



Net-Zero Energy Buildings—Now and What’s Next

Webinar – March 4, 2025



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This webinar was developed in partnership with the LEARN Program.

The LEARN Program is a San Diego-based workforce education and training program that has partnered with New Buildings Institute to offer free energy efficiency and electrification webinars. Please visit the LEARN website for more information: www.sandiegolearn.com



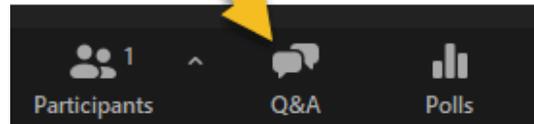
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Net-Zero Energy Buildings—Now and What's Next

In today's webinar we'll discuss:

- Net Zero Energy (NZE)
- How it compares to other building labels
- Their relevance today
- Why building owners choose this approach
- NZE commercial buildings, including affordable housing

Links to our slides and presentations will be sent to you. Feel free to chat with each other and ask presenters questions in the Q&A.



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Today's Panelists



Karina Hershberg
PAE



Sean Armstrong
Redwood Energy

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Net Zero Energy: Then, Now and the Future!



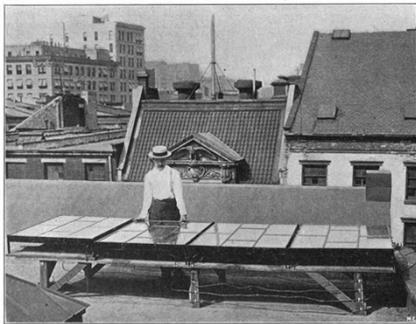
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EVs in 1900, Rooftop PV in 1909, and Electrification in 1916!



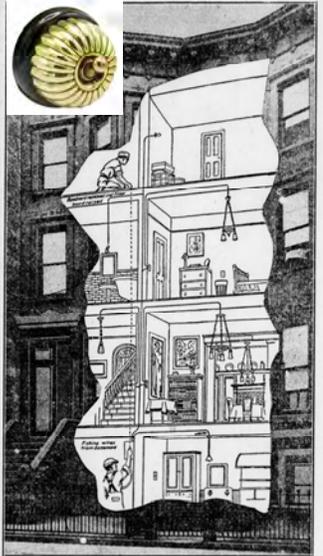
MODERN ELECTRICS
Vol. II. SEPTEMBER, 1909. No. 6

Harnessing Sunlight
BY RENE HOMER



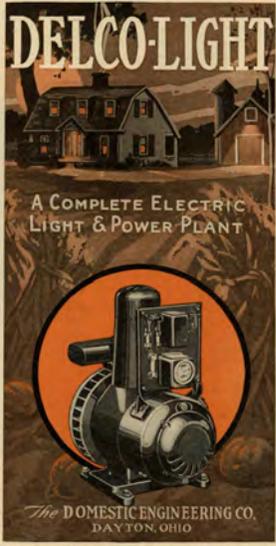
Mr. Cove and his Sun Electric Generators
Four units are shown in the picture, each consisting of 1804 plates of the new secret alloy. These units develop 60 watts each, 6 amperes at 110 volts. One form upon which he is experimenting will show a voltage of 300 per 10 sq. ft., though the amperage is very slight.

No House Too Old to Be Electrified



6

1920: One Million DC Microgrids In Rural America, where half of Americans lived and had no grid electricity.



DELCO-LIGHT
A COMPLETE ELECTRIC LIGHT & POWER PLANT
The DOMESTIC ENGINEERING CO. DAYTON, OHIO



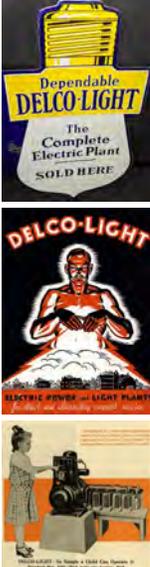
ELECTRIC LIGHTING for COUNTRY HOUSES

An Independent Plant
can be installed on your premises, affording a Brilliant Electric Light for less cost than gas, kerosene or acetylene.
With our Storage Battery System we can change your present illumination to good, steady electricity quickly and economically—In other systems the dynamo runs at night, even for one light.
We believe in a large storage capacity which may be charged in the day-time, requiring less power and attention.



No Engineer Needed
Your gardener or man-of-all-work can give it a few minutes daily—the best part of our system being that dynamo is not run at night.
The same power may be attached to a pump for water with effectiveness and economy. Our meter always acquaints you with the condition of the battery, no previous knowledge of electricity being necessary.
We have equipped some of the best yachts and finest country homes. Plants from \$550 up. Catalogue on request.

THE UNITED STATES BATTERY CO., 556 State Street, Brooklyn, N. Y.



Dependable **DELCO-LIGHT**
The Complete Electric Plant SOLD HERE

DELCO-LIGHT
ELECTRIC LIGHT & POWER PLANT
The Complete Electric Plant

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1923 Berkeley Blaze Triggers First All-Electric Houses

EXTRA *San Francisco Chronicle*
LEADING NEWSPAPER OF THE PACIFIC COAST REG. U.S. PAT. OFF.
FOUNDED 1865—VOL. CXXIII, NO. 65 SAN FRANCISCO, TUESDAY, SEPTEMBER 18, 1923—THIRTY-TWO PAGES DAILY 5 CENTS, SUNDAY 10 CENTS

FIRE SWEEPS BERKELEY

Fifty Blocks Razed; 6000 Left Homeless

Many Periled As Flames Cut Through City

Cragmont Residential District Is in Ruins; Dynamite Used to Block Path of Destruction; 600 Homes Destroyed

Six hundred of Berkeley's finest homes, fifty blocks in the restricted Cragmont residential section, went up in a whirlwind of flame and smoke yesterday afternoon, when a leech fire swept down the hills and struck treacherously at her back, as she helped her sister community Oakland fight the same enemy.

Within a few hours, 6000 persons were rendered homeless, millions of dollars worth of property was destroyed, and two persons are supposed to have lost their lives as the flames hit steep into the heart of the city before 7500 fire fighters rallied to victory.

For hours during the afternoon, it was nip and tuck in fight to save the business section. Then after time, the flames drove into the down town district, only to be beaten back. And not until well after dark, not until fashionable Craigmont...

About eight shows the flames that spread rapidly over the college city yesterday, burning 600 houses to the ground, reducing to ashes whole blocks of residences and other buildings and leaving thousands of persons homeless. The fire swept down the Cragmont canyon into the Cragmont district first, where everything was leveled before it.

