Better Buildings®
U.S. DEPARTMENT OF ENERGY

JUNE 8-11
2020 SUMMIT
A Virtual Leadership Symposium

Learn more: betterbuildingssolutioncenter.energy.gov/summit
Use the Zoom Chat Box to Ask Questions and Make Comments!
Social Media: Follow along with Better Buildings, Better Plants

#BBSummit2020

Twitter:
- @BetterBldgsDOE
- @BetterPlantsDOE

LinkedIn:
- www.linkedin.com/company/better-buildings/
- www.linkedin.com/showcase/better-plants/
Today’s Presenters

Krista Egger
Enterprise Community Partners

Ruchi Shah
Tenderloin Neighborhood Development Corporation

Michael Hindle
Passive to Positive
Krista Egger
Enterprise Community Partners

Submit Questions
Zoom Chat
Maximizing Performance in Affordable New Construction

June 10, 2020
Imagine a world where housing for low and moderate income people was not only abundant, but also healthy, safe, durable, comfortable, efficient, resilient, beautifully designed, and environmentally responsible.

And imagine that these exemplary homes are not just demonstrations of excellence, but the standard manner of designing, building, and operating high quality affordable housing.

As a community of housing providers, we have an opportunity to make this vision our reality, addressing today’s affordability challenges and the impacts of our changing climate.
Enterprise Green Communities certified projects are underway in 46 states, Puerto Rico + the District of Columbia. We have policy relationships in 27 states. Since 2004, we’ve impacted more than 127,000 homes and invested $3.9 billion in the development and preservation of green and affordable homes.
ENTERPRISE GREEN COMMUNITIES CRITERIA

A holistic approach to building a green community
2020 ENTERPRISE GREEN COMMUNITIES CRITERIA

INTEGRATIVE DESIGN
2020 ENTERPRISE GREEN COMMUNITIES CRITERIA

LOCATION + NEIGHBORHOOD FABRIC
2020 ENTERPRISE GREEN COMMUNITIES CRITERIA
CATEGORY 5: OPERATING ENERGY

PATH TO ZERO

MANDATORY BUILDING PERFORMANCE STANDARD

- 5.1a New Construction
- 5.1b Moderate or Substantial Rehab

MOVING TO ZERO ENERGY

- 5.2a Additional reductions in energy use
- 5.2b Near Zero Certification
- 5.3a PV/Solar Hot Water Ready
- 5.3b Renewable Energy

ZERO ENERGY

- 5.4 Zero Energy

MOVING TO ZERO CARBON

- 5.5a Electric Ready
- 5.5b All Electric

Criteria with an asterisk must also follow Criterion 78: Dehumidification, if in Climate Zones 1A, 2A, 3A, or 4A.

A project following 5.4 is exceeding 5.2a, 5.2b, 5.3a, and 5.3b, and not eligible for those points.
CATEGORY 7: HEALTHY LIVING ENVIRONMENT

REDUCING EXPOSURE TO ENVIRONMENTAL HAZARDS
7.1 Radon Mitigation
7.2 Reduce Lead Hazards in Pre-1978 Buildings
7.3 Combustion Equipment
7.4 Garage Isolation
7.5 Integrated Pest Management
7.6 Smoke-Free Policy

MANAGING THE INDOOR ENVIRONMENT
7.7 Ventilation
7.8 Dehumidification
7.9 Construction Pollution Management
7.10 Noise Reduction

PROMOTING HEALTH THROUGH DESIGN
7.11 Active Design: Promoting Physical Activity
7.12 Beyond ADA: Universal Design
7.13 Healing-Centered Design
2020 ENTERPRISE GREEN COMMUNITIES CRITERIA
2020 ENTERPRISE GREEN COMMUNITIES CRITERIA

Program: www.enterprisecommunity.org/green
Criteria: www.greencommunitiesonline.org
Questions: certification@enterprisecommunity.org
Q & A

Submit Questions

Zoom Chat
Ruchi Shah
Tenderloin Neighborhood Development Corporation

Submit Questions
Zoom Chat
Better Than Before
AT TNDC, WE BELIEVE HOUSING IS A HUMAN RIGHT.

