Title

Fuel Cell Data Center: Renewably Powering the Internet

Permalink

https://escholarship.org/uc/item/1sr9w2jn

Authors

Cheng, Aaron
Cobos, Gabrielle
Crowley, Michael
et al.

Publication Date

2016-04-01

Peer reviewed

Fuel Cell Data Center: Renewably Powering the Internet

Team Members: Aaron Cheng, Gabrielle Cobos, Michael Crowley, Robert Miller, Allen Schellerup, John Stansberry

Advisor: Dr. Jacob Brouwer

SAMUELI
SCHOOL OF ENGINEERING
UNIVERSITY of CALIFORNIA · IRVINE

Background

The ever expanding modern internet is stored on huge banks of hard drives called data centers. With the massive growth of data storage needs, a modern engineering challenge is to reduce the carbon footprint of data centers by powering them greenly.
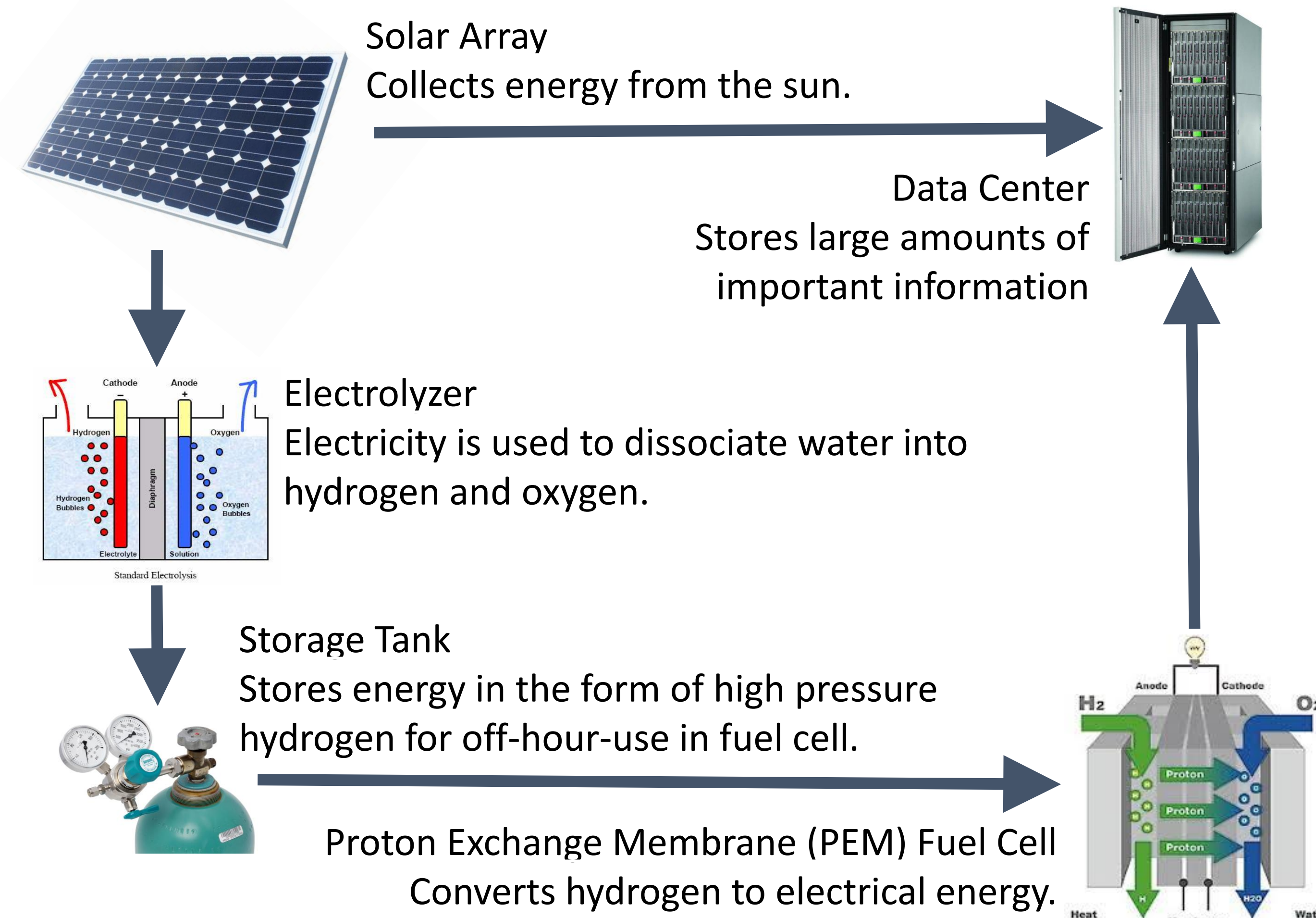
Goal