Private Houses, Fraternity Houses Destroyed Listed

List of Known Injured In Big Fire in Berkeley

20 Families Entrapped in Flame-Surrounded Canyon



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2019 East Bay Electrification Exposition Kicks Off Berkeley Gas Ban and 80 Others

Nancy C. Pec: A Santa Rosa Environmental Activist (1957 – 2017)
Killed by Climate Change



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1st Net Positive Apartments in N. America in 2012. Arcata, California.
1st Net Positive Housing Development in N. America in 2014. Free
EV Charging. Fort Bragg, California.



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Vertical PV in High Rise ZNE: 2011-2027

Bullet Center, Seattle. 2011

303 Battery, Seattle. 2024

Radia, Silver Spring, MD. 2024



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2010s-2020s: R&D For Power Efficient Products



700sf Garage Conversion to 1 Bed House

1400sf, 1973 "Double Wide" Electrification

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2018: New Smart Panels Balance An Abundance of Loads

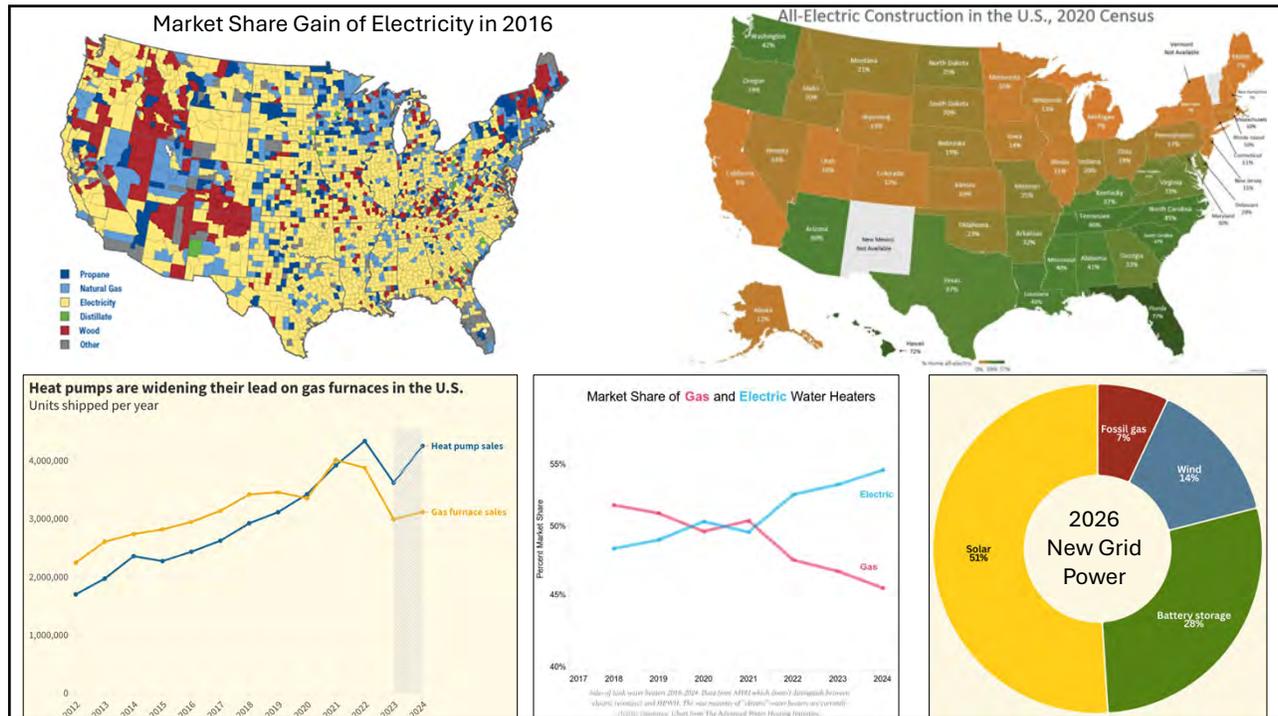
Span Panels Can Support 50A-100A Services



Lumin Panels Can Support 30A



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EVs and Bidirectional Chargers: 2011 Tsunami



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Bidirectional Bus Chargers!



An app allows fleet managers to monitor and schedule charging



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Emergency Services: Vehicle-to-Vasectomy?



Using V2L from his Rivian electric truck, Dr. Yang powered the vasectomy clinic—lights, electrocautery equipment, and fans while the power was out in Austin, TX.

Christopher Yang
@ChrisYangMD · Follow

I performed what is likely the world's first @Rivian powered vasectomy today. Power in clinic went out, patient didn't want to reschedule cause he already had time off. Electrocautery was normal, procedure went great! #rivianstories #rivian

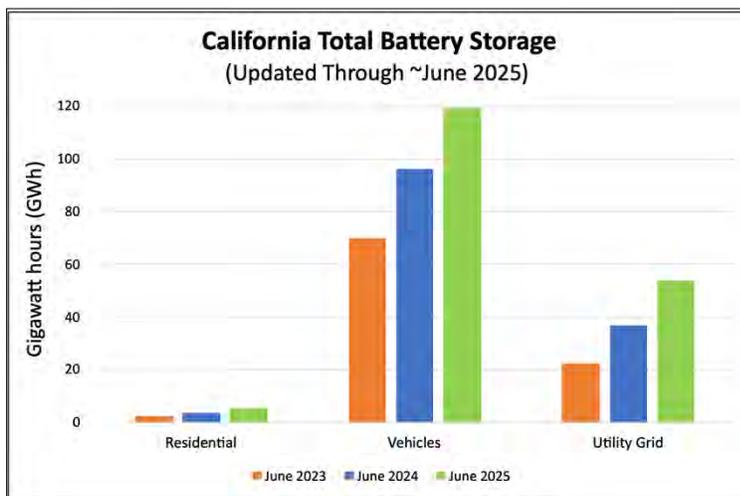
1:32 PM · Sep 1, 2022

6.7K Reply Copy link

[Read 252 replies](#)

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California Has More Than Twice As Much EV Battery as Grid Battery! 2.24M and Growing Fast!



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2021: "Next EPIC Challenge" from CEC requires 4pm-9pm Off-Grid. Owners asks for 100% Off-Grid!



