Veterans Memorial Building

Senior Center

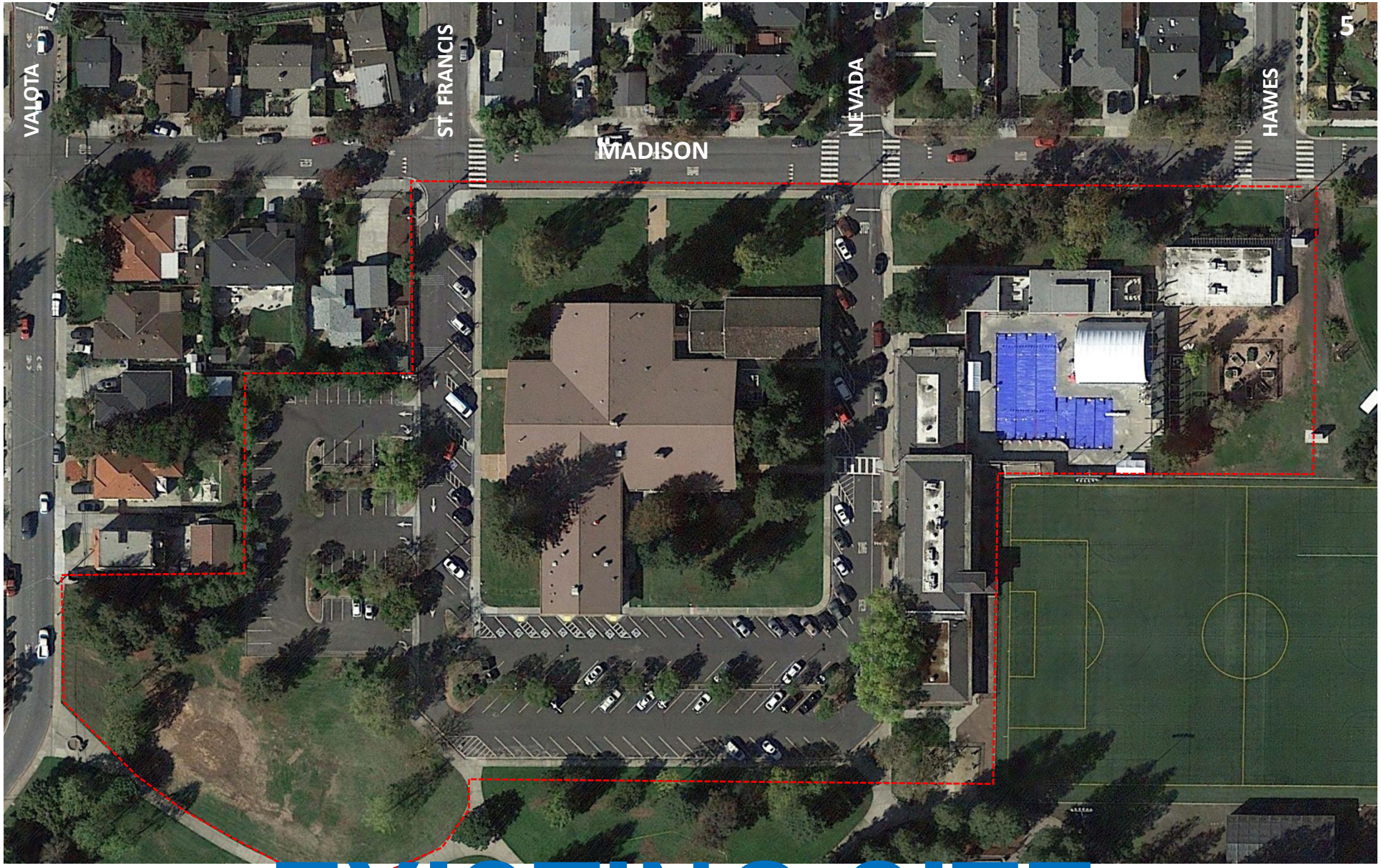
YMCA Joint Project

Redwood City

Sustainable Strategies, Energy Conservation & Resilience

Overview….

- Project Introduction
- Energy Goals and Sustainable Features
- Energy Saving Features: Implementation
- Photovoltaics and Microgrid
- LEED Highlights