Create a renewable energy model capable of continuously powering a data center using experimentally derived data.
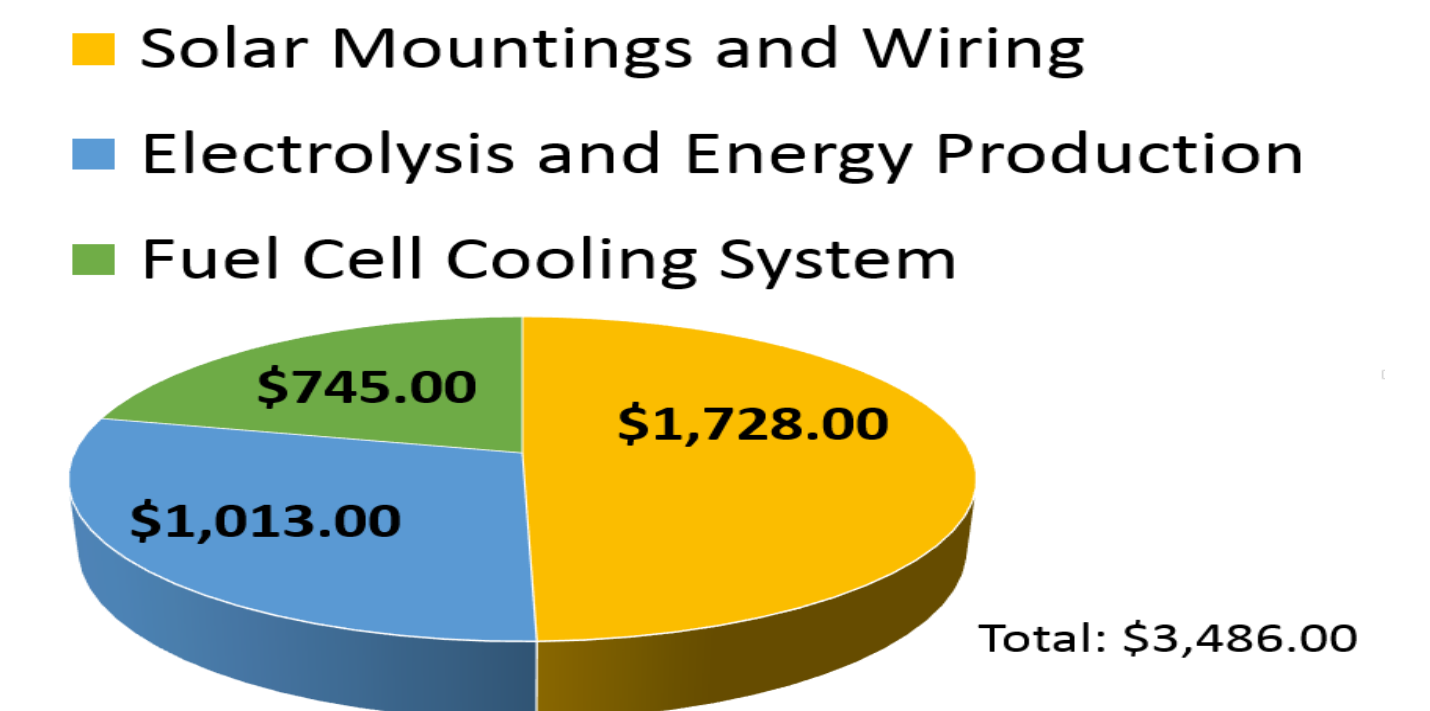
Objectives

1. Repair key system components and design system interconnects for system integration studies
2. Gather experimental data for model validation from each individual system component
3. Generate a computer model to power a 100 MW data center completely on renewable energy
4. Assess this model and explore real world viability using experimental data and system integration studies

Timeline

Project/Mo.	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Modeling	Solar		Fuel Cell		Electrolyzer		Hydrogen Storage		Data Center
Solar	Design Test Bed			Build Test System		Testing			Analyze
Fuel Cell	Design Cooling System			Build Cooling System	System Validation		Testing		Analyze
Electrolyzer	Testing								Analyze
Write-Up	Literature Review						Writing		

Solar Array
Collects energy from the sun.

Data Center
Stores large amounts of important information

Electrolyzer
Electricity is used to dissociate water into hydrogen and oxygen.

Standard Electrolysis

Storage Tank
Stores energy in the form of high pressure hydrogen for off-hour-use in fuel cell.