Every day we provide people who are struggling to make ends meet in San Francisco with permanently affordable homes. Because when a person has a place to call home, they have the foundation for a better life.

3,280 of our 4,100 residents live on an annual income of less than $15,000

3,450 homes

725 of our 3,450 homes are dedicated to the formerly homeless

725

56,000+ HOURS

Our onsite social workers dedicate 56,000+ hours a year to helping residents feel welcome and supported in their home

BUILDING HOMES AND COMMUNITY IN SAN FRANCISCO FOR OVER 35 YEARS

Our work began with a need for permanent affordable housing in the Tenderloin. As the need for more permanent affordable housing has grown, so have we.

43 BUILDINGS

11 BUILDINGS IN DEVELOPMENT

8 SF NEIGHBORHOODS

HOUSING COMES FIRST, IT’S NOT WHERE OUR WORK ENDS

Our work is grounded in our community’s needs and leads to programs such as:

TENDERLOIN AFTER-SCHOOL PROGRAM
240 kids (ages 7-18) learn and grow with free tutoring, cultural activities, and an annual College Tour program

TENDERLOIN PEOPLE’S GARDEN
3,000 lbs of free produce are distributed to Tenderloin residents every year to lessen the burden of food costs
Sustainability Goals

- **Energy & Water Use**: 20% Reduction by 2029
- **Waste**: 60% Waste Diversion by 2029
- **Carbon Emissions**: 50% Reduction by 2029
- **Certification**: Maybe?
Green and Healthy Building Standards

Baseline

Aspirational but Adoptable

“UP” Basis of Design
Strategies

- Local Jurisdiction
- Funders
  - Tax Credits
  - HUD
  - Banks
- Beat the Code Approach
- Stakeholder Engagement – Architects and Project Managers
40% of Portfolio has a Green Certification
9 LEED Projects
All-Electric isn’t expensive for (us)

### Cost and Benefits – Studies

<table>
<thead>
<tr>
<th></th>
<th>Change in Construction Cost ($/Sq Ft)</th>
<th>Lifetime Net Present Value ($/Sq Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family</td>
<td>-$5.01</td>
<td>$3.62</td>
</tr>
<tr>
<td>Multifamily 3 floors or less</td>
<td>-$1.18</td>
<td>$4.64</td>
</tr>
<tr>
<td>Multifamily 4-8 floors</td>
<td>-$0.13</td>
<td>$0.68</td>
</tr>
<tr>
<td>Retail</td>
<td>-$0.98</td>
<td>$6.37</td>
</tr>
<tr>
<td>Office</td>
<td>-$1.54</td>
<td>$1.09</td>
</tr>
</tbody>
</table>

**What Not to Do:**
- Switch to all-electric late in design
- Evaluate Systems in Isolation
- Solicit Minimal Bids

**What to Do:**
- Bring in Innovative Consultants
- Select Innovative GC and Subs
- Both Compliance & Performance Energy Models
- Set Clear Goals and get Buy In from All
- Evaluate On Site Renewables Options
- Commissioning – do it
Embodied Carbon

View Video »
Materials Matter

‘Upfront’ Embodied Carbon
Manufacturing, transportation, and installation of construction materials

Operational Carbon
Building energy consumption
Global Warming Potential per Division (kg CO2 eq)

- 3 - Concrete
- 4 - Masonry
- 5 - Metals
- 6 - Wood/Plastic/Composites
- 7 - Thermal and Moisture Protection
- 8 - Openings
- 9 - Finishes