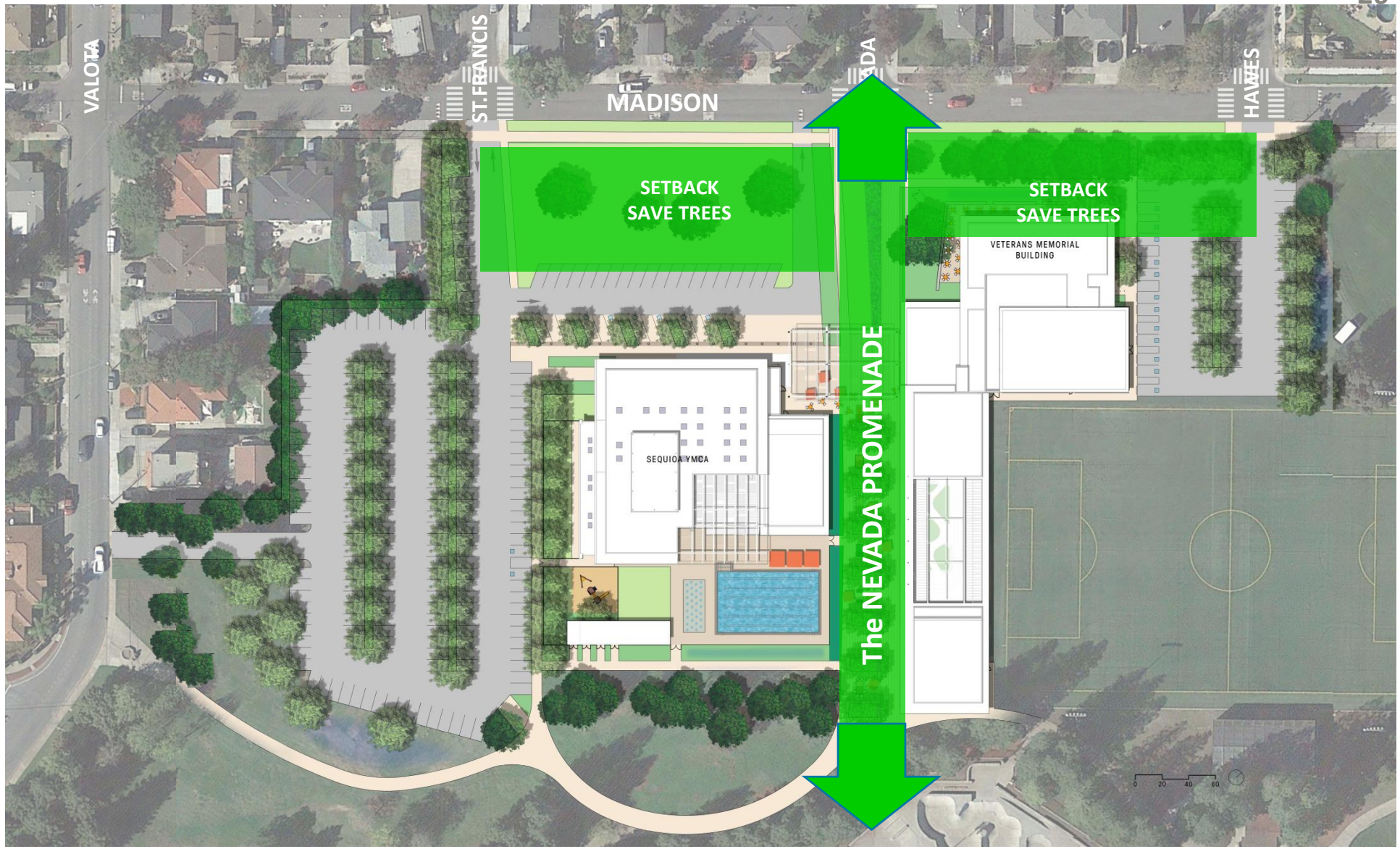


EXISTING SITE

COMMUNITY OUTREACH

Outreach: Veterans and NFL

PROPOSED PROJECT


VALOTA
ST.FRANCIS
MADISON
HAWES
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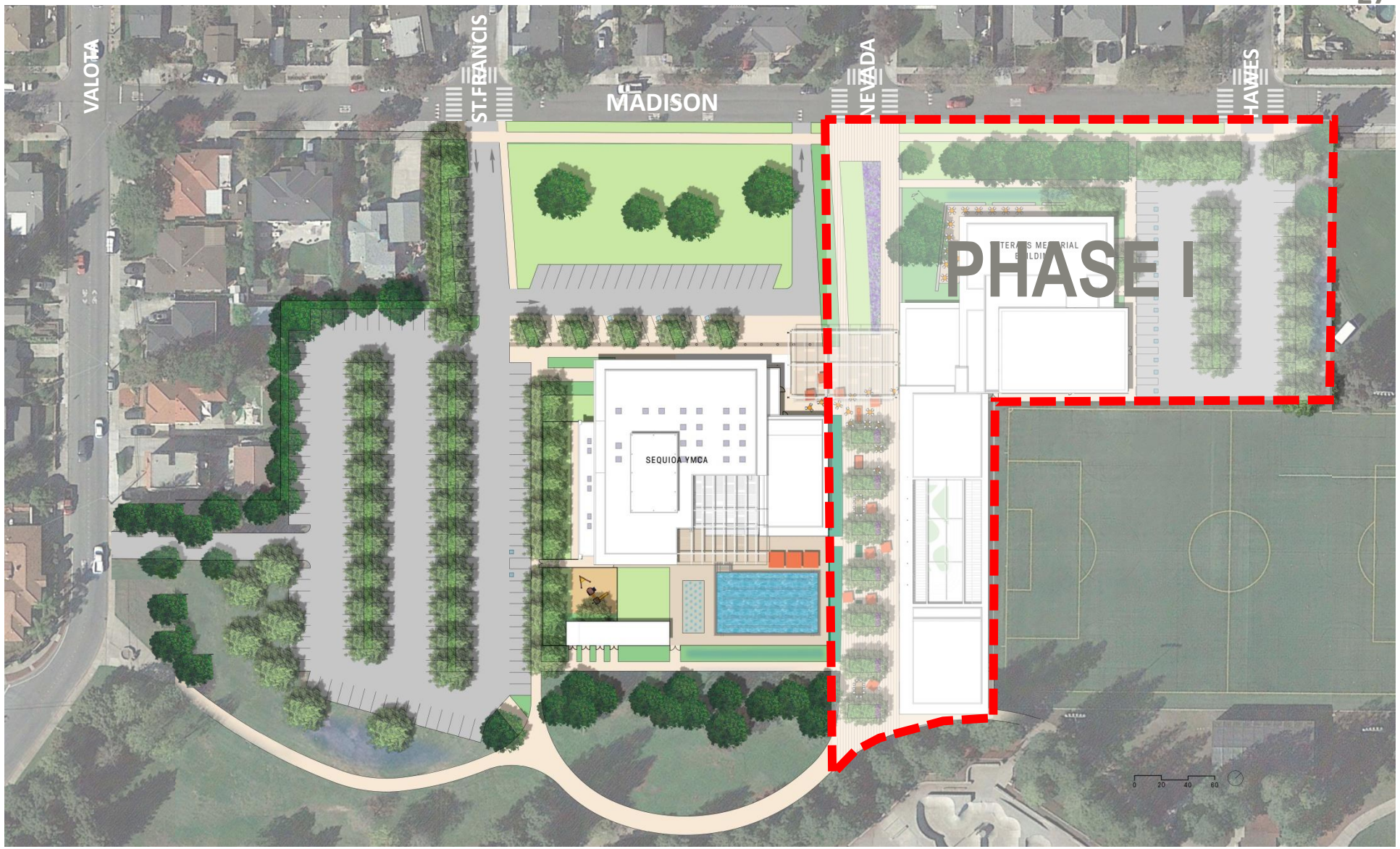
VETERANS MEMORIAL
BUILDING
SEQUOIA YMCA
The NEVADA PROMENADE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VETERANS
MEMORIAL
BUILDING

Overall Goals for Sustainability

- Efficient Use of Resources
- Energy Savings
- Decreased Operating Cost
- Water Conservation
- Healthy Environment

Strategies to Achieve Net Zero and LEED Platinum

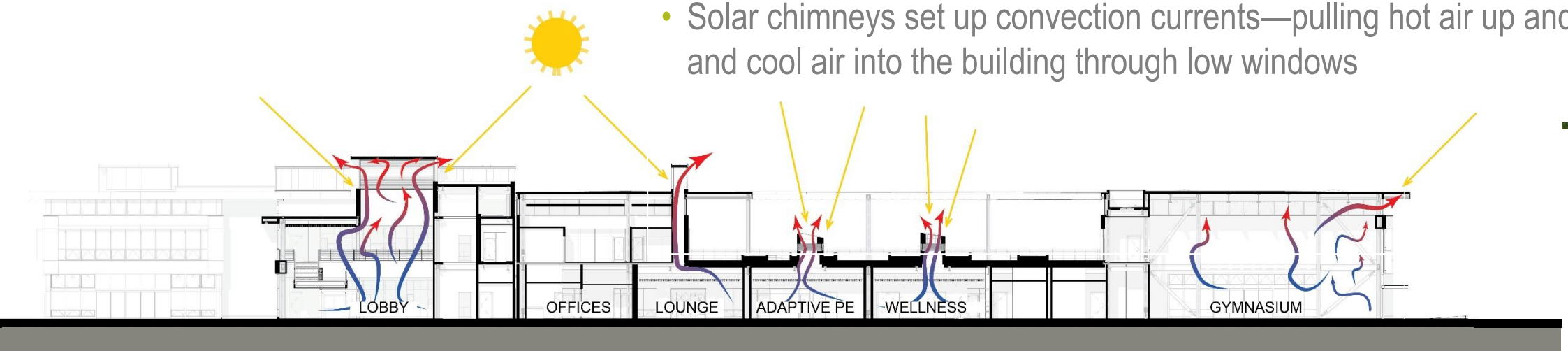
- **Reduce Energy Usage Through Natural Ventilation:** Redwood City's "Climate Best by Government Test"
- **No natural gas service:**
  - All electric commercial kitchen with induction cooking
  - HVAC system with air source heat pump, fan coil units, ERV's and trench heaters
- **Net Zero Energy:**
  - PV panels on roof sized to meet building loads
- **Provide Emergency Refuge in the Event of Local Disasters:**
  - Microgrid (integrated with PV system) will provide battery back-up for 72 hours
  - Domestic water storage tank will provide potable water

els/

Natural Ventilation

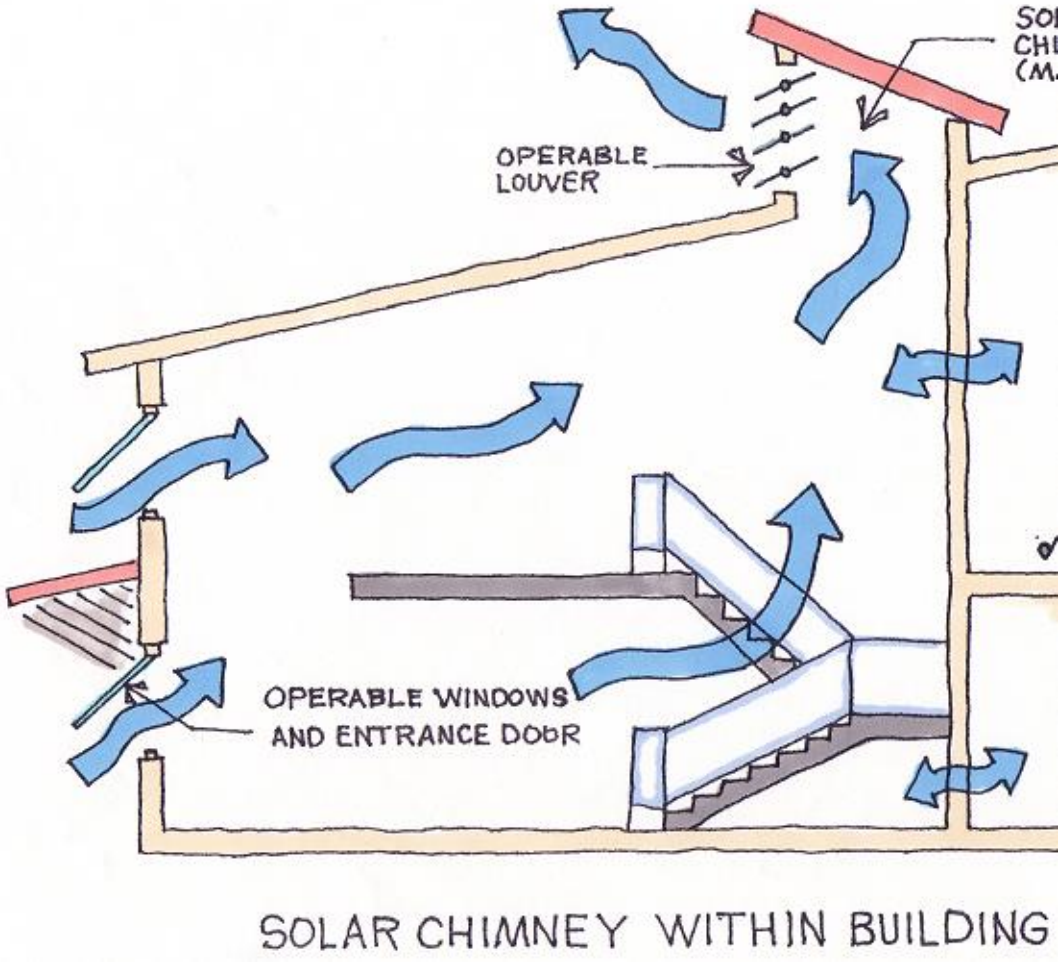
Natural Ventilation

- Operable windows and automated dampers in occupied spaces
- Building form chosen to facilitate cross ventilation and day-lighting
- Solar chimneys set up convection currents—pulling hot air up and out, and cool air into the building through low windows

