Resilient Campus Planning

ENERGY TRUST NEW BUILDINGS TRAINING

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GREEN HAMMER DESIGN BUILD
greenhammer.com

PAE
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ROSEVILLA
rosevilla.org

Agenda

ENERGY TRUST OF OREGON TRAINING | ROSE VILLA

Introduction
Rose Villa Campus

STEP
01

Set Goals
Resilience Action Plans

STEP
02

Analyze Strategies
Example: Microgrid Study

STEP
03

Implement Projects
Example: ROSE Port

STEP
04

Measure + Share Success
Example: Report Outs

Discussion
Questions and Answers

Rose Villa Campus

MAP LEGEND

- PHASE 0
- PHASE 1
- PHASE 2
- PHASE 3
- BUILDING
- CARPORT
- ROSE HAVENS

CAMPUS VALUES AND COMMUNITY

ZERO ENERGY DEVELOPMENTS

THE OAKS COMMUNITY
12 ZERO ENERGY HOMES


TRILLIUM TOWNHOMES
6 ZERO ENERGY HOMES

STEP 1

Setting Goals

Resilience Action Plans

Resilience Action Plans

1. The RAP is a long-range plan that requires **long-range vision** and community buy-in.

2. The goals and strategies are both **aspirational and achievable.**

3. The solutions result in **measurable** advancements and **operational savings.**

4. The RAP is **coordinated** with capital and master planning; it’s a **lens** not a separate project.

Define Resiliency & Clarify Priorities

ROSE VILLA'S DEFINITION

A resilient campus can maintain:

— **Stability** of its operations

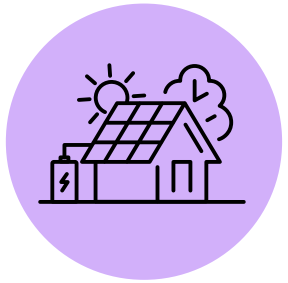
— **Safety** of its community

LEGEND

Set Measurable Goals

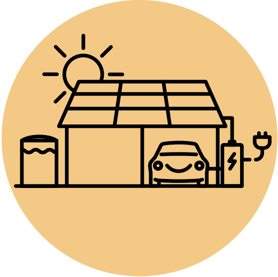
	PHASE 1 SET Goals & Strategies **END OF 2023**	PHASE 2 ANALYZE Scope & Cost **END OF 2023**	PHASE 3 ACHIEVE Goals & Capital Plan **END OF 2025**	PHASE 4 ACHIEVE Goals & Assess Progress **END OF 2030**	PHASE 5 ACHIEVE Goals & Set New Ones **END OF 2040**
ENERGY RESILIENCE	**PHASE 1 REPORT** Establish RAP Goals and Strategies	**PHASE 2 REPORT** Strategy Analysis, Cost, and Work Plans	**REDUCE** Energy Use Marginally **BACKUP** Energy for 3-5 Days	**REDUCE** Energy Use by 20% **BACKUP** Energy for 1-2 Weeks	**REDUCE** Energy Use by 50% **BACKUP** Energy for 2-3 Weeks
WATER RESILIENCE	**PHASE 1 REPORT** Establish RAP Goals and Strategies	**PHASE 2 REPORT** Strategy Analysis, Cost, and Work Plans	**REDUCE** Water Use Marginally **BACKUP** Water & Sanitation 2 Wks	**REDUCE** Water Use by 13% **BACKUP** Water & Sanitation 4 Wks	**REDUCE** Water Use by 25% **BACKUP** Water & Sanitation 4+ Wks
STRUCTURAL RESILIENCE	**PHASE 1 REPORT** Establish RAP Goals and Strategies	**PHASE 2 REPORT** Strategy Analysis, Cost, and Work Plans	**REINFORCE** Furniture and Equipment	**REINFORCE** Pre-1975 Homes	**BUILD** ROSE Amphitheater

Identify Strategies

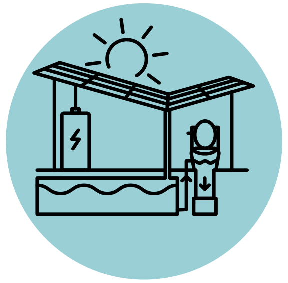


151 ROSE Homes
Retrofit old cottages into resilient homes

4 ROSE Havens
Retrofit of commons for emergency shelter



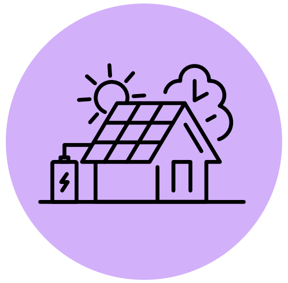
12 ROSE Ports
Retrofit carports into neighborhood hub



1 ROSE Amphitheater
New Regenerative venue and emergency shelter

ROSE = Resilient **O**perations + **S**ustainable **E**nergy

ROSE Strategies achieve RAP Goals



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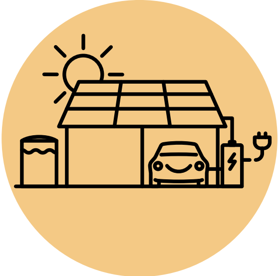

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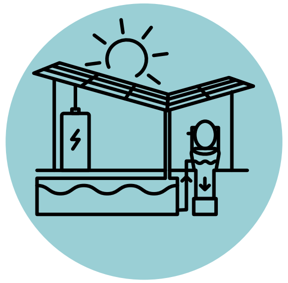
Retrofit carports into neighborhood hub



1 ROSE Amphitheater
New Regenerative venue and emergency shelter

Energy Goal

50% reduction in campus energy use
2-3 wks microgrid emergency power supply

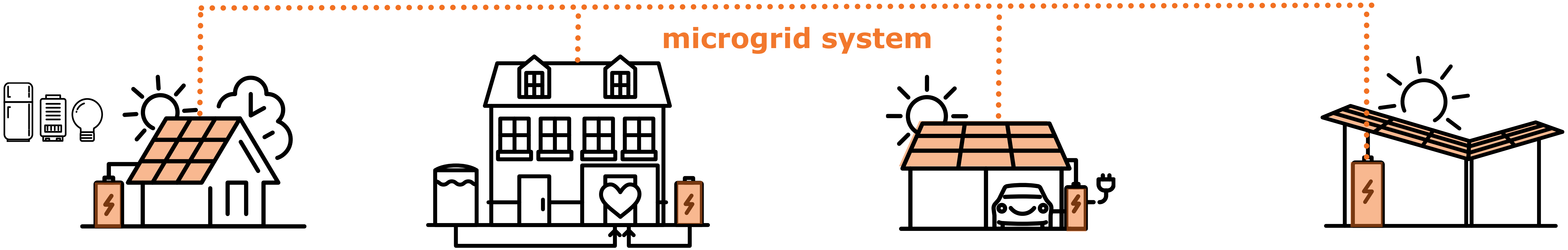
Water Goals

25% reduction in campus water use
4 wks emergency water supply and sanitation

Seismic Goals

Structurally reinforcing older buildings for safety
Building amphitheater for immediate occupancy

Key Strategies for Energy Resilience



151 ROSE Homes

- Increase insulation, air tightness
- Replace windows, fixtures, equip.
- Add solar and battery systems

4 ROSE Havens

- Optimize generator backups
- Transition to campus microgrid
- Upgrade for energy efficiency

12 ROSE Ports

- Add solar photovoltaic panels
- Add battery back up
- Add EV charging

1 ROSE Amphitheater

- Solar photovoltaic panels
- Battery backup
- EV charging

REDUCE ENERGY USE GOAL		ENERGY SUPPLY DURATION GOAL
~48* kBtu/sf/yr	PHASE 3	3-5 days more if sunny
save 20% ~38 kBtu/sf/yr	PHASE 4	1-2 weeks more if sunny
save 50% ~24 kBtu/sf/yr	PHASE 5	2-3 weeks more if sunny

*current energy usage

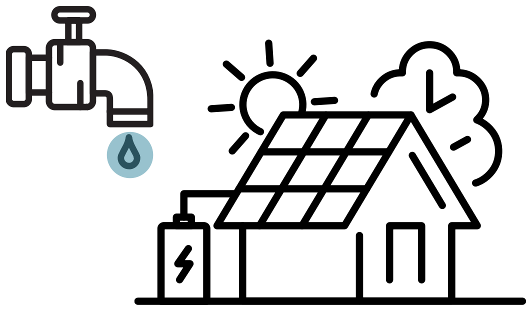
Energy Summary

1. **Focus first on least energy efficient buildings** as well as building/spaces that are to serve as emergency shelters.

