NYC's High Performance Retrofit Program and Resources

Aaron Ordower
Assistant Deputy Director
Mayor's Office of Sustainability - New York City

Larry Katz
Energy Engineer, NYC Accelerator Program

Rebecca Esau
Project Associate
Building Energy Exchange

Ryan Cassidy
Director of Sustainability & Construction
RiseBoro Community Partnership
OneNYC 2050

30 initiatives across 8 goals to secure our city’s future

Key commitments from *A Livable Climate*:
- Achieve carbon neutrality and 100% clean electricity
- Require buildings to cut their emissions
- Hydro-power City government
Key Findings about Building Energy Use

- **Greatest absolute number** of buildings: 1-4 family homes

- **Greatest share of GHG emissions**: Commercial and multifamily buildings

Source: PLUTO and 2015 GHG Inventory
Climate Mobilization Act

**LOCAL LAWS 92 AND 94**
requiring that the roofs of certain buildings be covered in green roofs or solar PV systems

**LOCAL LAW 95**
a building energy efficiency grade

**LOCAL LAW 96**
establishing a sustainable energy loan program (i.e. PACE)

**LOCAL LAW 97**
the commitment to achieve certain reductions in greenhouse gas emissions by 2050
Energy grades to be posted on buildings larger than 25,000sf in size, beginning October 2020
LOCAL LAW 95
a building energy efficiency grade

A
100-85

B
84-70

C
69-55

D
54-1

NYC Median
LOCAL LAW 96
establishing a sustainable energy loan program (i.e. PACE)

Financing for energy efficiency and renewable energy projects with long terms and little or no money down
LOCAL LAW 97
the commitment to achieve certain reductions in greenhouse gas emissions by 2050

BUILDINGS LARGER THAN 25,000SF IN SIZE:
Greenhouse gas emissions limits must be met starting in 2024
GHG emissions limits for all buildings >25,000 square feet
Creation of a DOB “Office of Building Energy and Emissions Performance”
Convening of an advisory board on future limits
Study for a building carbon trading scheme
City operations GHG reductions of 40% by 2025 and 50% by 2030
NYCHA properties need to meet GHG reductions of 40% by 2030
NYC emissions: 51.7 MtCO$_2$e

By 2030, the Climate Mobilization Act will achieve:

- 6 million tons of CO$_2$e reduced
- 26,700+ jobs created
- 150 hospitalizations avoided per year
- 50 to 130 deaths prevented per year
LOCAL LAW 97 TARGETS

GHG Intensity in 2016 (tCO$_2$e/sf)

- Worst 1st percentile
- Worst 5th percentile
- Worst 10th percentile
- Worst 20th percentile
- Worst 30th percentile
- Worst 40th percentile
- Best 1st percentile
- Best 5th percentile
- Best 10th percentile
- Best 20th percentile
- Best 30th percentile
- Best 40th percentile
- 50th percentile

2024 GHG Target
LOCAL LAW 97 TARGETS

GHG Intensity in 2016 (tCO₂e/sf)

- Worst 1st percentile
- Worst 5th percentile
- Worst 10th percentile
- Worst 20th percentile
- Worst 30th percentile
- Worst 40th percentile
- 50th percentile
- Best 40th percentile
- Best 30th percentile
- Best 20th percentile
- Best 10th percentile
- Best 5th percentile
- Best 1st percentile

2030 GHG Target
GHG Intensity in 2016 (tCO₂e/sf)

2050 GHG Target

Worst 1st percentile
Worst 5th percentile
Worst 10th percentile
Worst 20th percentile
Worst 30th percentile
Worst 40th percentile
50th percentile
Best 40th percentile
Best 30th percentile
Best 20th percentile
Best 10th percentile
Best 5th percentile
Best 1st percentile

LOCAL LAW 97 TARGETS
The energy used for space heating and domestic hot water (DHW) production accounts for the majority of building-based emissions.
Fossil fuels dominate energy use and GHG emissions from New York City’s buildings.
Nearly every building will need to complete a deep energy retrofit, and many will need to move away from fossil fuel-based heating and hot water systems.
Models of deep energy retrofit paths show that **40-60 percent energy reductions are possible using existing technologies and strategies.**