Proton Exchange Membrane (PEM) Fuel Cell
Converts hydrogen to electrical energy.

Renewable Energy Penetration

Energy Profiles vs Time

- PV (kWh)
- Fuel Cell Output (kWh)
- Grid (kWh)
- Data Center Load (kWh)

Providing Consistent Power with Variations in Solar Energy Availability

Percent of Renewable Energy (%) vs PV Size

- 0 kWh Battery
- 20 kWh Battery
- 40 kWh Battery
- 60 kWh Battery
- 80 kWh Battery
- 100 kWh Battery

Photovoltaic Solar Panels and Battery Energy Storage

Budget

- Solar Mountings and Wiring
- Electrolysis and Energy Production
- Fuel Cell Cooling System

$745.00
$1,013.00
$1,728.00

Total: $3,486.00

Innovation

Fulfill constant power demands with non-constant renewable energy sources in conjunction with energy storage.

Current Status

1. Install cooling system for PEM Fuel Cell
2. Constructing photovoltaic test bed
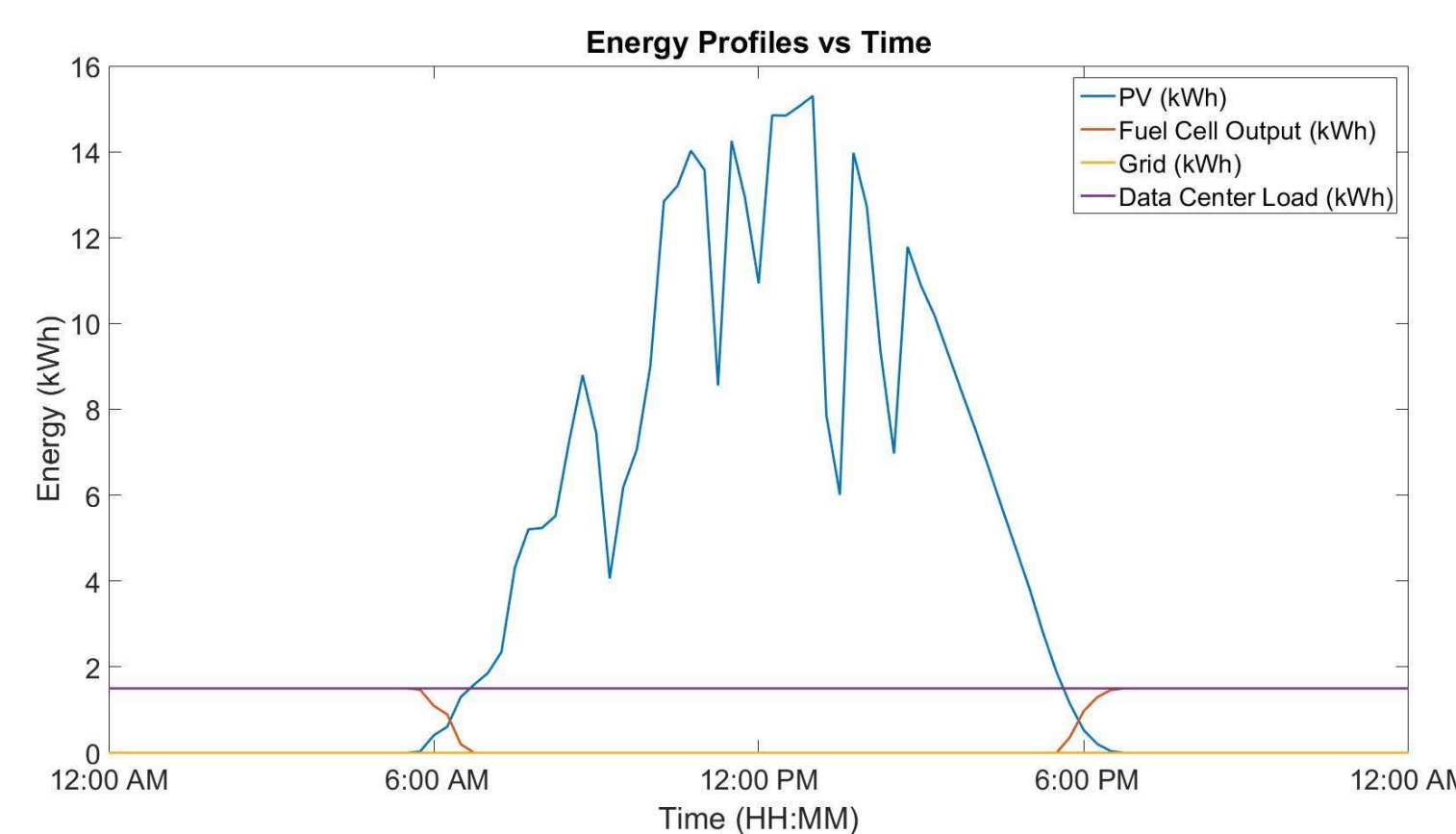**3.** Running various parameters on model

