BUILDING INNOVATION
Conference

Session B12 | 1:50 - 2:15 pm

Building Performance & Sustainability

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YES! We can make quality, affordable housing that's sustainable.

Innovations driving sustainability and affordability

Today we will explore how to use best practices to design affordable housing. You'll get a better understanding of:

1. Creating affordable housing that is sustainable, durable and meets a high aesthetic/quality standards.
2. The role of the building envelope in designing affordable housing that meets strict Passive House standards.
3. Mechanical systems and renewable energy sources in affordable housing projects.
4. The significance of durability in the selection of interior design materials.

"We have two crises: An affordable housing crisis and a climate crisis. Both can be addressed together with Passive House. It lowers the landlords costs, tenants costs and significantly reduces carbon footprint."

-- John Woelfling, principal with Dattner Architects and Passive House consultant in NYC

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What are your current thoughts on affordable housing design?

1. Sustainable, high-performance products drive up building costs

2. Affordable, multifamily housing detracts from residential communities

Neither of these need to be true.

But we need a long term mindset.

We will look at 3 options to make affordable housing both energy efficient and appealing with a lifetime cost approach vs. a short term lowest cost mindset.

Building envelope

Mechanical systems

Interior design

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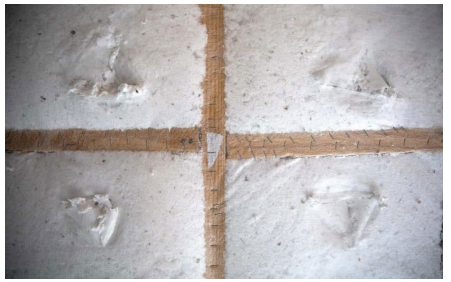
Building envelope

Affordable housing begins with affordable land which typically comes with challenges:

- Noise pollution
- Air pollution
- Environmental pollution
- Design challenges

Key features of a Passive House building:

- Super insulation
- Efficient windows
- Airtight enclosures
- Quality ventilation
- Free (passive) heating



Walls packed from the inside with blown-in fiberglass insulation

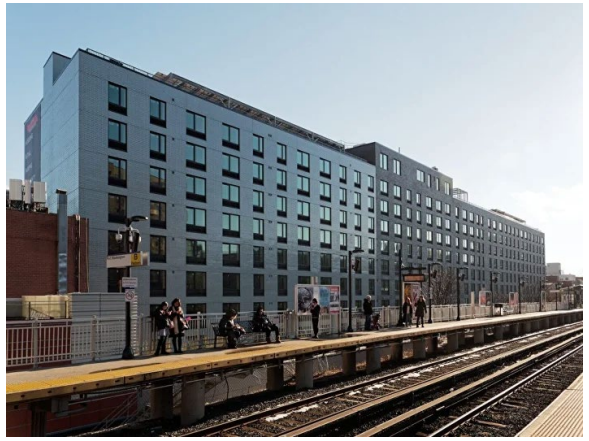
Blue air barrier wrap and sealing tape around high performance uPVC windows

What can high-performance windows contribute to the envelope?

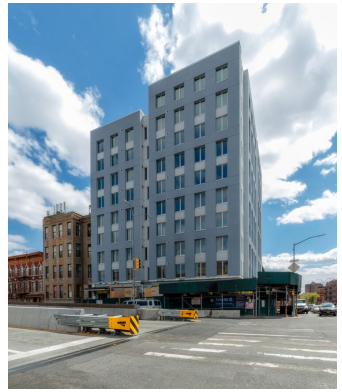
High-performance uPVC fenestration solutions are widely used in multi-housing projects.

- 5x less CO_2 than aluminum during production
- 60% less drafts creating tight seal against sound, air, and water infiltration
- Thermally non-conductive with superior weatherability
- Excellent longevity with minimized maintenance

Bell Tower, Seatle Housing Authority, WA



One Flushing, an affordable multifamily and senior housing in Queens, NY



Harry T. Nance Apartments, a 9-story affordable housing building in Brooklyn, NY

What can high-performance windows contribute to the envelope?

Thermal performance

	uPVC Casement	uPVC Tilt-Turn	uPVC Hinged Door
U-value Standard (dual pane, low E)	0.26	0.28	0.30
U-value Advanced (triple pane, low E)	0.18	0.17	0.24

	Aluminum Casement	Aluminum Tilt-Turn	Aluminum Hinged Door
U-value Standard (dual pane, low E)	0.46	0.46	0.48
U-value Advanced (triple pane, low E)	0.36	0.36	0.37

uPVC tilt-turn

Aluminum tilt-turn

U-value 2x lower than aluminum

Orchards at Orenco | OR

Goals:

- Secure a transit-oriented design site
- Build a project affordable for those earning incomes less than $30,000 per year
- Develop an energy efficient building built to Passive House energy standards

Products: Glass-fiber reinforced uPVC tilt-turn windows and hinged doors, thermal-bridge-free foundation, whole-building heat-recovery ventilation, solar panels, etc.

