No More Blackouts!
A Solar & Storage Design for the University Retirement Community

Brianna Dooley[1], Julie He[2], Thomas Patten[1], Muhammad Ali Qamar[1]
[1]Energy Graduate Group, [2]Physics & Astronomy

The University Retirement Community is a 332,000 sq. ft. facility that houses senior residents in independent and assisted living quarters. There is also a Skilled Nursing Facility and Memory Care.

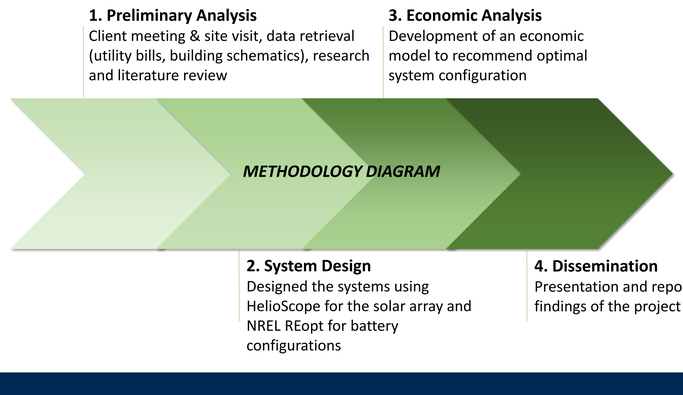
INTRODUCTION

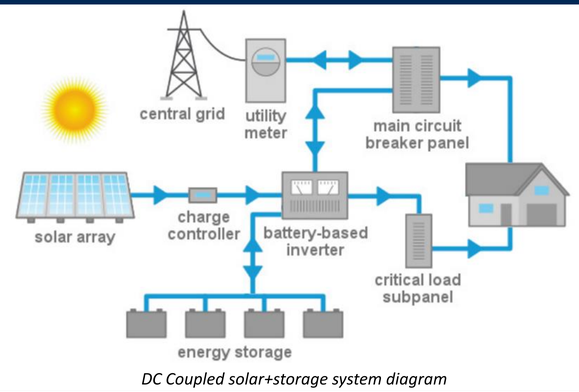
In summer of 2021, The University Retirement Community (URC) experienced a power outage for some hours. In response, the residents formed **URC Energy Sustainability and Resiliency Committee**. Currently, the URC does not have a reliable energy backup and storage system, leaving residents vulnerable to heat and other potentially fatal extreme weather adversities. ***The Committee tasked us to design a reasonably costed solar photovoltaic (PV) and battery storage system that will allow critical operations and functions to continue at the URC for at least several hours during an outage.***

SOLAR PV & BATTERY SYSTEM DESIGN

To design multiple configurations of solar photovoltaic and battery energy storage systems, the team devised an extensive methodology with specific objectives presented in the methodology diagram.

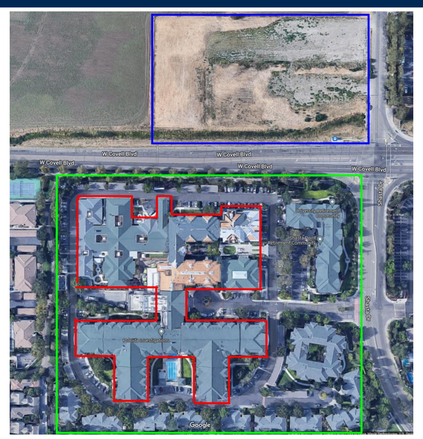
HelioScope REopt





DC Coupled solar+storage system diagram

OPTIMAL DESIGNS



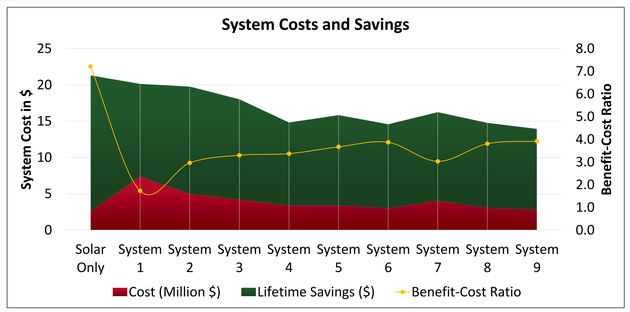
Aerial view of URC campus (green), URC main facility (red), and additional 4-acre parcel north of W Covell Blvd (Blue).

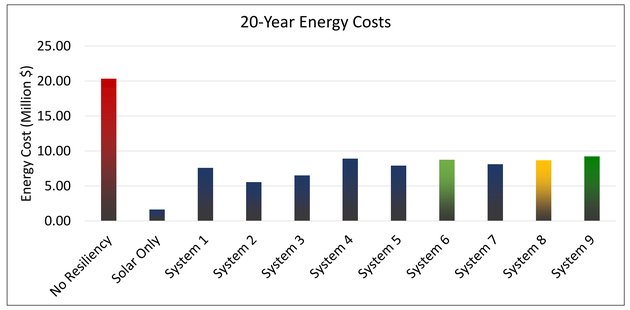
A HelioScope design of solar PV systems including rooftop, carport and groun-mount (SAT) subsystems. Total system szie: 1875 kWp.

1,906 hours of usable sunlight per year
Based on day-to-day analysis of weather patterns

104,970 sq feet available for solar panels
Based on 3D modeling of your roof and nearby trees

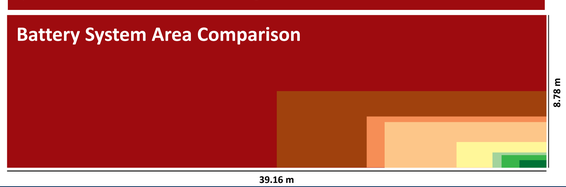
Description	AC (kW)	DC (kWp)	Specific Energy (kWh/kWp)	Annual Energy (kWh/yr)	Pct. Of Annual Energy Demand
Carports	337	391	1484	580	12%
Ground-mount (SAT)	890	1080	2046	2220	46%
Rooftop, S/E/W surfaces	336.8	404.1	1581	527.1	11%
	1564	1875		3327	69%





Payback Period for the Designed Systems

Design	Details	Battery kWh	Years
Solar Only	1875 kW Rooftop Solar		3.3
System 9	Solar + 30% Load Storage 4h	16456	5.2
System 6	Solar + Half Load Storage 4h	8228	5.3
System 8	Solar + 30% Load Storage 8h	5485	5.5
System 5	Solar + Full Load Storage 4h	**2743**	5.8
System 3	Solar + Full Load Storage 8h	2743	6.6
System 4	Solar + Half Load Storage 8h	1371	7.2
System 2	Solar + Half Load Storage 24h	4937	7.5
System 7	Solar + 30% Load Storage 24h	1646	8.1
System 1	Solar + Full Load Storage 24h	823	13.8



RECOMMENDATION

We recommend **1875 kWp sized solar system**. Techno-economic analysis recommends **systems 9, 6, and 8** (in this order) due to their best benefit-cost ratio, IRR and payback period at a practical cost.