Coming Soon to a Code Near You, Net Zero and Passive House
Who Are We?

- **Mary Nitschke** is President of the Utility Management Advisory board, possesses an Energy Resource Management Certificate from UC Davis, and two Bachelors of Art from UC Berkeley and her Multifamily Building Energy Efficiency certification from the Building Performance Institute. She is the Director of Services Manager for the award winning Prometheus Real Estate Group, Inc.

- **Lori Hanson** serves as an Operations Manager for Greystar, where she is responsible for assisting with property performance, regional performance initiatives, and operational project management. Lori provides support services to the 150,000 units in the Western part of the United States and specializes in improving property performance and enhancing operational efficiency.

- **Robert Schock** is Senior Vice President, Director of Property Management at Yarco and is responsible for day to day management operations of the firms’ 100 properties across eight states. With over 40 years in the business, Bob is a recognized industry leader, who in 2016, was named Management Executive of the Year by the Apartment Association of Kansas City. He has earned the CPM designation through IREM and is a Certified Commercial Investment Member (CCIM).

- **Rachel Kuykendall** is a Senior Program Manager at the Association for Energy Affordability, Inc. specializing in improving energy efficiency in existing multifamily buildings and the creation of zero net energy/net positive projects. She has served as an energy efficiency program manager and program implementer for the Energy Upgrade California: Bay Area Multifamily Building Enhancement Program.
Why we think you should care?

1) New Construction Design Ideas Can Help you create more efficient Product now.
2) You can apply some of these tricks to existing stock.
3) Green is the new Black!
4) What happens in new design makes its way into our Codes.
Everyone’s Doing it

Currently, 44 states, Washington, D.C., and four territories have established state building energy codes for commercial buildings.

Forty-three states, Washington, D.C., and four territories have state building energy codes for residential buildings.
Who is looking to do it

- States are updating or strengthening building energy codes to help owners and renters reap the economic and comfort benefits of improved heating and cooling systems, insulation and ventilation.

- In 2015, legislation on building energy codes was enacted in Arizona, California (Assembly Bill 802 and Assembly Bill 865), Florida, Georgia, Illinois, Maine, Maryland, Minnesota, Nebraska, Nevada, North Carolina, Texas and Washington (House Bill 1101 and Senate Bill 5024).
What we have learned from the Past

Figure ES.1: States with EERSs: 2005 and 2015

Sources: 2005 map from EPA 2006; 2015 map from ACEEE 2014b and DSIRE 2015.
Code: not just for new construction

What was this  Became this  And is now this
What you will get from today

• Three Innovations in New Building Types: Net Zero, Passive House, and The Living Building
• How to Operate this new stock
• Ideas you can integrate into your existing Stock
• A look into the future so you are prepared
Now, let’s talk about Net Zero

Lori Hanson
GreyStar
ZERO NET ENERGY
What is Net Zero?

A “net zero” community is one that, on an annual basis, produces as much or more energy than it consumes.
How can this happen?

The “Net Zero” goal is achieved through highly engineered buildings using the latest in proven, energy-efficiency technologies combined with harvesting the free and renewable power of the sun (solar).
Example: West Village - Davis, CA
Energy Reduction

- High Performance Low-E Glass
- Light-Colored Cool Roofs Reflect Sunlight and Minimize Heat Gain
- High Efficacy Lighting Technology
- Greenwave Power Management System
- Upgraded Insulation
- Radiant Barrier Roof Sheathing
- Sunshades Designed Specific to Each Solar Orientation
- High-Efficiency Electric Heat Pump Heating and Cooling Systems
Energy Production

- Solar Panels Designed to Provide Entire Energy Load (33,000 panels!)
Interiors

- Low VOC Interior Paint
- Eco-Quartz Countertops, Greenguard Rated
- Wood-like Flooring made of 50% Recycled Content
- Water-based, Low VOC Finishes for Cabinets
- Oversized Windows for Natural Light and Ventilation
- Ceiling Fans in Living Rooms and Bedrooms to Promote Air Circulation
Water Conservation

- Low-Flow Faucets
- Low-Flow Toilets
- Energy Star Appliances
- Drought-tolerant and Native Plants
Water Retention