**Eight Key Building Typologies**

- **Commercial, Pre-war, ≤ 7 Stories**
  - Citywide Building Area: 2.7%
  - Citywide Building-based GHG: 5.4%
- **Commercial, Pre-war, > 7 Stories**
  - Citywide Building Area: 0.7%
  - Citywide Building-based GHG: 1.3%
- **Commercial, Post-war, > 7 Stories**
  - Citywide Building Area: 5.9%
  - Citywide Building-based GHG: 4.3%
- **Commercial, Very Large**
  - Citywide Building Area: 5.9%
  - Citywide Building-based GHG: 11.7%
- **1-4 Family Home**
  - Citywide Building Area: 25.7%
  - Citywide Building-based GHG: 18.9%
- **Multifamily, Pre-war, ≤ 7 Stories**
  - Citywide Building Area: 15.9%
  - Citywide Building-based GHG: 11.5%
- **Multifamily, Post-war, > 7 Stories**
  - Citywide Building Area: 5.9%
  - Citywide Building-based GHG: 4.3%
- **Multifamily, Post-1960, > 7 Stories**
  - Citywide Building Area: 3.3%
  - Citywide Building-based GHG: 2.4%

**Sample Deep Retrofit Path Results**

**Multifamily, Post-War, > Seven Stories**

**Electrification Paths:**

- **Path 3:** Heat Pumps for Heating and Cooling
- **Path 4:** Heat Pumps with Building Envelope Measures
New York City’s Energy Efficiency Programs

The City has created a suite of programs and policies to help decision-makers understand their buildings’ energy use and make voluntary upgrades.
NYC Accelerator

Free Help. Simple Fixes. Big Results.

- Work with you one-on-one to understand your needs
- Connect you with qualified contractors to do the job
- Find cash incentives and financing to help pay for your upgrades
- Train your building staff so your building continues to run efficiently
- Support you every step of the way from project start to finish
The High Performance Retrofit Track

- Pilot deep energy retrofits in real buildings
- 15-year capital plans to reach high performance
- Upgrades to all major building systems: HVAC, DHW, Envelope
- Develop a pathway for implementation across larger portfolios
High Performance Track Services

- Create capital plans that integrate energy efficiency
- Educate and train on high performance technology
- Deploy intern capacity
- Train decision makers on high performance retrofits
- Support implementation of early capital projects
High Performance Retrofit Track (HPRT) Mission

Support the planning and implementation of deep energy retrofit measures to achieve an EUI = 40-60 kBtu/sq.ft. and GHG emissions reduction of 40-60% for all privately-owned building types.
High Performance Retrofit Track (HPRT) Process

Data Collection
• Local law 87 audit review
• Equipment inventory review
• On-site visit

Resources
• Deep Energy Retrofit Planning Analysis (DERPA) reports
• HPRT 15-year plan
• Technical Primers

Pre-engineering feasibility assessment
Deep Energy Retrofit Planning Report (DERPA)

Summary of Your Building
123 45th Street

- Tenant Electricity
- Owner Electricity
- Tenant Gas - N/A
- Owner Gas
- Tenant Oil - N/A
- Owner Oil - N/A
- Tenant Steam - N/A
- Owner Steam - N/A

106 kBTU/SF

108,633 SF
12 stories
1965
Steam Boiler
Room by room
Brick/Stone on Steel Frame
Heat Exchanger with Heating System

NYC Energy Efficiency Grade
C

ENERGY STAR® score
45

Package 1
Deep Optimization

Site Energy Savings
44% to 54%
Major existing systems are optimized as much as possible

Package 2
Hydronic Conversion

Site Energy Savings
50% to 58%
Low temp hydronic heating with high efficiency plant

Package 3
Heat Pumps for Heating

Site Energy Savings
66% to 72%
High efficiency heat pumps for heating and cooling