2. **Reduce energy loads with passive efficiency** upgrades, then right-size mechanical systems that actively use energy.

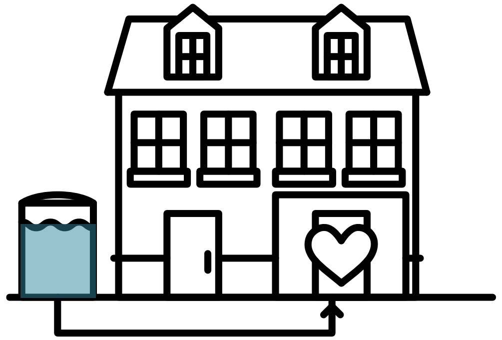
3. **Time Solar installs with roof replacements** and/or w/ funding opportunities for cost efficiency

Key Strategies for Water Resilience



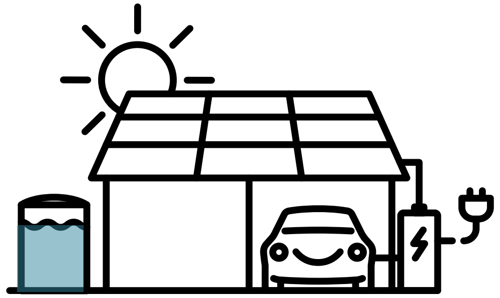
151 ROSE Homes

- Increase water efficiency w/
- Fixture & equipment replacement
- Store bottled water



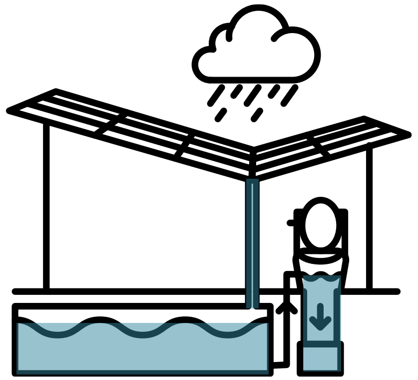
4 ROSE Havens

- Add rainwater catchment
- Add rainwater purification
- Store bottled water



12 ROSE Ports

- Add rainwater catchment
- Add rainwater purification
- Store bottled water



1 ROSE Amphitheater

- Rainwater Catchment
- Rainwater purification
- Composting toilets

REDUCE WATER USE GOAL		WATER SUPPLY + SANITATION GOAL
1,009,870* gal/month	PHASE 3	2 weeks
save 13% ~878,587 gal/month	PHASE 4	2 weeks or more if rainy; 2-4 weeks for sanitary
save 25% ~757,403 gal/month	PHASE 5	4 weeks or more if rainy

*current water usage

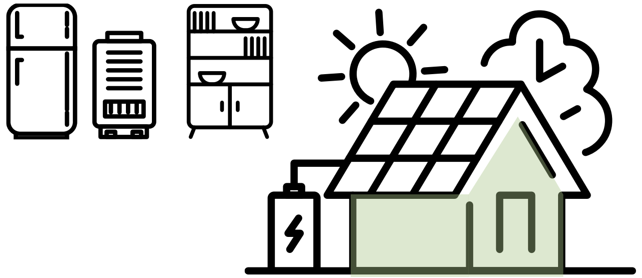
Water Resiliency Summary

1. **Invest in water resiliency upgrades** using cost savings from lower water bills.

2. **Purifying rainwater is the safest source** of renewable emergency potable water supply, compared to filtering greywater or river water.

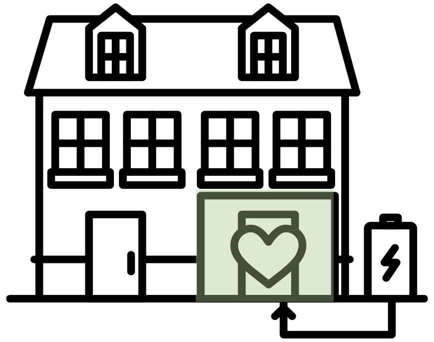
3. **Human waste management can be rudimentary** during an emergency. Living Machines require too much maintenance and space, and cost too much.

Key Strategies for Seismic Resilience



151 ROSE Homes

- Strap objects to walls
- Seismically reinforce structure
- Install earthquake gas shut offs



4 ROSE Havens

- Strap objects to walls
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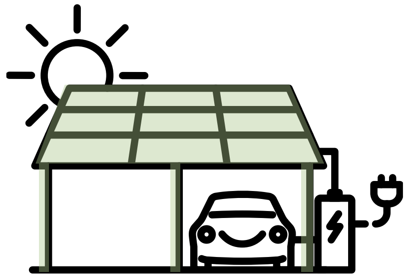
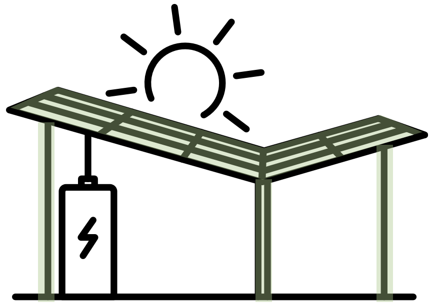


12 ROSE Ports

- Design for Immediate Occupancy
- Seismic Category 4 Standard



1 ROSE Amphitheater

- Design for Immediate Occupancy
- Seismic Category 4 Standard

PHASE 3 | PHASE 4 | PHASE 5

INCREASE SAFE EVACUATION		INCREASE QUAKE-SAFE PLACES
Cottages don't meet seismic code — **Secure Objects**	PHASE 3	No campus buildings meet code for "immediate occupancy"
Retrofit TBD% Pre-1975 Cottages	PHASE 4	Consider increasing cottage resiliency from Category II to IV
Retrofit Rest of Pre-1975 Cottages	PHASE 5	**Retrofit 1+ Haven to meet code for "immediate occupancy"**

Optimize Strategies!

1. **Synchronize strategies**
   to minimize costs and time
   during design and construction

2. **Scale strategies**
   appropriately so that solutions occur
   at building, neighborhood & campus.

3. **Phase strategies**
   to increase resiliency over time and
   align with other campus development

4. **Everyday benefits**
   to increase resiliency over time and
   align with other campus development

Emergency Response Plan

Improved Stockpiles

Revise ReadyForce Response Guide

Improve Sanitation.

Create Campus Response Maps

Supply Water and Sanitation

Host Annual "Refresh" Parties

ONGOING

Engage Your Community!