"Can you make it off-grid? PG&E delays are the #1 problem for all our developments." - Dan Johnson, Danco

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Power Efficient Appliances For Winter



Rheem 120V HPWH
indoors vs
SanCO₂
COP 3.1 vs. 3.5
\$3800/apt vs. \$14,700



Ephoca Pro 120V PTHP vs.
multihead minisplit
COP 3.5 vs. COP 3.2
\$11,000/apt vs. \$15,000

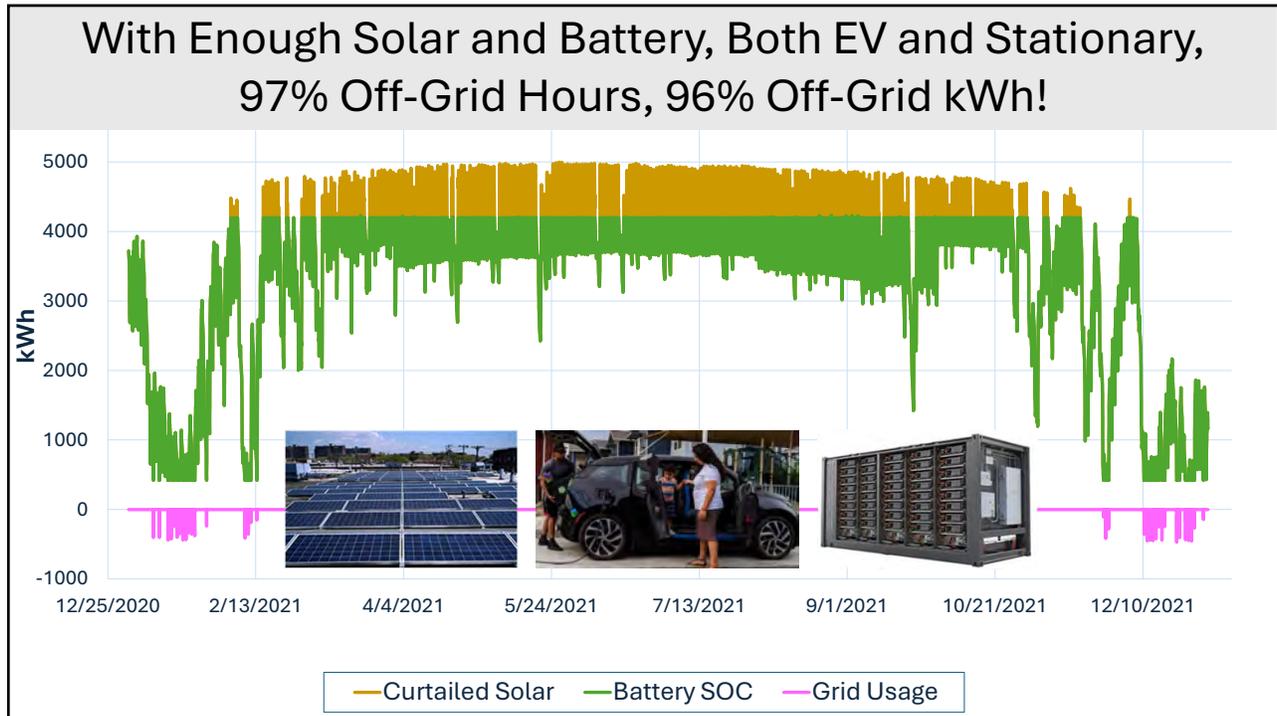


120V Induction Range
vs. Resistance
COP 0.85 vs. 0.60
\$1500 vs. \$700
Induction is just \$400
with rebate

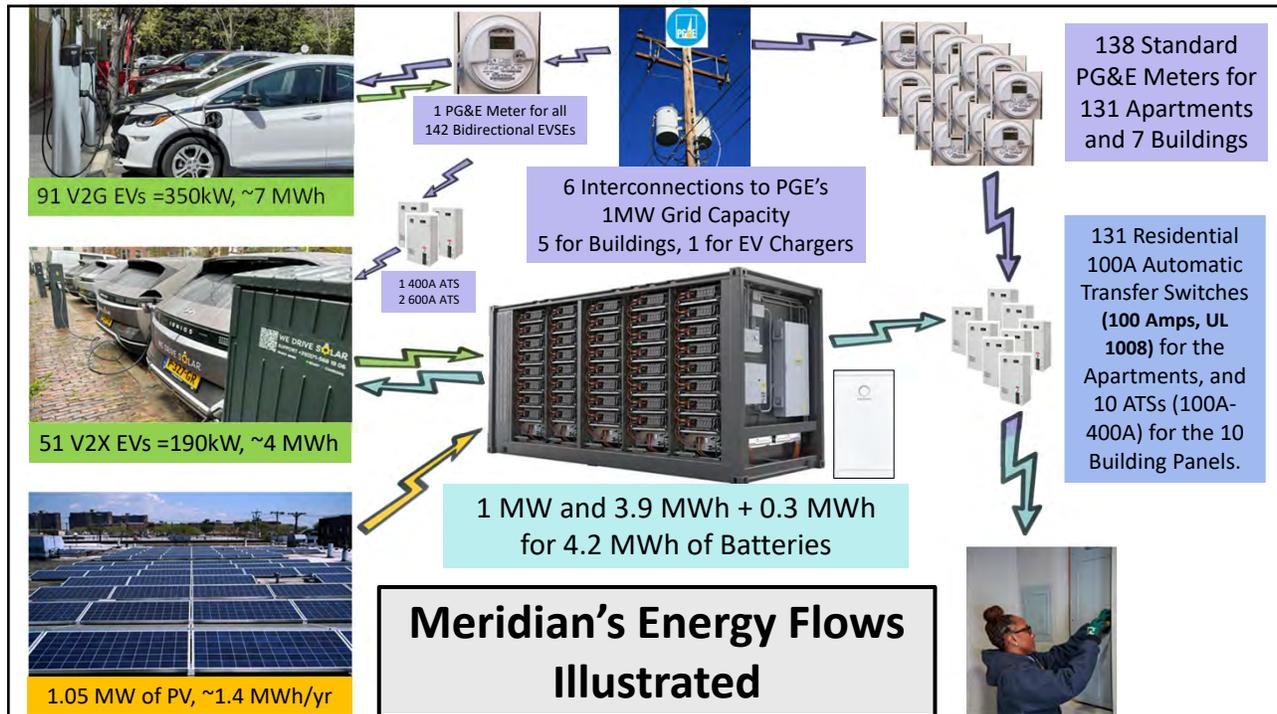


Miele Commercial HP
Dryer vs. Resistance
CEF 9.7 vs. CEF 2.0
\$4,500 vs. \$2200
7-year payback

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For \$12M: An Electric “Silent 120” Luxury Yacht, Jet Ski and Submarine
100% Off-Grid 100 miles/day on 40kW of Solar + 800kWh Battery



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Thank you for your attention!