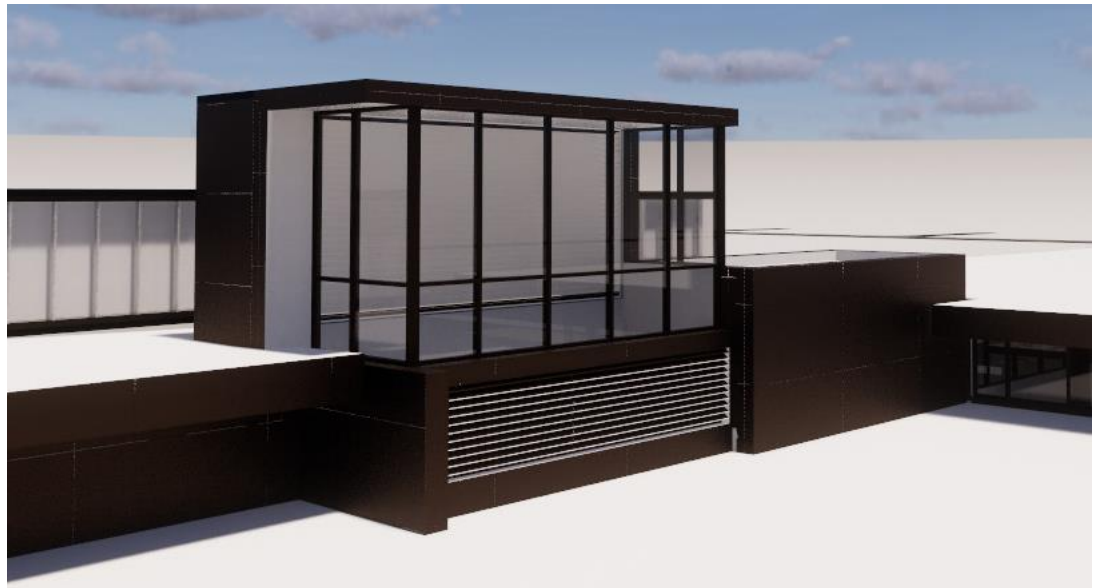


Natural Ventilation

Solar Chimneys

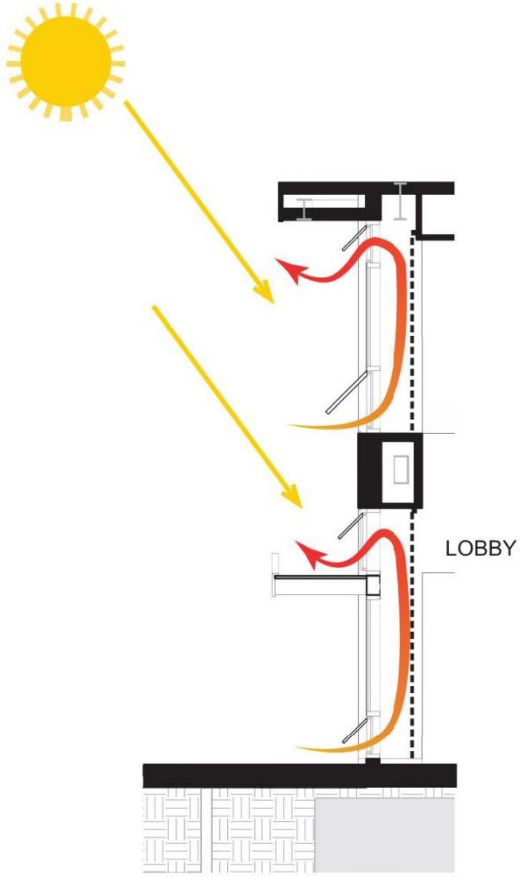


SOLAR CHIMNEY WITHIN BUILDING



Natural Ventilation

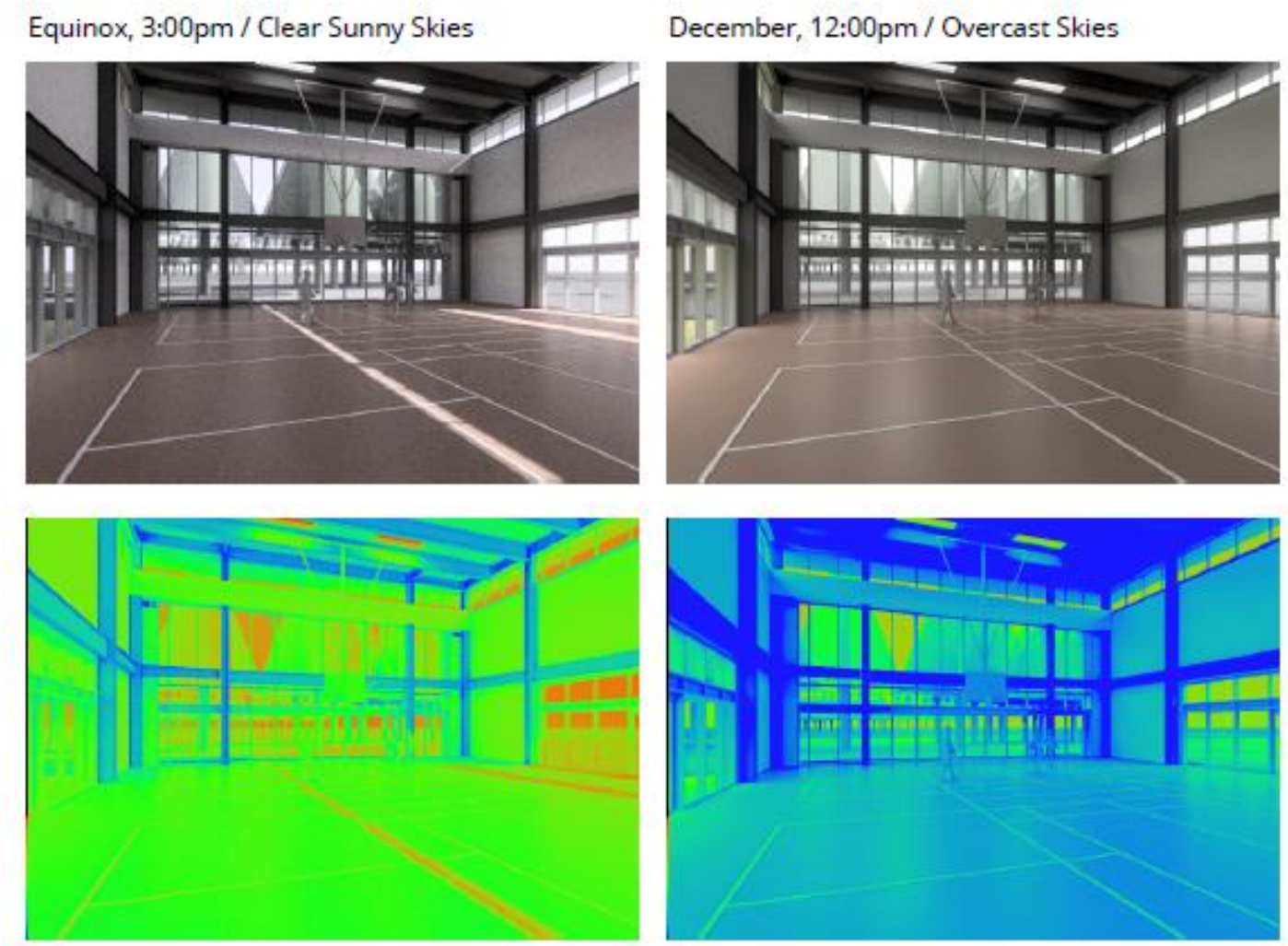
Natural Ventilation - Solar Shading



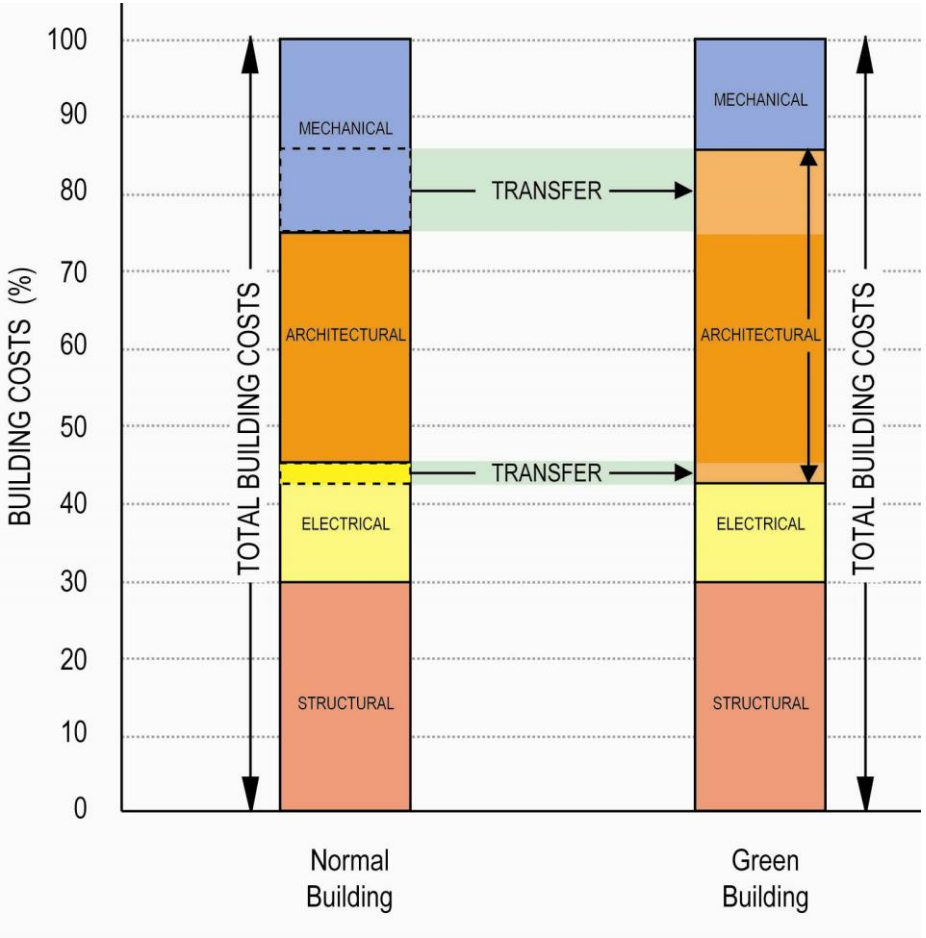
- **Double skin** mitigates solar gain by trapping heat and venting it out.
- Cost effective approach using interior roller shade
- Transparent when no direct solar gain for view and light

Daylighting and Solar Shading

- Modelling for solar gain and daylighting allows us to optimize natural light and views
