueling with locally produced hydrogen

Use Case 3: Islanding

Example of an islanding process and subsequent operation





Use Case 3: Islanding

Sonoma County Fires | **2017**

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Microgrid Kept Power On Even as the California Wildfires Caused Outages

October 27, 2017 By Lisa Cohn | 1 Comment

104 | 622 | 70 | 796 SHARES

When the islanded microgrid at Stone Edge Farm near Sonoma, Calif., kept operating for 10 days in spite of the fires that caused outages nearby, the operators seized the opportunity to learn as much as possible from the surprises they encountered.

The first surprise, of course, were the fires that struck suddenly, stoked by high winds and dry conditions. While the fires didn't burn the farm's property, they came within about five miles.

"At 5 am I got a phone call from an employee who couldn't get into work because everything was burning," said Craig Wooster, general contractor for the microgrid project. "I reached for the light and there was no light at my place, which instantly told me we needed to get the microgrid into island mode."

California National Guard photo, Oct. 12, 2017.

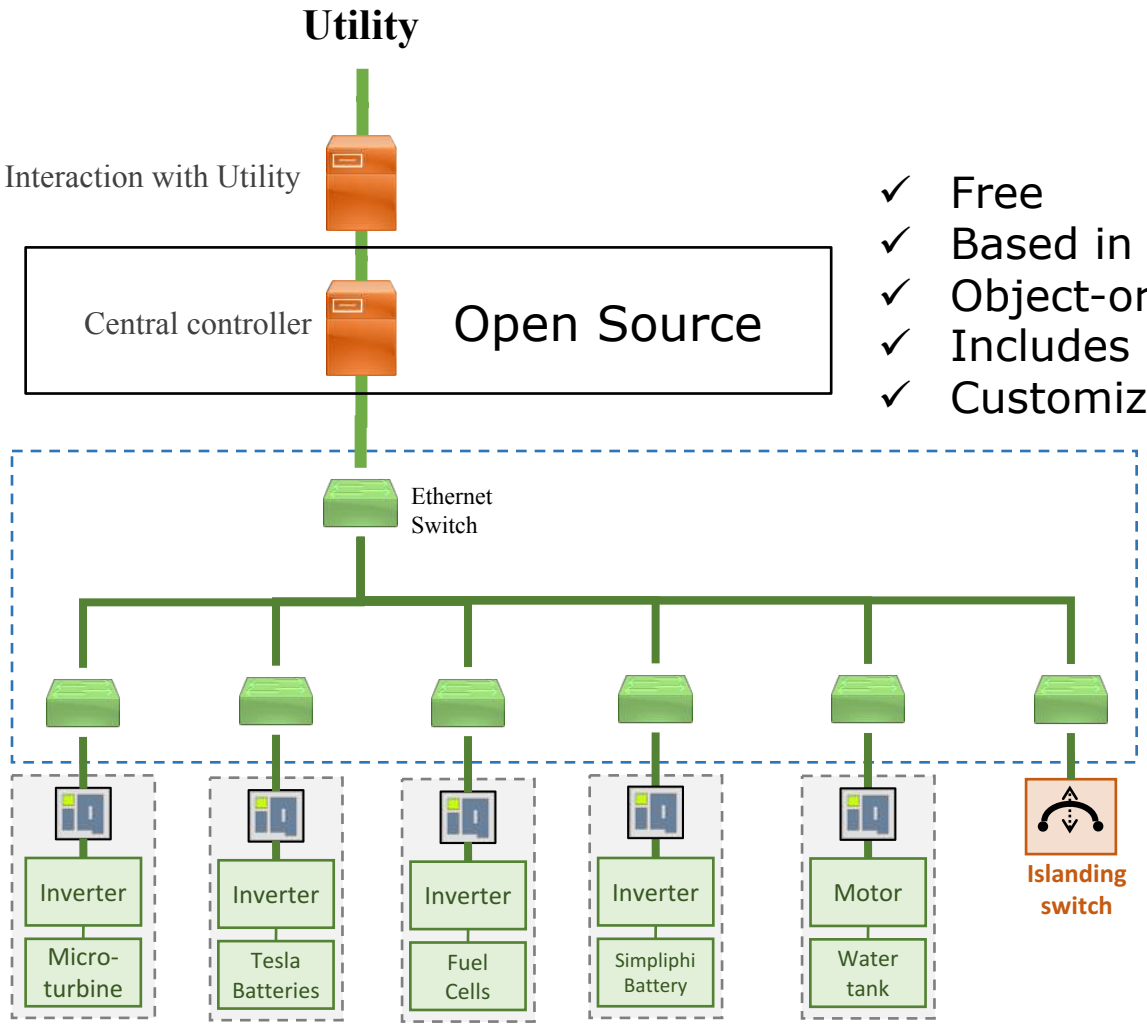
Thank You

Contact:

