The Williams & Russell Project

District Systems for Equity-Centered Development

Energy Trust Net Zero Fellowship

Adre 6.13.2024

Presentation Agenda

1. Acknowledgement 2. Research Process 3. Development Overview	10 minutes
4. District Systems Overview 5. Waste System 6. Water Systems	10 minutes
7. Energy Systems ○ Energy Efficiency ○ Solar Generation ○ Battery Storage ○ Microgrid	30 minutes
8. Microgrid Partnerships 9. Funding 10. Conclusions	10 minutes

Team Acknowledgement

Conversations with:

- Pacific Power (PP)
- Pacific Northwest National Laboratory (PNNL)
- Third Party Providers
    - MidValley Power
    - ENEL X
    - Infracenters

Client: Williams Russell CDC

Research & Development Lead: Adre

Waste System: COR

Rainwater and Greywater Systems: Biohabitats

Energy Systems: PAE

Architecture: LEVER

Cost Estimator: COLAS CONSTRUCTION

Research Funder: EnergyTrust of Oregon

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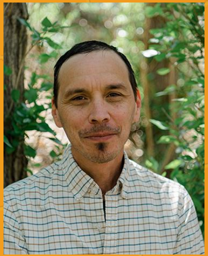

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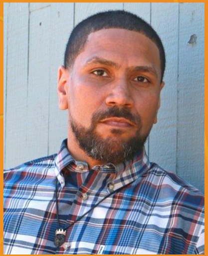

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Research Process

Goals

Research Systems

- How can district systems build community resiliency and economic benefit?
- What are possible district energy, water, and waste systems?

Learn from Existing Projects

- What are the challenges in district systems from other projects?

Estimated Cost for Interested Parties to Make Decisions

- Are the upfront costs of a district system, operations, and maintenance costs worth it to benefit the community?

Discussions with utility about partnership

- What microgrid design is most beneficial to community that can be supported by the utility?

Methodology

1. Brainstorm all district systems with industry leaders
2. Research district systems that are feasible for the project
3. Develop design options based on the project assumptions
4. Calculate the estimated cost of district systems
5. Discuss with interested parties on findings and receive their feedback
6. Discuss with 3rd party infrastructure owner/operators
7. Discuss with utility about partnership and grid-interconnectivity
8. Present findings to interested parties

Key Terms

Resiliency
Generally, resiliency is the planning and investment aimed at adapting to challenges in a manner that lessens impact of residents and communities. For this project, resiliency is to provide power for 48 hours during a major utility power outage.

Community Resiliency
Capacity to withstand and recover from disruptions from climate change, economic volatility and systemic and institutional injustices.

District
For this project, the district includes the full city block of Williams and Russell, including the three developments of Affordable Homeownership, Affordable Apartments and the Black Business Hub.

Renewable Energy Source
Power created by renewable source, like solar and wind.

Energy Efficiency
Resilience strategy to reduce energy required to provide services.

Net Zero
The state where carbon emissions due to human activities and removals of these gases are equal.

Water Savings
Reducing the amount of water required to provide services.

Backup Energy Storage System (BESS)
Energy stored onsite, i.e battery

Energy Use Intensity (EUI)
Measurement of energy load in a building.

Operations and Maintenance (O&M)
Day to day activities required to maintain systems and facilities.

MicroGrid (MG)
A small, self-contained energy system that can operate in connection with or independently from the main power grid.

Distributed Energy Resources (DERS)
Small, modular energy generation and storage that provide electricity on site and is grid-connected.

Islanding
DERS continue to provide power to the system even when the electrical grid is disconnected.

Key Terms (continued)

Greywater
Relatively clean waste water from baths, showers, sinks, washing machine and kitchen appliances.

Demand Response (DR)
Balancing the demand on power grids by encouraging customers to shift use to times when electricity is more plentiful through lower cost or monetary incentives.

OZONE Generator
Filters that intentionally emit ozone for disinfection for water treatment, compared to chlorination. Required equipment for tier 2 and tier 3 greywater systems.

Geoexchange
Energy efficient mechanical system using the recovery of heat from the earth using a heat pump.

Ground Source HVAC
Energy efficient heating/cooling system for buildings using heat transferred to or from the ground. Geo-exchange is an example of ground source HVAC.

Photovoltaic (PV)
Solar Panel System.

Medium Voltage Switch Vault (MV Switch Vault)
Space containing electrical equipment operating above 600 volts. Contains a centralized collection of circuit breakers, fuses, and disconnect switches that protect, control, and isolate electrical equipment.

PAC Distributions
Equipment and conduits that the electrical utility owns and is responsible for.

Customer Distributions
Equipment and conduits that the customer owns and is responsible for.

Behind the Meter
Referring to any electrical equipment and distributions that is owned and the customer responsibility.

Front of the Meter
Any electrical equipment that is owned and operated by the utility.

Development Overview

Concept

The Williams & Russell Project aims to honor and enrich Portland's Black community, create wealth, and promote a healthier economy by providing affordable rental apartments and homeownership as well as business opportunities for the community, especially those whose families were impacted by displacement.

Image Courtesy of: LEVER Architecture

Development Concept

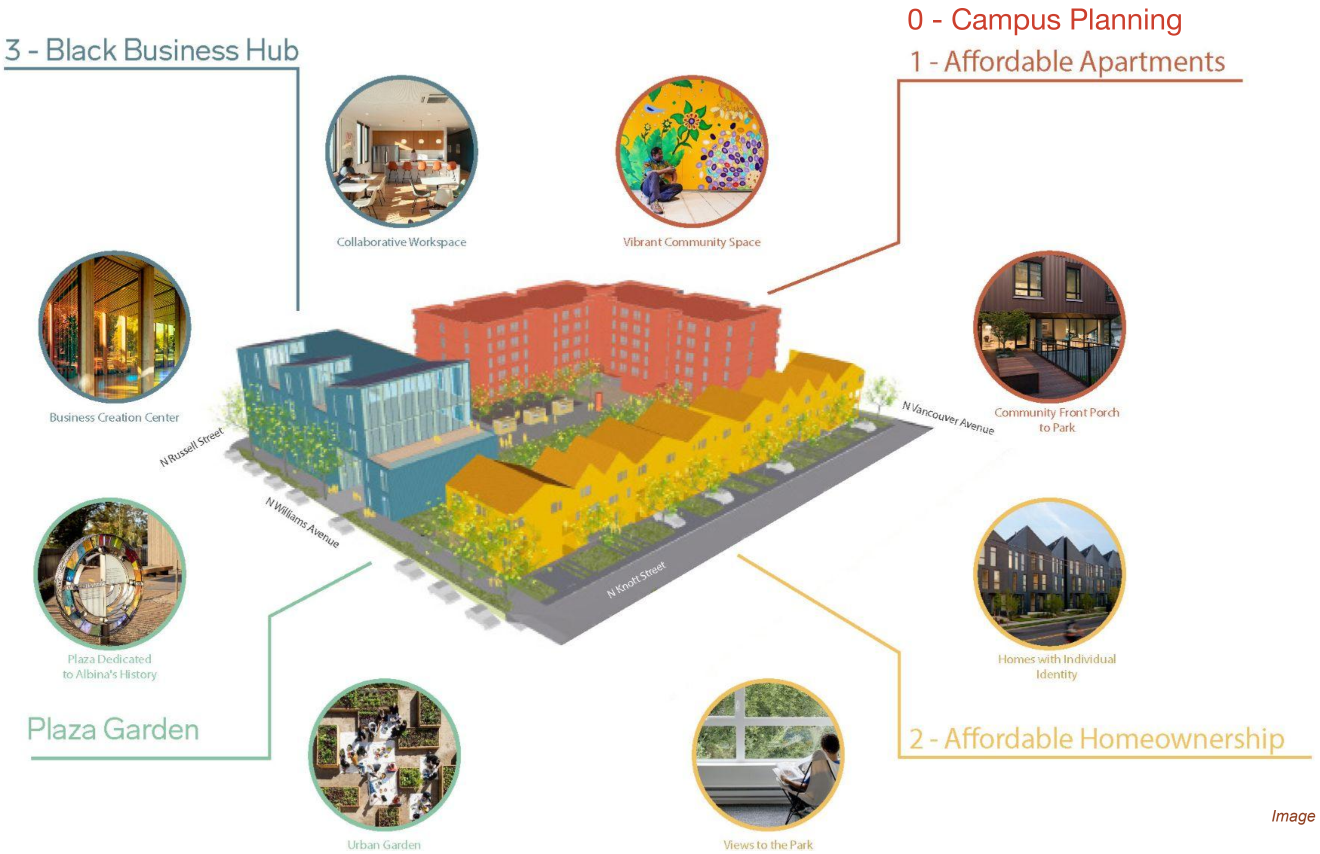

Image Courtesy of: LEVER Architecture

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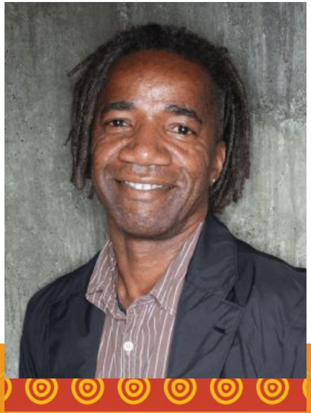


Walter Hood
Founder
Hood Design Studio

Development Team

Construction, Architecture, & Landscape Architecture

Affordable Apartments

Development Overview

Project Highlights | Developer: PCRI

- **Program**: 6-story apartment building with 85 affordable units at 30-80% AMI
  - 1 Bedroom: $520 - $1,154
  - 2 Bedroom: $616 - $1,378
  - 3 Bedroom: $705 - $1,585
- **Amenities**: Community room, culturally-specific resident services, & early childhood services
- **Parking**: 14 stalls (podium/surface)
- **Sustainability**: LEED Gold, Earth Advantage, or National Green Building Standard
- **Equity**: N/NE Preference Policy
- **Schedule**: Jul 2023 - Aug 2027

Affordable Homeownership Development Overview

Project Highlights | Developer: Adre

- **Program**: 20 homes of “missing middle” housing in townhouse style with condo ownership at 60-120% AMI
  - 3 bedroom - 10 homes (50%) (5 include ADU)
  - 2 bedroom - 10 homes (50%)
- **Size / Price**: 1,150 - 1,750 sq ft / $250,000 - $650,000
- **Down payment assistance**: ~$125,000
- **Amenities**: Private outdoor spaces
- **Parking**: 20 stalls (garage/surface)
- **Sustainability**: Earth Advantage Platinum
- **Schedule**: November 2023 - June 2026

Black Business Hub

Development Overview

Project Highlights | Developer: Adre

- **Program**: Workforce training/education, co-working space, business accelerator, business growth, and professional development for youth
  - Affordable office space ($22/SF NNN)
  - Affordable retail space ($25/SF NNN)
- **Size**: 30,000 sqft / 4 story building
- **Amenities:** Plaza, garden, community room, and cafe
- **Sustainability:** LEED Gold
- **Parking:** 27 stalls (underground)
- **Schedule:** January 2024 - March 2027

Community Benefits

Wealth Creation: Knowledge, Resource, Health, and Community

- New pathway for residents to **come back home**, with a sense of healing, hope, and pride
- Opportunities for gainful **employment** (and apprenticeships) in construction
- Affordable spaces to grow **businesses** and have access to **workforce** education and training
- Well-designed **affordable apartments**
- Opportunity to buy **affordable homes** with access to down payment assistance

Diversity / Equity

Contracting

- Diverse leadership team and deep commitment to engaging diverse consultants through development, leasing/sales, and asset management
- 100% of contracted dollars will go to a Black-owned firm and over 30% of subcontractors will be women-and/or BIPOC-owned businesses

Leasing and Management

- Programming will be grounded in culturally-specific services
- Housing leasing and sales will follow the N/NE Preference Policy
- Team will work with W+R CDC to develop a project that provides continual community benefit

District Systems Overview

Systems

Waste System

- Diversion from Landfill
- Recycling
- Composting Food Waste

Water Systems

- Rainwater Collection and Reuse
- Greywater Recycling

Energy Systems

- Energy Efficient Buildings
- Energy Efficiency GeoExchange
- Renewable Energy Generation
- Backup Energy Storage Systems (BESS)
- Microgrids

Community Benefit

Environmental Sustainability

- Renewable Energy
- Water Collection
- Heating & Cooling
- Waste Diversion

Resiliency

- Upfront Investment for Systems
- Power During Grid Outages
- Being able to withstand climate events

Economic Viability

- Operations and Maintenance
- Grid Connected
- Operational Cost Savings
- Potential Revenue

Waste System

Summary

Findings from City of Roses Disposal & Recycling (COR)

- City of Portland requires waste management companies to divert yard debris and recycling collection
- A District Waste System would include post consumer collections (i.e clothing, furniture, ‘non-recyclable’ plastics, food to be composted onsite) that are above and beyond City requirements
- Republic Waste Management (franchised for the site) does not support a District Waste System

Conclusion

- The project will not be pursuing a District Waste System after building completion but will focus on Path to Net Zero waste management during construction
- This will reduce waste, re-circulating materials to be repurposed, and diverting waste from landfills

Water Systems

Water Systems

Goals

Approach

1. Identify all site opportunities to collect rainwater
2. Determine the most impactful water reuse strategy
3. Identify simple operational systems and minimal costs

Design

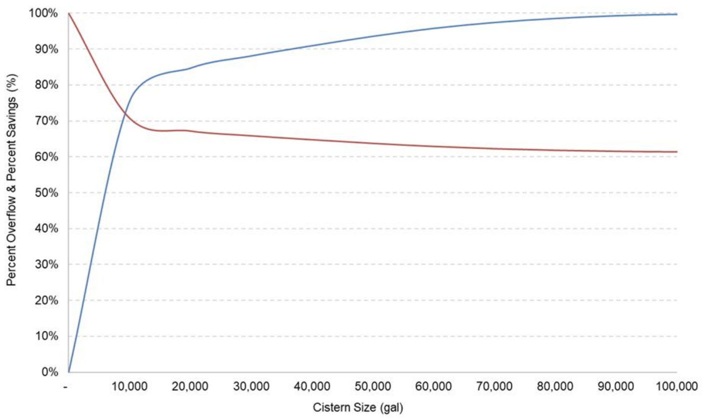
- Use rainwater collection for non-potable (undrinkable) demands
- Use collected greywater from sinks, tubs, laundry for non-potable demands

Rainwater Design Options

Option 1
Rainwater collected on all roofs goes to BBH and Affordable Homeownership toilets