- Green Swales and Rain Gardens
- Landscaped Storm Water Detention Ponds

Native plants do not require fertilizer, and absorb runoff and pollutants
Native plants attract birds and butterflies
Runoff is collected from hard surfaces and directed into the garden
Depression filled with mixture of sand, topsoil and compost
Existing soil
Transportation

- Site Plan Designed Around Optimal Bike Access
- Integrated Bike Network Linking Community and Campus
- Unitrans Bus Line
Thoughtful Design

- The central building roofs feature a saw-toothed configuration that increases southern facing surfaces maximizing photovoltaic production.
- The use of large windows and patio doors encourages residents to naturally light their apartments and utilize the heavy cross Sacramento Delta breezes of Davis.
- The primary ingress and egress point of the community is accessible only by bicycle and creates an incentive for students to bike over drive.
Culture and Education

- Community support / partnership
- California Public Utilities Commission (CPUC) created policy requiring all new residential statewide construction to be ZNE by 2020
- Student activism
Fun Facts!

- There are approximately 3,500 ZNE buildings across the U.S.!
- West Village has the potential to be the largest planned zero net energy community in the US (97% recently).
- Each building monitored by “WattzOn” = measurement.
- Green ambassadors live on site to understand impact to residents.
- “Empower Hour” gets residents involved.
- The top 20 consuming residents receive personalized coaching; 20 lowest receive gift cards and incentives.
## Energy Snapshot

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Percent ZNE</th>
<th>Net Usage (kWh)</th>
<th>Total Consumption (kWh)</th>
<th>Total Production (kWh)</th>
<th>Units Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The Ramble Phase 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resident Units</td>
<td>129%</td>
<td>-23,426</td>
<td>81,190</td>
<td>104,616</td>
<td>93%</td>
</tr>
<tr>
<td>Common Areas</td>
<td>120%</td>
<td>-7,078</td>
<td>36,115</td>
<td>45,273</td>
<td>54%</td>
</tr>
<tr>
<td>Total</td>
<td>126%</td>
<td>-31,104</td>
<td>117,305</td>
<td>150,889</td>
<td>93%</td>
</tr>
<tr>
<td><strong>The Ramble Phase 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resident Units</td>
<td>111%</td>
<td>-8,559</td>
<td>75,911</td>
<td>84,470</td>
<td>77%</td>
</tr>
<tr>
<td>Common Areas</td>
<td>127%</td>
<td>-9,266</td>
<td>33,724</td>
<td>42,990</td>
<td>81%</td>
</tr>
<tr>
<td>Total</td>
<td>116%</td>
<td>-17,825</td>
<td>109,635</td>
<td>127,460</td>
<td>77%</td>
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<tr>
<td><strong>Solstice</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resident Units*</td>
<td></td>
<td>--</td>
<td>160,986</td>
<td>--</td>
<td>88%</td>
</tr>
<tr>
<td>Common Areas</td>
<td>84%</td>
<td>22,097</td>
<td>141,784</td>
<td>119,687</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>40%</td>
<td>183,083</td>
<td>302,769</td>
<td>239,374</td>
<td>89%</td>
</tr>
<tr>
<td><strong>Viridian</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resident Units**</td>
<td>101%</td>
<td>-298</td>
<td>44,737</td>
<td>45,024</td>
<td>77%</td>
</tr>
<tr>
<td>Common Areas</td>
<td>90%</td>
<td>4,716</td>
<td>48,537</td>
<td>43,221</td>
<td>73%</td>
</tr>
<tr>
<td>Total</td>
<td>95%</td>
<td>4,418</td>
<td>93,232</td>
<td>88,245</td>
<td>77%</td>
</tr>
<tr>
<td><strong>WEST VILLAGE TOTAL</strong></td>
<td>78%</td>
<td>138,572</td>
<td>620,032</td>
<td>486,460</td>
<td>85%</td>
</tr>
</tbody>
</table>
The energy we use = the energy we make!