Embodied Carbon
Low Embodied Carbon Concrete
### CAST-IN-PLACE CONCRETE

<table>
<thead>
<tr>
<th>Concrete Location</th>
<th>GGBFS Content Min, Max (percent)</th>
<th>Flyash Content Min, Max (percent)</th>
<th>SCM Content (Total Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Footings</td>
<td>40,50</td>
<td>20,30</td>
<td>70</td>
</tr>
<tr>
<td>Grade Beams</td>
<td>40,50</td>
<td>20,30</td>
<td>70</td>
</tr>
<tr>
<td>Mat Slab</td>
<td>40,50</td>
<td>20,30</td>
<td>70</td>
</tr>
<tr>
<td>Slab on grade</td>
<td>40,50</td>
<td>20,30</td>
<td>70</td>
</tr>
<tr>
<td>Columns</td>
<td>20,30</td>
<td>20,30</td>
<td>50</td>
</tr>
<tr>
<td>Walls/Pilasters</td>
<td>20,30</td>
<td>20,30</td>
<td>50</td>
</tr>
<tr>
<td>P/T Slab</td>
<td>0,10</td>
<td>15,20</td>
<td>20</td>
</tr>
</tbody>
</table>

Source - KPPF

**NOTES:**

- Supplemental Cementitious Materials (SCM)
- Percentages of GGBFS and Flyash may be individually adjusted within the limits provided in order to maintain total SCM content
- Carbon cure can be added to all of the mixes
  [https://www.carboncure.com/](https://www.carboncure.com/)
Low Embodied Carbon Concrete

What to Ask When Specifying Concrete

• Can the amount of cement be reduced in the concrete mix?
• Can the overall mass of concrete in the project be reduced?
• What is the least energy-intensive cement kiln that is locally available?
• What carbon-sequestering aggregate or mix techniques can be included?
Low Embodied Carbon Concrete
Thank You!

Ruchi Shah, 
Senior Sustainability Manager

rshah@tndc.org

“I don’t want your hope. I don’t want you to be hopeful. I want you to panic ... and act as if the house was on fire. ”

Greta Thunberg 
Environmental Activist
Q & A
Submit Questions
Zoom Chat
Michael Hindle
Passive to Positive

Submit Questions
Zoom Chat

U.S. DEPARTMENT OF ENERGY
THE GREAT HOPe . . .

THE ELUSIVE PROMISE OF

SIMPLIFIED, REPLICABLE, HIGH PERFORMANCE

IT'S ALL ABOUT THE TEAM

NOT JUST A PLATITUDE – IT'S ALL IN THE ATTITUDE
- SERIOUSLY – IT'S TRUE !!
IT'S ALL ABOUT THE TEAM

DO THEY WANT IT?

DO THEY CARE?
Our climate is changing.

Maps of numbers of days over 100°F/yr of recent past and two emissions scenarios.

Recent Past, 1961 - 1979

Lower Emissions Scenario, 2080-2099

Higher Emissions Scenario, 2080-2099
BUILDINGS PLAY A BIG PART
BUILDINGS ACCOUNT FOR ALMOST HALF THE CO₂ EMISSIONS

energy use and CO₂ emissions per capita and by sector
REDUCE OPERATIONAL ENERGY DEMAND

75% SPACE CONDITIONING REDUCTION

PATH TO ZERO
SIMPLIFIED, REPLICABLE, HIGH PERFORMANCE

REQUIRES COMMITTED AND TRULY COLLABORATIVE DESIGN

NOT JUST A PLATITUDE – IT’S ALL IN THE ATTITUDE – SERIOUSLY – IT’S TRUE !!
GILFORD VILLAGE KNOLLS III
AFFORDABLE SENIOR LIVING