Award: Best Overall Project and Best Affordable Housing Project, 2015 PHIUS Passive House Projects

Orchards at Orenco | OR

Achievements:

- 57-unit affordable multi-family housing Passive House Certified
- 80% reduction in heating demand
- 50% reduction for overall energy use relative to comparable buildings
- Outstanding transit-oriented location on the MAX light rail line

Passive House cost premium 11%

Finch Cambridge | MA

Goal: Design a new, affordable housing development both climate hazard resilient and meeting PHIUS standards

Products: High-performance triple-pane uPVC tilt-turn windows, 3-layer air barrier wrap, fiberglass insulation in the wall cavities, stormwater infrastructure, solar photovoltaic array, efficient electric heat pumps, etc.

Awards: Best Overall Project, 2020 PHIUS Passive House Projects Competition • PRISM Award | Best Affordable Community • 2021 BSA Sustainable Design Award

Finch Cambridge | MA

Achievements:

- Employment of Passive building design with mitigation measures for extreme heat and flooding
- 40% more energy efficient than even the toughest building codes; beating LEED Platinum and Energy Star standards

Passive house standard added about 2% to the total construction cost

© Anthony Crisafulli

425 Grand Concourse | NY

Goal: Be an example of the commercial and operational viability of high-rise Passive House projects for affordable housing in an highly impacted asthma area due to high air pollution

Products: High-performance dual-pane uPVC windows, continuous insulation, solar shading devices, energy-recovery ventilation, heat-recovery heating and cooling, efficient irrigation, low-flow plumbing fixtures, green roof, etc.

Awards: High-rise Multifamily Winner & Best Overall Project, 2022 PHIUS Passive House Project Design Competition • 2023 Green Good Design Sustainability Awards by the European Centre and the Chicago Athenaeum • NALHFA's 2023 Multifamily Excellence Award

425 Grand Concourse | NY

Achievements:

- Provide filtered, ventilated fresh creating a healthy living environment while minimizing outdoor-indoor noise transmission and reducing utility costs
- 90% lower energy demand for cooling and heating and 70% of the whole energy demand than conventional housing projects
- Largest PHIUS-certified Passive House development in North America

"Today, PHIUS projects on average are only 2% more than code buildings."

-- Christoph Stump, VP Design and Construction at Trinity Financial, Inc

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Mechanical systems

Saving cost by maximizing energy efficiency:

Air vs Water

- Water transfers thermal energy about 7 times more effectively than air.[1]
- Nearly ½ of all zero-energy buildings incorporate radiant to meet energy goals

How can we further maximize energy savings with integrated design?

1. Pair radiant with DOAS = **30%+ savings**
2. Combine with renewable energy source (geo) = **50%+ savings**

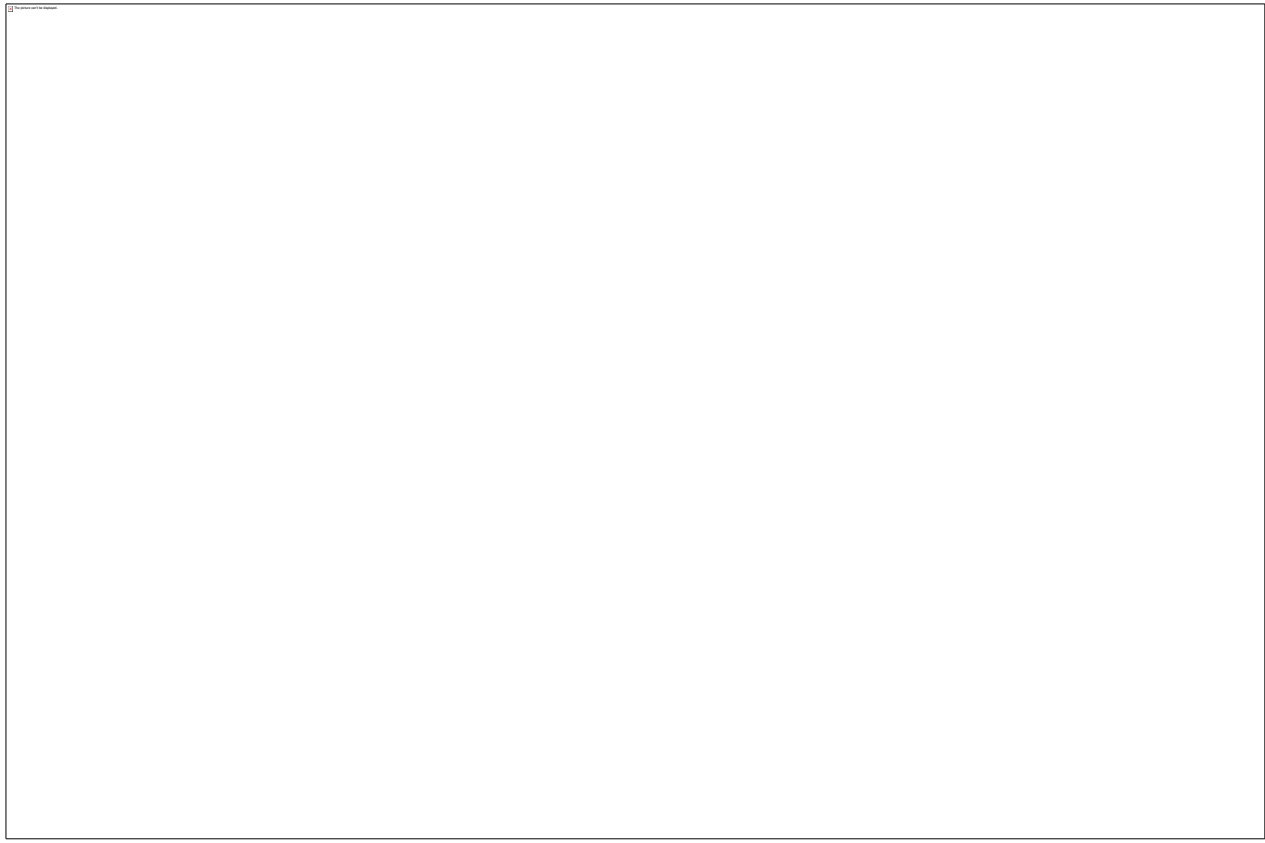
1 Center for the Built Environment (CBE) at the University of California Berkeley