- Balance daylight and solar gain



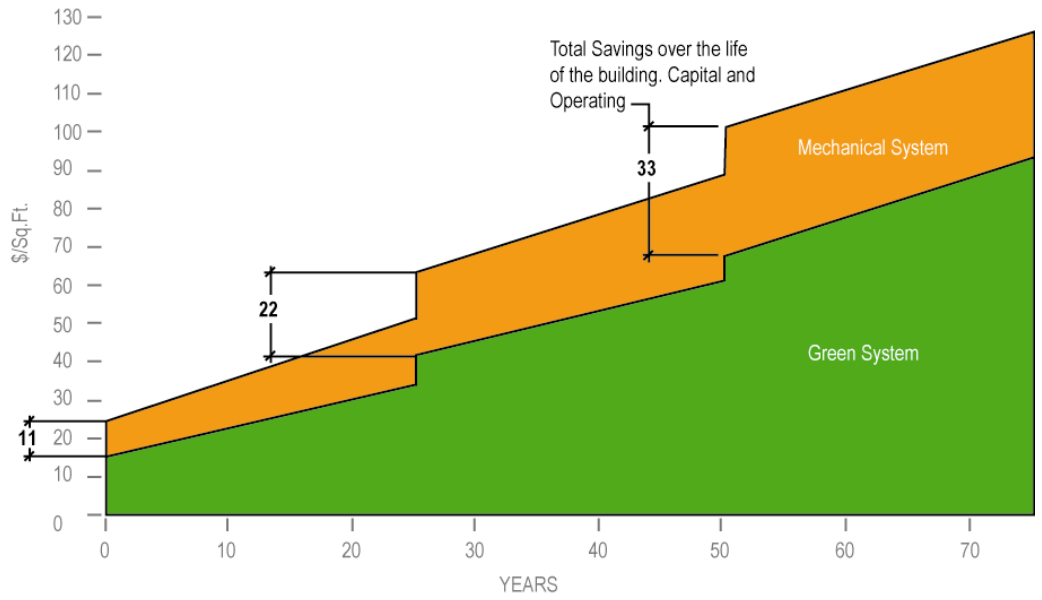
Overall Sustainable Design Synergies



COST TRANSFER

- Little or No Cost Increase Overall
- Reduced Mechanical Cost
- Invest in Architecture
- Active to Passive
- Fragile to Robust
- Longer Life
- Less Cost Over Life
- Simpler

Natural Ventilation – Operating Cost



COST & PERFORMANCE

Conventional Mechanical System

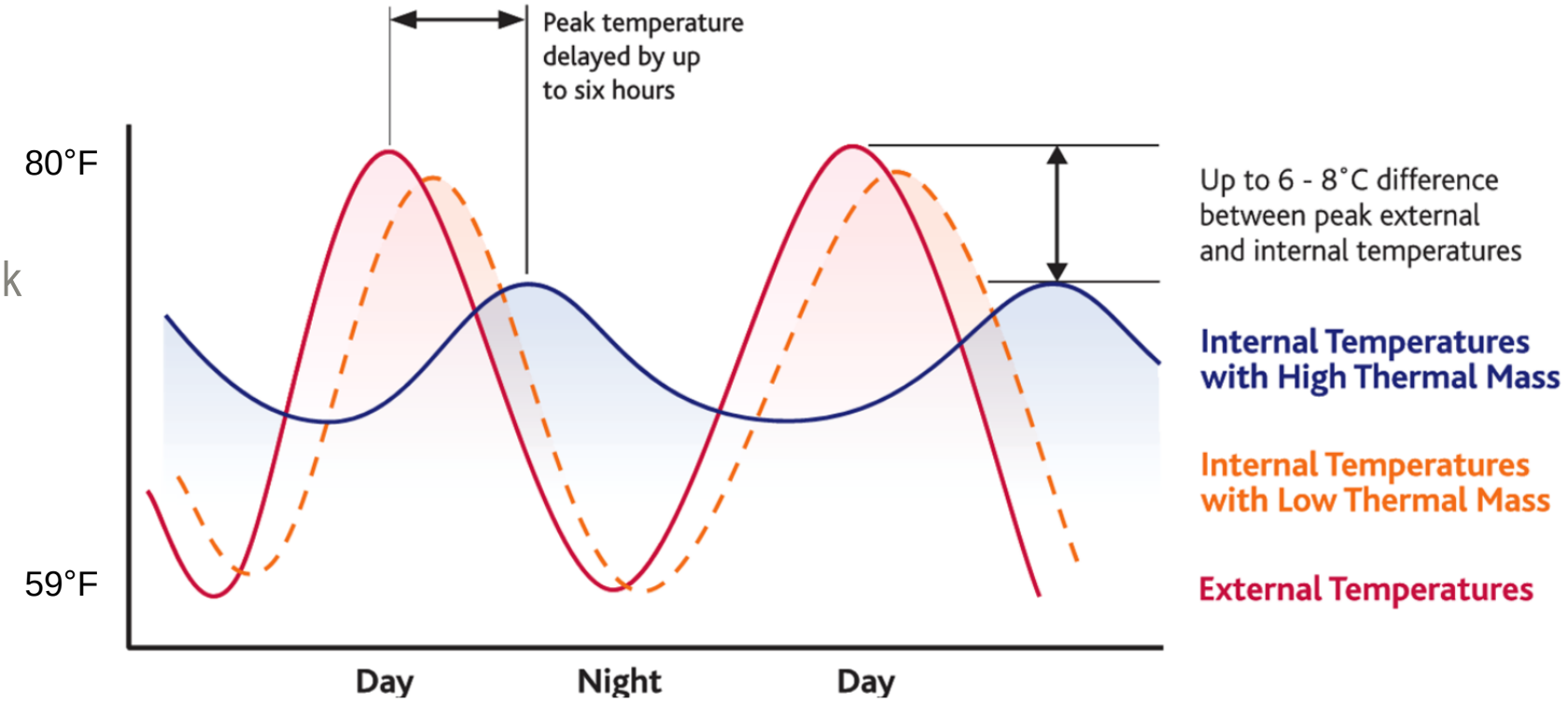
Green Mechanical System

Minimization through innovation makes sense environmentally, socially, as well as economically.