THE FIRST LOW INCOME HOUSING TAX CREDIT HIGH PERFORMANCE PROJECT IN NH

THE FIRST MULTI-FAMILY PASSIVE HOUSE IN NEW HAMPSHIRE PHIUS PRE-CERTIFIED (UNDER CONSTRUCTION)
BUILDING 1B

WASHINGTON, DC

108 UNITS OF AFFORDABLE HOUSING AND RETAIL

Preservation of Affordable Housing,
Architect: EDG
BUILDING 1A

WASHINGTON, DC

134 UNITS OF AFFORDABLE HOUSING AND RETAIL

Preservation of Affordable Housing, Architect: Grimm + Parker
BUILDING 2

WASHINGTON, DC

196 UNITS OF AFFORDABLE HOUSING AND RETAIL

Preservation of Affordable Housing,
Architect: Grimm+Parker
SINGLE CAVITY PRE-FABRICATION

SIMPLE ASSEMBLIES BUT . . .
PODIUMS ARE THERMAL BRIDGING NIGHTMARES AND ARE HIGH CARBON INTENSITY
PODIUMS ARE THERMAL BRIDGING NIGHTMARES AND ARE HIGH CARBON INTENSITY
RESET THE CARBON BALANCE

What if we stop increasing emissions?
Even at the current emissions rate, CO2 is released into the atmosphere nearly twice as fast as it is removed—so the bathtub will continue to fill.

How do we cause CO2 emissions?
Four-fifths is from burning fossil fuels. Nearly all the rest is from deforestation and other changes in land use.

How much is too much?
No one is sure. Some scientists think we need to reduce the CO2 level back down to 350 parts per million (ppm)—equivalent to 714 billion metric tons of carbon—to avoid serious climate impacts. But if current emissions trends continue, 480 ppm will be passed well before mid-century.

How does CO2 cause warming?
It absorbs some of the heat radiation coming off Earth’s sunbathed surface and reradiates it back downward.

Where does our CO2 go?
Plants and soil absorb about a third each year, and ocean surface waters about a quarter. The rest stays airborne for a long time.

©2015 Passive Houe Alliance US  | PHAUS

Image from climatesight.org
**Time is a Critical Factor**

**TIME** is a critical factor
Emissions averted today contribute more to slowing climate change than emissions averted in the future.

*From 2020-30 up-front embodied carbon contributes more than the ongoing operational emissions.*

---

**Total Carbon Emissions of Global New Construction**
Every Year from 2020 • Business as Usual Projection

- **Upfront Embodied Carbon**
- **Operational Emissions**

---

**DAY 1**
A building will have emitted 100% of its embodied carbon the day it is built.

**TODAY to 2030**
Embodied carbon is the largest contributor of GHGs.

**BY 2050**
Embodied carbon can still be the majority of emissions.

---

**Materials Matter**
Scenario 1
Baseline Code Build
Typical Code Build
R-10/20/24/38
eC = 20.8 tons CO2e
Nat. gas heat = 2.0 tons/yr
84.8 tons @ 2050

Scenario 5
High Foam with Heat Pump
Ontario High Perf. Build
R-20/30/40/60
eC = 90.3 tons CO2e
Heat pump = 0.1 tons/yr
91.9 tons @ 2050

Scenario 6
Best Case
High Perf. Natural Build
R-20/30/40/60
eC = -10.5 tons CO2e
Heat pump = 0.1 tons/yr
-8.9 tons @ 2050

Legwood, Racuvk, & McAvion 2018
Materials Matter
The same building can have very different up-front embodied carbon emissions (UEC)

High UEC
- Assembly includes:
  - High carbon concrete
  - XPS & closed cell spray foam
  - Brick cladding
  - Steel interior framing
  - Drywall
  - Vinyl windows
  - Tile & carpet flooring
  - Clay tile roofing

Typical UEC
- Assembly includes:
  - Average carbon concrete
  - Mineral wool insulation
  - Fiber cement cladding
  - Wood & T&J interior framing
  - Drywall
  - Vinyl windows
  - Engineered wood & vinyl flooring
  - Asphalt shingle roofing