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The Future of Net Zero Energy

NEW SOLUTIONS FOR A NEW ERA

pae-engineers.com | March 4, 2026



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Engineering that **matters**



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Leaders in Sustainable Design

PAE PAE Living Building | Portland, OR

20
LIVING BUILDINGS
6 ACHIEVED 14 PURSUING
18
CARBON NEUTRAL
8 ACHIEVED 10 PURSUING
56
NET ZERO ENERGY
15 ACHIEVED 41 PURSUING
13
PASSIVE HOUSE
6 ACHIEVED 7 PURSUING
112
LEED PLATINUM
60 ACHIEVED 52 PURSUING
100
ALL ELECTRIC
47 ACHIEVED 53 PURSUING

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Net Zero Energy

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WHAT IS A NET ZERO ENERGY BUILDING?
NREL DEFINITION:

Zero energy buildings produce at least as much energy as they consume on an annual basis.

*It's so easy to say and understand...
...who wouldn't want one?*



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"Net Zero Energy" means...



Annualized
(i.e. compounded across the year)



Energy is made when the sun is shining
(for solar)



"Hey Utility! Take all the clean energy I make and find a good use for it."
(if you can)



When my building is not producing surplus renewable energy, it's buying energy from the grid...
whatever energy is flowing on the grid at that time.




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“Net Zero Energy” is not...



Fully addressing operational carbon emissions



“Zero Carbon”



The end game in Green Building...
But it is an important step along the way.



Due to the varying carbon emissions intensity of the grid, most Net Zero Energy buildings, in most locations, are not yet Zero Emissions.



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Load Shifting

Cost Reductions, Emissions Avoidance, and Grid Resilience

Northern California



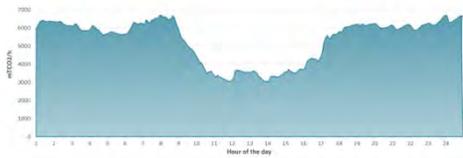
CAISO EMISSIONS



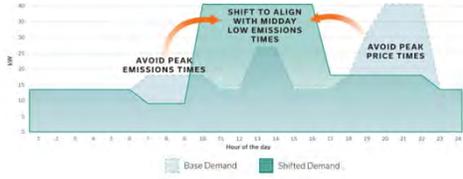
TOU PRICING



AVOIDED EMISSIONS



DEMAND SHIFT



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The Future is Now

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Introducing: Future Ready Buildings

A Future Ready Building is an energy-efficient building that flexibly and strategically adapts when and how it uses energy to reduce operating costs, function efficiently during disruptive events, and minimize carbon emissions.

Benefits:

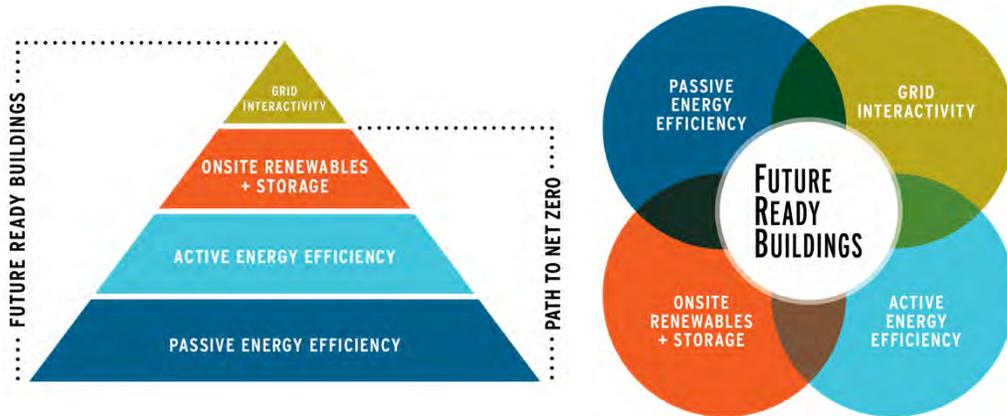
- Energy savings
- Cost savings
- Increased building resilience
- Decarbonization benefits



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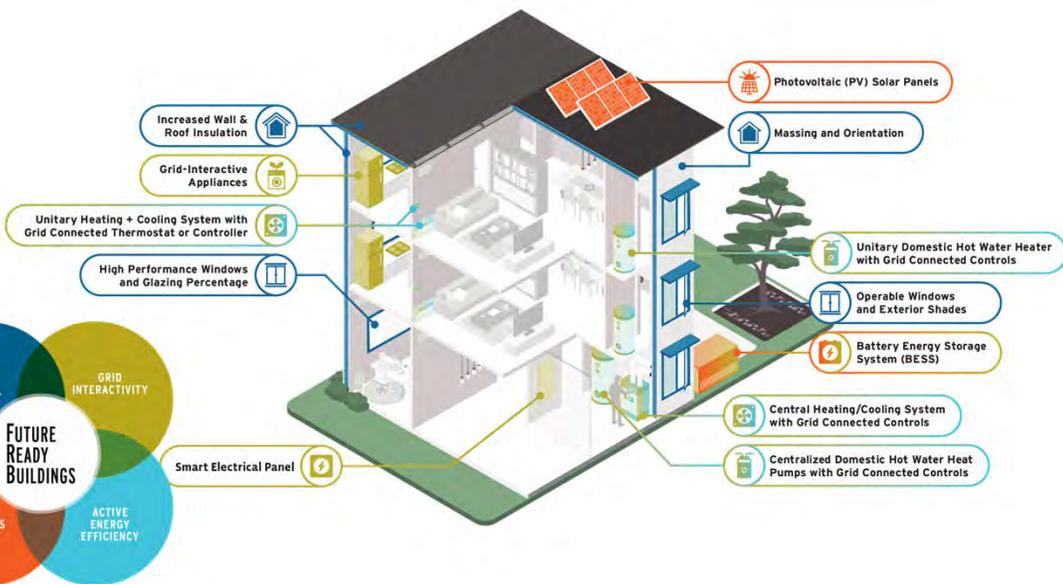
What Makes a Building Future Ready?