Thermal Mass

Thermal mass in strategic areas reduces and delays peak temperatures

Impact:



Photovoltaics

PV Options

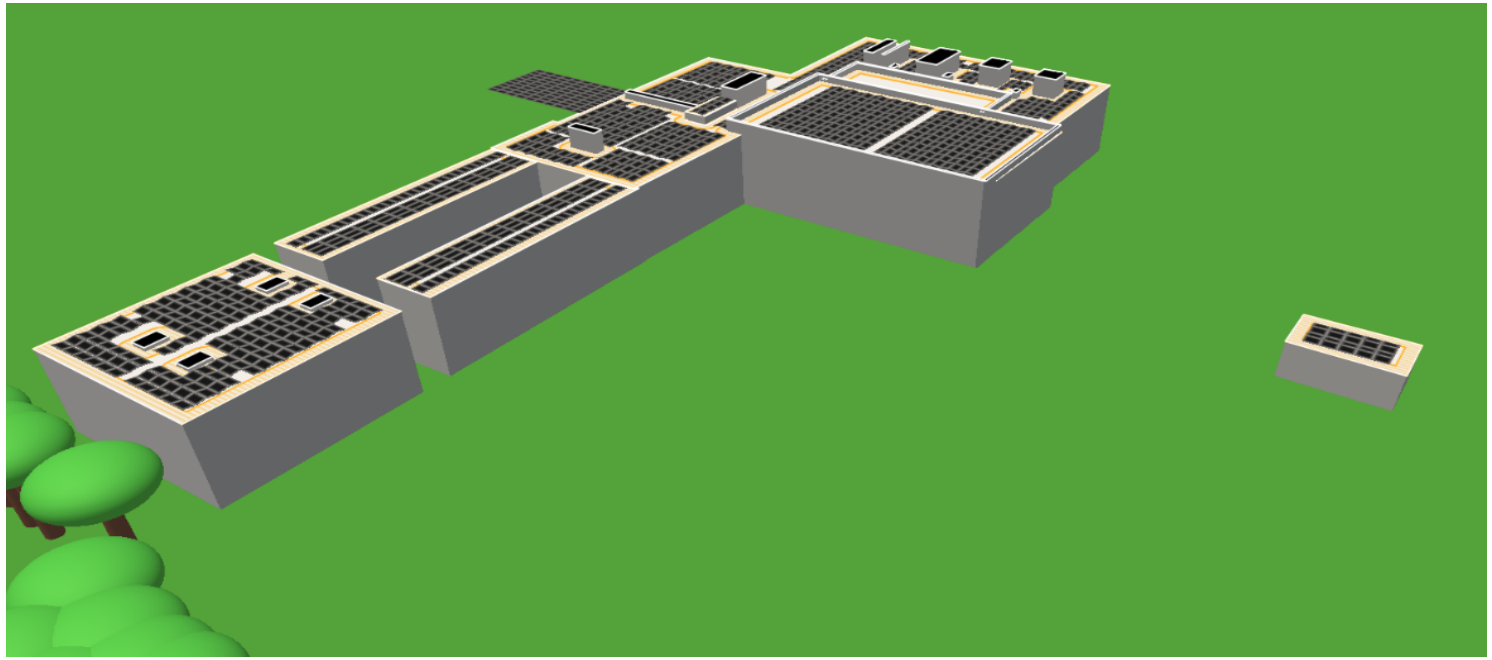
Roof Mounted SunPower Modules

Lumos Solar Panels Doubling as Sun Shade

SunPower Carport

PV Preliminary Layout Maximum Potential

PV ROOF DESIGNATIONS		
Roof	Solar Size (kW)	PV production (kWh)
North Roof	69.8	84,978
Theatre Roof	103.0	150,216
Lobby Roof	38.8	54,305
South Roof	62.6	91,040
Gymnasium Roof	60.6	90,701
Promenade Trellis	46.6	67,491
East Trellis (Lumos)	12.6	16,391
West Trellis (Lumos)	12.6	16,391
East Trellis Roof	9.7	13,098
West Trellis Roof	9.7	13,098
Battery Shed Roof	7.3	11,008



Maximum Layout:

- **Estimated Building Energy Usage: 385,000 kWh**
- **Target PV Production to achieve NZE(20%SF): 462,000 kWh**
- **Solar = 409.6 kW**
- **Estimated 1st year Production = 548,714 kWh**

PV ROOF DESIGNATIONS		
Roof	Solar Size (kW)	PV production (kWh)
North Roof	51.21	62,317
Theatre Roof	103.0	150,216
Lobby Roof	38.8	54,305
South Roof	62.6	91,040
Gymnasium Roof	60.6	90,701
Promenade Trellis (Lumos)	24	34,727
East Trellis (Lumos)	12.6	16,391
West Trellis (Lumos)	12.6	16,391
East Trellis Roof	9.7	13,098
West Trellis Roof	9.7	13,098
Battery Shed Roof	7.3	11,098

NOTES: HIGHLIGHTED AREAS ARE RECOMMENDED BY IG.

PV Preliminary Layout Net Zero Energy

NOTES: HIGHLIGHTED AREAS IN RED ARE RECOMMENDED BY IG TO BE REMOVED FOR NZE DESIGN.

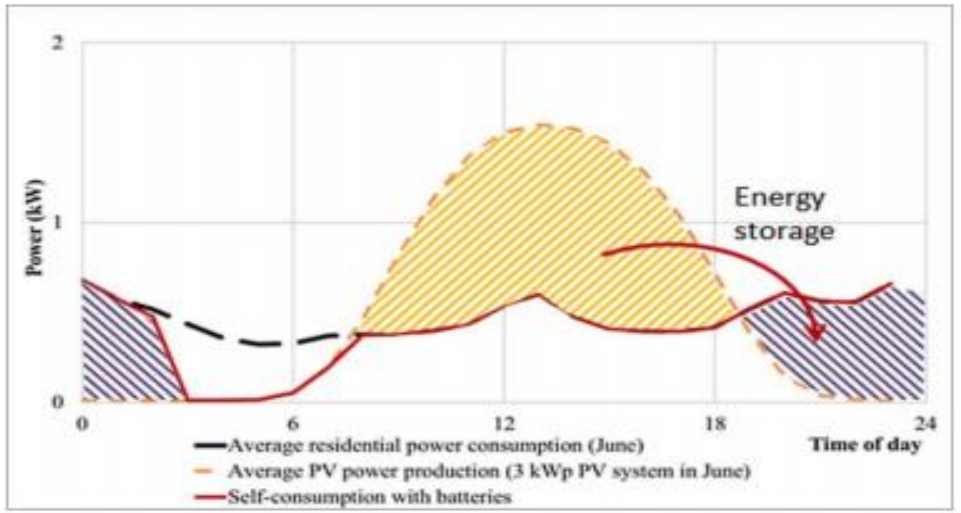
NZE Building:

- Estimated Building Energy Usage: 385,000 kWh
- Target PV Production to achieve NZE(20%SF): 462,000 kWh
- Solar = 327 kW
- Estimated 1st Year Production = 461,782 kWh

Benefits of Solar + Storage

Increased Self Consumption

- PV Array provides power for the microgrid system by charging the battery.
- When the PV array is not charging the battery, it provides power to the building and exports excess energy to the utility reducing Utility Bills.