Option 2
Rainwater collected on all roofs goes to Affordable Apartments toilets

Size of Cistern to Flushing Demand



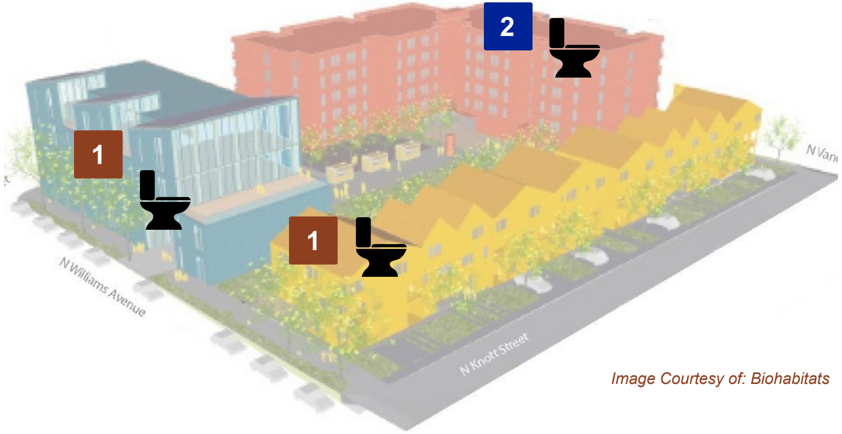


Image Courtesy of: Biohabitats

- Rain collected from roofs into a 20,000 gallon cistern meets **70-80% of the toilets flushing demand** for both options
- Requires 100 sq ft of semi-conditioned mechanical room for water treatment equipment

Greywater Design Options

Option 3
Greywater from the Affordable Apartments used for site irrigation

Option 4
Greywater from the BBH and Affordable Homeownership used for BBH toilets

Option 5
Greywater from Affordable Apartments used for Affordable Apartments toilets

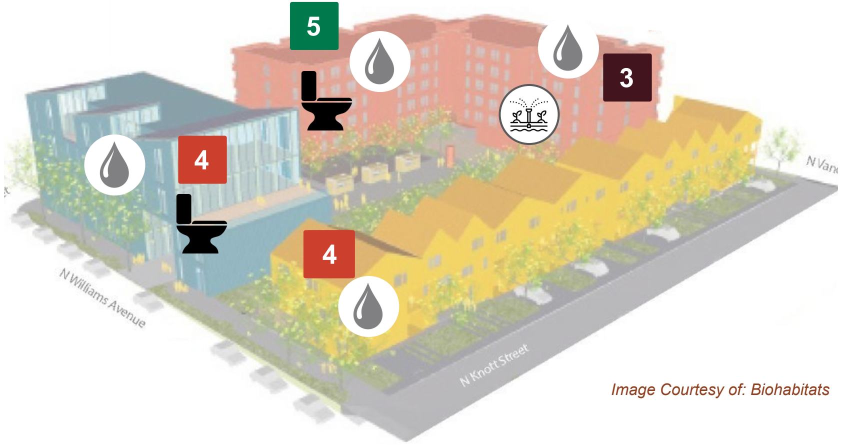


Image Courtesy of: Biohabitats

- Greywater = water from bathroom sinks, showers, tubs, and laundry
- The greywater waste piping system will be an additional piping system, treatment, and cost

Greywater Treatment

Mechanical Room in Rose Villa, Portland OR by Biohabitats

Summary

Design Options	Simplicity	Space	Energy	O&M	Water Saved	ROM Cost*
1: Rainwater collected on all roofs goes to BBH and Affordable Homeownership toilets	●●	●●	●●	●●●	●●	$303K
2: Rainwater collected on all roofs goes to Affordable Apartments toilets	●●	●●	●●	●●●	●●	$303K
3:Greywater from the Affordable Apartments used for site irrigation	●●●	●●●	●●●	●●●●	●●●	$540K
4: Greywater from the BBH & Affordable Homeownership used for BBH toilets	●●●●	●●●	●●●●	●●●●	●●●●	$644K
5: Greywater from Affordable Apartments used for Affordable Apartments toilets	●●●●●	●●●●●	●●●●	●●●●●	●●●●	$950K

*Pricing from Colas, RMS, and CHC Hydro; includes the supplemental water system storage, piping, mechanical room and general contractor costs for the rainwater and greywater systems above the conventional waste system.

Energy Systems

Energy Systems

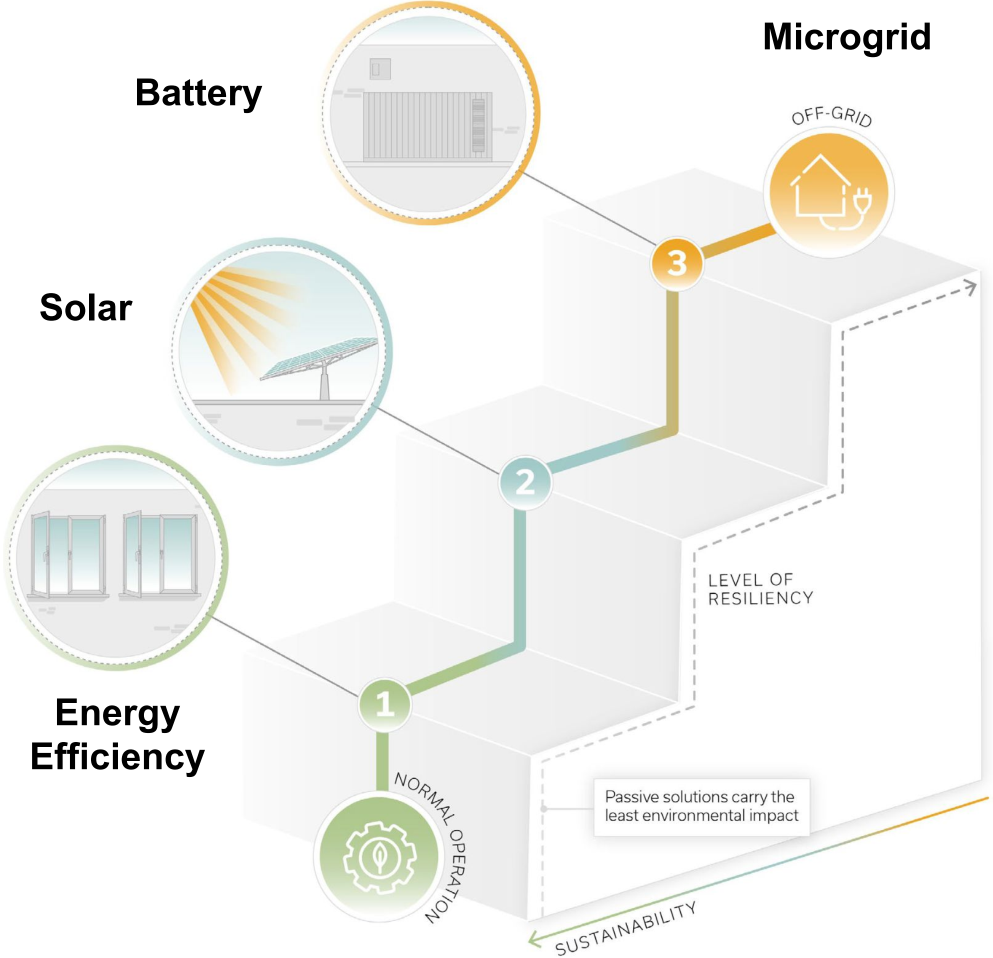
Goals

How are we defining resiliency?

- Respond to loss of a primary power source
- Backup power for up to 2 days

Energy System Components

1. Energy Efficiency
   - Passive Design (per building)
   - Geoexchange for load reduction for heating and cooling (onsite)
2. Solar Generation (onsite)
3. Battery Storage (onsite)
4. Microgrid



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Energy Efficiency

Energy Efficiency

Goals

Approach

1. Energy targets for buildings (15 EUI)
2. Energy efficient design (envelope, windows, insulation, and fixtures)
3. Buildings with heat pumps and outdoor air systems
4. District Geoexchange Loop connected to all of the buildings
5. Is Net Zero Operations feasible?

Design

- Used “case study buildings” to model each building type to be as close to net zero as possible
- Modeled building performance with IESVE software

Energy Efficiency

Affordable Apartments

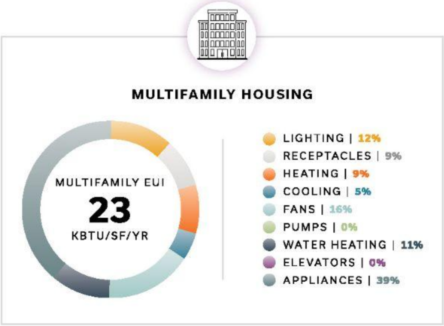
Typical Multi-Family = 59 EUI

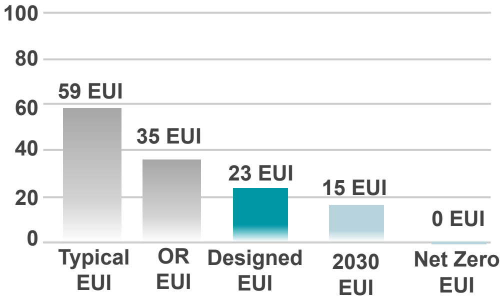
Energy Efficient Design

- High performance envelope
- Window to Wall Ratio at 19%
- Energy efficient fixtures
- District Geoexchange Loop with distributed building heat pumps with Heat Recovery at 65%
- Dedicated outdoor air system (DOAS) - fresh air

Lighting	4	EUI
Receptacles	11	EUI
Heating	2	EUI
Cooling	0	EUI
Fans	2	EUI
Pumps	0	EUI
Water Heating	1	EUI
Elevators	0	EUI
Appliances	3	EUI

Energy Efficient Design = 23 EUI





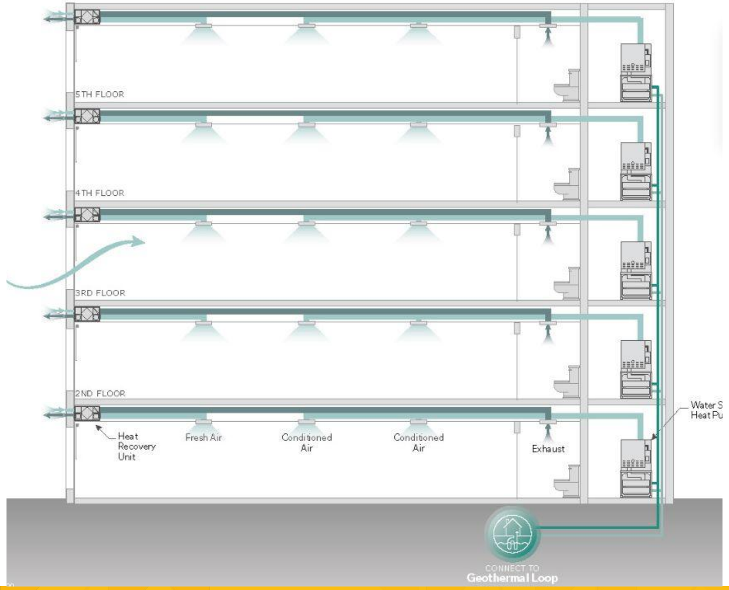


Image Courtesy of: PAE

Energy Efficiency

Affordable Homes

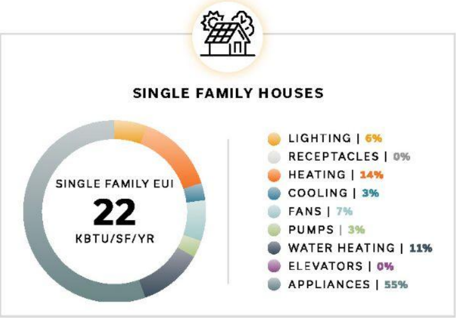
Typical Single Family House = 100 EUI

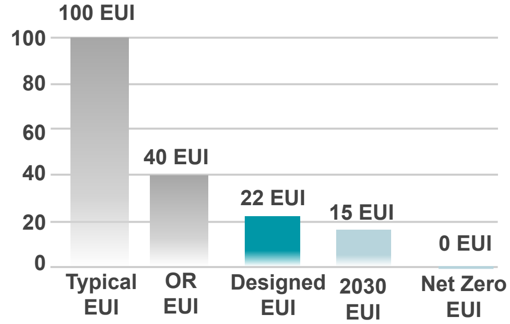
Energy Efficient Design

- High performance envelope
- Window to Wall Ratio at 13%
- Energy efficient fixtures
- District Geoexchange Loop with distributed building heat pumps with Heat Recovery at 65%
- Fresh air ventilation and exhaust in ceiling

Lighting	1	EUI
Receptacles	0	EUI
Heating	3	EUI
Cooling	1	EUI
Fans	2	EUI
Pumps	1	EUI
Water Heating	2	EUI
Elevators	0	EUI
Appliances	12	EUI

Energy Efficient Design = 22 EUI





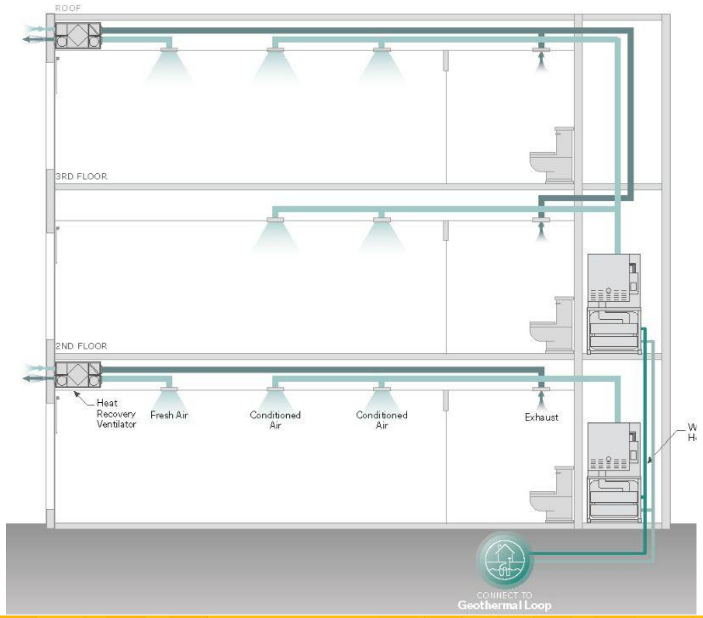


Image Courtesy of: PAE

Energy Efficiency

Black Business Hub

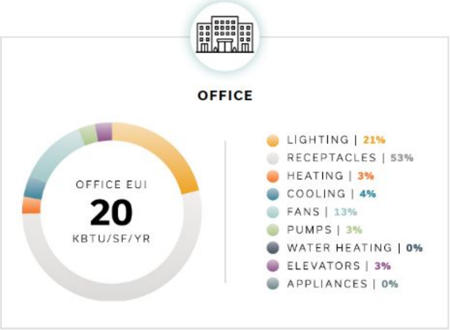
Typical Office = 53 EUI

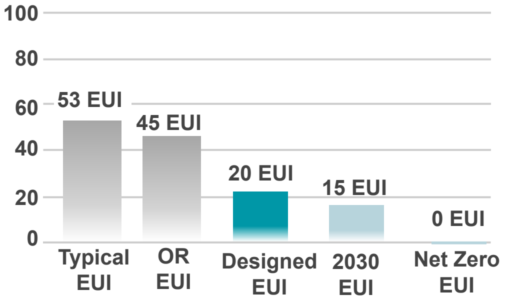
Energy Efficient Design

- High performance envelope
- Window to Wall Ratio at 34%
- Energy efficient fixtures
- District Geoexchange Loop with distributed building heat pumps with Heat Recovery at 72%
- Dedicated outdoor air system (DOAS) - fresh air