A Future Ready Building has features that help make its energy use efficient and flexible.



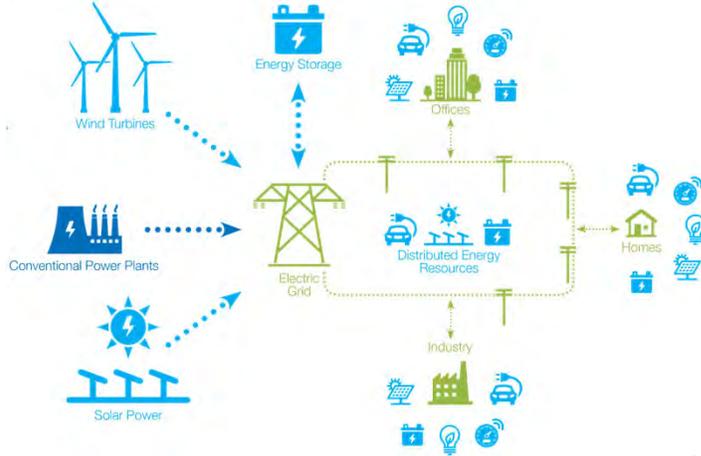
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What Makes a Building Future Ready?



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GridOptimal empowers players on both sides of the meter to actively support the transition to a carbon-free grid.



GridOptimal Technologies and Strategies

- renewable energy
- energy efficiency
- electric vehicle
- energy storage
- smart connected controls

GRIDOPTIMAL
BUILDINGS INITIATIVE

<https://newbuildings.org/resource/gridoptimal/>

EnergyTrust
of Oregon

www.energytrust.org/future-ready-buildings

CONTACT US TO ENROLL YOUR PROJECT:

newbuildings@energytrust.org

or call 1.877.467.0930

SCAN THE QR CODE TO LEARN MORE:



OR VIEW THE LINK BELOW

<https://register.gotowebinar.com/register/4124185006287033690>

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CASE STUDY

The PAE Living Building

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PAE Living Building

PORTLAND, OR | OPENED IN 2021



Developer-led Living Buildings are a possibility

WHAT WE LEARNED



- To maintain tenant flexibility 20-25 EUJ is ideal in Portland



- Developing a Living Building can be done with ROI ~10%
 - 10% lease rate increase
 - 10-year hold for capital



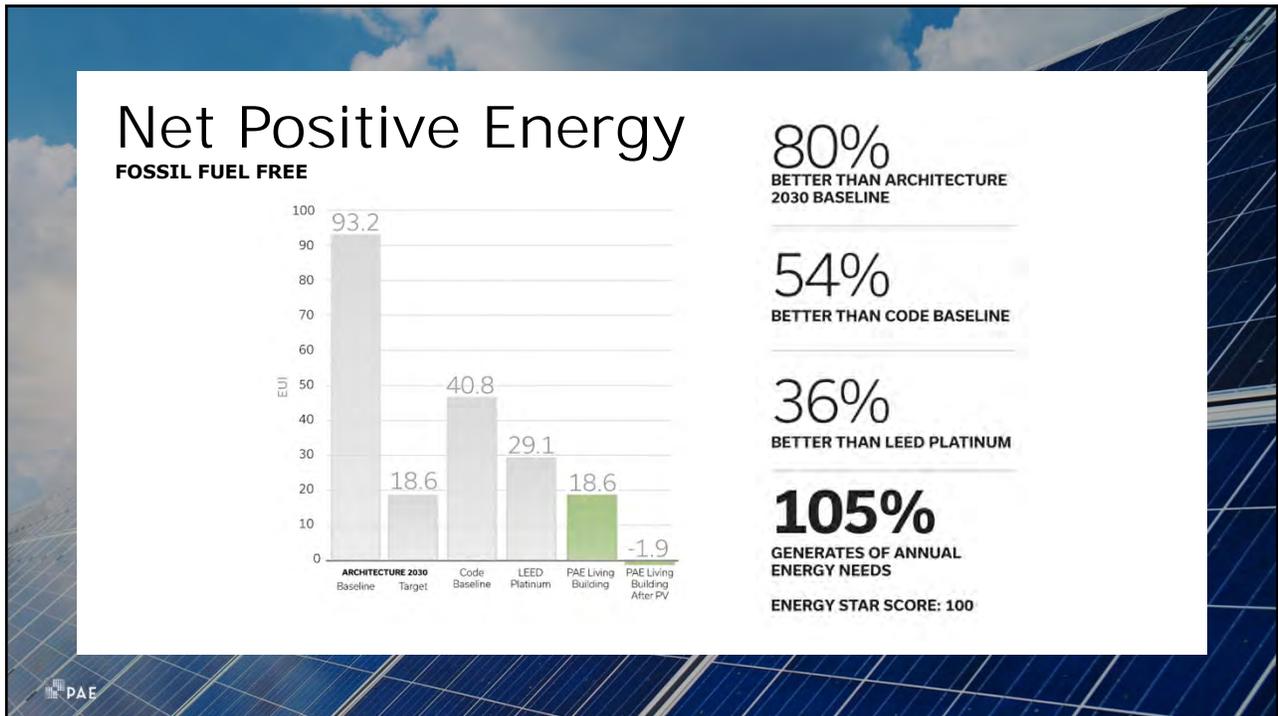
- Vacuum flush + composting provides better control



- 60% of our PV-generation is on an array donated to an affordable housing development.
- Microgrids, batteries, resilience, and the grid.