Source: Hyun Jin Julie YU (2017) A PROSPECTIVE ECONOMIC ASSESSMENT OF RESIDENTIAL PV SELF-CONSUMPTION WITH BATTERIES AND ITS SYSTEMIC EFFECTS, AND THE IMPLICATIONS FOR PUBLIC POLICIES: THE FRENCH CASE IN 2030 Chaire European Electricity Markets Foundation Paris-Dauphine

Normal Operation PV + Storage System

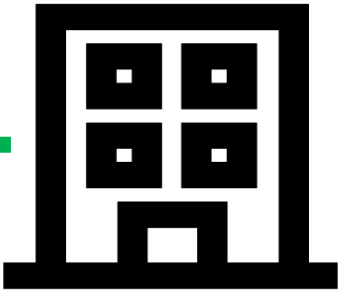
PV will power Microgrid

SunPower Solar Modules

SolarEdge PV Inverter

Main Distribution Panel for Building

Utility



Building Loads

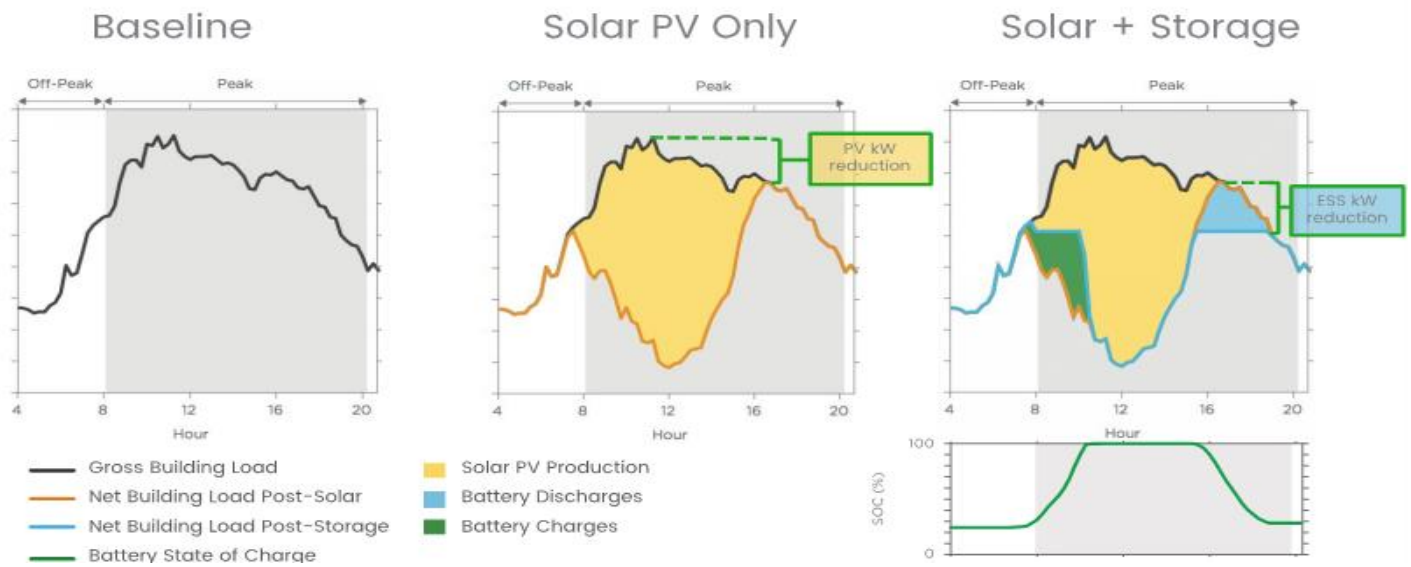
Schneider Electric Batteries

Backup Loads Panel

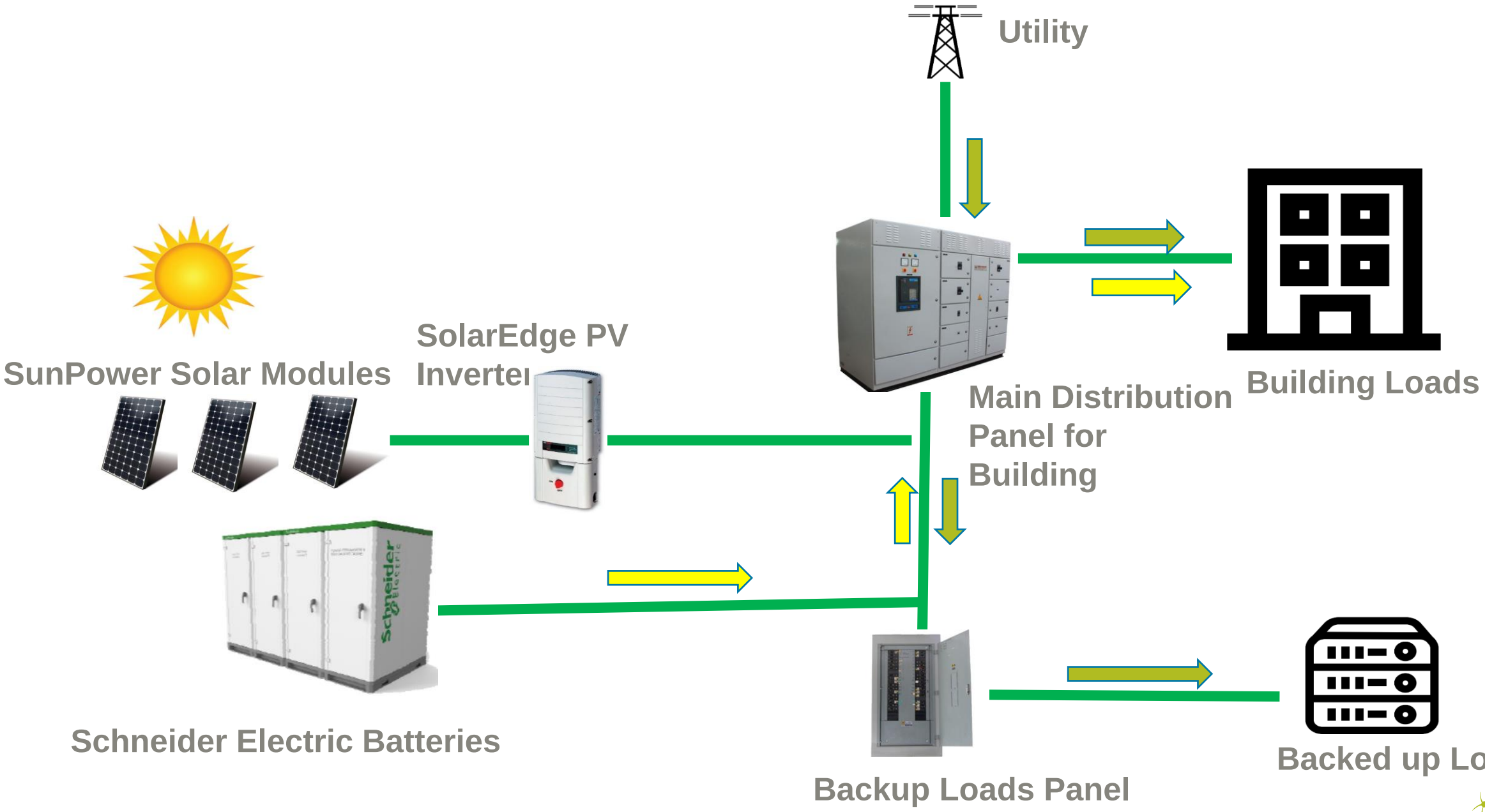
Backed up Loads

Peak Shaving Application

- Energy Companies charge more during certai times of day and also for higher power requirements.
- This may result in high utility bills.



Peak Shaving Application



Back-Up Operation

During a Utility Power Outage, PV System and BESS will provide power to the Building.

Approximately 25% of Building Load for 72 Hours

- Solar System: 327 KW → NZE Building (Only)
- Battery System: 250 kW/ 500 kWh

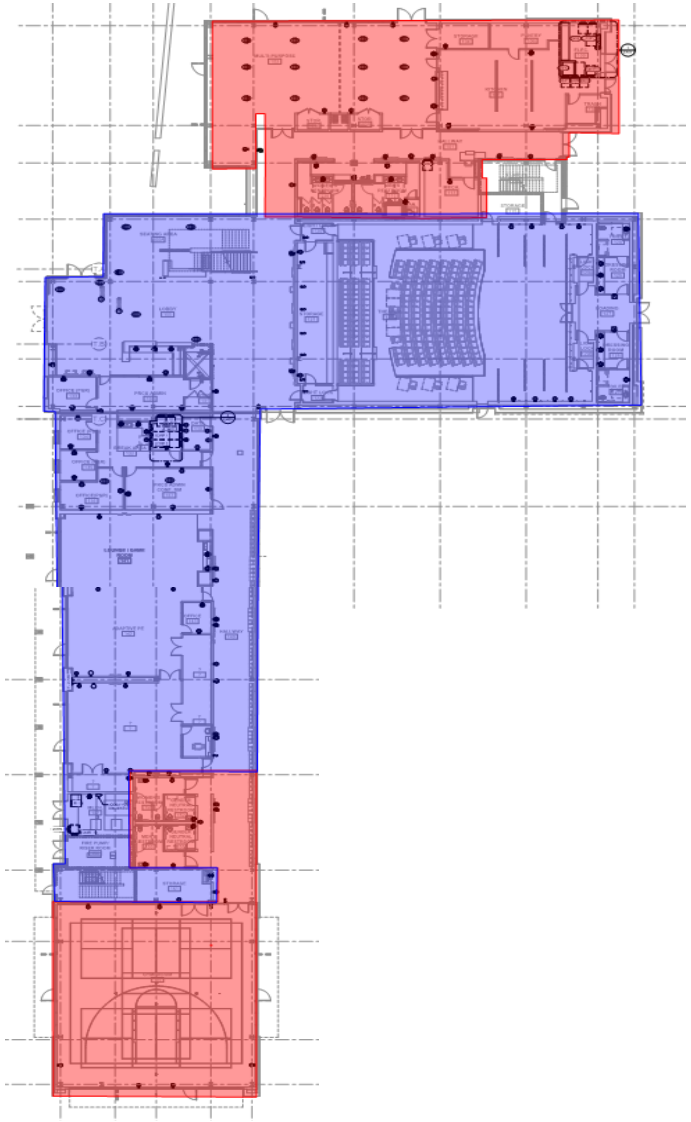
Back up Capabilities of Battery/Solar System

- In the case of a power outage the batteries will provide backup power to the loads currently in the table below. Once the battery/solar system is unable to supply loads the Building will have no power.
  - Night time black out – Loads can be sustained till Day time.
  - Day time black out – Solar will kick in and supply excess to charge battery system. Battery system will take the load into night till it discharges completely.
  - Potential to bring up additional loads other than the loads in the table provided in the building for 9 months from March - November utility outage.