1. **Form a resident committee** that provides feedback, analysis and even some implementation of actions
2. **Educate staff and residents** regularly to keep them engaged, informed and supportive of the RAP
3. **Collaborate** with change makers and Garner buy-in from your jurisdiction

STEP 2

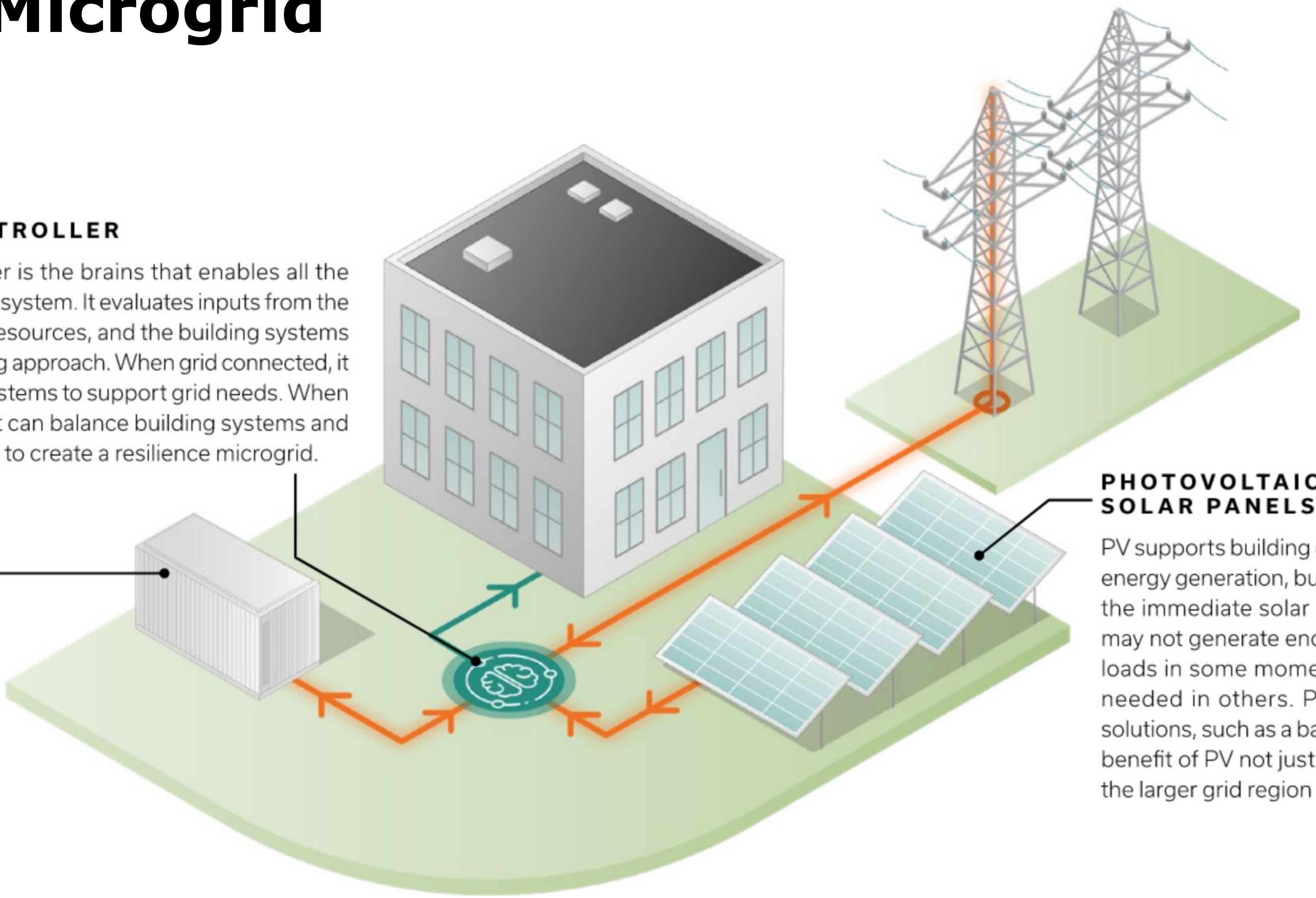
Analyze Strategies

Microgrids

What is a Microgrid

MICROGRID CONTROLLER

The microgrid controller is the brains that enables all the pieces to act as a unified system. It evaluates inputs from the grid, the onsite energy resources, and the building systems to determine its operating approach. When grid connected, it can leverage building systems to support grid needs. When islanded from the grid, it can balance building systems and onsite energy resources to create a resilience microgrid.