Lighting	4	EUI
Receptacles	10	EUI
Heating	1	EUI
Cooling	1	EUI
Fans	2	EUI
Pumps	1	EUI
Water Heating	0	EUI
Elevators	1	EUI
Appliances	0	EUI

Energy Efficient Design = 20 EUI





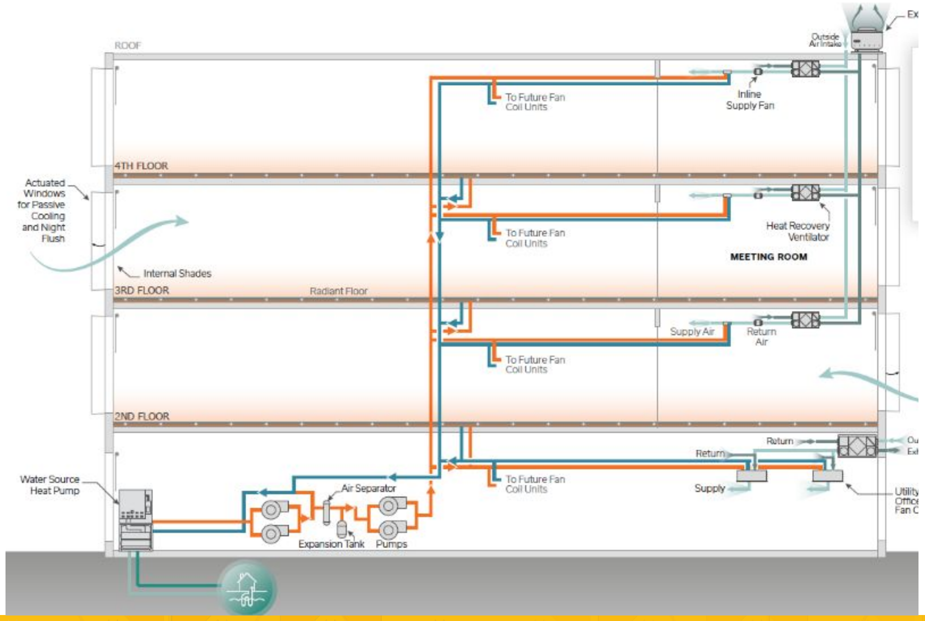


Image Courtesy of: PAE

District Geoexchange Loop

Loop for Heating and Cooling

Integrated energy efficient mechanical system using heat recovery from the earth using a heat pump

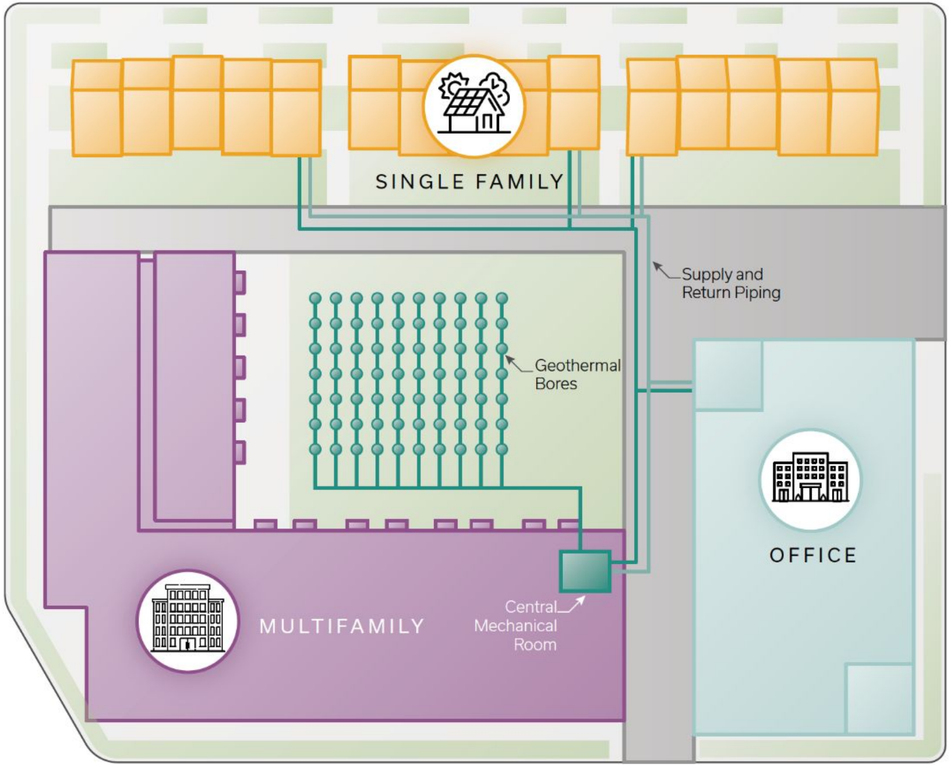
- Geothermal bores (250’ cables in the ground)
- Central mechanical room
- Supply and return piping to buildings
- Heat pumps (in the buildings)

Advantages

- Energy efficient system
- Climate resilient- better operating in extreme conditions
- Sharing heat recovery between buildings

Disadvantages

- Digging 250’ bores
- Requires dedicated technical property management
- Higher first cost - $840K



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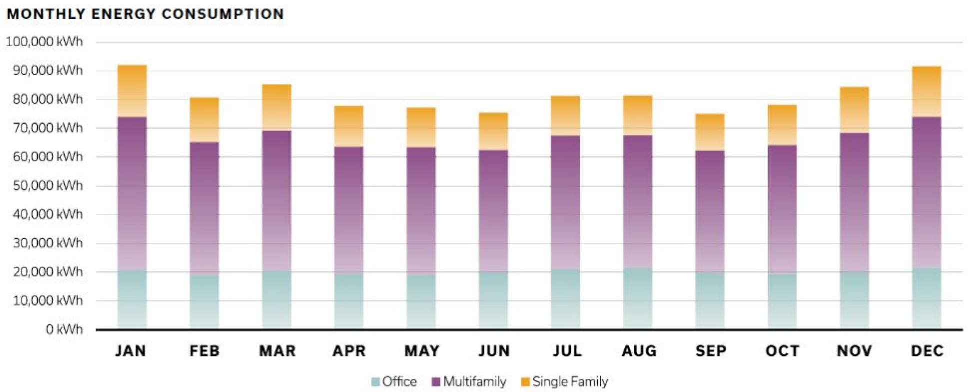
Summary



Is Net Zero Operations feasible?

- With energy efficiency measures and district geoexchange loop, the project achieved 34% of Net Zero operations
- The energy use has been reduced by 66% (65 EUI to 22 EUI)

Image Courtesy of: PAE

Solar Generation

Solar Generation

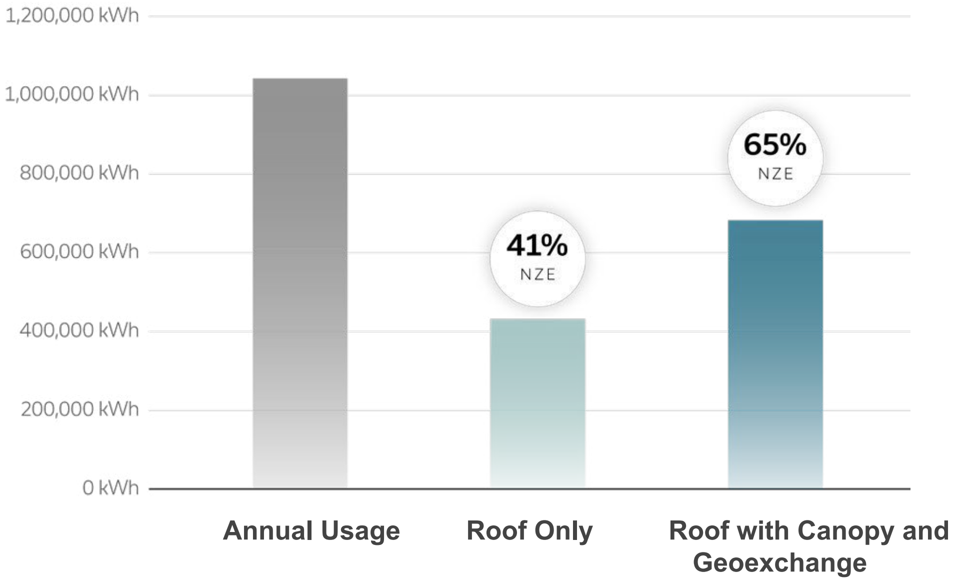
Goals

Approach

1. Identify all site opportunities on where solar can be placed
2. Determine the most productive Solar Array orientation
3. Is Net Zero Operations feasible?

Design

- Racking and orientation
- Single vs dual tilt racking
- Roof panels and/or canopy



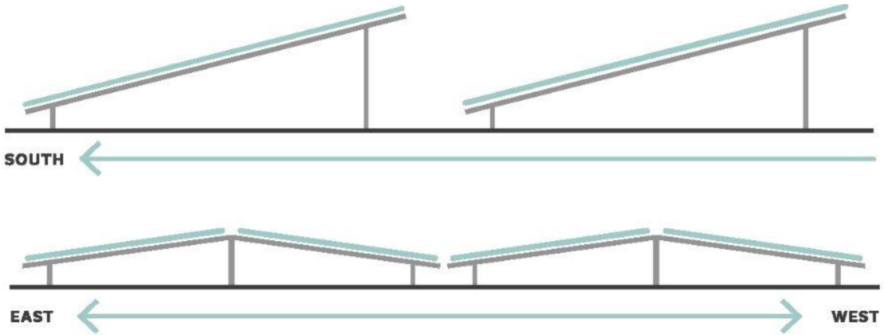


Image Courtesy of: PAE

Solar Generation

Single Tilt Roof

Affordable Apartments

- 237 Solar Panels
- 156 KW
- 90% Solar Access

Affordable Homeownership

- 180 Solar Panels
- 93 KW
- 90% Solar Access

Black Business Hub

- 154 Solar Panels
- 102 KW
- 90% Solar Access

TOTAL 351 KW

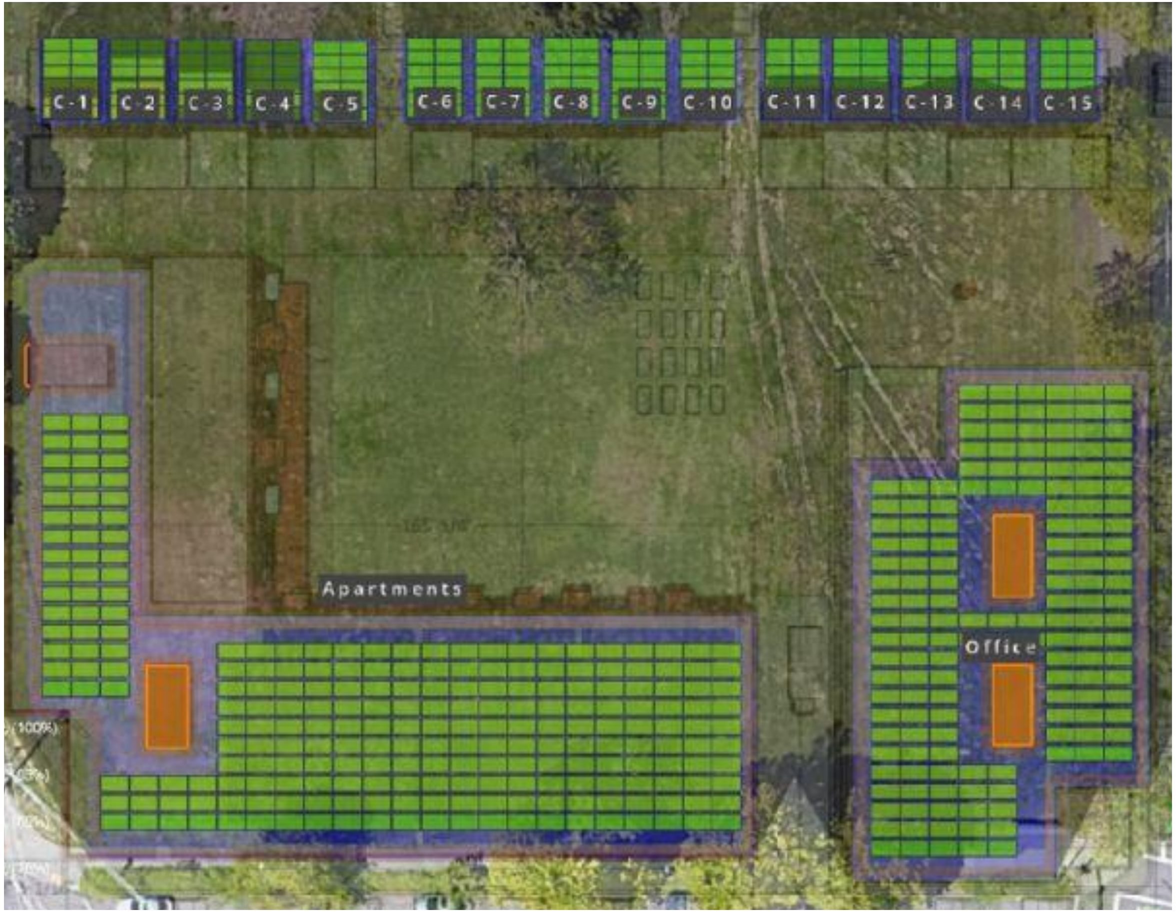


Image Courtesy of: PAE

Solar Generation

Dual Tilt Roof

Affordable Apartments

- 268 Solar Panels
- 177 KW
- 90% Solar Access

Affordable Homeownership

- 180 Solar Panels
- 93 KW
- 90% Solar Access

Black Business Hub

- 162 Solar Panels
- 107 KW
- 90% Solar Access

TOTAL 377 KW

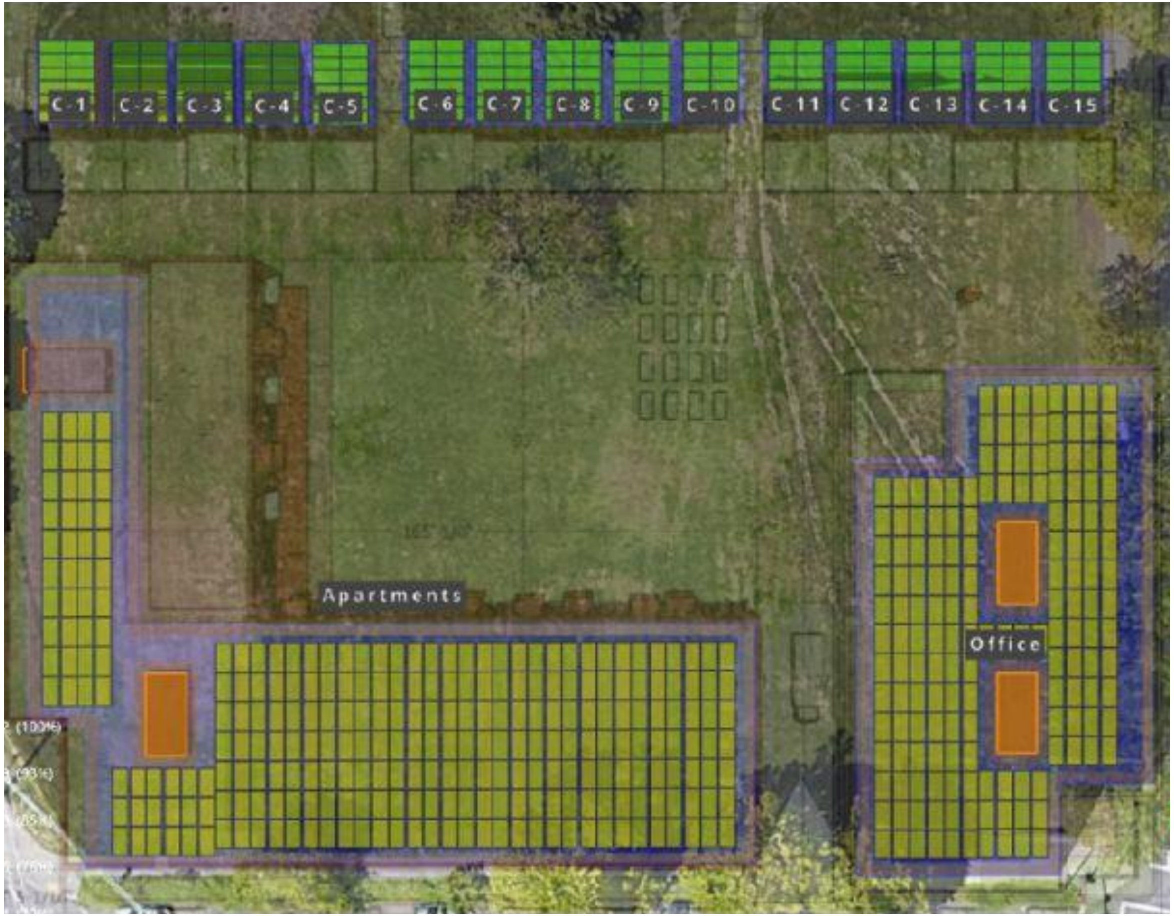


Image Courtesy of: PAE

Solar Generation

Dual Tilt and Canopy

Dual Tilt Roof (all buildings)

- 377 Solar Panels
- 377 KW
- 90% Solar Access

Courtyard Canopy

- 190 Solar Panels
- 190 KW
- 90% Solar Access
- 12,000 square feet of canopy area

TOTAL 567 KW

33% increase above Dual Tilt Roof

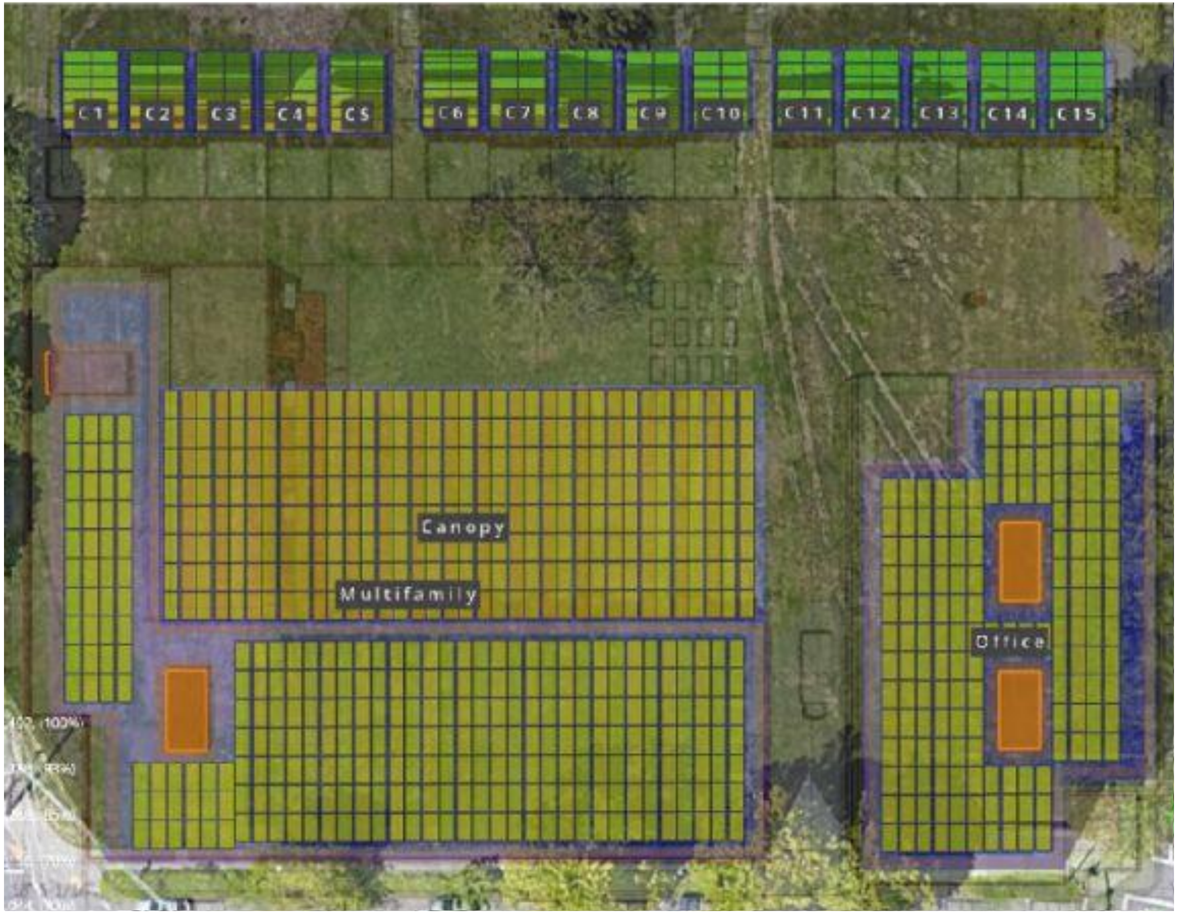


Image Courtesy of: PAE

Solar Generation

Dual Tilt and Geoexchange

Dual Tilt Roof (all buildings)

- 377 Solar Panels
- 377 KW

Courtyard Canopy

- 190 Solar Panels
- 190 KW

Geoexchange

- 190 Solar Panels
- 38 KW
- 90% Solar Access

TOTAL 467 KW

20% increase above Dual Tilt Roof

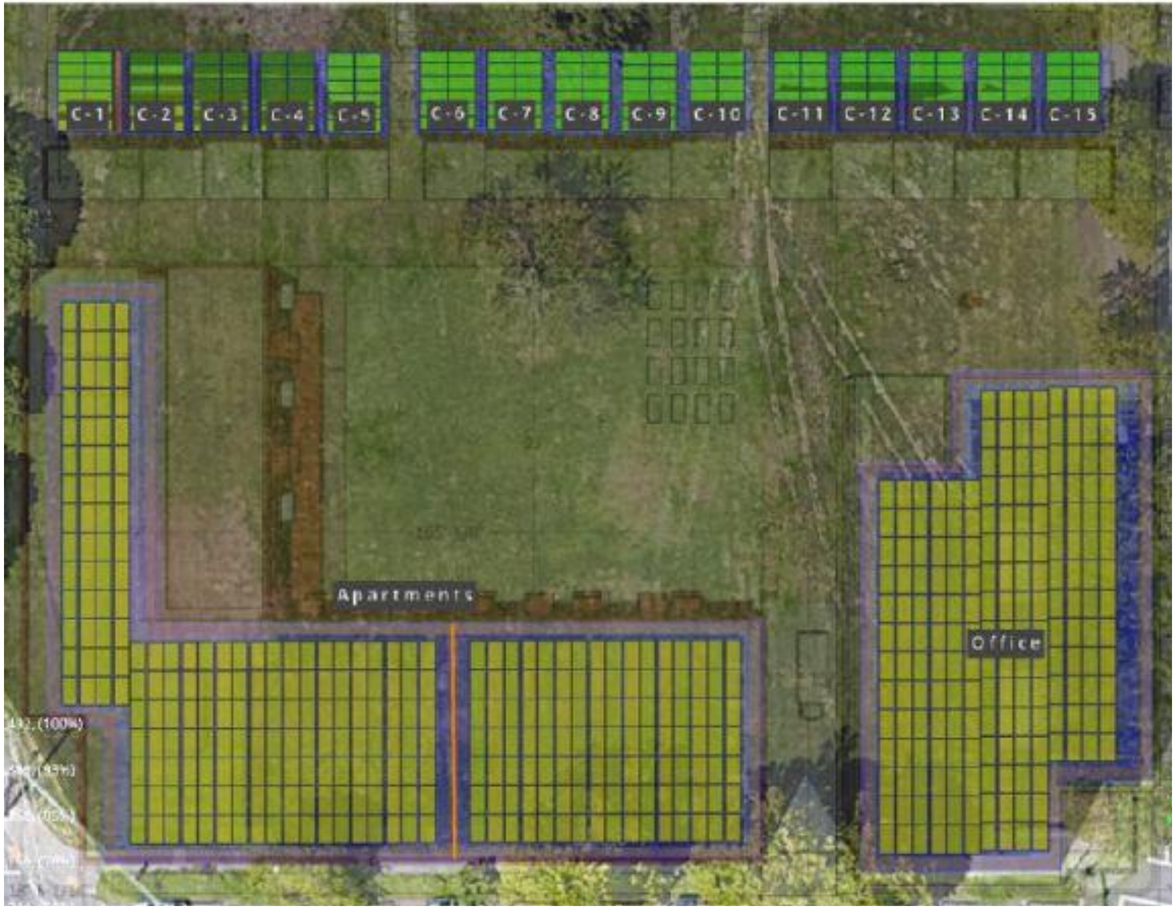


Image Courtesy of: PAE

Solar Generation

Dual Tilt, Canopy and Geoexchange

Dual Tilt Roof (all buildings)

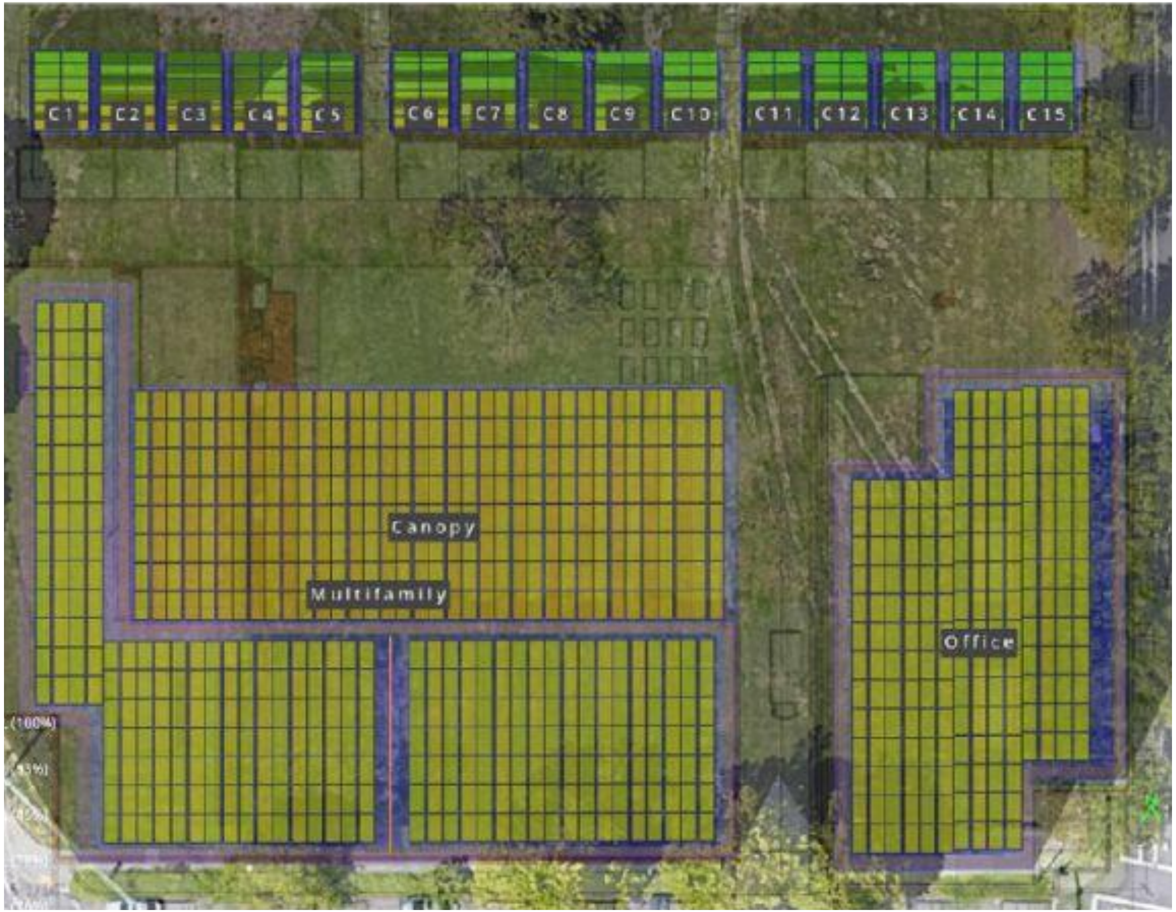
- 377 Solar Panels
- 377 KW
- 90% Solar Access

Geoexchange

- 190 Solar Panels
- 38 KW
- 90% Solar Access

TOTAL 607 KW

40% increase above Dual Tilt Roof



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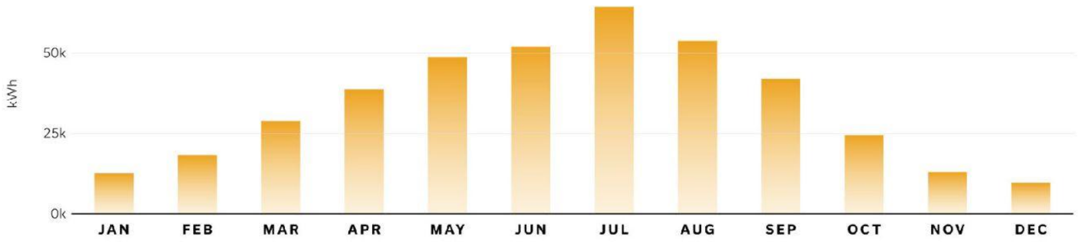
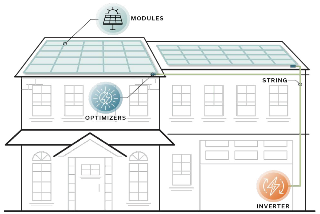
Summary

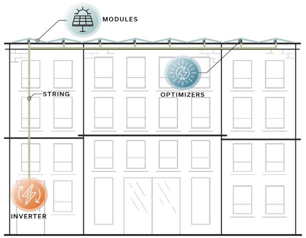


	ARRAY AREA	MOUNTING OPTION	KW	MWH	# OF PANELS
ROOF TOP ARRAYS	Office	SOUTH	102	120	154
		EAST/WEST	107	121	162
	Multifamily Housing	SOUTH	156	184	237
		EAST/WEST	177	199	268
	Single Family Housing 15 UNITS	FLUSH MOUNT	93	112	180
	Total of All Roof Top Arrays	SOUTH	351	416	571
		EAST/WEST (BASE DESIGN)	377	432	610
EXPANSION OPTIONS	Canopy Only	EAST/WEST	190	207	288
	Geoexchange HVAC	EAST/WEST	38	44	58
	Canopy and Geoexchange	EAST/WEST	228	251	346
	Total Possible on Campus		605	683	956

Is Net Zero Operations feasible?

- With energy efficiency measures, district geoexchange loop, and solar with dual tilt and canopy the project achieved 65% of Net Zero operations





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Energy Systems Summary

Design Options	Simplicity	Space	Energy Generated or Saved	O&M	ROM Cost
Heat Pumps and Geoexchange Loop	●●	●●●●	●●●	●●	$840K
Solar (buildings)	●	●●	●●	●	$1.0M
Solar (buildings + canopy)	●	●●●	●●●	●	$1.6M
Solar and Geoexchange Loop	●●●●	●●●●●	●●●●●	●●●	$2.4M

* Pricing from Colas includes the solar panel modules, inverters, optimizers, panel claws, conduit, (70) geothermal bores, heading equipment and general contractor costs for the district energy systems

Battery Storage

Goals

Approach

- Backup Energy Storage System (BESS) module is 10’ wide x 14’ long x 7’ high
- Providing backup power for 2 days
- Balancing the size of the BESS system versus open green space
- Prioritize residential buildings over the office building

Battery Sizing Options

Option A: 100% Backup Power

- Lighting, heating, internet, refrigeration, cold water, appliances, power outlets
- No hot water and air conditioning

Option B: 50% Backup Power

- Building owners decide during design which 50% of building stays operational
- Priority would be communal areas (hallways and community rooms)

Option C: 100% Backup Power, Half of Loads for All Housing

Option D: 100% Backup Power, Apartments Only

Battery Storage

Option A

100% Backup Power

Backup Energy Storage System (BESS)

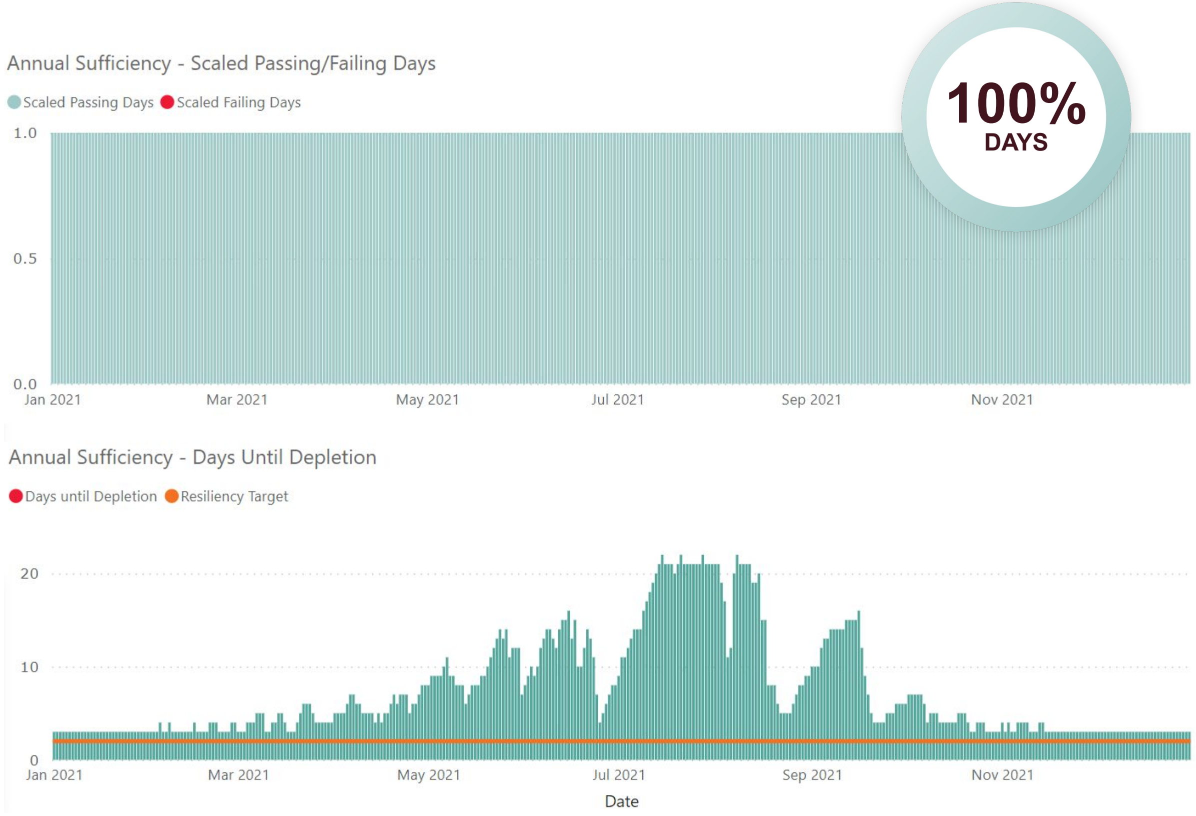
- 6,120 kWH stored energy
- 9 battery modules
- PV: Rooftop Only

Advantages

- 100% resiliency for all buildings is achieved all year

Disadvantages

- Size of battery modules will take up all of the site green space



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Battery Storage

Option B

50% Backup Power

Backup Energy Storage System (BESS)

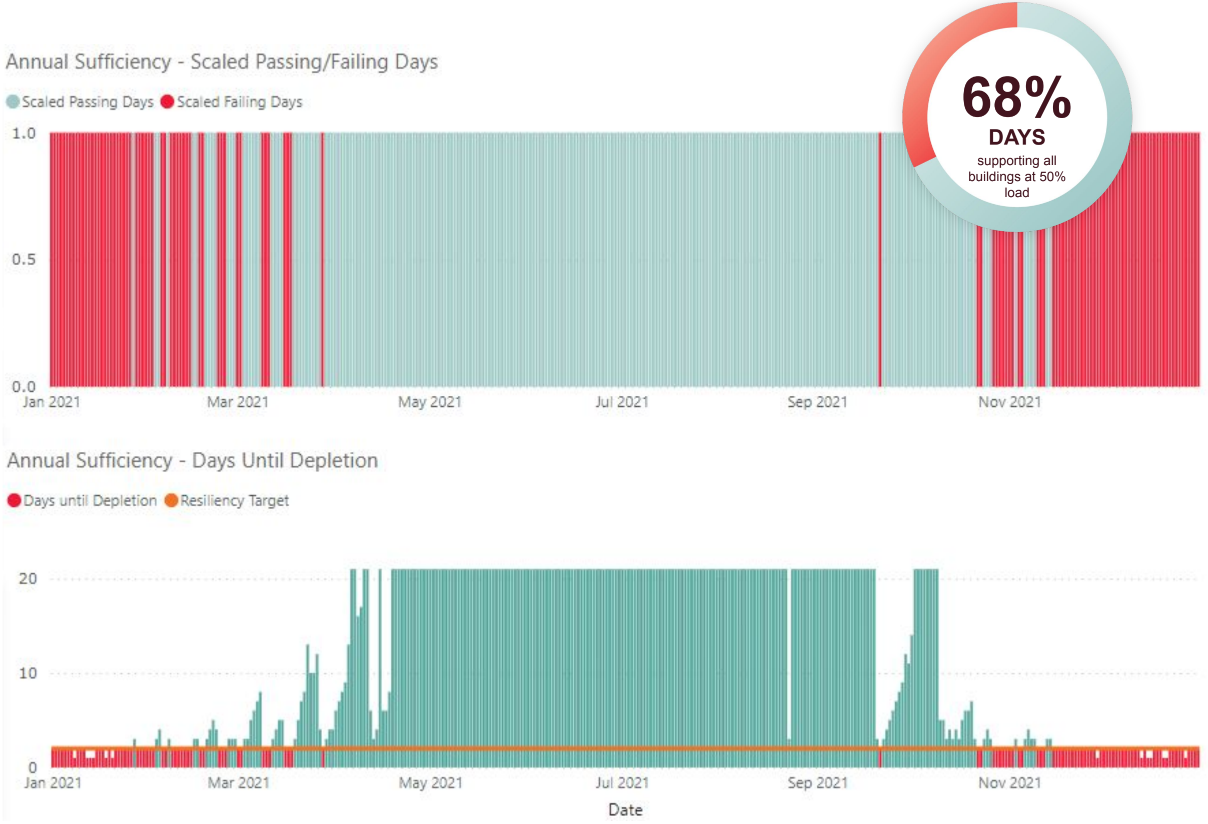
- 1,320 kWH stored energy
- 2 battery modules
- PV: Rooftop Only

Advantages

- 50% resiliency for all buildings is achieved 2/3 of the year
- Smaller battery preserves green space

Disadvantages

- Does not meet full resilience



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Battery Storage

Option C

100% Backup Power, Half of Loads of All Housing

Backup Energy Storage System (BESS)

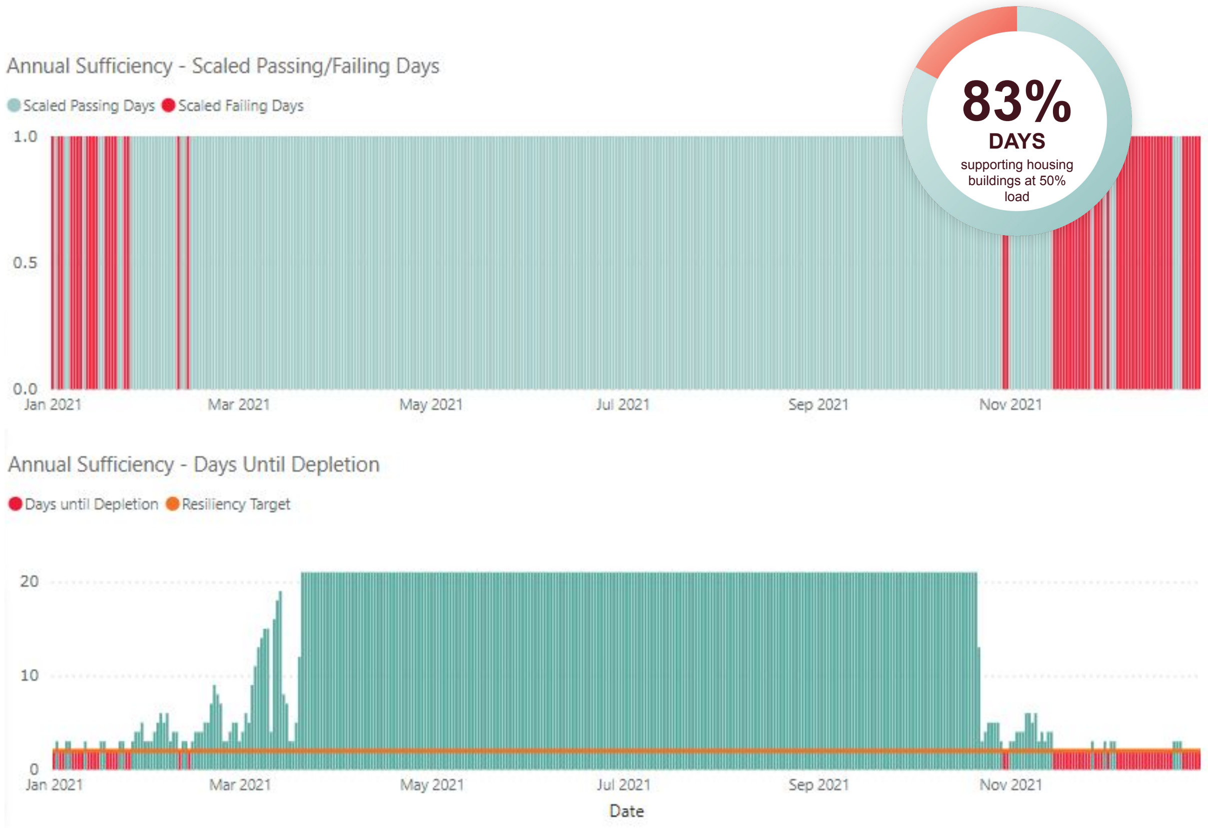
- 1,320 kWH stored energy
- 2 battery modules
- PV: Rooftop Only

Advantages

- 50% resiliency for all housing is achieved 3/4 of the year
- Providing critical load backup to all residents during an outage

Disadvantages

- Only provides backup to residents not to office users
- Only critical load support



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Battery Storage

Option D

100% Backup Power, Apartments

Backup Energy Storage System (BESS)

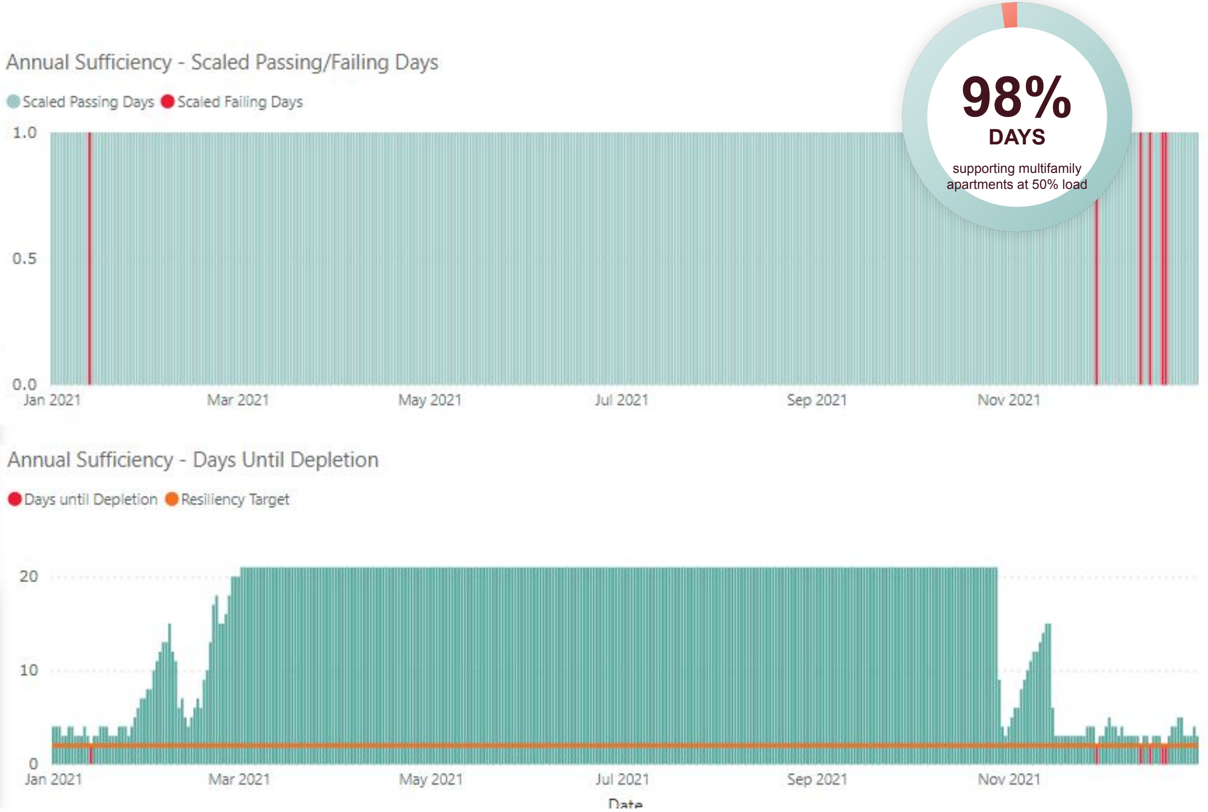
- 1,320 kWH stored energy
- 2 battery modules
- PV: Rooftop Only

Advantages

- 50% resiliency for apartment is achieved 98% of the year
- Providing backup to majority of residents during an outage

Disadvantages

- Only provides backup to the apartment residents, not homeowners or office users
- Only critical load support



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Summary

Options	PV Location	PV panels dedicated to BESS	BESS Size	# of BESS Modules	Battery Net Price
A: 100% Backup Power	All Rooftops	203 kW	6,120 kwh	9 modules	$4.3M
B: 50% Backup Power	All Rooftops	203 kW	1,320 kwh	2 modules	$2.9M
C: 100% Backup Power, Half of Loads of All Housing	All Rooftops & Canopy	203 kW	1,320 kwh	2 modules	$2.9M
D: 100% Backup Power, Apartments	All Rooftops	203 kW	1,320 kwh	2 modules	$2.9M

* Option C and D assumes the Black Business Hub back-up battery storage is given to the residents during a power outage
** BESS system specified is ELM Microgrid 250 kW/660 kWh

Microgrid

Microgrid

Goals

Our team sees microgrids as the future of the energy industry. This study allowed us to move beyond theoretical analysis to explore real world challenges.

Approach

1. Identify opportunities for a Microgrid
2. Understand requirements of microgrid to be grid-connected
3. Can we create a district microgrid that the utility owns and operates?

Design

- Single building vs district requirements
- Identify what equipment is customer owned vs utility owned
- Design microgrid to **Island** and to be **Grid-interconnected**

Microgrid

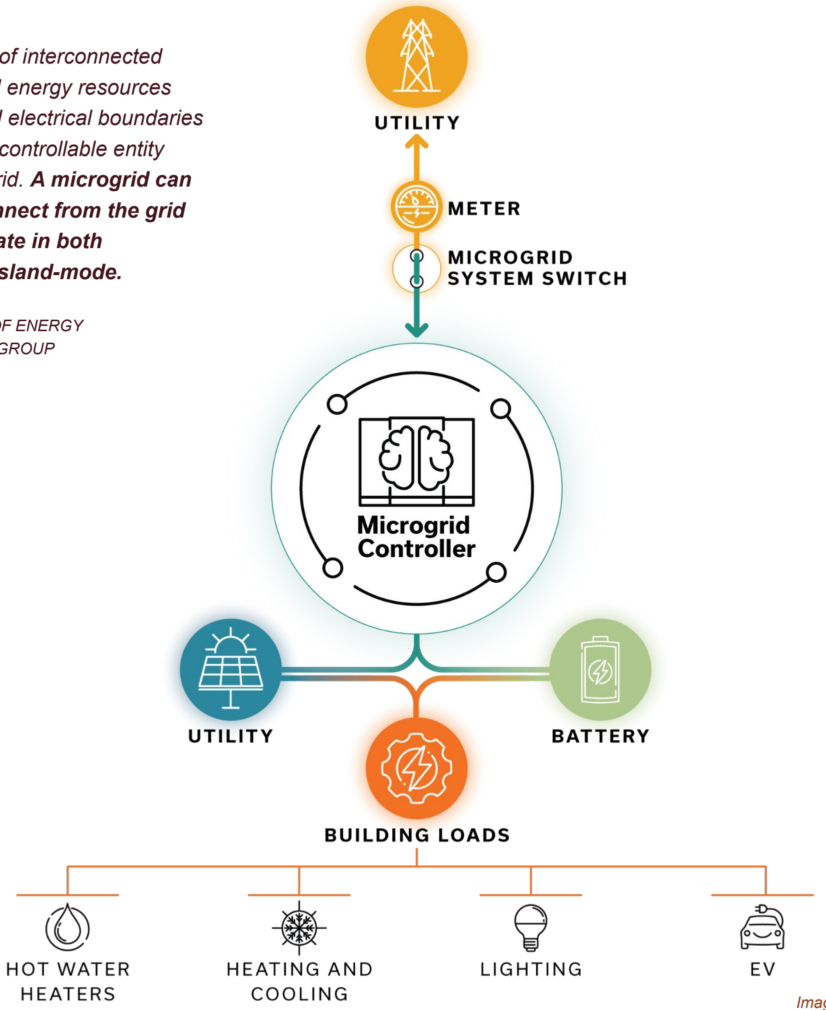
What is a Microgrid?

Microgrid Components

- **Loads:** Any system that uses energy
- **Onsite Generation and Storage:** Solar PV Panels and Battery
- **Microgrid Controller:** Control system for the microgrid, can also include controllable electrical equipment like circuit breakers
- **Microgrid Disconnect:** A disconnection point from utility to a microgrid where systems can operate independently

A microgrid is group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. ***A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.***

THE U.S. DEPARTMENT OF ENERGY MICROGRID EXCHANGE GROUP



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Microgrid

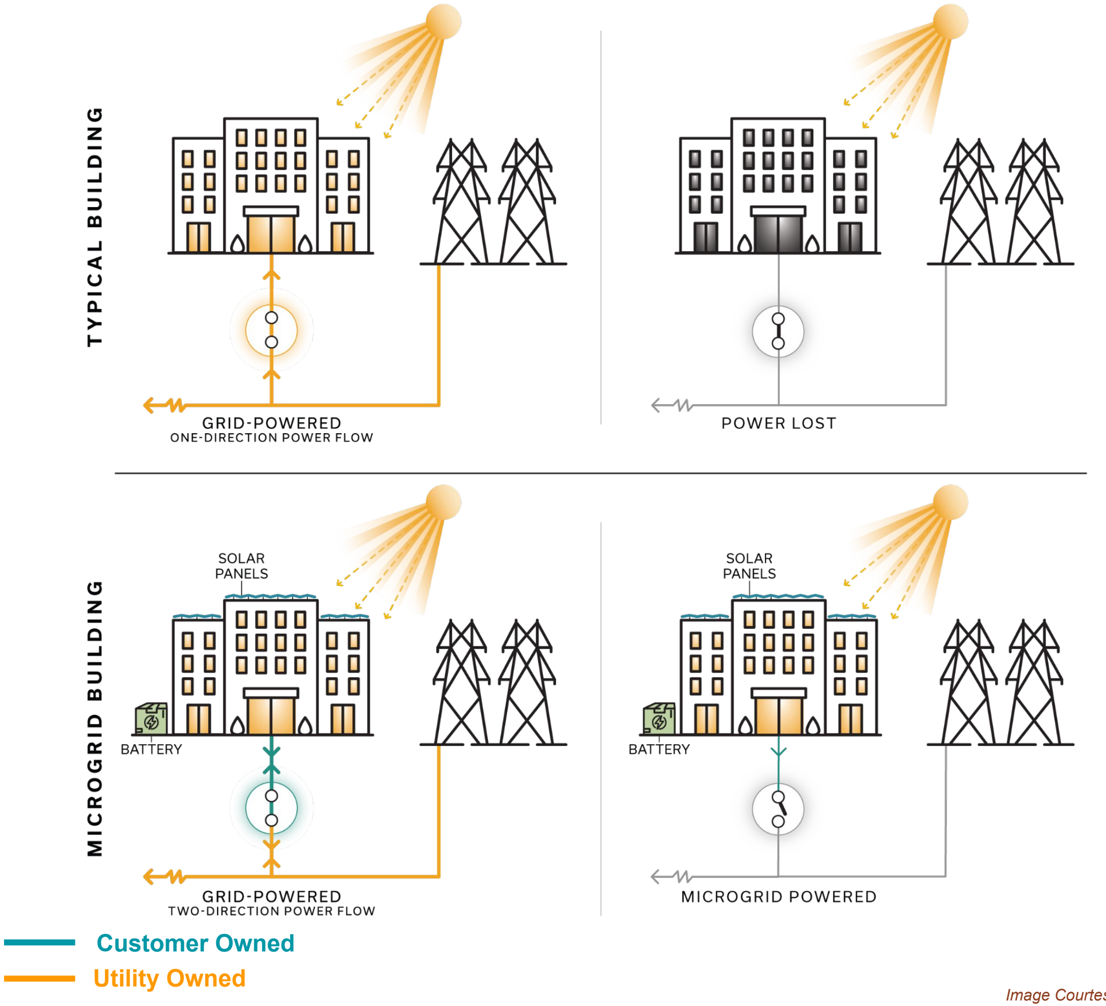
How does a Microgrid operate?

Grid Connected

- The microgrid works in collaboration with the utility grid
- Benefits include reduced operating costs, improved grid resilience, reduced operating emissions

Grid Disconnected

- The microgrid operates independently of the utility grid
- Benefit is local energy resilience



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Microgrid

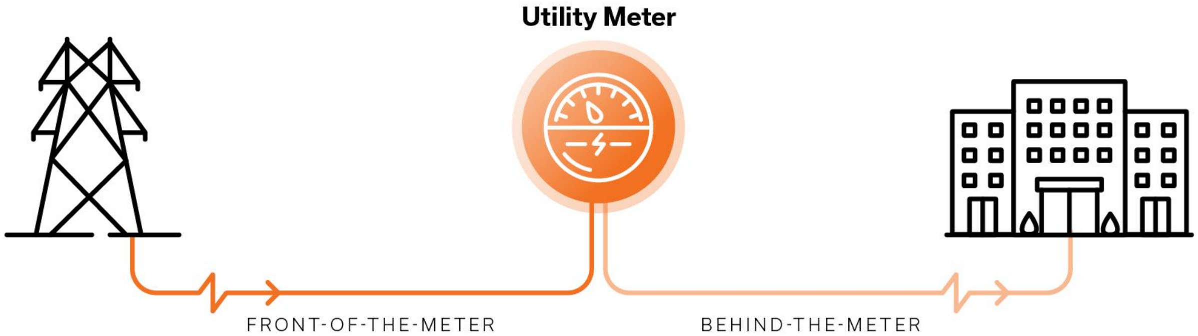
How does Microgrid connect to meter?

Meter Connections

- **Utility Meter:** The demarcation between the utility-owned and customer-owned infrastructure

- **Front of the Meter:** Utility owned and managed infrastructure

- **Behind the Meter:** Customer owned and managed infrastructure.



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Microgrid

Option A

Individual Building Microgrids

Components

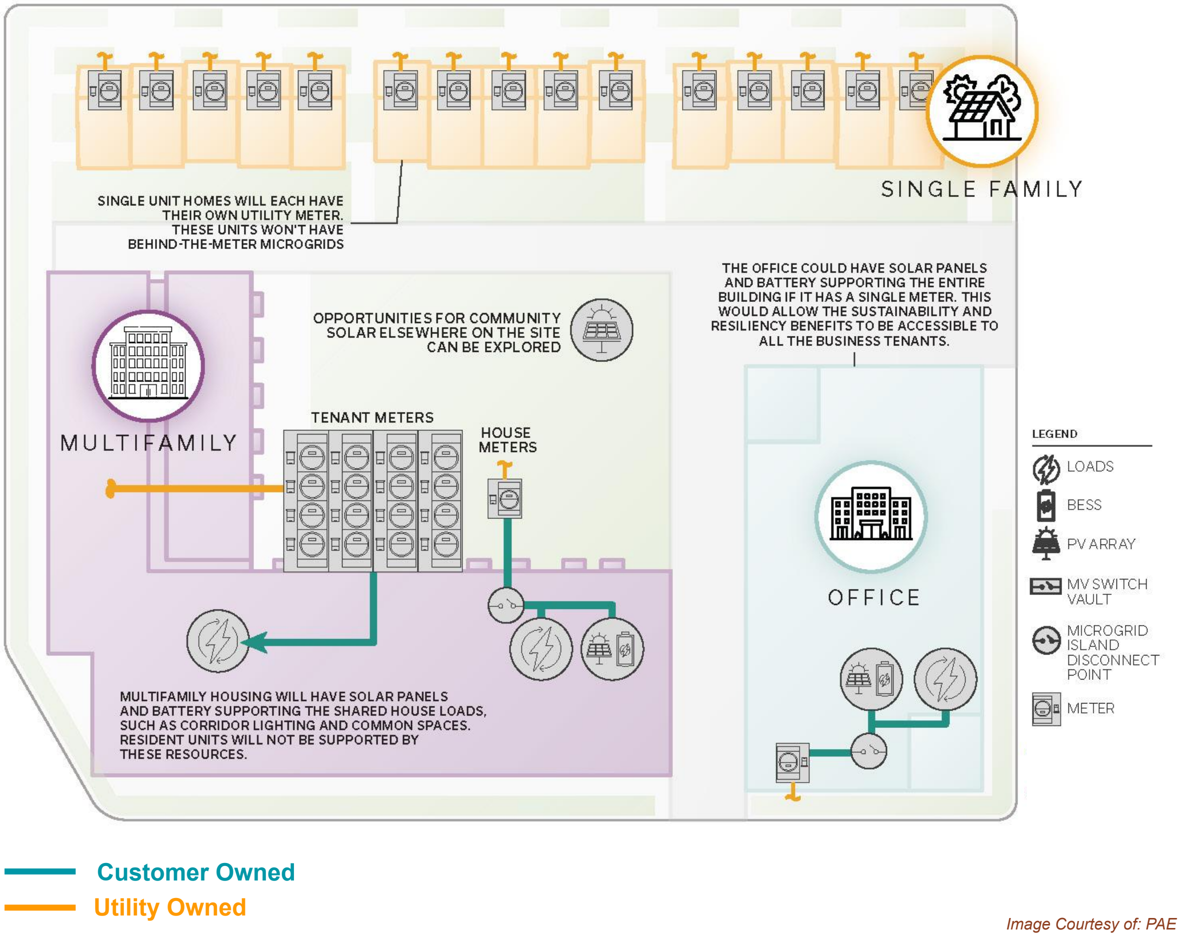
- Each building has its own BESS
- Each building has island disconnect point
- Each building has 1 primary meter on the customer side
- Each building is served by Pacific Power infrastructure at nearest connection point

Advantages

- Precedents for completing this now

Disadvantages

- Microgrid backup for affordable apartments is only feasible for building house load (communal spaces, hallways, etc)



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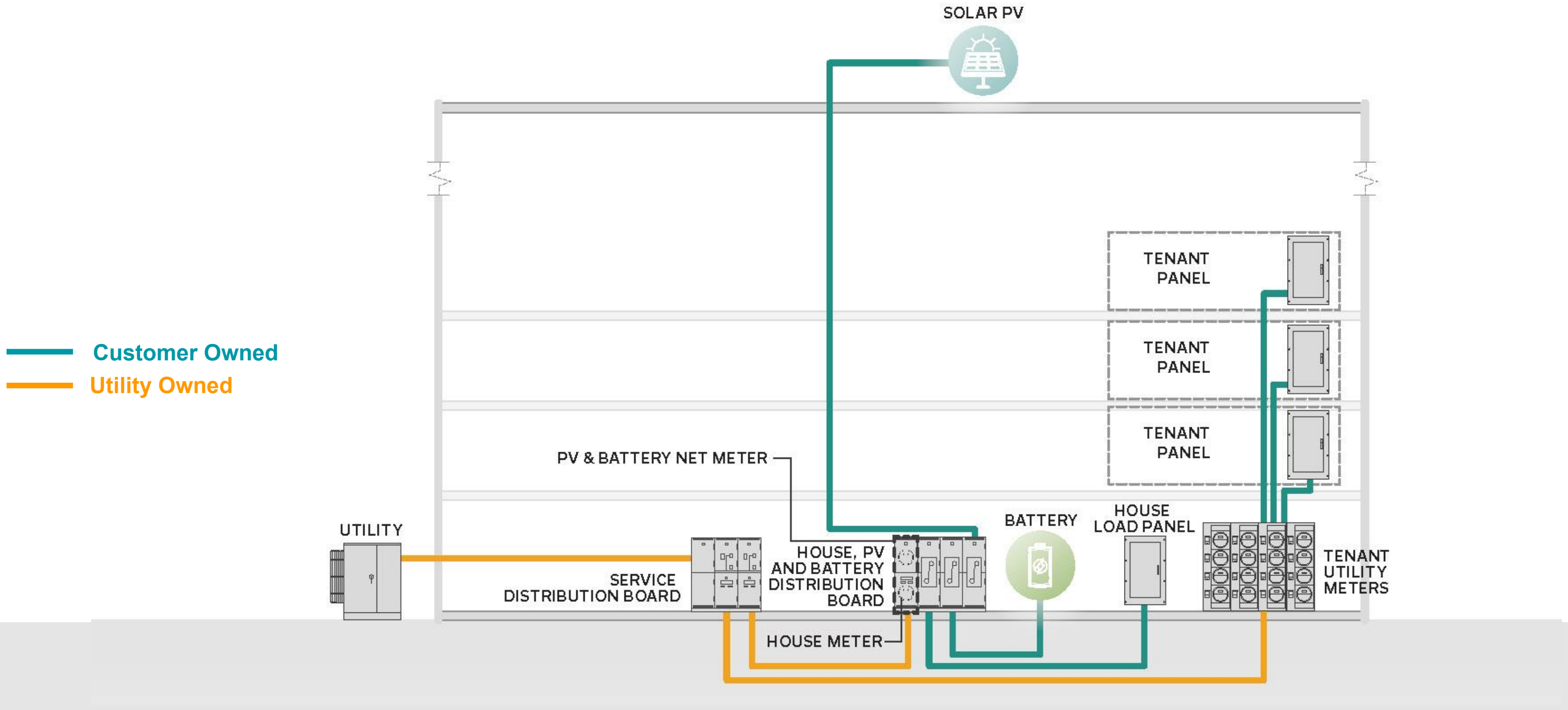
Option A Individual Building Microgrids



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Microgrid

Option B

District Microgrid-Ready

Components

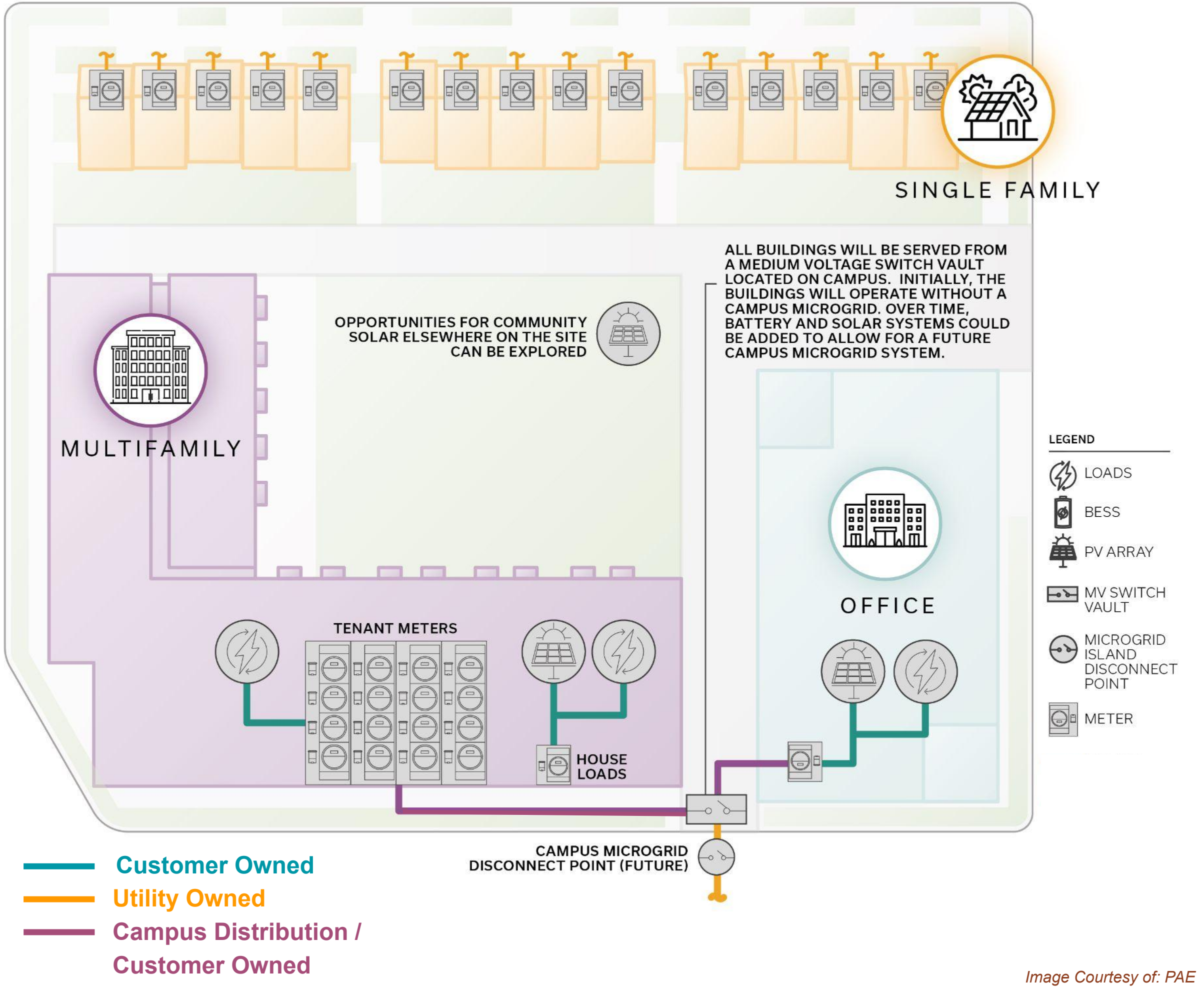
- Operate like Option A on Day 1, as individual microgrids per building
- Install all conduit and vault now for future district microgrid

Advantages

- Ready for future microgrid
- Less site disruption in the future

Disadvantages

- Infrastructure behind MV switch vault is customer owned, operated, and maintained
- Only utility and major contractors can service distribution equipment
- One meter connected to utility in the future district microgrid option



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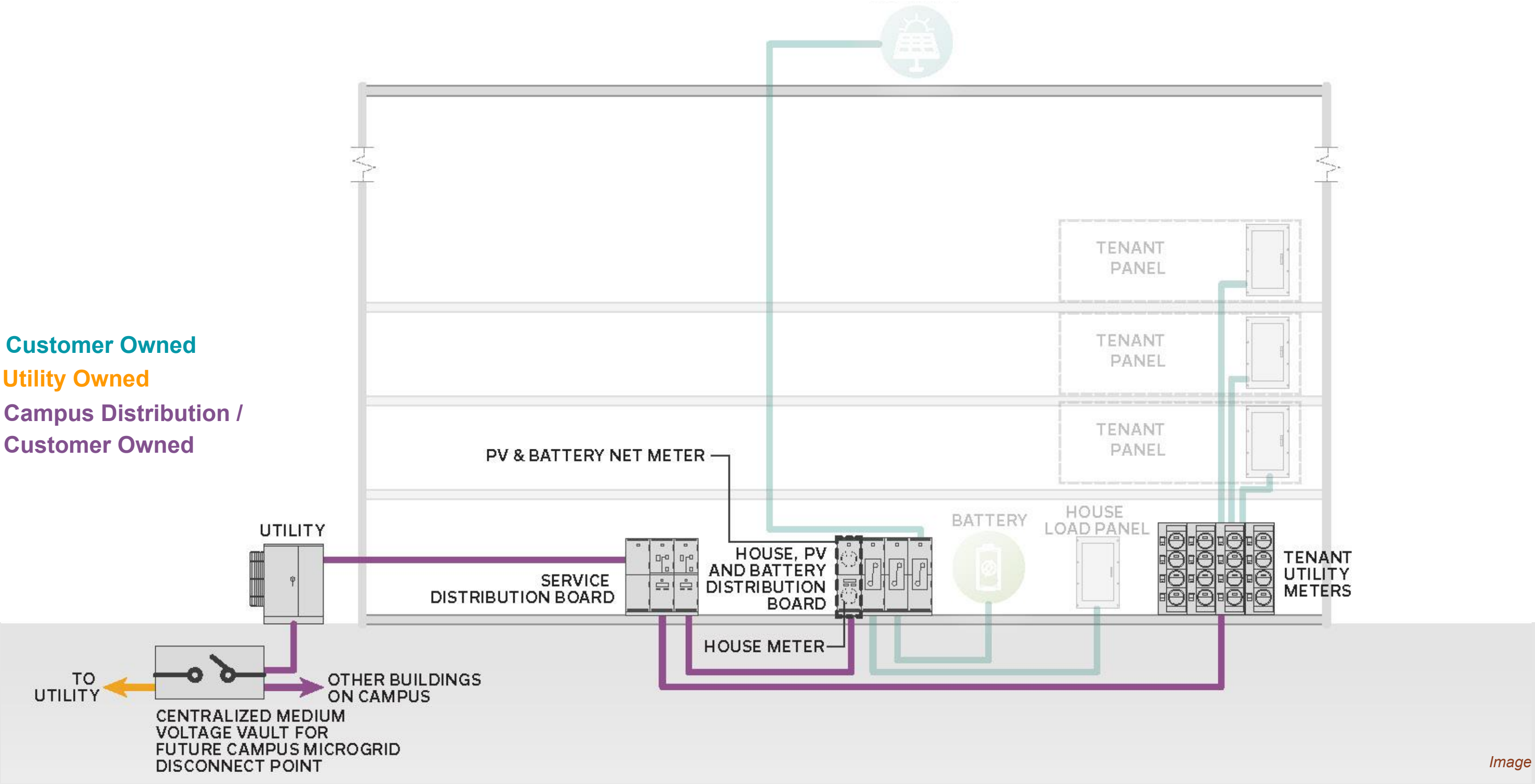
Option B District Microgrid-Ready

- Customer Owned
- Utility Owned
- Campus Distribution / Customer Owned



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Microgrid

Option C

Multi-Metered Whole Building Microgrid

Components

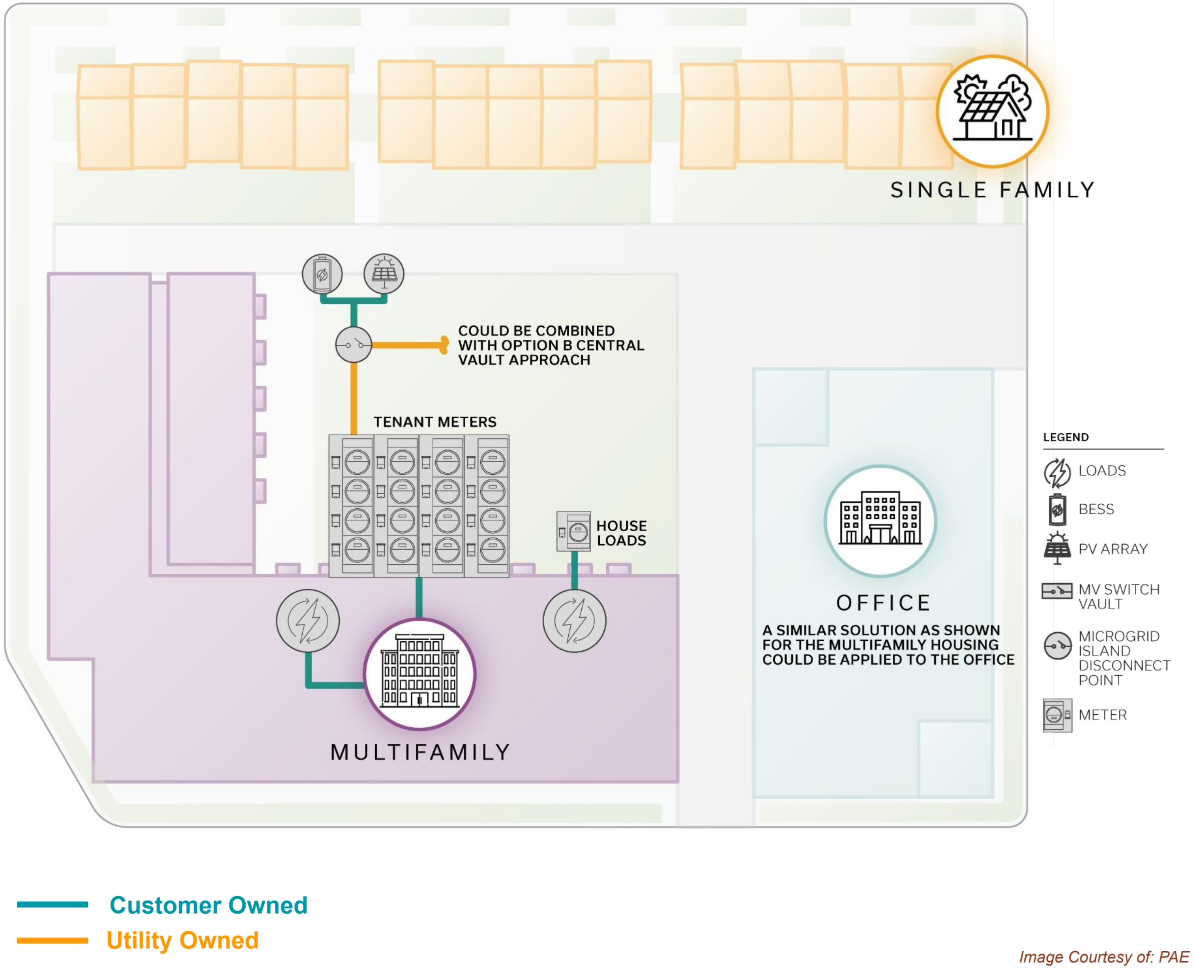
- Microgrid disconnect is on the utility side of the meter, NOT customer side, only impacts the island disconnect

Advantages

- Multimeter connection
- Provides resiliency for all apartment units
- Allows all building systems to be supported by a district microgrid
- Can be combined with Option B

Disadvantages

- In initial discussions with utility, it was indicated this would not be allowed under current interconnection policies



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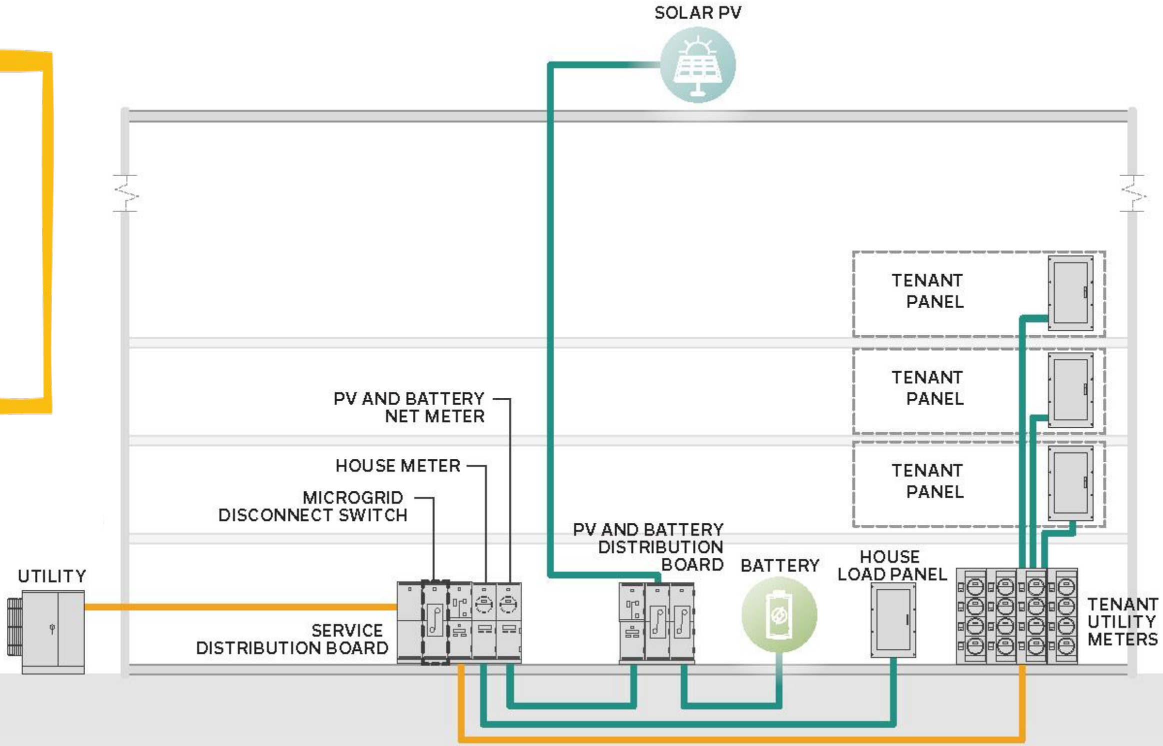
Option C Multi-Metered Whole Building Microgrid

New Approach: Multimeter with Front of Meter Disconnects

- Keep individual tenant meters to help promote individual energy efficiency practices, but allow for shared resilience and cost benefits from a microgrid by locating the PV and battery ahead of the meters yet still accessible.

Customer Owned
Utility Owned



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Summary

Microgrid Options	Components	Ownership	Advantages	Disadvantages	ROM Cost
A: Individual Building Microgrids	Each building has its own meter and utility connection	Each building owner owns their individual microgrid, utility owns meter connect	Can be implemented right now	Is not a district microgrid, but a series of individual building microgrids	$
B: District Microgrid-Ready	Same as Option A, plus conduit infrastructure and vault of switchgear, owned by building owners	Each building owner owns their individual microgrid with one owner of the infrastructure for future microgrid. Utility owns meter connect.	Future proofing now during development for district microgrid	Individual building microgrids, can only be house loads for apartments, and 1 meter for Black Business Hub. Building owners responsible for cost of district infrastructure	$$
C: Multi-Metered Whole Building Microgrid	Disconnect is on utility side	Options of one owner or shared ownership of microgrid, utility owns meter and island disconnect	Provides full resiliency for all apartments and Black Business Hub, using sub metering	Requires approval of a new location for microgrid disconnect, which has no current path	$$$

Can we create a district microgrid that the utility owns and operates?

No. The only path is a campus owned and operated microgrid.

* Actuals Costs for the microgrid were not analyzed in this research
** The microgrid is designed based on capacity of energy storage
*** The research does not address the operations across building owners

Microgrid Partnerships

Utility Conversation

Pacific Power Current Microgrid Ability

- Clean Energy Plan and Community Based Renewable Energy (CBRE) is in pilot stages
- Beginning of Demand Response (DR) program for commercial and industrial not residential
- No current incentive programs in place, no current tariffs
- No current path for grid connection on district level

Pacific Power Barriers

- No path to support design with more than 1 meter
- Project site may not need a microgrid (hospital adjacency outage is unlikely)
- 30% of Pacific Power region is in Oregon and is not able to prioritize Oregon urban customers over customers in other states
- Not able to support being a contractor for the services of vault equipment
- Adamant about Rule 8, which prohibits multifamily housing to be connected to utility with multiple meters (despite case studies across the country)
- Not able to support in changing rules of net metering

Ownership & Operations

Microgrid Partnerships

Option 1: Single Owner - Williams & Russell CDC

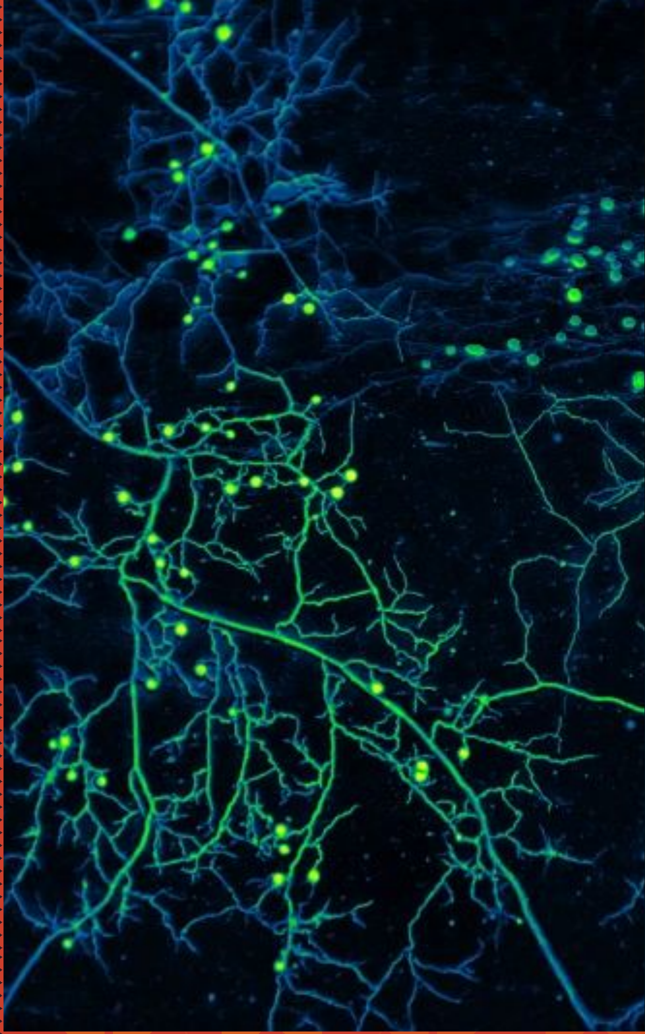
- Owner distributes and sells energy to all parties
- Simplified metering
- Requires systems operator

Option 2: Multi-Owner - Williams & Russell CDC and PCRI

- Meter Black Business Hub and Affordable Apartments separately
- Affordable Homeownership requires to be submetered under 1 meter
- Requires systems operator

Option 3: Third Party

- Third party company owns and operates infrastructure systems and sells energy to all parties



Third Party

Microgrid Partnerships

Owner/Operators:

Enel X
- Own and operate systems across the US
- No precedent in working with Pacific Power
- No current projects in Oregon

Mid Valley Power
- Own and operate systems across West Coast
- Provided additional pricing for the systems
- Interested in working on this project

Infracenters
- Local company working on OMSI microgrid development
- Interested in working on this project

Summary

Utility Conversation

Takeaways	Barriers	Opportunities
In beginnings of Community Renewable program	Focused on large commercial and industrial	Offer programs and support for residential
No current path to support grid connected microgrid	Only 1 meter connection excludes multi-metered buildings	Consider policy of Rule 8 to provide multi-metered connections to grid
Not able to support servicing customer owned microgrid equipment	Only 2 companies in US and utilities can service microgrid controller equipment	Utilities to consider being a service provider for community microgrid systems

Ownership & Operations

Options	Advantages	Disadvantages
1: Single Owner: W&R CDC	Simple ownership that has control and benefit of microgrid	Requires operational expertise and added staff
2: Multi-Owner: W&R CDC and PCRI	Building owners have control and benefit of microgrid	Requires operational expertise and added staff
3: Third Party	Expertise in technical systems, distribution, and management	An additional provider on project team

Funding

Funding Sources

Federal Government

- **Inflation Reduction Act (IRA):** tax credit potential up to 36% of cost
- **Federal Investment Tax Credit (ITC):** 30% for commercial and residential
- **Environmental Protection Agency (EPA) Greenhouse Gas Reduction Fund:** grants and loans
- **US Department of Energy (DOE):** grants

State and City Government

- **Oregon Department of Energy (ODOE):** grants
- **Portland Clean Energy Fund (PCEF):** grants for equipment, operations, and maintenance
- **Energy Trust of Oregon (ETO):** incentives for energy efficiency, solar, and battery storage

Conclusion

Findings

Advantages of District Systems

- Enable multiple smaller projects with multiple owners to share efficiencies and resources in water and energy systems
- Distributes the initial costs across multiple buildings
- Reduce operational costs across multiple projects
- Provides access to power during an outage
- Provide additional resiliency and efficiencies to residents, workers, and visitors that is not typical on the building scale
- Operational cost can be built into the overall budget and is fundable

Challenges of Implementation

- Water and energy systems have specialized equipment and require technically experienced property management to operate and maintain district systems
- There is no current pathway for the utility to own and operate a multimeter system, this is a huge barrier for the creation of a multiple ownership districts and precludes multi-family residents from resilience benefits of microgrids

Architecture 2030

Architecture 2030 is committed to buildings being net-zero by the year 2030 (EUI 0)

In 2023, the target is 85% reduction of emissions of baseline designs (EUI 15)

Outcomes

- Designed District Energy Efficiency EUI = 22
- With solar on all buildings, canopy, and geoexchange, project can reach 65% Net Zero
- Housing and office require a higher energy load than can be provided onsite with energy efficient design, solar generation, battery storage, and a microgrid
- District can opt in for off site solar to achieve Net Zero

Replicability

Steps for Replicability in Similarly Scaled Project

1. **Build Consensus:** with stakeholders on resiliency goals and meet regularly to develop the systems, cost, and operational impact
2. **Design for Building Efficiency:** Design for water efficiency, water recirculation, energy efficiency, passive design, solar and energy storage in each building (key community benefits and can be achieved with or without the district systems)
3. **Start Utility Conversations:** to understand what is feasible and identify constraints
4. **Design Systems**
    a. **Waste System:** work with waste management contractors to prioritize recycling, composting, and multiple streams that divert waste from landfill
    b. **Water Systems:** onsite water resources to be re-used for non-potable demand
    c. **Energy Systems:** onsite energy generation, storage, and a microgrid provides a resilient system that operates in the event of an outage

Questions & Comments

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