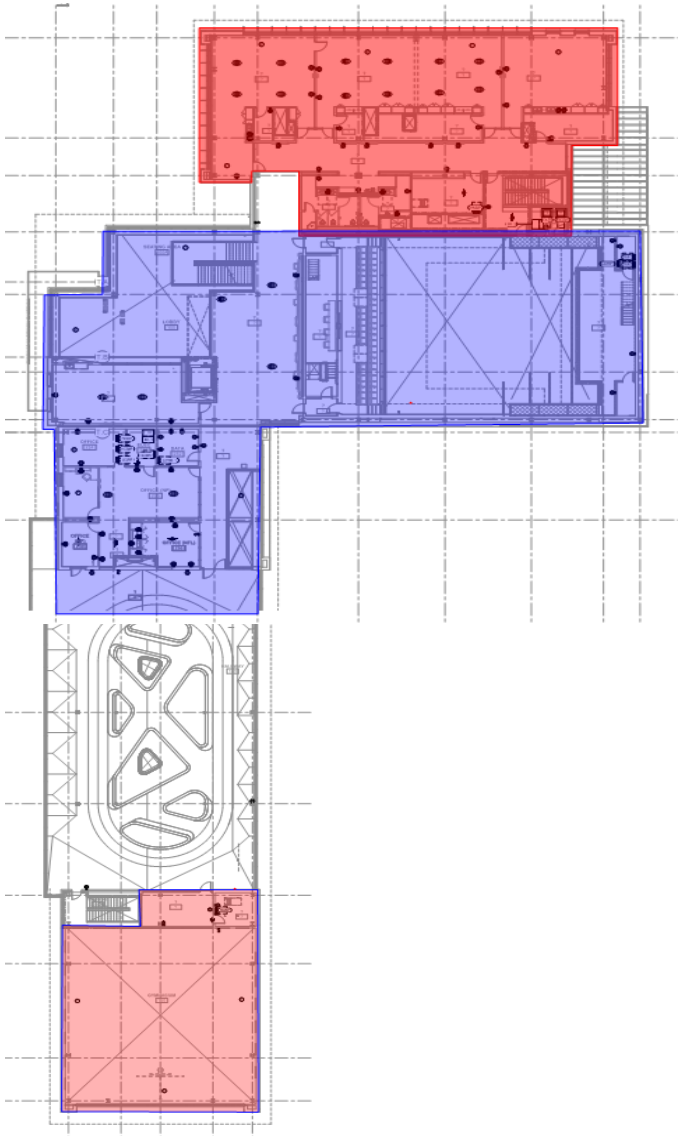
Type of Load	% of Load
Lighting (Multipurpose Room Lower Level)	25%
Plug Load (Multipurpose room Lower Level)	25%
Natural Air Ventilation Equipment	100%
Lighting Load (Kitchen)	50%
Kitchen Load	50%
Lighting (Bathrooms)	10%
Plug Load(Bathrooms)	5%
Lighting (Storage Rooms)	10%
Plug Loads (Storage Rooms)	10%
Lighting (Multipurpose Room Upper Level)	15%
Plug Load (Multipurpose room Upper Level)	15%
Lighting (Storage Rooms Upper Level)	10%
Plug Loads (Storage Rooms Upper Level)	10%
Lighting (Gymnasium Lower and Upper Level)	25%
Plug Load (Gymnasium room Lower and Upper Level)	25%
Lighting (Entire Building except areas above)	10%

Areas required to be on Back up Load

LOWER LEVEL



UPPER LEVEL



- Areas in Red, refer to Load table on Previous slide for microgrid loads.
- Areas in Blue, only emergency lighting and Fire alarm systems are on microgrid.

LEED GOALS

Platinum – 83 point target

Point Highlights:

- Demand Response
- Green Power
- Protect and Restore Habitat
- Enhanced Commissioning
- Rainwater Management
- Indoor Water Reduction
- Heat Island Reduction
- Low Emitting Materials
- Indoor Air Testing

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Redwood City

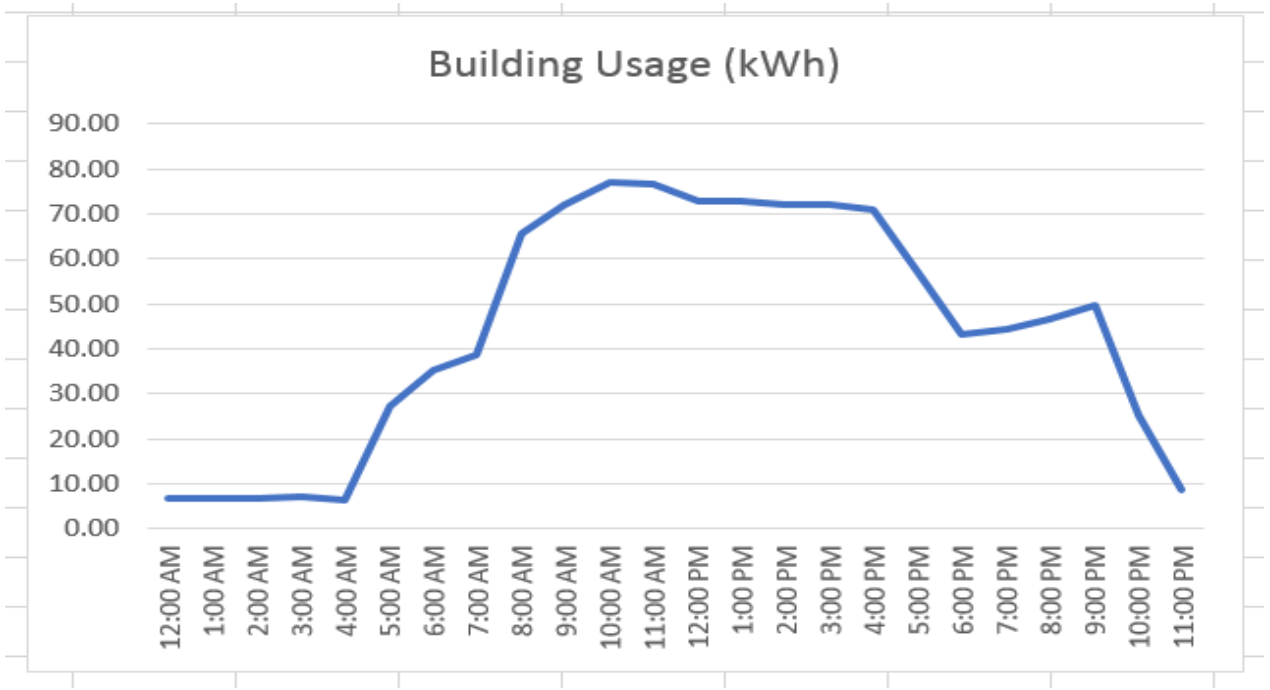
Sustainable Strategies, Energy Conservation & Resilience

