# **Beyond Zero: Designing Healthy Buildings**

In this Beyond Zero Series event with Building Energy Exchange and NYSERDA, speakers will demonstrate how carbon neutral, high-performance buildings not only remove emissions from the design, construction, and operation of our buildings, but also provide healthier, more comfortable, cleaner spaces for us to live.

### **Opening Remarks**

Gwen McLaughlin, Project Manager, NYSERDA

### Moderator

Jonce Walker, Global Director of Sustainability and Wellness, HLW

#### **Speakers**

Elizabeth Garland, MD, MS, Professor, Dept. of Env Medicine and Public Health, Icahn School of Medicine at Mount Sinai

Sara Bayer, Associate Principal & Director of Sustainability, Magnusson Architecture and Planning Asok Thirunavukarasu, Director of Sustainability, Paul A. Castrucci Architects Amalia Cuadra, Senior Director of Engineering, EN-POWER Group

June 16, 2022 | 12 to 1:30 pm | 1.5 AIA LU|HSW Building Energy Exchange | 31 Chambers St, New York NY 10007



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building energy exchange BE-EX BEYOND ZERO SERIES: DESIGNING HEALTHY BUILDINGS

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# MAP MAGNUSSON ARCHITECTURE AND PLANNING

Jugustine Terrace 571 E 1671

# THE RISE – CONTEXT



### VITAL BROOKLYN INITIATIVE - SITE J

NY State's comprehensive community development strategy to address social, economic, and health disparities in Central Brooklyn

### 8 Integrated Areas of Investment

- Affordable Housing
- Open Space & Recreation
- Healthy Food
- Economic Development & Job Creation
- Education & Youth Development
- Community-based Healthcare
- Violence Prevention
- Resiliency





# **RISE**

Xenolith Partners LLC Community Preservation Corporation Community Solutions/ Brownsville Partnership

Women's Prison Association Osborne Association Community Capacity Development Brownsville Think Tank Matters Spin City Brownsville Plus Project EATS

Magnusson Architecture and Planning Bruno Frustaci General Contracting Bright Power

# THE RISE - PROJECT OVERVIEW

- 76,000+ SF new mixed-use building
- 72 units of affordable housing
  - 65% supportive for formerly incarcerated individuals & families
  - 35% affordable for households earning 30%-60% AMI
- 13,000+ SF community facility space
  - On-site Supportive Services
    - Women's Prison Association & The Osborne Association
  - Local organizations:

Education, job readiness, employment training, violence reduction, health/wellness, fitness, arts, gardening

- Community Capacity Development
- Brownsville Think Tank Matters
- Spin City Brownsville Plus
- 7,000+ SF green space rooftop farm/garden
  - Project Eats
- 3,000 SF One Brooklyn Health System (office)
- Design Principles: Sustainability, Trauma Informed Design, Design for Health & Wellness, Active Design, Universal Design











**GREEN SPACES AND GREEN WALL** 



# PRINCIPLES OF THE NEW NORMAL

#### 5 CORE PRINCIPLES OF HEALTHY, EFFICIENT, DURABLE, AND SUSTAINABLE BUILDINGS:



**Vs. CODE MIN** 

# CURRENT CODE



### NON-AIRTIGHT ENCLOSURE + EXHAUST ONLY VENITLATION =

"FRESH AIR" FROM LEAKY WALLS!

IMAGE SOURCE: BUILDING SCIENCE CORP

# AIRTIGHTNESS + BALANCED VENTILATION



**SOURCE: PHIUS** 

SOURCE: BE-EX BETTER VENTILATION PLAYBOOK

# THERMAL ENVELOPE

### **Triple Pane Windows**

- U 0.10
- SHGC 0.30
- Window/Wall Ratio:
  - 24% at Residential
  - 35% with Community Facility

### **Thermal insulation**

- Above Grade Wall R20 (U=0.05)
- Roof R50 (U=0.02)
- Foundation Wall R16 (U=0.06)
- Below grade slab
  - Foam Glass Gravel R11.9 (U=0.08)
  - Rigid Stone Wool R8 (U=0.12)

### Thermal bridges

- Thermal pads
- Aerated concrete block
- Stand off clips

### Air sealing

• 0.033 cfm/sf enclosure





## HVAC/REFRIGERANT MANAGEMENT

# HORIZONTAL DISTRIBUTION (ex. heat recovery)



VERTICAL DISTRIBUTION



# MATERIALS/EMBODIED CARBON



### Locally produced as much as possible

• Aggregate for concrete

### Recycled content as much as possible

- Gypsum Recycled content info
- Structural Steel 50% Recycled Content

### **Construction waste management**

• Min. 75% diversion rate

### **Alternate Materials**

- Foam glass in lieu of high psi foam
- Stone wool and in lieu of typical XPS insulation
- Reduce the cement in concrete, CMU and precast plank: Increase curing time, Alternate SCMs

