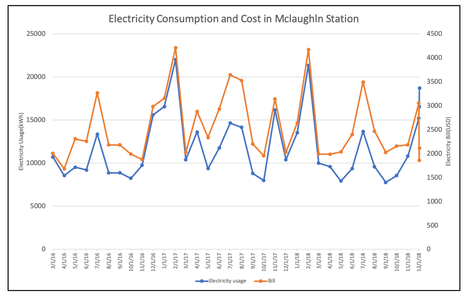
Determining the Solar Energy Potential for McLaughlin Natural Reserve

ABT 212 Spring 2019: Samanvith Pamireddy, Lexi Valenti, Tianyu Ying

Contact: *spamireddy@ucdavis.edu, avalenti@ucdavis.edu, tyying@ucdavis.edu*

Introduction

The Donald and Sylvia McLaughlin Natural Reserve protects 7,050 acres of habitats near Lower Lake, California and is predominately used by researchers conducting experiments on the rare flora and fauna found on The Reserve. There are two main buildings which use electricity, the field station and the warehouse. The Reserve's extremely high electricity bill for such little energy usage motivated the client to investigate ways to cut cost on their electricity. The client is interested in exploring the solar energy potential of The Reserve.



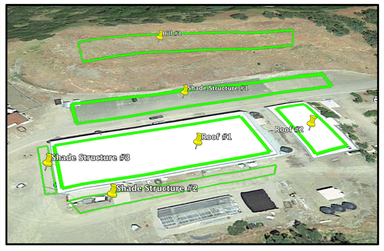
Objectives

1. Determine solar energy potential of the facility
2. Funding suggestions
3. Recommend systems based on analysis

Objective Functions

- Energy Potential: Maximized
- Carbon Neutrality: Maximized
- Cost: Minimized

McLaughlin Reserve Potential Photovoltaic Infrastructure Locations



Location	Area (ft²)
Hill #1	10,805
Shade Structure #1	15,645
Shade Structure #2	3,400
Shade Structure #3	880
Roof #1	19,200
Roof #2	4,230

Methods

Google Earth / ArcGIS — Spatial Analysis → PVSYST / HOMER PRO — Modeling → Cost analysis → **Total solar energy potential of the reserve, cost, and recommendations for optimal system**

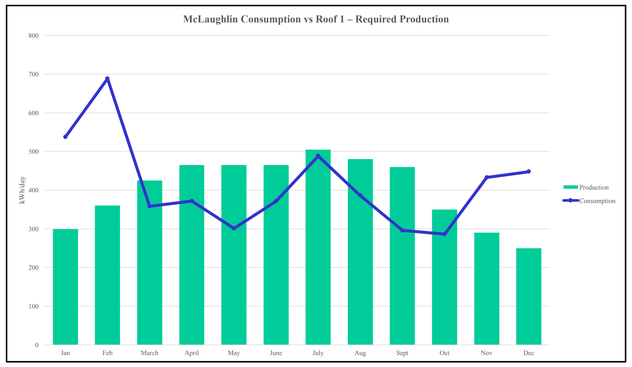
Acknowledgments

Special Thanks to : Kurt Kornbluth , Lisa Slaughter, Josh Morejohn, David Phillips, Devon Schmidt, and SunPower

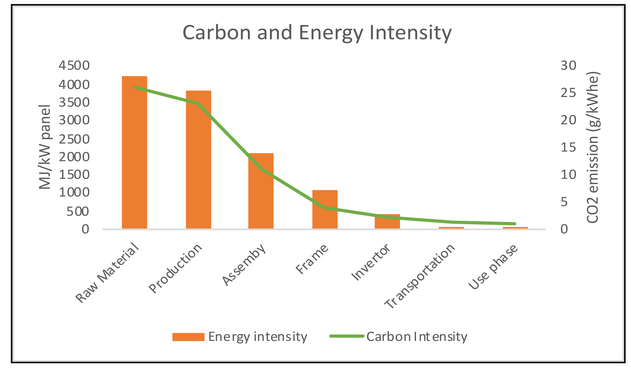
Results

Roof 1 – Best option for minimizing cost while maximizing energy production

		Area (sq.ft)	Panel Tilt, Azimuth (°)	Energy (kWh)	LCOE ($/kWh)	Investment ($)
Roof 1	Max	19,200	30,0	438,920	0.07	724,281.00
	Required	6,340		145,240	0.06	241,226.00
Hillside	Max	10,805	38, -60	221,224	0.06	377,148.00
	Required	6,340		145,00		281,422.00

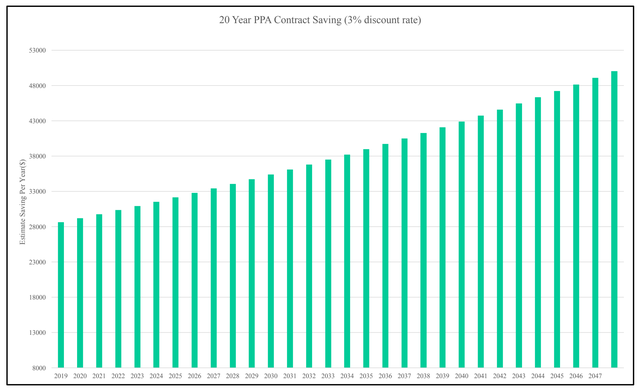


The Reserve will require a net-metering system to meet demand



Estimate Energy Intensity is 11,691.8 MJ/kW
The system emits 68.47 gram $CO2_e$ per kWh_e

Recommendations and Future Scope



- **PPA Lifetime Saving**
  - The current annual saving using PPA is $34,604.80, 30-year saving would be $1,151,730.75 (for Roof 1 energy demand met)

Future Scope

- Maximize or meet requirements?
- Structural integrity of roof?
- Load reduction from new HVAC system?
- Unexpected new loads?
- Further investigate PPA options