 **58k**  **20**
 Net Zero Energy Square Feet Net Zero Water Energy Use Intensity

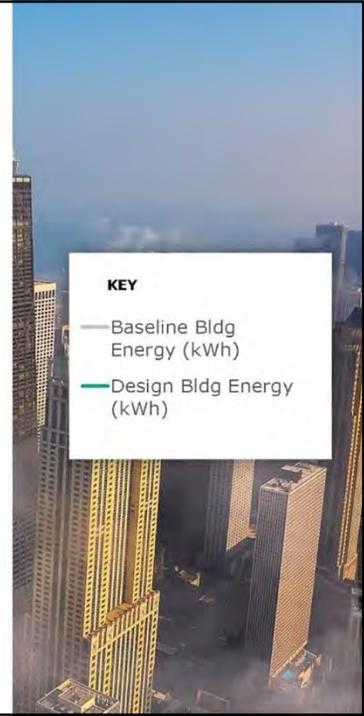
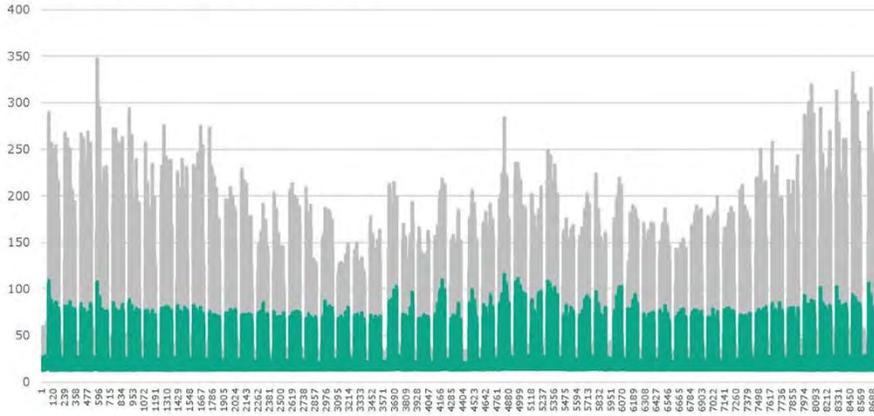
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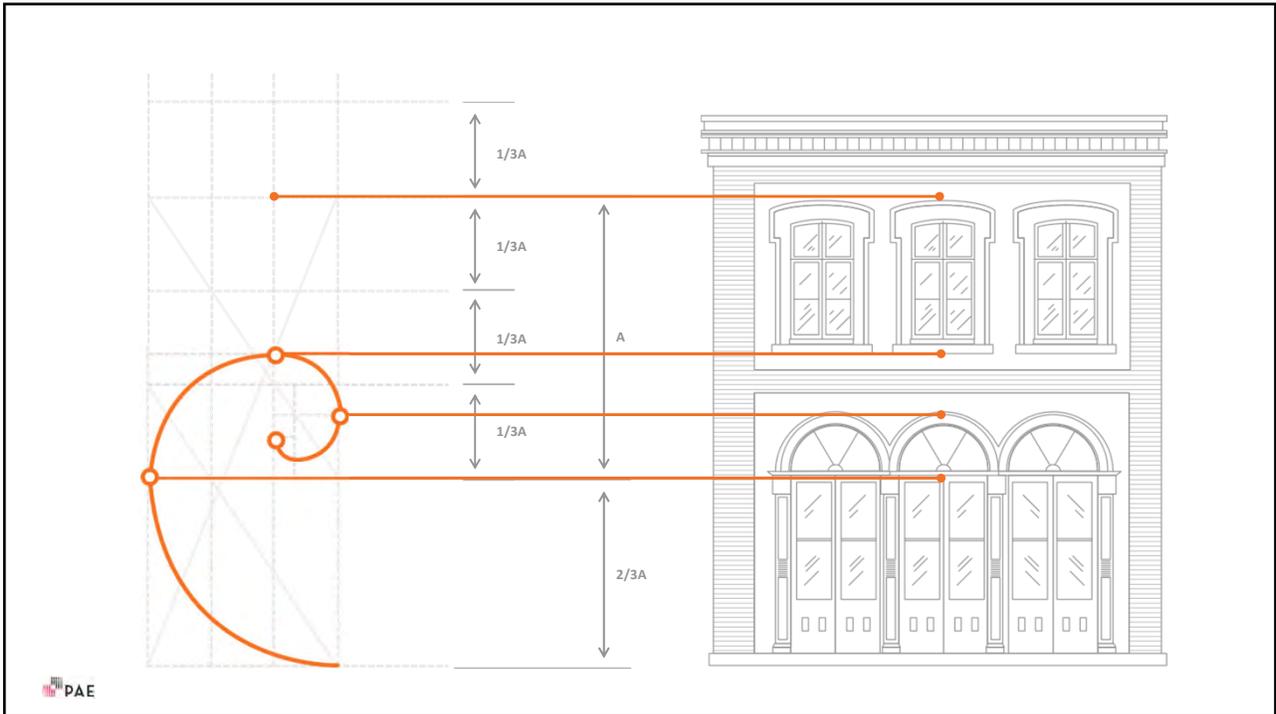
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Stop Peaks Before They Start