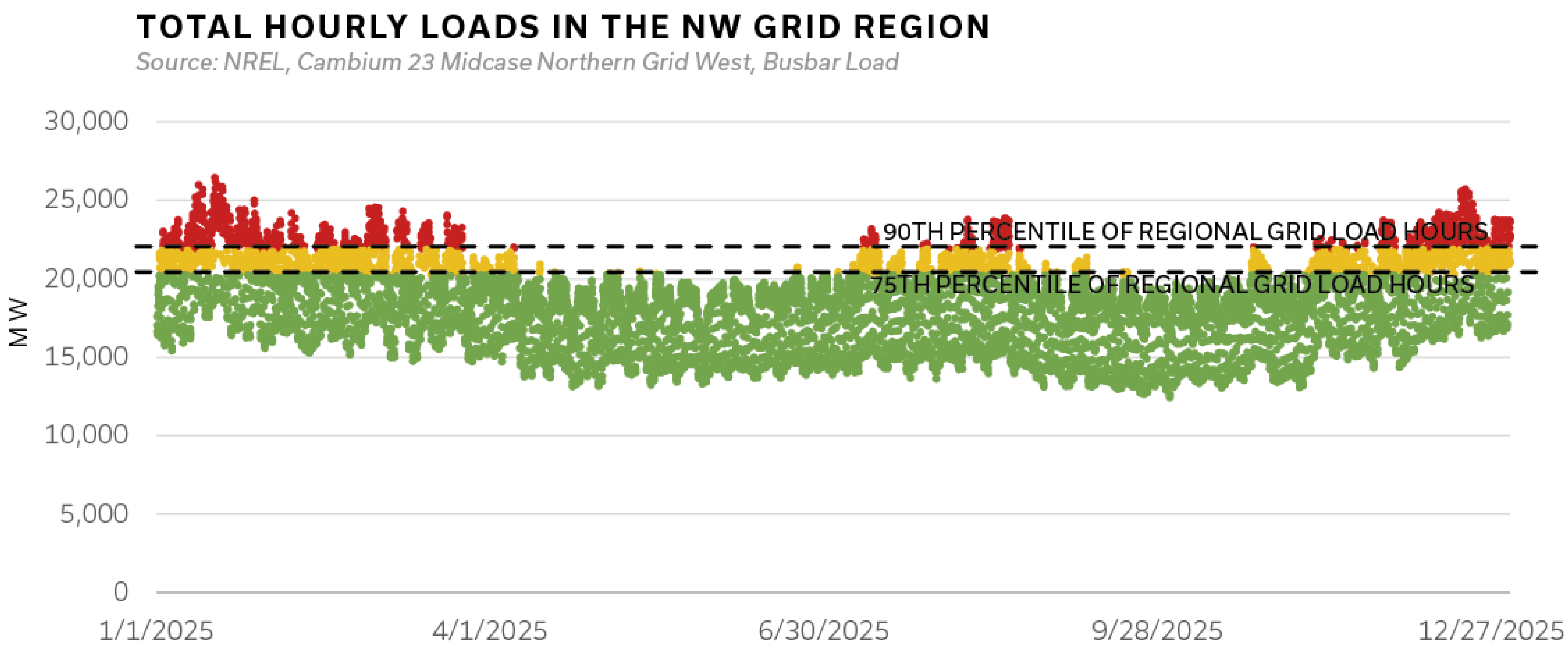
BATTERY ENERGY STORAGE

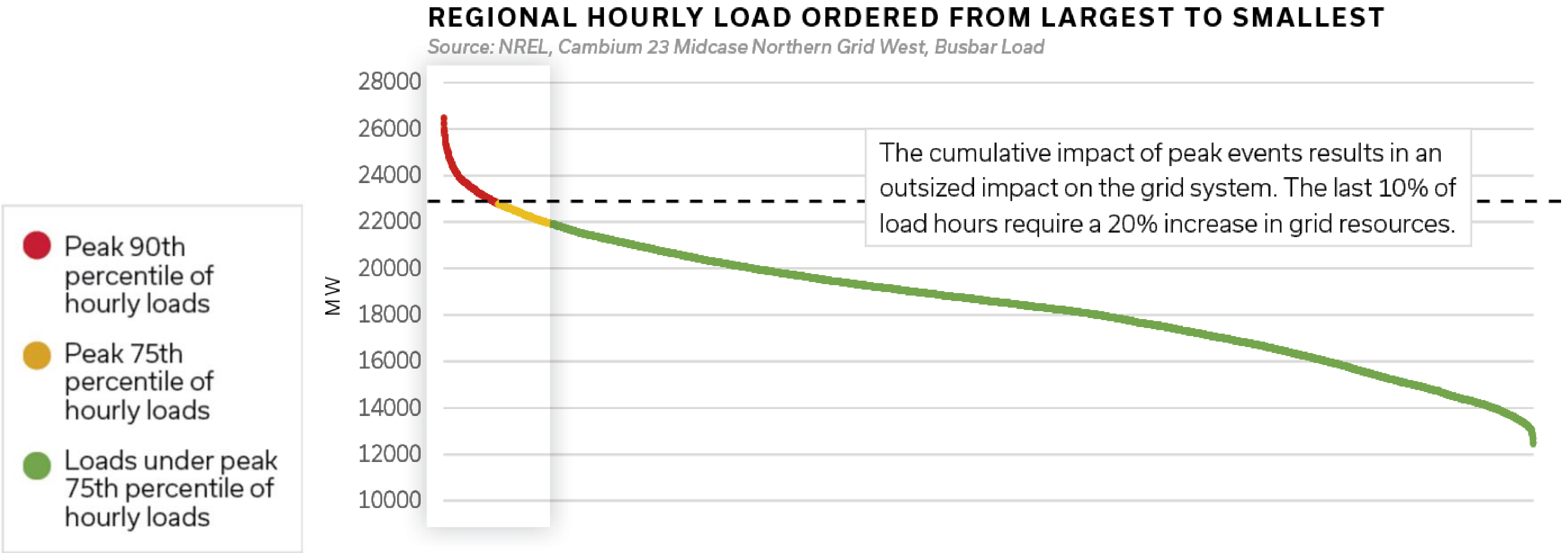
Energy storage, often in the form of batteries, are a key component of the microgrid. The specific charge and discharge operations will depend on the prioritization of the battery's use for energy resilience, operating cost reduction, or grid services.

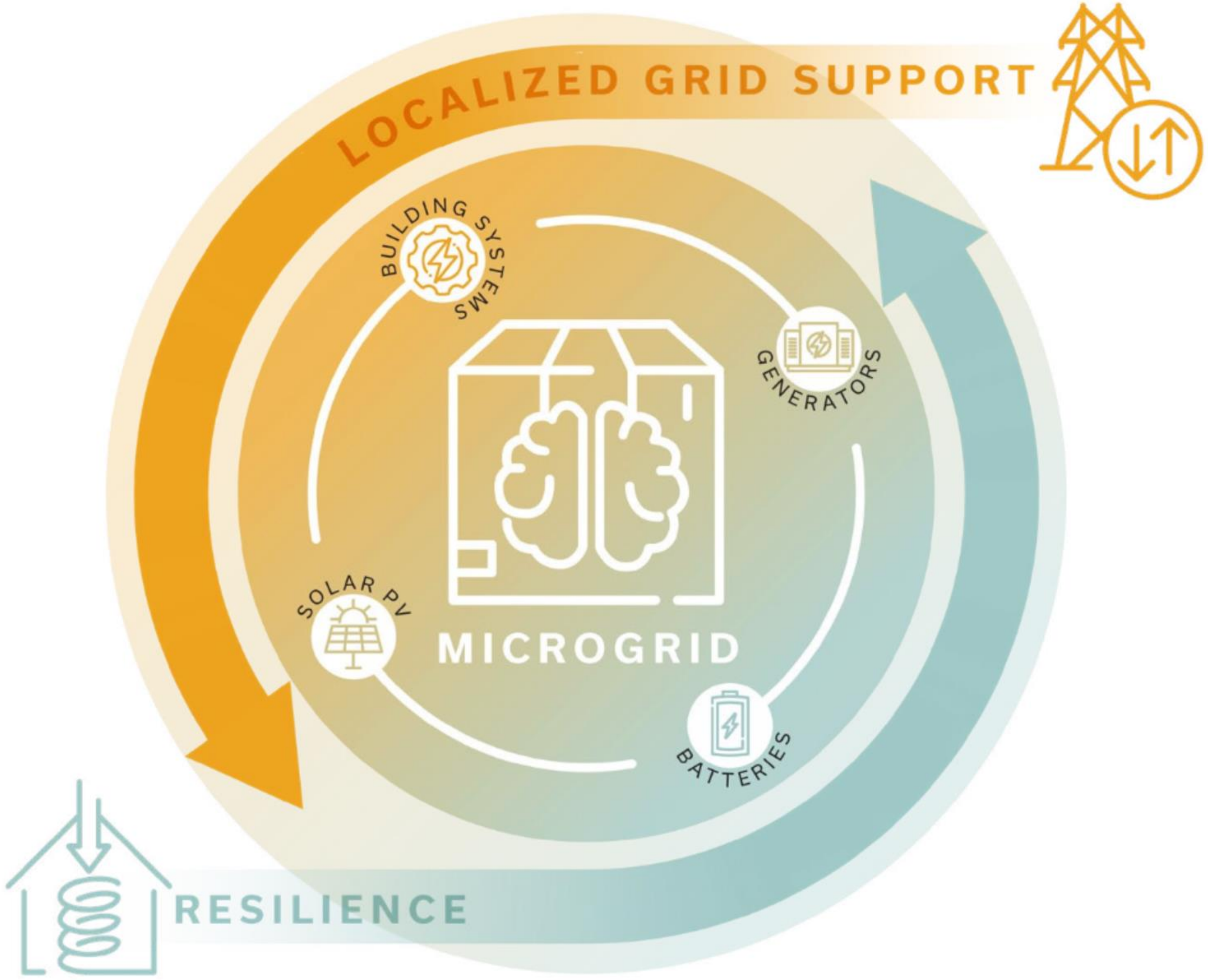
PHOTOVOLTAIC (PV) SOLAR PANELS

PV supports building energy use with onsite energy generation, but is fully dependent on the immediate solar resource. It therefore may not generate enough to cover building loads in some moments and more than is needed in others. Partnering with other solutions, such as a battery, can increase the benefit of PV not just to one building but to the larger grid region as well.

Considering the Impacts of Peak Demands

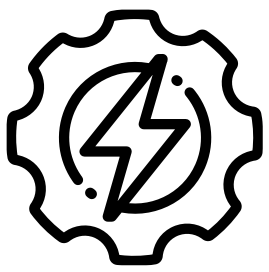





LOCALIZED GRID SUPPORT
BUILDING SYSTEMS
GENERATORS
SOLAR PV
MICROGRID
BATTERIES
RESILIENCE

Microgrids for Your Existing Campus in Just Three Easy Steps!

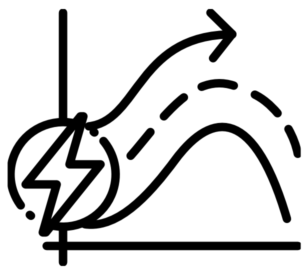
STEP 1



Understand Your Design Conditions

- Existing Systems
- Existing Loads
- Onsite Generation Potential

STEP 2



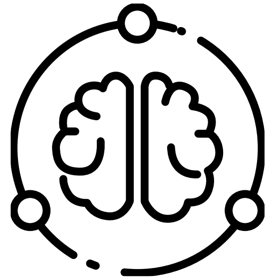
Establish Your Operation Goals

How is the project defining resilience?

- Loads
- Duration
- Operating Scenarios

Determine system architecture and resource sizes based on operating requirements

STEP 3



Design a Microgrid!

Success!