Next Step

1. Achieve start-up and steady state operation on PEM Fuel Cell
2. Gather load demand profile from data center
3. Determine necessary system integration components and controls scheme

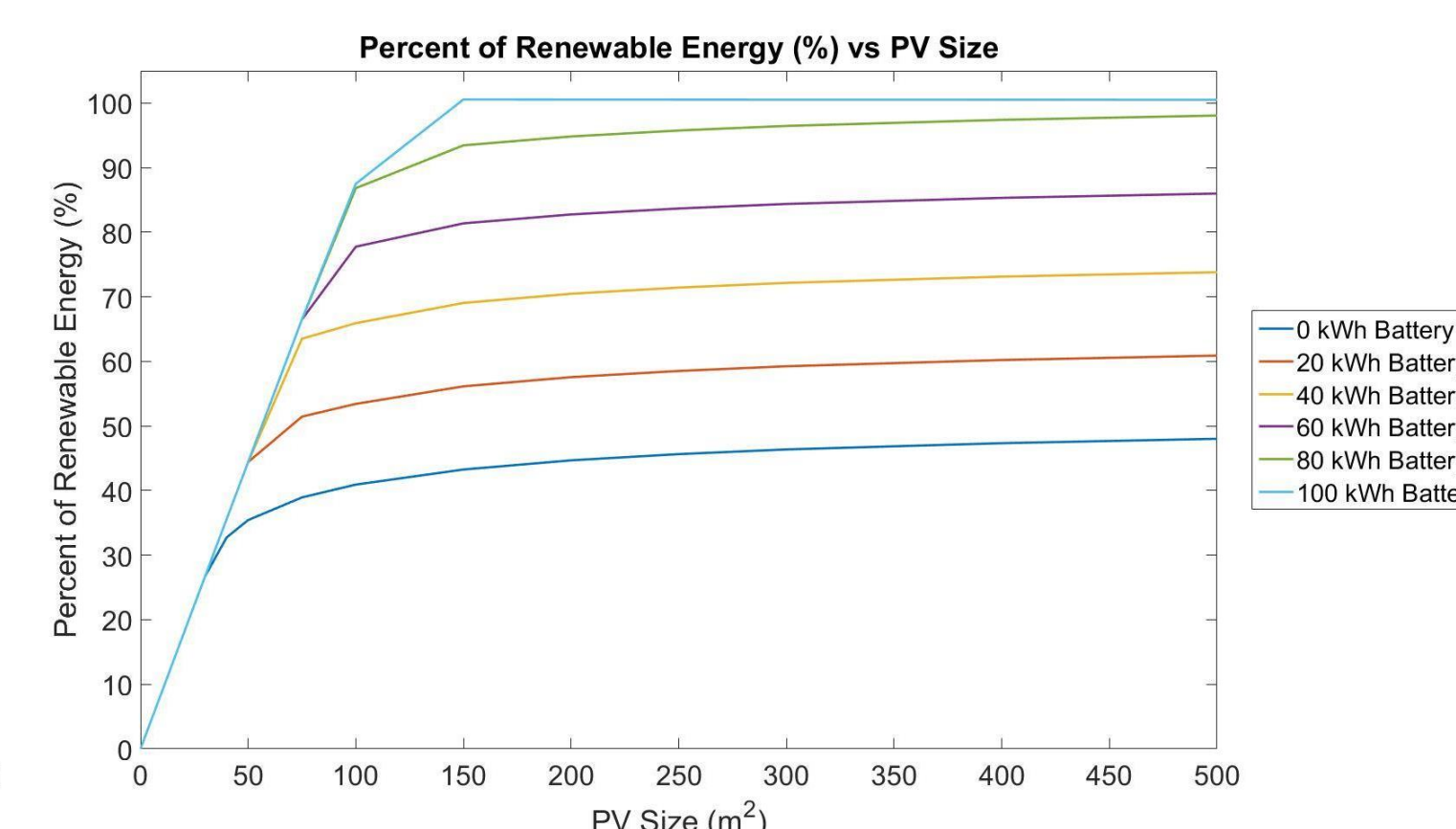For additional information contact team lead:
Gabrielle Cobos gcobos@uci.edu

Or scan our QR code: