The Next EPIC Challenge: Meridian at Corona Station

Reimagining Affordable Mixed-Use Development in a Carbon-Constrained Future

Redwood Energy

Zero Carbon Retreat September 20th, 2023 Emily Higbee, Dylan Anderson, Cobe Phillips, Jessie Lee

Presentation Topi

- Introduction
- Emerging Technologies and Design Considerations
- Solar and Battery
- Electric Vehicle and Bidirectional Charging Strategy



Project Team and Purpose

• EPIC Challenge Project Team:

- EPRI (prime)
- Redwood Energy (emerging technologies, site liais
- PAE (energy modeling, MEP engineering)
- Mithun (sustainability consulting, architect)
- Danco Communities (site owner)

• Purpose:

- California Energy Commission Grant. Competition for the "Build" Phase
- fund the design of emerging technologies and building systems integration to enable a zero-net energy, all-electric, transit integrated affordable multifamily community



DANCO

MITHUN

EPIC Challenge Goals and Objectives Summary

- 斧
- Design achievement (compared to T24 2022 code)
 - 50% reduction in tenant energy burden
 - 40% reduction in embodied carbon
 - 90% reduction in operational carbon
 - Evaluate and incorporate innovative emerging technologies
 - Electrical Load Control
 - Eliminate net-energy use from the residential building between of 4 and 9 PM
 - Tier 1 critical loads indefinitely and Tier 2 critical loads for 24 hours
 - 20% of the building's peak load must be available to managed
 - All residential end uses must be controllable
 - Electric Vehicles
 - 20% Installed EV charging stations, all remaining parking spaces must be EV-ready
 - Work with the community to understand their drivers around





Site Introductio

- Petaluma, CA
- 131 affordable housing units
- Three and four story buildings
- 138 parking spaces
- A SMART train station is intended to be built on-site, including a platform
- Electric food trucks
- Resident services







VIEW LOOKING WEST



VIEW LOOKING NORTH ON N. MCDOWELL BLVD



NEW LOOKING EAST ON N. MCDOWELL BLVD



VIEW FROM PARKING LOT

VIEW FROM EAST DRIVEWAY ENT



Building Integrated Photovolt aics

Mitrex Solar Facade Layers





R-12 rock wool insulation + Mitrex's BIPV Siding = ~**\$87/ft**² **ThermaC ork** Sequesters 7 times the CO₂ involved in harvesting, processing and shipping

Mold Resistant

Natural Flame Retardant: Class B Fire Resistance

Insulation: R-4 per inch

3" ThermaCork painted



HVAC: Ephoca Wall Mounted Pro Mini-splits: ~\$5,000/room

Ephoca Pro: ~\$3,750/room

Performance in Petaluma's climate: COP 3.45-3.55 & EER 12.05-12.31

Options: 120V or 240V -Meridian will use 120V

Options: R32 or R410a -Meridian will use R32 (~1/3 the GWP)



What's so great about the Rheem ProTerra® Plug-in Heat Pump Water Heater with HydroBoost (120V Shared Circuit)?



120V Shared Circuit

- Doesn't require its own 15 Amp breaker
- Uses about 1/3 the power of the Dedicated Circuit model

Compared to centralized systems:

(cost per residential unit)

Rheem 120V HPWH

 \$2,500 for the product & \$3,800 installed

Sharc waste water recovery HPWH

\$4,200 for the product alone

Induction Cooking in Affordable Housing?

A few ENERGY STAR® Emerging Technology Award winning induction Blomberg Options to choose from amsung







According to the EPA: Induction: 85% efficient Radiant Electric: 75%-

Miele PDR 908 HP – The First of its Kind!

Volume: 4.59 ft³

Miele Commercial HP Dryer: <u>~\$4,450</u> Electric Resistance Commercial Dryer: **~\$1,600**

7 year payback

Requires a third-party payment system

Meridian will use



Not Yet Available in the United States... But Hopefully Someday!!!



Solar and Bategy Minimal Unidirectional Connection - Stand-by Grid Connection



Why no BIPV?

- Building integrated PV costed out to \$5,600/kW <u>AFTER</u> 50% tax credits, our design was \$2,300/kW after tax
- Only about 60% as energy productive as rooftop PV
- We pulled off designing a really great carport that got us enough PV
- BIPV would definitely be great for a taller highrise to meet Title 24 and provide, but not for us

Battery and Storage Summary

- All-electric design means higher energy use
- 2.0 MWh Battery system Project level Demand Response
- Runs on a "Renewables Bus Bar"
 - Allows Battery to be trickle-charged by the grid in critical periods (outside of 4-9PM, and mostly in the winter months)
 - Phase control for critical and non-critical loads
- Lithium Iron Phosphate (LiFePo) Battery Chemistry
 - Much more fire-safe than previous Lithium chemistries
 - Much heavier, and more energy dense, and lasts more cycles
- Rheem 120V Heat Pump Water Heaters charged primarily by the Sun!
 - CTA-2045 controller lets us place most heating during solar hours

Concept

- Utilize Bidirectionally Connected Vehicles to Supplement Building Load Demand
 - ~ 50 Vehicles each discharging approximately 11.5 kWh/day (just over 25% of total battery capacity for Nissan Leaf)
 - Recharge Vehicles for free using curtailed solar
 - Avoid approximately 7000 kWh of static battery storage
- Incentivize residents to take part in V2X charging through annual compensation or VIP parking

The Difference Bidirectional Vehicles Make

State of Battery with V2X

Charger Options (include price comparison)

Electric Vehicle Stations						
Model	Output Rating (kW)	Level (1,2,3)	# of Stations	# of Stations with Grid or Building Interactive Capability		
Fermata FE-15	15	3	30	30		
InCharge ICE-V2X	22	З	18	18		
Ford Charge Station Pro	19.2	3	10	1		
Nuvve Powerport	19.2	2	89	0		

Summary thus far....

- 93% savings in energy costs
- 92% operational carbon emission savings (no embodied carbon)
- MoreAttoueldencedy Cost (\$)

	_		Building with Solar +		
	Βι	uilding	Battery		
	Proposed	Baseline (Title- 24)	Proposed	Baseline (Title- 24)	
Annual On	\$240,779 erational C	\$345,160 arbon Emission	\$ 14,944	\$199,068	
(Metric Ton	СО2-е)		Building	with Solar +	
	Βι	uilding	Battery		
	Proposed	Baseline (Title- 24)	Proposed	Baseline (Title- 24)	
Total	52.9	76.8	5	62.6	
Savings	31.10%	-	<u>92%</u>	-	

Thank you for listening! Any Questions?

Emily Higbee, Dylan Anderson, Cobe Phillips, Jessie Lee L10

bustransit

Contact omily@redwoodenergy net