woosteraquatic@live.com

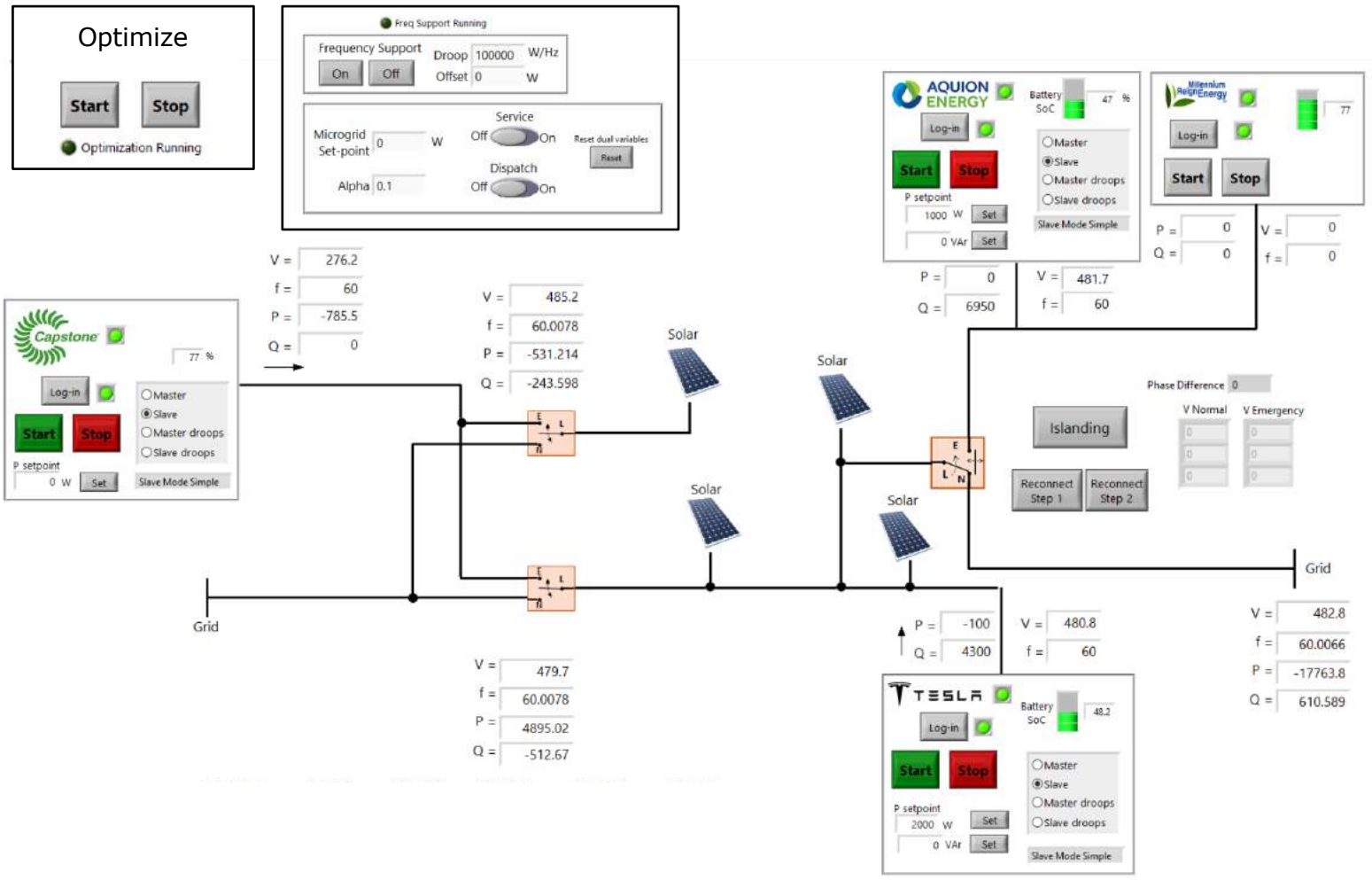
www.sefmicrogrid.com

Breeze - An Open-Source Central Controller



- ✓ Free
- ✓ Based in Labview
- ✓ Object-oriented approach
- ✓ Includes important functions
- ✓ Customizable by end user

Breeze - An Open-Source Central Controller



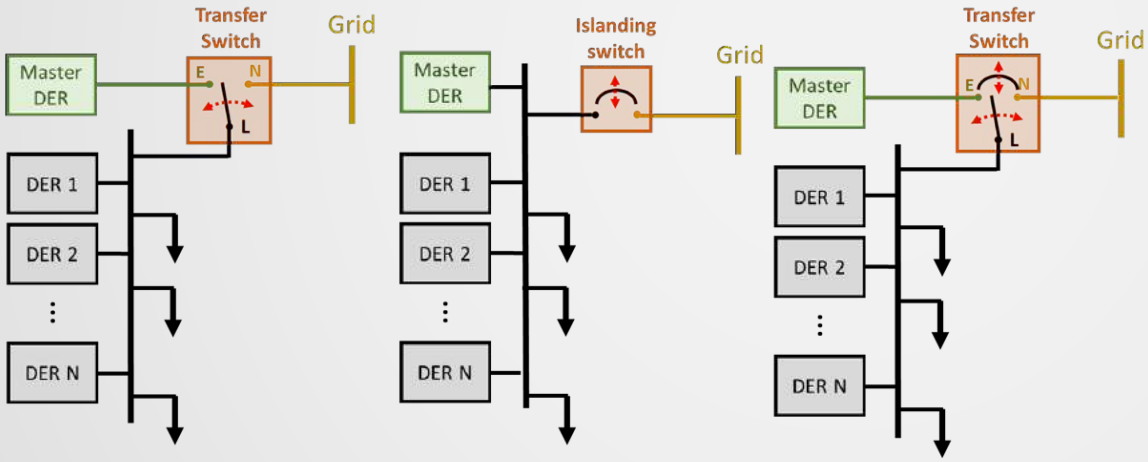
Islanding process detail

Islanding process

1. Grid lost
2. Switch disconnects mains
3. Pre-selected source to Master

Reconnection process

1. Grid back and stable
2. Synchronize
3. Close switch / Master to Slave



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