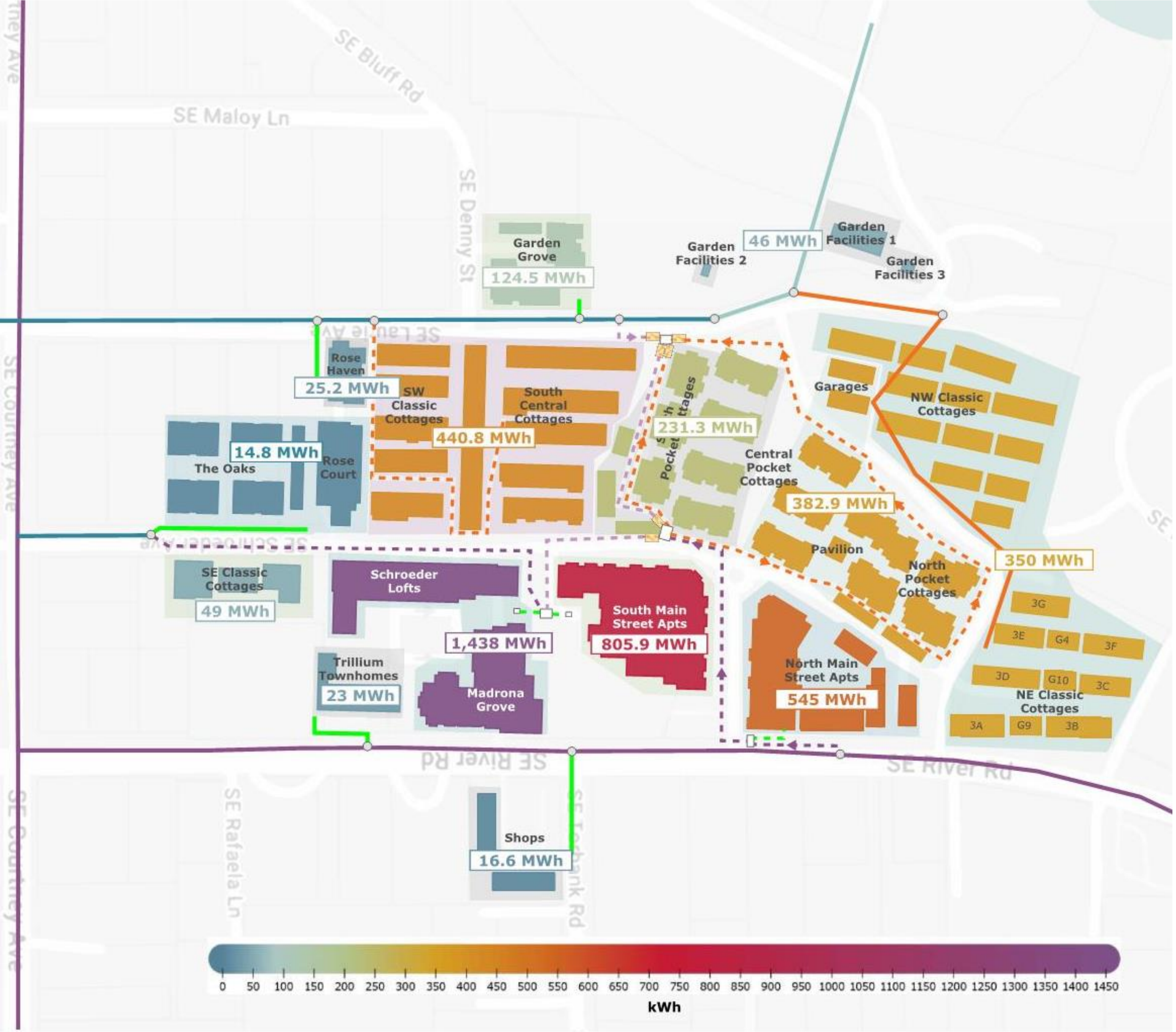
Existing Infrastructure Challenges

LEGEND

	SECONDARY METERING All infrastructure after the meter is utility owned and operated
	PRIMARY METERING All infrastructure after the meter is customer owned and operated

MAP LEGEND

- POWER POLE
- VAULT
- OPEN CONNECTION
- OVERHEAD 3 PHASE 4/0
- OVERHEAD 3 PHASE #2 ACSR
- OVERHEAD 2 PHASE #2 ACSR
- OVERHEAD 1 PHASE #2 ACSR
- UNDERGROUND 3 PHASE 1/0
- UNDERGROUND 1 PHASE #2
- MISSING INFO
- UNDERGROUND MISSING INFO