Best Conventional UEC
- Assembly includes:
  - High SCM concrete
  - Cellulose & wood fiberboard insulation
  - Wood cladding
  - Wood interior framing
  - Drywall & wood walls
  - Aluminum clad wood windows
  - Engineered wood & FSC hardwood flooring
  - Steel roofing

Best UEC
- Assembly includes:
  - Iso-Span ICF with high SCM concrete
  - Expanded glass sub-grade insulation
  - Straw & wood fiberboard insulation
  - Wood cladding
  - Compressed straw panel interior walls
  - ReWall interior cladding
  - Wood windows
  - Linoleum & FSC softwood flooring
  - Cedar shake roofing
PODIUMS ARE THERMAL BRIDGING NIGHTMARES + CARBON INTENSIVE

BUT DO THEY HAVE TO BE??
DIDN’T I SAY SOMETHING ABOUT . . . ?

IT’S ALL ABOUT THE TEAM !!!

NOT JUST A PLATITUDE – IT’S ALL IN THE ATTITUDE
- SERIOUSLY – IT’S TRUE !!
URBAN VILLAGE

SOMERSET DEVELOPMENT
WASHINGTON, DC

117 UNITS OF AFFORDABLE HOUSING
PH, LOW CARBON, MICROGRID

1ST PHASE
PODIUMS ARE THERMAL BRIDGING NIGHTMARES

DESIGNING ALL-WOOD PODIUMS

March 4, 2015

by K. Woods

Wood construction sequenced for cost savings.

Mid-rise framing of structurally composite wood columns.

Advantages of cost savings look for new solutions to increase sustainability.

Lower cost:
Use of wood building materials can yield cost reductions in two California projects. For example, at the Galen Center—came in at two-thirds the cost of a concrete structure.

Simpler installation:

MASS TIMBER PODIUM AND SHAFTS
BUILD WITH REGENERATIVE MATERIALS
MATERIAL SELECTION FOR REGENERATIVE IMPACT
IF YOU ARE BUILDING NEW – MAKE IT **LOW-CARBON**

WE CAN NOT BUILD OUR WAY TO LOW CARBON
WEINBERG COMMONS

THE FIRST PASSIVE HOUSE RETROFIT APARTMENT BUILDINGS IN NORTH AMERICA
• PROVIDE ROBUST, **ABOVE CODE**, ENVELOPE W/ MINIMAL THERMAL BRIDGES

• AIRTIGHTNESS THAT IS 5X THE STANDARD THRESHOLD

• FOR THE “HOLES” IN THE ENVELOPE, INSERT HIGH PERFORMANCE SYSTEMS

• MANAGE SOLAR GAIN WITH WINDOW "APERTURES"

• A RESILIENT SKIN (RAINSCREEN)
North Negley Ave.
Pittsburgh, PA

- Deep Energy Retrofit
- Adaptive Re-use
- Affordable Housing
- Performance Venue
- Community Workspace
NORTH NEGLEY AVE, PITTSBURGH

- sequester carbon
- zero energy
- provide wildlife habitat
- transform waste
- produce food
- celebrate creativity

enhance the lives of individuals and the community

COURTNEY KOSLOW
Beacon Communities, Development Director
Development Partner

BEACON communities
WE CAN CREATE THE FIRST
DRAWDOWN COMMUNITIES!
FOSSIL FUELS AND INTERNAL COMBUSTION AND REFREGERANT SUPERCHARGED EVERYTHING

FORM FOLLOWS FUEL

...and made our culture unsustainable
TIME TO HONOR OUR HERITAGE

FORM ALWAYS HAS FOLLOWED FUEL . . . WHAT DID WE FORGET?

The Anasazi (Hisatsinom) 1100-1300 C.E.
FORM FOLLOWS FUEL
MORE GOOD NEWS

PASSIVE DESIGN, THEN ACTIVE GENERATION

REDUCED DEMAND = REDUCED RELIANCE

THIS IS THE PATH TO RESILIENCY
ONE WEEK POWER OUT IN JANUARY:
HIGH PERFORMANCE ENVELOPE MAINTAINS COMFORT AND SAFETY
POWER TO THE PEOPLE
KEEP IT LOCAL: SELF-POWER IS WHERE IT'S AT!