### **Material Transparency**

• Calling for EPD in specs





FOAM GLASS GRAVEL



GREENGUARD GOLD CERTIFIED ACOUSTIC INSULATION



STONE WOOL INSULATION









SUSTAINABLE GYPSUM BOARD WITH RECYCLED GREEN FACE AND BROWN BACK PAPERS

STRUCTURAL STEEL MANUFACTURED IN NORTH AMERICA WITH MIN 50% RECYCLED CONTENT

D IN NORTH GREEN LABEL PLUS CERTIFIED CARPET TILE

HFO XPS INSULATION



AUTOCLAVED AERATED CONCRETE BLOCKS

CMU WITH LOWER GWP

FLOORSCORE CERTIFIED LUXURY VINYL TILE

CALLING FOR EPD IN SPECS



# INDOOR ENVIRONMENTAL QUALITY

# THE RIS

### Ventilation

• ERV – balanced filtered fresh air

### **Contaminant control**

- No interior combustion
- Smoke free building
- Walk off mats at entrances
- Apartment Compartmentation

## **Healthy Materials**

- No/Low VOC
- Floorscore or Green Guard finishes
- Calling for HPD in specs
- Solid surface
- Simplified material palette









RESIDENTIAL ENTRY LOBBY

COMMUNITY ROOM AT TERRACE

# PERFORMANCE



### SOURCE ENERGY USE INTENSITY (EUI)

(w/o renewables)

Goals for Building As Proposed:

21.26 kBtu/sf/yr1.80 kgCO2/sfSITE EUI: 17.25 kBtu/sf

Avg NYC Multifamily Bldg: Code Building (2020): PHIUS Primary Energy: PHI Primary Energy: LL97- 2024 limit: LL97- 2030 limit: 112 kBtu/sf/yr 90 kBtu/sf/yr Approx 34 kBtu/sf/yr Approx 23.3 kBtu/sf/yr 6.75 kgCO2/sf 4.07 kgCO2/sf

PHI

#### Certification Goal:

# Paul a. castrucci architects Iowards Decarbonization Towards Improved Health and Well Being

Presented by: Asok Thirunavukarasu, Director of Sustainability at Paul A. Castrucci, <u>Architects</u>

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# Sick Building Syndrome

1000s of years - the superstructure protects from rain, wind, and temperature.

Industrial revolution till present day:

> the exterior skeleton of the building need not be load-bearing.

> the function of the building evolved to control the flow of heat, air, noise, water, and vapor.

> the envelope has to be durable

The shift from using one material to the fragmentation of the building envelope to meet its various requirements. Multiple layers of "ultra-processed materials."

1970s energy crisis > pushes towards energy-conscious design that leads to a more airtight building envelope.

So, we spent 90% of our days indoors; unsurprisingly, people started to get sick from being in their homes.

Source: United States Environmental Protection Agency Photo credits: Justin Bautista from unsplash.com



# **Indoor Air Quality and Health**

**Short-term effects**: irritation of the eyes, nose, and throat, headaches, dizziness, and fatigue

**Long-term effects:** prolonged exposure can lead to respiratory diseases (including asthma, heart diseases and cancer, and can be severely debilitating or fatal.)

#### Sources of pollutants include:

- Infiltration of outdoor pollution and unwanted sources
  - > Cars, garages, radon, garbage areas
- Lack of or improper installation of ventilation systems
- Lack of maintenance of building systems
- Off-gassing of indoor materials and furniture
- Cleaning, maintenance, or personal use products
- Moisture issues
  - > Built-up moisture in bathrooms and kitchen
  - > Condensation risk at cold spots
- Lead, Asbestos
- Pesticides



# **Indoor Air Quality and Equity**

The most marginalized communities in our society are more likely to live in spaces with poor indoor air quality, impacting health, productivity, and educational outcomes. > Older and poorly maintained homes with faulty types of equipment > Inadequate or no ventilation systems or ventilation systems with maintenance issues > Higher use of combustion equipment for cooking and heating

Low-income communities tend to be built near highways and industrial sites and in areas with a lack of green spaces with higher urban heat island effects.

**COVID19** disproportionately impacted low-income communities. Density is not a significant driver - as we saw areas of high density in Toronto and Vancouver not affected as dense low-income communities in NYC.

#### What are the reasons?

> Pre-existing health conditions and poor access to health care.
 > Many in low-income communities are essential workers who must take public transportation.