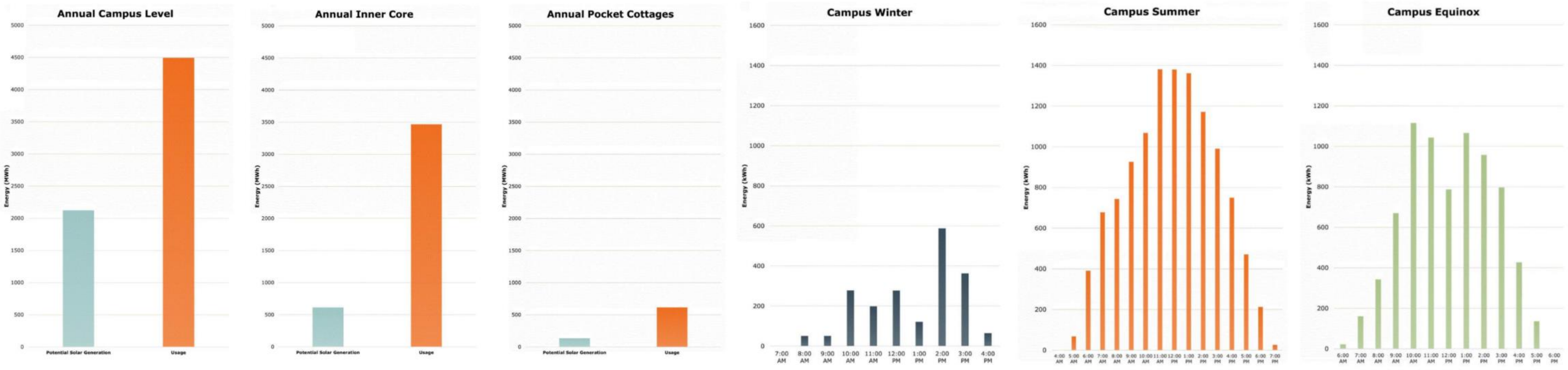
Yearly Energy Density

Onsite Generation Potential

SOLAR PRODUCTION STUDY RESULTS

Solar Production Study: Results | ROSE VILLA

Hourly Solar Production



ONSITE STORAGE STUDY

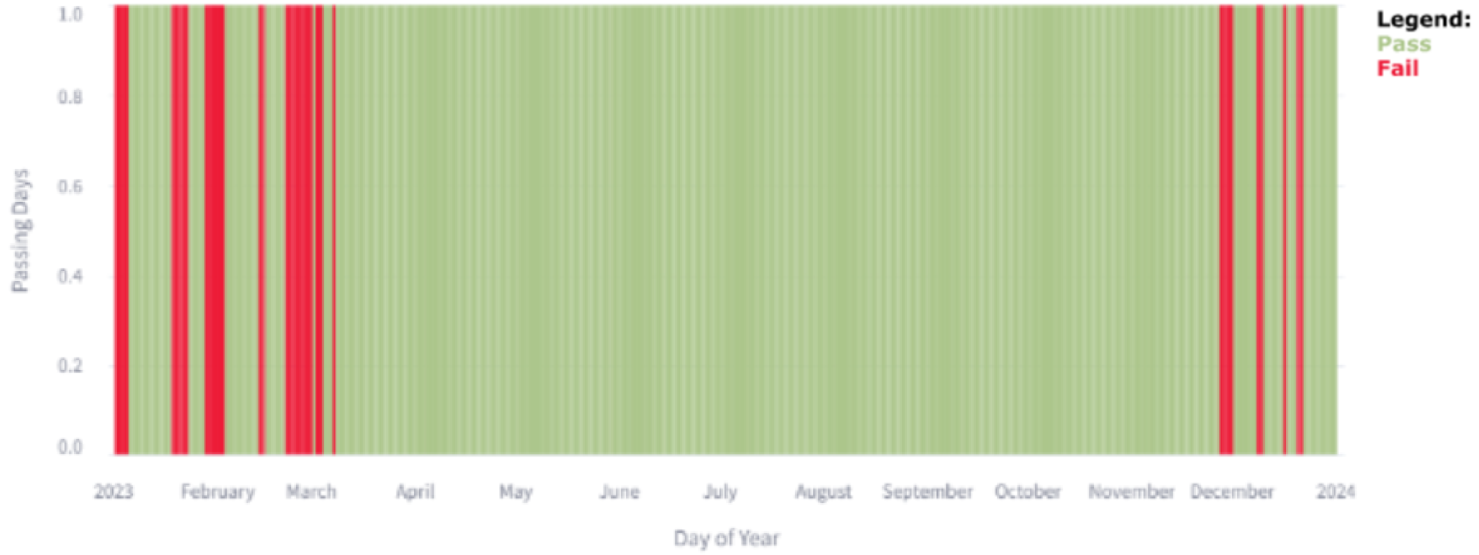
BATTERY SIZING ESTIMATES

Campus Level

REQUIRED BATTERY CAPACITY

Campus Level

PASSING DAYS

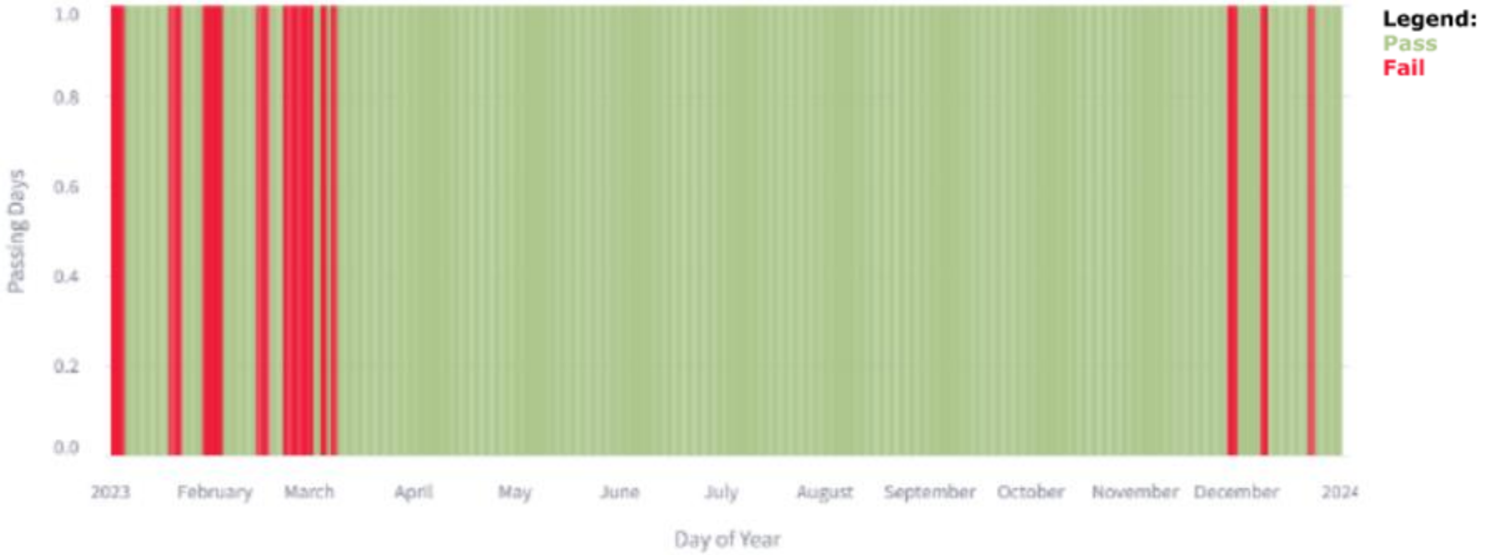


Campus Level No PV

REQUIRED BATTERY CAPACITY

Campus Level No PV

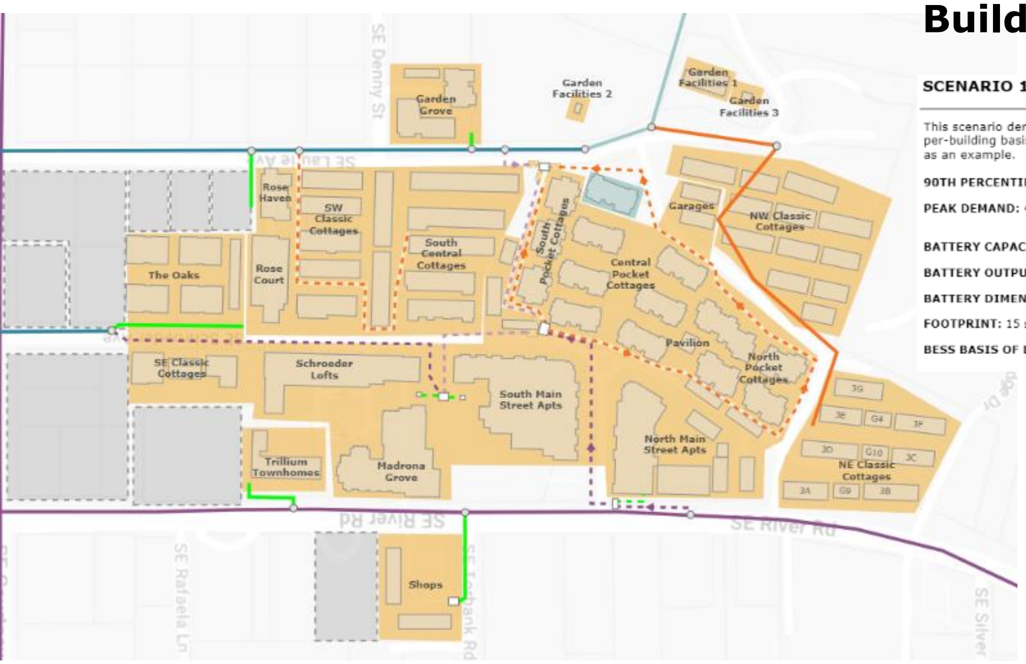
PASSING DAYS



MICROGRID SCALES – CONCEPT OPTIONS

ROSE PORT + MICROGRID ALIGNMENT CHARRETTE

Building



SCENARIO 1 - Single Building

This scenario demonstrates a microgrid on a per-building basis, using a single pocket cottage as an example.

90TH PERCENTILE 1-DAY USAGE: 181 kWh

PEAK DEMAND: 45.55 kW

BATTERY CAPACITY: 220 kWh

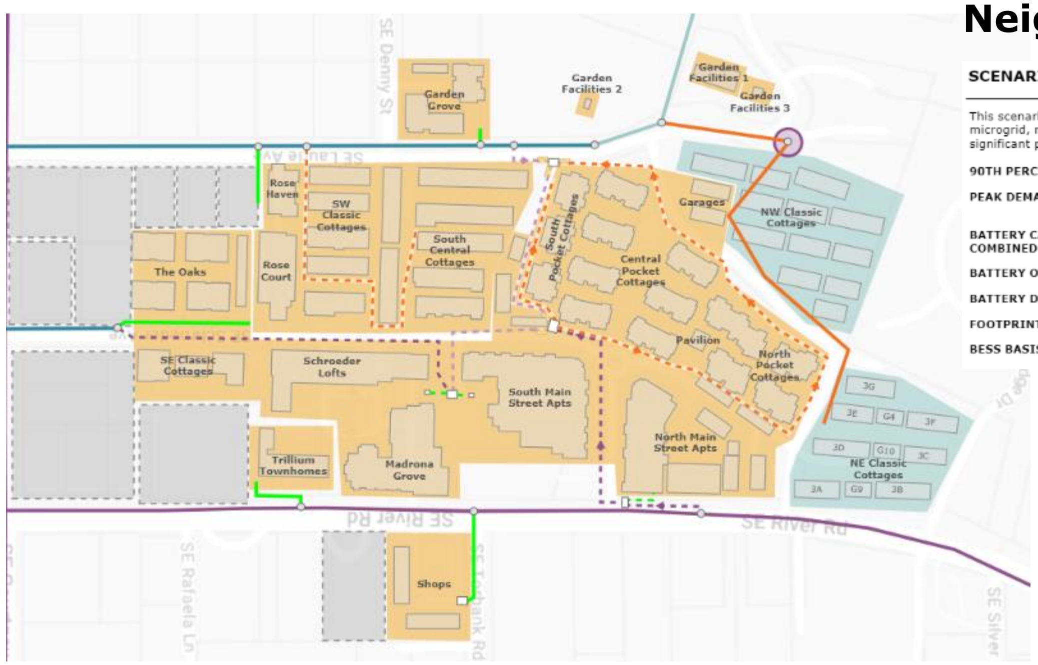
BATTERY OUTPUT: 125 kW

BATTERY DIMENSIONS: 5'0"L x 3'0"W x 8'8"H

FOOTPRINT: 15 sf per Cottage

BESS BASIS OF DESIGN: ELM Microgrid

Neighborhood



SCENARIO 2 - North Classic Cottages

This scenario demonstrates a single neighborhood microgrid, minimizing reclosers but excluding a significant portion of the campus from the microgrid.