LOADS, GENERATION AND STORAGE - January, critical load, heat pump water heater NO HEAT

- Original Electrical load
- Net load
- Net Load after battery
- SOC
- Battery discharge
- PV
POWER TO THE PEOPLE

IN THE SUMMER WE MAKE $$$ FOR COMMUNITY SELLING SURPLUS POWER DURING PEAK HOURS

KEEP IT LOCAL: SELF-POWER IS WHERE IT'S AT!
A WISER INVESTMENT

THE US IS ABOUT TO SPEND $1.5 TO $2 TRILLION UPDATING AGING POWER INFRASTRUCTURE

• AVOIDED INFRASTRUCTURE INVESTMENTS AND MAINTENANCE
• GRID SERVICES
• PUBLIC HEALTH IMPACTS
• STORMWATER IMPACTS
• CLIMATE IMPACTS
• CRIME REDUCTION
• EDUCATION IMPACTS
IMPERATIVES

REDUCE OPERATIONAL ENERGY

REDUCE EMBODIED CARBON

CAPTURE AND SEQUESTER CARBON

REDUCE EMBODIED TOXICITY

RESILIENT SYSTEMS + COMMUNITIES

REGENERATIVE LAND AND WATER USE

PHOTO: RICHARD MISRACH
DESTRUCTION OF OUR ATMOSPHERE

ITS ALL ABOUT YOU!!
MICHAEL HINDLE CPHC, CPHB, Principal
passivetopositive@gmail.com
240-431-1281
PASSIVE HOUSE INSTITUTE/US (PHIUS)Former board member
PASSIVE HOUSE ALLIANCE-US Former President
Q & A

Submit Questions

Zoom Chat
Better Buildings: Summer Webinar Series

**BEHIND THE METER**
**DISTRIBUTED ENERGY RESOURCES:**
BEST PRACTICES FOR INTEGRATING DERS INTO COMMERCIAL BUILDINGS

July 8

**NEXT-GENERATION BUILDING PERFORMANCE POLICIES:**
MAXIMIZING ENERGY SAVINGS AND ENVIRONMENTAL IMPACTS

July 16

**EVERYONE HAS A DATA CENTER:**
HOW TO BE AN ENERGY CHAMPION FOR YOURS

July 28

**PROGRAM DESIGN WITH EVERYONE IN MIND:**
LOW-INCOME SOLAR PROGRAM STRATEGIES

July 9

**STRATEGIES TO COMBINE ENERGY + HEALTH UPGRADES IN MULTIFAMILY HOUSING**

July 21

**SUCCEED WITH SUBMETERING:**
HOW TO MAKE THE BUSINESS CASE

August 4

**THE DYNAMIC DUO:**
UNLEASH PUBLIC SECTOR ENERGY SAVINGS WITH FINANCING AND TECHNICAL ASSISTANCE

July 14

**CASE IN POINT:**
OREGON’S RECENT EFFORTS TO REDUCE PLUG LOAD ENERGY CONSUMPTION

July 22

REGISTER NOW

[Logo: Better Buildings]

[Logo: U.S. Department of Energy]
Additional Questions?
Please Contact Us

Follow us on Twitter @BetterBldgsDOE

Better Buildings Solution Center https://betterbuildingssolutioncenter.energy.gov/

General Inquiries betterbuildings@retechadvisors.com

Program Support ksanderson@retechadvisors.com

Krista Egger
Enterprise Community Partners
kegger@enterprisecommunity.org

Ruchi Shah
Tenderloin Neighborhood Development Corporation
rshah@tndc.org

Michael Hindle
Passive to Positive
michael@passivetopositive.com

Josh Geyer
HUD
Joshua.M.Geyer@hud.gov