# **Indoor Air Quality and Equity**



Figure 1. Percentage of homes with maintenance defects, by NYC Community District, 2014 25 - 41%41 - 51%51 - 60%60 - 69%69 - 82% Uninhabited land Figure 3. Asthma-related ED visits per 10,000 children age 5-17, by NYC Community District, 2015 28 - 77 per 10,000 77 - 169 per 10,000 169 - 315 per 10,000 315-475 per 10,000 475 - 647 per 10,000 Uninhabited land be

ex paul a. castrucci architects

# **Climate Change and Indoor Air quality**

Climate change leads to rising CO2 levels, warmer temperatures, and increased frequency and intensity of storms (flooding, rain events, severe heat...)

- > outdoor air-borne allergens which can infiltrate indoor spaces.
- > potential for pathogen development (i.e., covid-19.)
  - Increase dampness and humidity for prolonged periods can lead to growth of mold, dust mites and other biological contaminants (Eastern USA: increase growth of legionella.)

# **Towards Decarbonization**

Heat (energy) recovery ventilators to continuous ventilation for optimized indoor air quality while saving energy and cost on utility bills

High performing building envelope reduces the risk of condensation and moisture build-up.

Electric or induction stoves (gas cooking stoves release carbon monoxide (CO2), nitrogen dioxide (NO2), PM2.5, and formaldehyde (CH2O or HCHO).)

Improved resilient of the buildings.



Grace's Place senior housing proposed in Far Rockaway, Queens. Rendering by Paul A. Castrucci, Architects



# **Bethany Senior Terraces**

Proposed project, located on 604 E 40th Street, Brooklyn NY. The project will be 40,000 GSF and provide 58 units of affordable senior housing (aged 62+ and under 50% AMI).

#### Key Features:

- Passive House design (50% reduction in energy usage)
- Thermal envelope, air sealing, energy recovery ventilators to enhance air quality
- 100% electrified, with variable flow refrigerant systems (VRF), energy recover ventilators ERVs, induction stove-tops and heat pump hot water heaters
- Modular construction (reduces construction by 6 months)
- Photovoltaic solar array capable of Near Net Zero energy emissions
- NYSERDA Buildings of Excellence Award
- PHIUS+ 2018 certification
- Enterprise Green Communities Certification
- Indoor airPLUS certification



# **Bethany Senior Terraces**

Rendering by Paul A. Castrucci, Architects



# **Modular Strategy**

Factory built environment = more control = better workmanship

Individual ERVs for each unit to ensure continous PH ventilation rates and continous exhausts in bathrooms/kitchen to remove odor, and moisture built-ups.

#### **Pros:**

1) Best possible indoor air quality.

2) Fits well with modular construction approach

#### Cons:

 Individual ERVs cost more than centralized ERVs
 More maintenance required (However, the building is affordable housing for seniors - regular maintenance schedule is an opportunity for check in with residents can be seen as a positive.



# **Resilient Communities**

Community resilience is the sustained ability of communities to withstand, adapt to, and recover from adversity. Community resilience is very cost-effective and the physical, behavioral, social, and environmental health and wellbeing is a big part of overall resilience.

#### **Passive House and Resilience**

- > Improved temperature fluctuations during power outages
- > Solar and backup power to run essential systems

Encouraging physical and group activities show that communities endure disasters much more effectively.

- > Connection between the outdoor/indoor spaces
- > Encourage group activies
- > Encouraging the use of stairs by creating beautiful spaces and making staircases central



# **Additional Strategies**

> Requesting transparency from material manufacturers (third-party certification on the amount of known chemicals harmful to humans)

i.e., Paint/sealants/adhesive should have low to no Volatile organic compounds (VOCs), > Eliminate the use of products that are asthmagens, including Formaldehyde which at times is used in binding agents for insulation

> Selecting moisture-resistant materials in areas of moisture built-up, such as bathrooms and kitchen

> In areas of potential flooding - eliminating materials that will rot due to moisture

#### Durability is also essential:

We want to ensure that materials are compatible and do not react with each other. And design for no moisture built up. Good detailing with a focus on the hygrothermal performance and condensation risk analysis

Testing and verification for improved workmanship.



# **Closing Thoughts**

- Choosing to built for the people and selecting teams that have good understanding of strategies to decarbonize. Understanding these strategies not only reduce energy, carbon emissions, and utility cost but also provide healthier indoor space; a winning combination!
- And it is about spending a bit more time in the design periods to capture all the goals while also controlling for cost increases.
- Passive House buildings are similar in cost to conventional construction with a cost increase of between 0 and 10%.
- IAQ (monitors etc)
- How to demonstrate the value of the improvements to stakeholders (developers, residents, banks, government partners etc)





Rendering by Paul A. Castrucci, Architects

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# discuss.

### Moderator

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# thank you.