90TH PERCENTILE 1-DAY USAGE: 1,400 kWh

PEAK DEMAND: 110 kW

BATTERY CAPACITY: 660 kWh + 880 kWh expansion
COMBINED CAPACITY: 1,560 kWh

BATTERY OUTPUT: 250 kW

BATTERY DIMENSIONS: (2) 10'4"L x 6'3"W x 9'3"H

FOOTPRINT: ~130 sq ft, about the size of a parking space

BESS BASIS OF DESIGN: ELM Microgrid

LEGEND

- OUT OF MICROGRID
- IN MICROGRID
- BATTERY SYSTEM FOOTPRINT
- MICROGRID RECLOSER ~$200K EACH
- OVERHEAD 3 PHASE 4/0
- OVERHEAD 3 PHASE #2 ACSR
- OVERHEAD 2 PHASE #2 ACSR
- OVERHEAD 1 PHASE #2 ACSR
- UNDERGROUND 3 PHASE 1/0
- UNDERGROUND 1 PHASE #2
- MYSTERY LINE
- UNDERGROUND MYSTERY LINE

Partial Campus

SCENARIO 3 - Partial Campus

This scenario minimizes the number of reclosers but excludes a significant portion of the campus from the microgrid.

90TH PERCENTILE 1-DAY USAGE: 11,688 kWh

PEAK DEMAND: 927 kW

BATTERY CAPACITY: 8,256 kWh + 3,440 kWh
COMBINED CAPACITY: 11,696 kWh

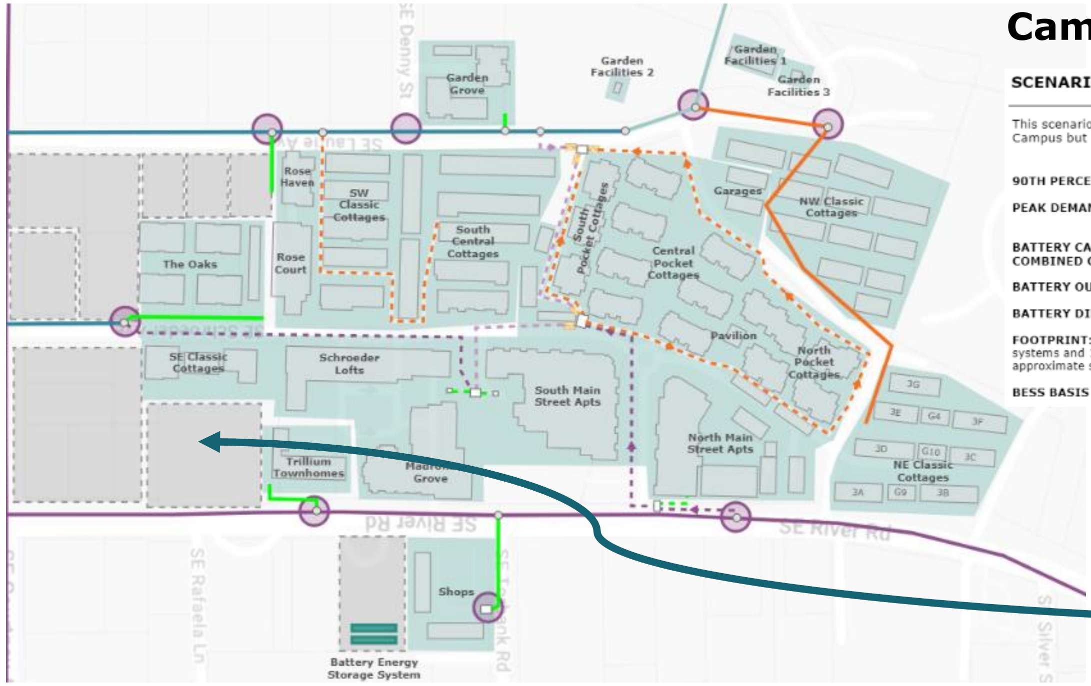
BATTERY OUTPUT: 1,500 kW

BATTERY DIMENSIONS: 70'0"L x 15'0"W x 9'0"H
39'0"L x 15'0"W x 9'0"H

FOOTPRINT: ~1635 sq ft, excluding 6' clearance between systems and 10' clearance from property line. See map for approximate scale.

BESS BASIS OF DESIGN: ELM Microgrid

Campus



SCENARIO 4 - Whole Campus

This scenario covers the entirety of the Rose Villa Campus but requires more reclosers.

90TH PERCENTILE 1-DAY USAGE: 15,839 kWh

PEAK DEMAND: 1,256 kW

BATTERY CAPACITY: (2) 8,256 kWh
COMBINED CAPACITY: 16,512 kWh

BATTERY OUTPUT: 1,500 kW

BATTERY DIMENSIONS: (2) 70'0"L x 15'0"W x 9'0"H

FOOTPRINT: ~2,100 sf, excluding 6' clearance between systems and 10' clearance from property line. See map for approximate scale.

BESS BASIS OF DESIGN: ELM Microgrid

Large BESS

SCENARIO 5 - 20MWh/80MWh Region

This scenario covers the entirety of the Rose Villa Campus plus an unknown amount of the surrounding region, totaling 80MWh and 20MW.

BATTERY CAPACITY: 8,256 kWh
COMBINED CAPACITY: 75,304

BATTERY OUTPUT: 1,500 kW
COMBINED OUTPUT: 19,500 kW

BATTERY DIMENSIONS: (13) 70'0"L x 15'0"W x 9'0"H

FOOTPRINT: ~14082 sq ft including Control House and Transformer, excluding 6' clearance between systems and 10' clearance from property line
See map for approx. scale