END

Resilience Strategies

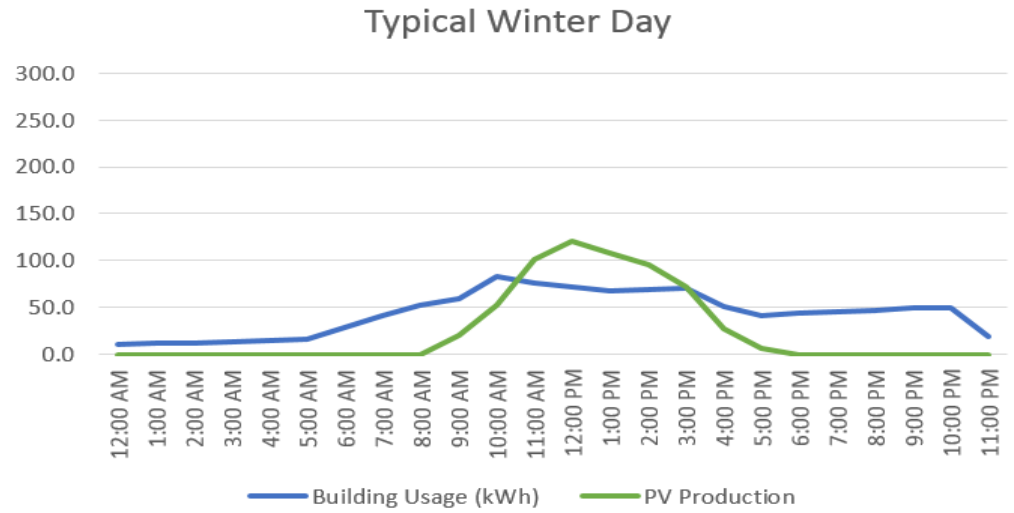
- Planning – Provide shelter to 100-125 people in an emergency
  - Beds can be set up in the gym and upstairs multi-purpose rooms
  - Meals will be provided from the kitchen
  - Kitchen will operate even during a power outage
- Power - Battery back-up and PV system designed to provide 25% of the building loads for a minimum of three days.
  - PV system integrated with micro-grid provides backup in case of power outages and will also reduce peak load demand
- Water - Domestic water storage tank provides water in an emergency

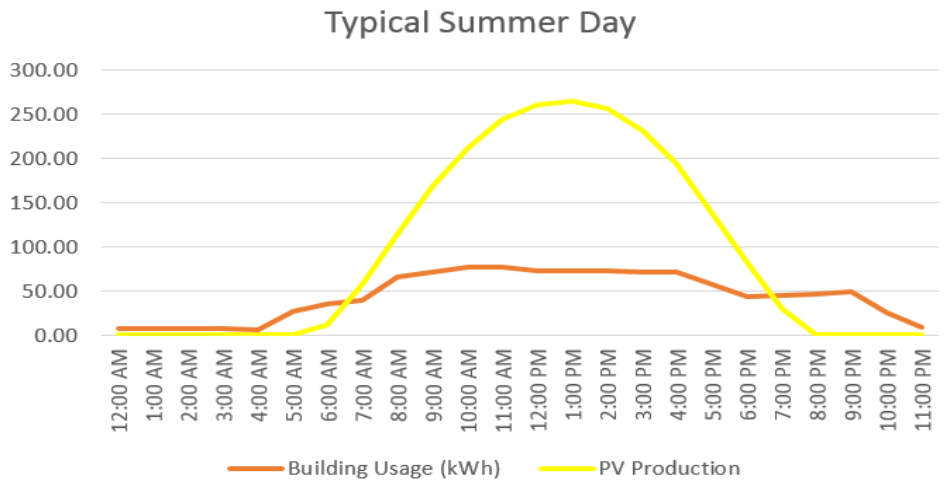
Load Profile of Building



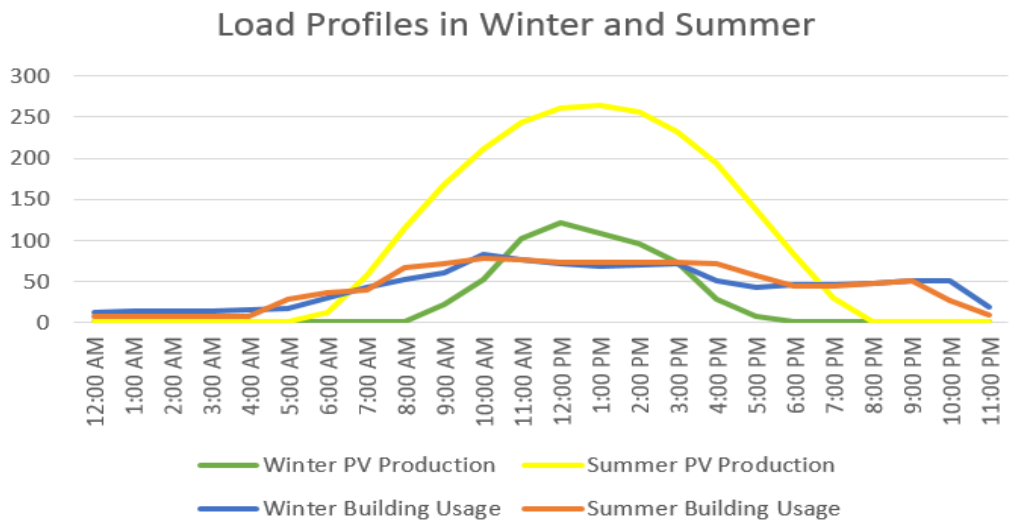
- Energy usage of the building over the course of a day.

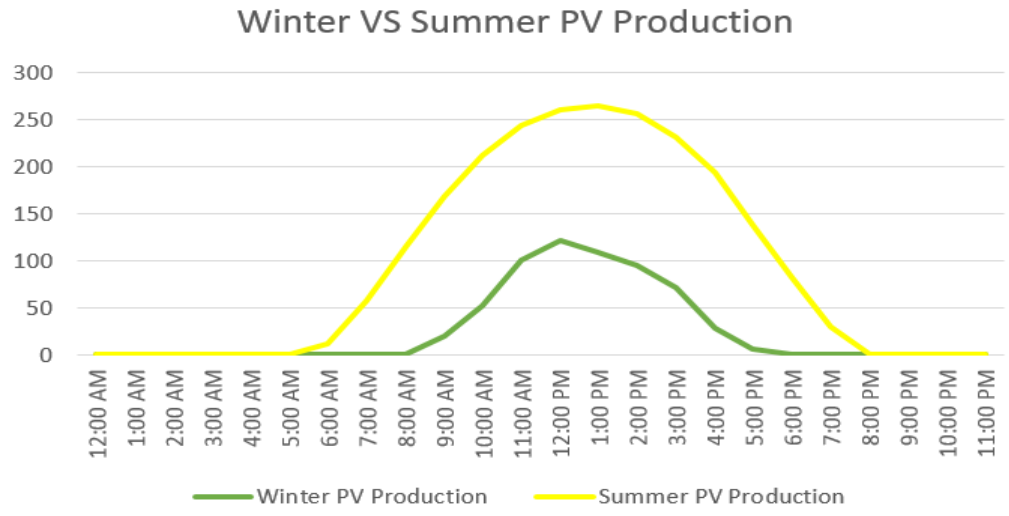
Load Profile of Building VS PV Production



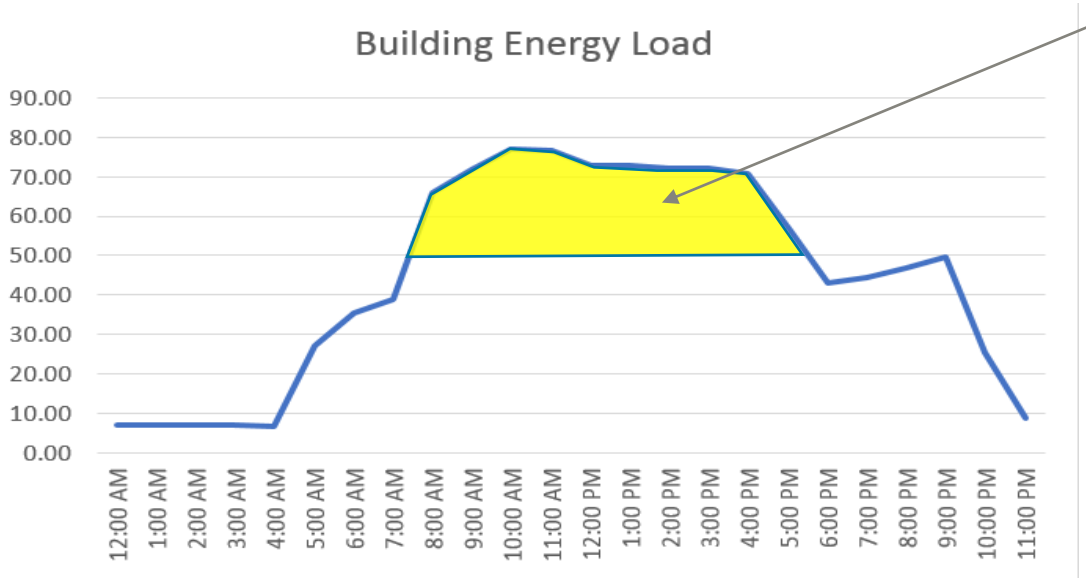


- NZE Buildings also have utility charges as the PV Production and Building Usage profiles are not in sync with each other.





Peak Shaving Application



Battery will provide required energy to reduce Peak Demand charge.

- Peak Demand may comprise of 50% of Utility Bill.
- BESS system helps reduce the PEAK Demand of the building resulting in reduced utility bills.