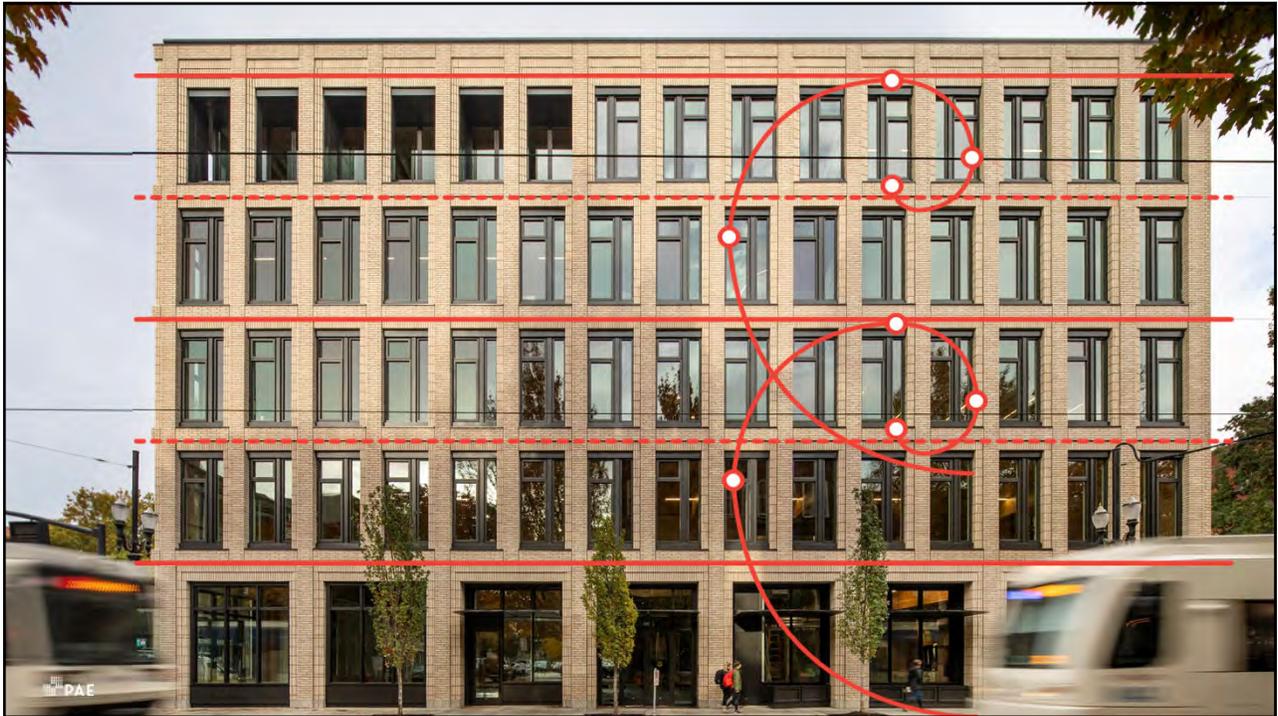
Peak Reduction with Good Design



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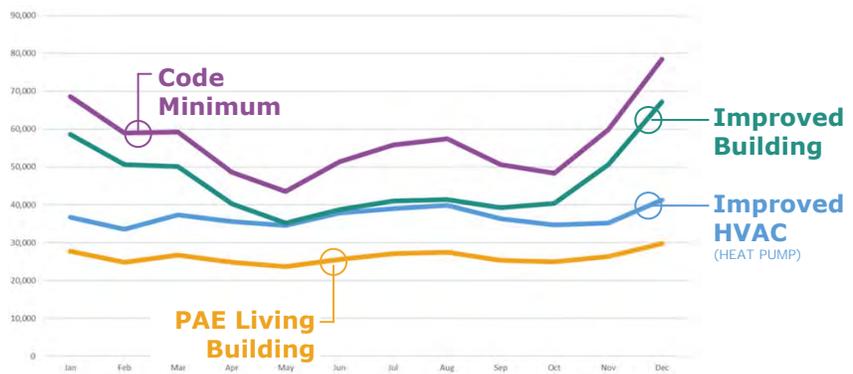
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Reduce Peaks Through Design

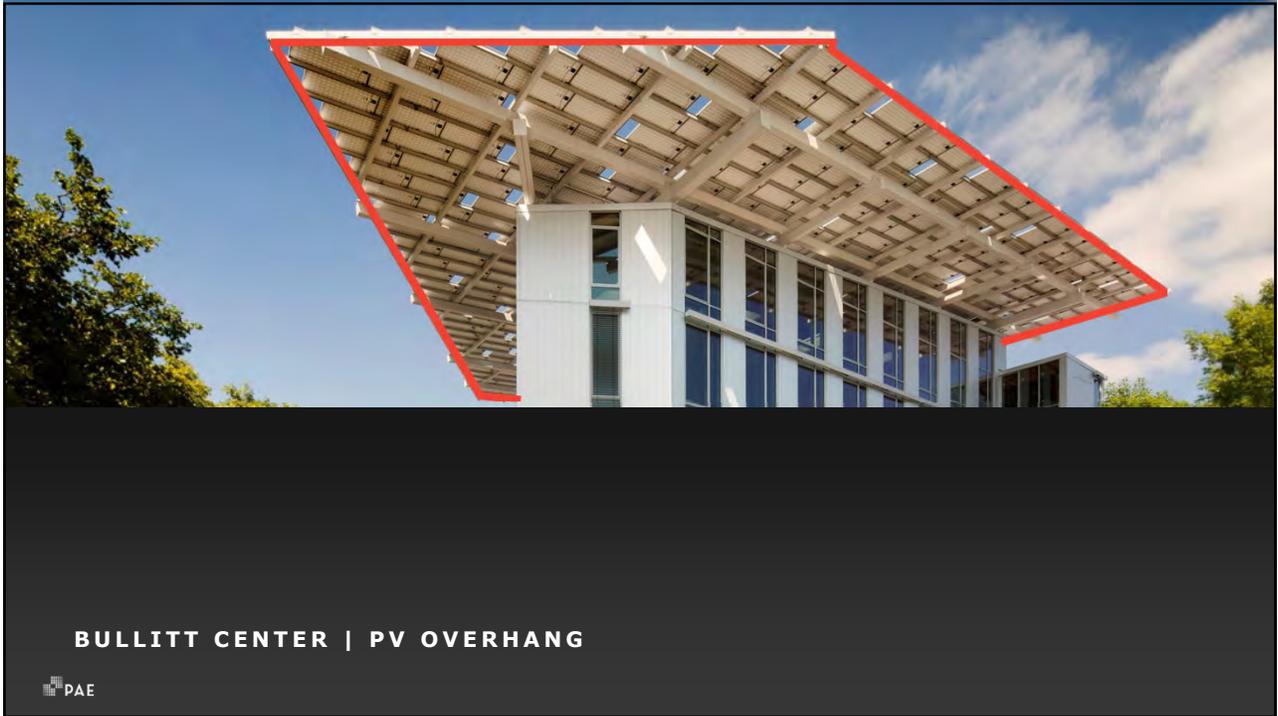


PEAK REDUCTION THROUGH DESIGN:

Improved Building = Summer Peak Reductions

Heat Pump = Winter Peak Reduction

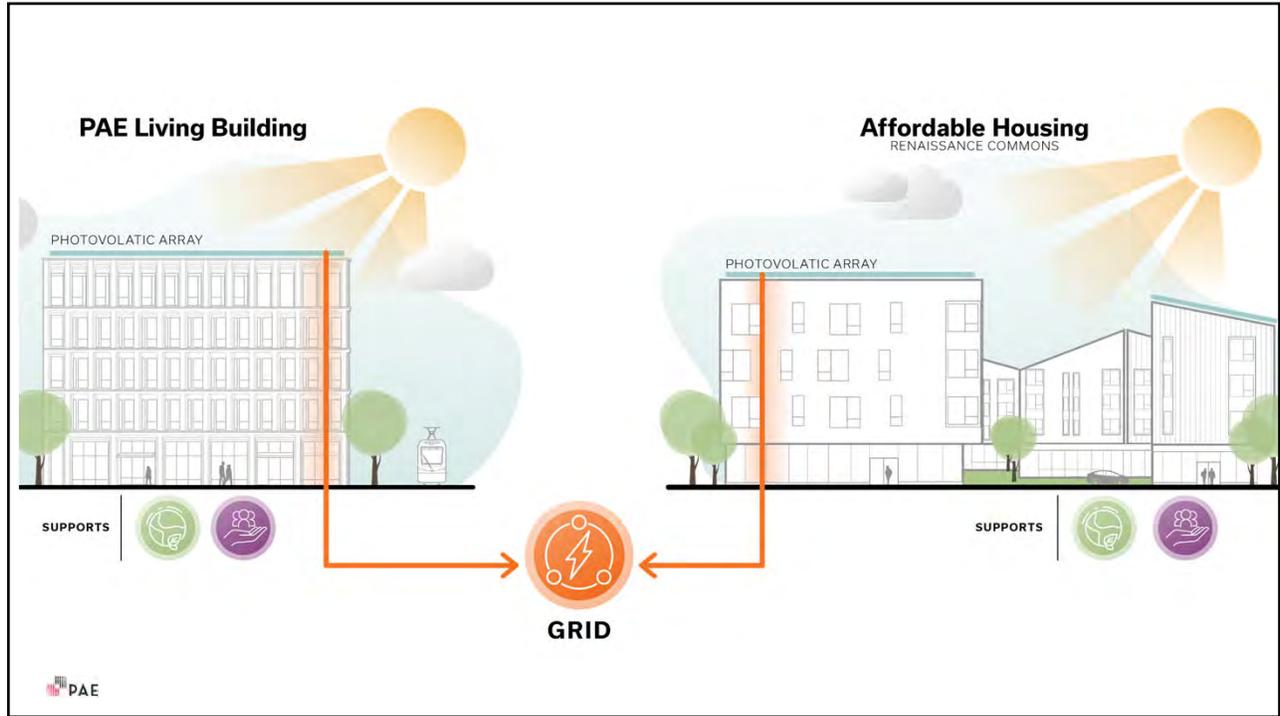
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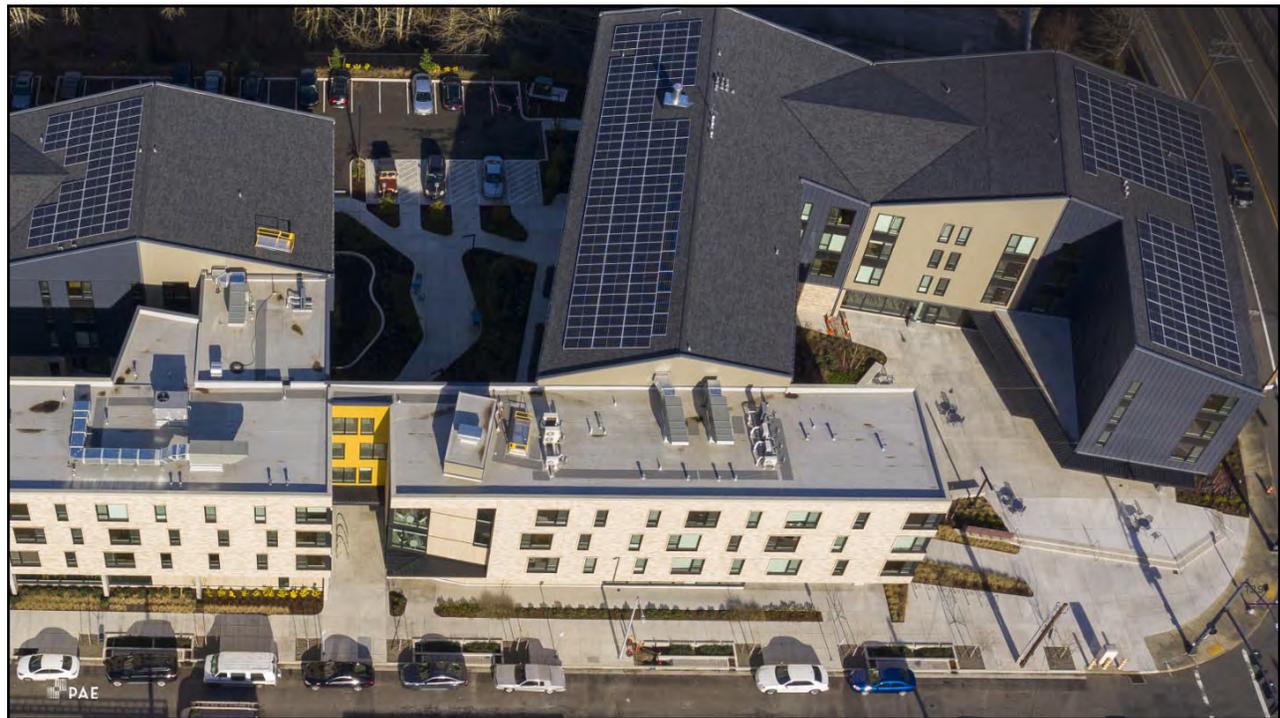
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Ongoing Research

- Continued optimization of grid-interactivity of the microgrid with PGE
- Pilot project exploring the future of building controls. External partners:

PAE

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Questions?

Thank you for your interest and
joining us today!

nbi new buildings
institute
www.newbuildings.org

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Want to go deeper?

*BESF webinar on Future
Ready Buildings - Modeling
Tools, Resources and
Incentives*

Attend the webinar that
follows next

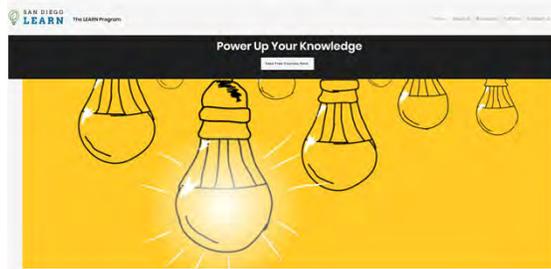
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Share your feedback in this short survey

Power up your electrification knowledge with the San Diego LEARN program: www.sandiegolearn.com



nbi new buildings institute
www.newbuildings.org

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Other LEARN courses of interest:



Batteries Hidden in Plain Sight: HPWHs with Thermal Storage

Using HPWHs to conserve space while storing more energy.



Net Zero Energy

Essentials of Zero Net energy buildings, campuses, and communities, and the "passive house."



Microgrids for a Resilient, Renewable Future

How microgrids are playing a role in modernizing the power grid and strengthening community resilience.



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