University of Chicago | IL

Goal: Target EUI of **56.6 kBtu/ft^2** vs average Chicago-area residence hall EUI of 150 kBtu/ft^2

Mechanical systems: Hydronic radiant heating and cooling system with automated controls

Eliminated 1,920 metric tons of CO_2 emissions/year



YWCA Toronto Elm Centre | ON

Goal: Align with City of Toronto's energy efficiency and energy consumption targets while providing affordable housing to 300+ women-led families

Mechanical systems: Geothermal well field integrated with a thermally-activated slab radiant heating and cooling system; multi-stage heat recovery system

Eliminated 415 tons of CO_2 emissions/year

"The YWCA Elm Centre was designed to be a safe haven, a place where women and their children can heal and grow. The building's radiant heating and cooling system plays an important role in creating this safe haven by providing an exceptional level of comfort and ease of use for our residents, as well as notable energy-efficient operation."

-- Sarah Blackstock, YWCA Toronto

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Interior design

A few spaces where durable materials can have a big impact:

- Tile in heavily trafficked areas such as lobby walls and floors and used in units
- Durable cabinetry surfaces like HPL

"Cheap is expensive! For the developer or landlord, low-cost interior surfaces will cost them much more over the life of the building."
-- John Woelfling of Dattner Architects

Durable materials standing up to hard use

Tile, solid-surface countertops and high-quality laminates on cabinetry – are the overall, affordable choice.

- Reduces the need for costly interior finish retrofits and the risk of excessive maintenance
- Labor costs of building a new kitchen can be 20-30% of budget
- Increased product life-cycle reduces impact on landfills

Tile scores high on visual impact and durability

Social Housing in Ibiza, Spain

- Social housing project uses extensive tile on walls instead of paint
- Traditional looking glazed stoneware tiles guarantee aesthetic appeal and high durability

Products: Wall tiles

Award: Winner of 2022 Tile of Spain Awards of Architecture and Interior Design

David's House Ministries | MI

Goal: Remodel a group home to create a calming, yet durable living space for people with disabilities

Products:

- HPL surface instead of real wood or TFL
- LVT flooring designed to resist wheelchair marks
- Durable, low-maintenance quartz countertops

Forming a successful high-performance design team.

- Understand the low-energy model you are targeting (Passive house, Net Zero, etc.)
- Use target low-energy expert consultants to:
  - Modeling energy balance
  - Comparing product performance and costs from manufacturing partners
- Involving all stakeholders early
- Educating residents to minimize energy

"A lot of times, when we don't have this opportunity to participate early on in projects, things get drawn up that we as contractors can't make work. Our front-end work on this project kept us from holding up construction on the job."

-- Ryan Blackman, Mechanical Inc.

University of Chicago project

Yes, affordable and sustainable is possible with:

- Well-designed and widely communicated legislation, codes and incentives
- Extensive collaboration across the main building components during design
- Installation training to ensure target performance is met
- Product innovation to address any performance gaps

Thank you