Result: “Net Zero / ZNE” Energy Usage!
Now, let’s talk about Passive House

Robert Schock
Yarco
2nd + Delaware

“Building The Future We Want”
122 Delaware
Kansas City, MO
276 unit Luxury Apartment Homes
Passive House Certified
We need everyone – Government Ministers and policymakers, business and civil society leaders, and young people – to work together to create a future worth choosing, a future we want.”

-Secretary General Ban Ki-Moon
What is Passive House?

• Passive house is a rigorous standard for energy efficiency in a building
  – More rigorous than LEED Platinum certification

• Wrapping a building in a blanket.
  – In our case, 16” thick concrete and insulation
  – Triple pane windows

• A Passive House built building will consume up to 90% less energy than a standard built building.
Thermogram

The dark colors on this thermogram of a Passive House, at right, shows how little heat is escaping compared to a traditional building to the left.
What is Passive House?

- It is most applicable to new construction, though there have been some retrofitted structures that have been certified.
- Has been most popular in Europe, mainly in German speaking and Scandinavian countries.
- Probably because of the individuals that developed the concept and standards in place today.
Bo Adamson, co-originator of the passive house concept.

Wolfgang Feist, co-originator of the passive house concept, and founder of the Passivhouse Institut in Germany.
What is Passive House?

• To become Passive House certified, the requirements are based on:
  – Annual heating and cooling demand within certain strict parameters
  – Total Primary energy consumption for heating, hot water and electricity.
  – Air leakage rate. Must be less than 0.05 cubic feet per minute.
Strategic Plan

Project Pipeline

2nd + Delaware

276 unit Passive-house Certified development in Kansas City, MO

Funded with HUD 221(d)4 loan guarantee, Low Income Housing Tax Credits and Equity.

Cost: $50 million

CO2 Reductions: 2,400 Tons/Year

Affordable Units: 55

Start Construction: August, 2016
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2nd + Delaware
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2nd + Delaware
2nd + Delaware
2nd + Delaware
2nd + Delaware
How to Build the World’s Most Energy-Efficient Building
Construction Process

2nd + Delaware
Construction Process

Southwest Garage
Construction Process

Southeast Building
Construction Process

Insulated Walls
The New Development Model

Passive House Construction

Current Development Model uses poorly insulated walls and oversized mechanical systems to compensate for the thermal losses.

Passive House Model calls for super insulated building envelopes and require 70-90% less energy to heat and cool the building.

$119.00 per month → $26.47 per month

Passive House Buildings have 70-90% lower utility bills.
Additional Environmental Benefits

Natural Gas Combined Heat and Power

CHP CAPTURES ENERGY THAT WOULD NORMALLY BE LOST in power generation and uses it to provide heating and cooling, making CHP 75-80 PERCENT EFFICIENT at using fuels.

82 GW
The current installed capacity of CHP -- about 8 percent of U.S. generating capacity.

40 GW
The national goal for added CHP capacity, signed in an August 2012 Executive Order by President Obama.

Meeting this goal would:

- Save American manufacturers and consumers $10 billion each year
- Spur $40 to $80 billion in new capital investments in plants and facilities
- Save 1 percent of all energy use in the U.S. (or quadrillion BTUs of energy)
- Reduce emissions by the equivalent of taking 25 million cars off the road
Micro-Turbine System
Micro-Turbine System
EVR: Energy Recovery Ventilator &
HVR: Heat Recovery Ventilator
Additional Environmental Benefits

Reduction in Source Energy Consumption

![Bar chart showing reduction in source energy consumption.](chart.png)

- **96% Reduction in Source Energy Consumption**

<table>
<thead>
<tr>
<th>Conditioned Space (sf)</th>
<th>Total Energy Consumption kBtu/yr</th>
<th>Source Energy (kBtu/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Multifamily High-Rise</td>
<td>277,512</td>
<td>145,370,339</td>
</tr>
<tr>
<td>Second and Delaware Apartments</td>
<td>290,754</td>
<td>5,798,500</td>
</tr>
</tbody>
</table>

Legend:
- Typical High-Rise
- Second & Delaware

#nmhcOPTECH @apartmentwire
High Performance Windows

Triple Glazed Certified Windows

Triple-glazed windows hold 3 layers of glass. This extra layer, combined with a highly-insulated frame keeps the interior of the window within 2 degrees of the interior, air temperature. The end result is remarkably better, thermal comfort.
2nd + Delaware

The New Development Model

- 276 Unit Multifamily Project
- Transit Oriented
- Passive House Certified
- 20% Workforce Housing
The New Development Model

Transit Oriented Development

Monthly Transportation

Living in transit oriented neighborhoods can reduce transportation cost by 70%.