BESS BASIS OF DESIGN: ELM Microgrid

STEP 3

Implement Projects

ROSE Port

ROSE Port

NEIGHBORHOOD RESILIENCE HUB

— **4-stall carport (881 sf)**
for four residents' vehicles

— **Existing concrete slab/walls**
of previous bermed garage

— **MassPly roof** and Glulam beams

— **Collects and stores**
solar energy and potable water

— **Neighborhood emergency hub** with backup energy, water,

— **Proof of concept**
for ~12 more ROSE Ports on campus

ROSE POT

Resilient Energy Systems

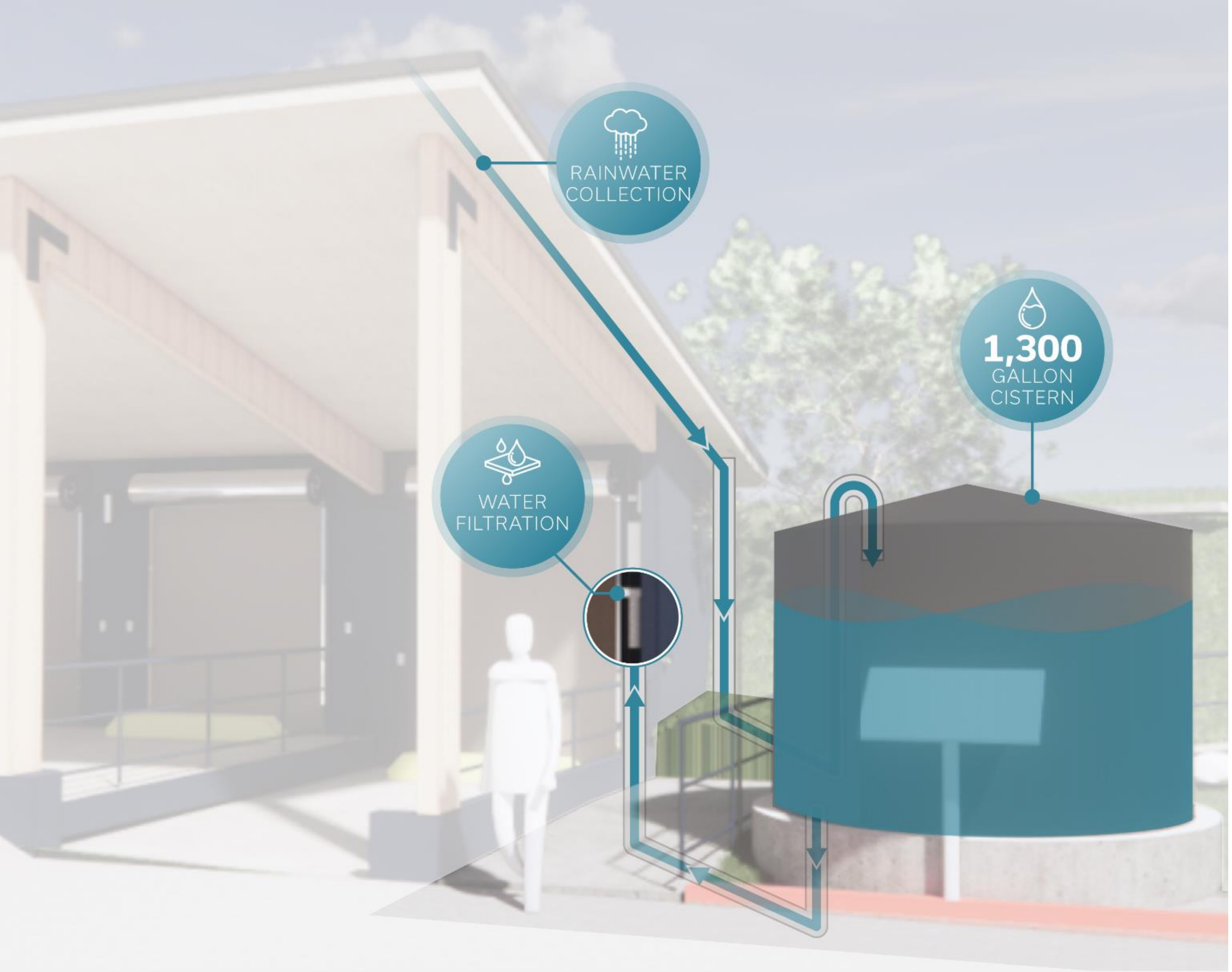
— **17.2 kW solar** photovoltaic panels + battery backup

— **27 kW battery** system

— **Certified Zero Energy** by ILFI after 1yr of operation

— **Level 1 trickle charging** for (4) residents' EV vehicles

— **Net metering** and meter aggregation



ROSE PORT

Resilient Water Systems

— **950sf** metal roof receives

— **~21,000 gallon/year** of rainwater

— Stored in **3100 gallon** cistern

— Pumped using PV+battery power

— Filtered and purified w/ **UV system**

— For emergency **potable** water use

— For some/all residents for **2-4 wks**

— Clear pipes for educational purpose

ROSE Port Next Steps

- Educational placards
- Gathering space
- Mural on walls

RV RAP
ROSE VILLA RESILIENCY ACTION PLAN

2023 IN REVIEW

The Rose Villa RAP team is committed to strengthening the campus' resilience to events such as power outages, earthquakes, heatwaves and wildfire smoke events. Read on to find out how we're leading the way to a more resilient and sustainable community!

AIR QUALITY

Around campus we have

Purple Air PM2.5 air monitors to measure fine particulates

Two portable CO2 monitors to inform ventilation rates

SAVING WATER

5,082 gallons of emergency water stored on campus

Updated specifications for low-flow WaterSense fixtures for all future construction and renovations

EMERGENCY RESPONSE

RV's Resident Emergency Guide — Updated and distributed to all independent-living residents

5,600 sanitation waste bags — Ready for use if toilets are non-operational

Developed Ready Force neighborhood maps

Procured and stored **2** weeks of emergency food

COTTAGE RETROFIT

Working on detailed analysis of various cottage retrofit options to improve comfort, energy efficiency and earthquake safety without displacing residents during construction

ENERGY UPGRADES

Planning for campus utility grid upgrades to increase resilience to outages, including renewable energy generation and storage

RAP EDUCATION

6 Educational sessions with staff and residents

12 Committee meetings

In addition, Ready Force hosted four expert presentations on earthquake preparedness, emergency sanitation, summer heat and wildfire smoke

In collaboration with Ready Force and Green Hammer

RV RAP
ROSE VILLA RESILIENCY ACTION PLAN

2025 PROJECTS

EMERGENCY RESPONSE

Constructing the 1st ROSE Port on campus this Spring! This Zero Energy carport will produce and store 100% of its own clean, solar power and potable water for emergency use. Designed to withstand large earthquakes, it will serve as the first of many campus emergency hubs.

ENERGY UPGRADES

12 Level 2 Electric Vehicle (EV) chargers to be installed in early 2025 through PGE's Make Ready EV Program.

...

Replacing inefficient lighting

Refining plans for campus micro-grids including solar photovoltaics and batteries.

COTTAGE RETROFITS

Implementing a comprehensive Renovation Guide and Checklist that is aligned with Rose Villa's resilience and sustainability goals.

AIR QUALITY

Monitoring indoor air quality throughout the year — **1YR**

40 Air purifiers — Ready to be deployed on days with poor Air Quality Index (AQI) days

SAVING WATER

Installing water-conserving drip irrigation systems and smart controls

RAP EDUCATION

Hosting 2nd Annual Refresh Party

Sharing RAP knowledge through a TV show, webinars, consultations, and new online resources.

In collaboration with Ready Force and Green Hammer

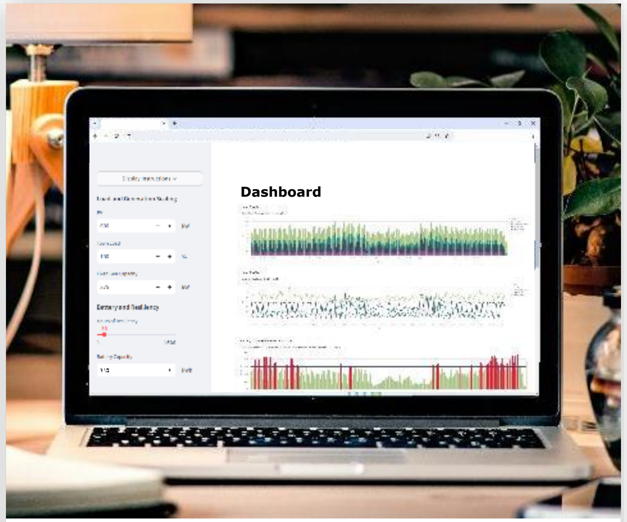
Campus Resiliency Projects for 2025 and Beyond

Fleet Electrification

INSTALLING 12 EV CHARGERS THROUGH THE MAKE READY PROGRAM

Advancements TV Show

AIRING THIS YEAR ON AMAZON PRIME



Web Dashboard with Resources

WITH EUI DASHBOARD AND OTHER METRICS, EDUCATIONAL RESOURCES

Upcoming Development

NEW ZERO ENERGY NEIGHBORHOODS AND A PASSIVE HOUSE TOWER

Keys to Success

Rose Villa Leadership

Community Engagement

Aspirational Yet Achievable Goals

Synchronizing and Scaling Solutions

Discussion

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