Conventional Development

$598.25 per month

Transit Oriented Development

$192.60 per month
Operational Challenges-Anticipated

- Environmentally friendly items like ice melt
- An array of Green cleaning products
- Making sure the landscaping is fertilized with Green products.
- How to I maintain the landscaping on the roof?
  - How do they get their equipment up there? Or even if we store it, getting it up there initially.
- Allocating charging stations in the garage.
Operational Challenges-Anticipated

– Only LED lights, even in the apartments-lease/community policies.

– Special cleaning instructions for the polished concrete floors, etc.-community policies

– Size

– Maintenance of the HVAC systems

– No Smoking

– Along with all the, normal, everyday fun that comes with property management!
2nd + Delaware

“Building The Future We Want”
122 Delaware
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Now, let’s talk about
Living Building Challenge

Rachel Kuykendall
Association For Energy Affordability
Beyond Zero

Using the Living Building Challenge as a Positive Design Tool
Not-for-profit, mission-driven, technical services & training organization at the forefront of increasing energy efficiency and resource conservation in multifamily buildings since 1993.

Over 130 professional energy engineers, project managers, building scientists, trainers and technical consultants. Locations in NY, CA, & IL.

Large and diverse base of clients including utilities, federal, state and local housing agencies, local governments, the DOE, and over a thousand building owners, management companies, architects and developers.
LIVING BUILDING CHALLENGE

PLACE
WATER
ENERGY
HEALTH AND HAPPINESS
MATERIALS
EQUITY
BEAUTY
Energy

“One hundred and five percent of the project's energy needs must be supplied by on-site renewable energy on a net annual basis, without the use of on-site combustion. Projects must provide on-site energy storage for resiliency.”
How To Implement the Energy Petal

• Use Passive House as Envelope design tool
• High efficiency appliances with feedback/monitoring
• Balanced mechanical ventilation with heat/energy recovery
• Heat Pump Heating and Water Heating
• Electric Induction Cooking
What to Implement Now

Envelope Design/Fine Tuning During Schematic Design

Heat Pump Water Heating

Balanced Ventilation with Heat Recovery
Water

“One hundred percent of the project’s water needs must be supplied by captured precipitation or other natural closed loop water systems, and/or by recycling used project water, and must be purified as needed without the use of chemicals.

All stormwater and water discharge, including grey and blackwater, must be treated on-site and managed either through re-use, a closed loop system, or infiltration. Excess stormwater can be released onto adjacent sites under certain conditions.”
How To Implement the Water Petal

Source: International Living Future Institute
What to Implement Now

Low-Flow Fixtures and Devices

Optimize Landscapes to be Low Water

Graywater Treatment for Toilets or Landscaping
“The project cannot contain any of the following Red List materials or chemicals:

- Alkylphenols
- Asbestos
- Bisphenol A (BPA)
- Cadmium
- Chlorinated Polyethylene and Chlorosulfonated Polyethylene
- Chlorobenzenes
- Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs)
- Chloroprene (Neoprene)
- Chromium VI
- Chlorinated Polyvinyl Chloride (CPVC)
- Formaldehyde (added)
- Halogenated Flame Retardants (HFRs)
- Lead (added)
- Mercury
- Polychlorinated Biphenyls (PCBs)
- Perfluorinated Compounds (PFCs)
- Phthalates
- Polyvinyl Chloride (PVC)
- Polyvinylidene Chloride (PVDC)
- Short Chain Chlorinated Paraffins
- Wood treatments containing Creosote, Arsenic or Pentachlorophenol
- Volatile Organic Compounds (VOCs) in wet applied products
What to Implement Now

Removal of Foam-Based Products

Zero-VOC Paints and Adhesives

Removal of Vinyl Flooring
Rachel Kuykendall
Senior Program Manager
rkuykendall@aea.us.org