Package 4
Package 3 + Wall Insulation

Site Energy Savings
72% to 78%
High efficiency heat pumps and added insulation where possible
High Performance Retrofit Plan

Existing Building System Optimization: pre-Electrification
- Space Heating, Cooling, Ventilation: Improve distribution, controls; maintenance
- Lighting
- Envelope: Air sealing
- On-site generation: Solar

Existing Building System End of Life: Electrification Opportunity
- Space Heating, Cooling, Ventilation: Heat pumps, DOAS
- Domestic Hot Water: Heat Pumps
10 Participants, 30 Buildings

- BronxPro Group
- RiseBoro Community Partnership
- FirstService Residential
- StuyTOWN Stuyvesant Town | Peter Cooper Village
- AvalonBay Communities
- Fourth Avenue Owners Corp.
- Memorial Sloan Kettering Cancer Center
- NYC Health + Hospitals
- NYU
HPRT Projects & Support

Projects:
- Air Source Heat Pumps (ASHP)
- DHW heat pumps (ASHP)
- Hybrid heat pump (AWHP)
- Windows
- Advanced central space cooling technology

Support Services
- Building site visits
- Multifamily residential board meeting presentations
- Pilot project planning support
- Review vendor proposals and RFP for heating and cooling system
- Vendor engagements
Technology Primers: Electrification

Air to Water Heat Pumps (AWHPs)
Highly efficient domestic hot water production that reduces emissions and energy costs.

Mini-Split Systems
Highly efficient heat pumps for decentralized electric heating and cooling in multifamily buildings.

Solar Photovoltaics & Batteries
Clean, renewable electricity generation and storage to dramatically reduce utility costs.
building energy exchange

Rebecca Esau AIA
Associate, Projects
The Building Energy Exchange works to reduce the effects of climate change by improving the built environment.

We accelerate the transition to healthy, comfortable, and energy efficient buildings by serving as a resource and trusted expert to the building industry.
the problem
buildings are responsible for 70% of NYC’s greenhouse gas emissions

buildings are essential to combating climate change; they must become dramatically more:

- efficient
- comfortable
- affordable
- resilient
the solution
connecting decision makers with actionable information

100,000+ building decision makers in New York City + energy efficiency solutions & education
what is BEEEx?

a global center for excellence dedicated to building energy efficiency

building community

networking, inspiring stories, topical events

everyday efficiency

incremental measures, systems and products

high performance

long term planning, holistic retrofits
what is BEEEx?
a global center for excellence dedicated to building energy efficiency

1. education
   training, events & symposia

2. tools
   reports, case studies & campaigns

3. exhibits
   advanced technology & hands-on experiences
1. education

diverse programming that informs on energy efficiency

700 trainings & events in our energy efficiency resource center

19,000 building decision makers have attended BEEEx programming

50+ organizations have hosted events in our space
2. tools
research & initiatives that have real impact

reports that turn data into action

campaigns that engage entire communities

case studies with clear, critical lessons
3. exhibits
hands-on experiences that display advanced technology and inspire action

- **educational**: exhibits demystify energy efficiency
- **transformative**: exhibits inspire action
- **fun**: exhibits are hands-on, interactive experiences
case: electrification
supporting fossil fuel conversion retrofits

Climate Mobilization Act primer
free one-hour seminar
case: high performance tech primers
intro to deep-energy saving technologies + implementation best-practices

- Mini-Split Systems
  Highly efficient, decentralized electric heating and cooling for multifamily buildings.

- Variable Refrigerant Flow (VRF) Systems
  Highly efficient, centralized electric heating and cooling for multifamily buildings.

- Solar Photovoltaics & Energy Storage
  Clean, renewable electricity generation to support resiliency and reduce energy costs.

- Air Sealing For Room Air Conditioners
  Increasing air conditioner efficiencies while improving the building envelope.

- Metro Steam Optimization
  Modernizing and optimizing metro steam heat for efficiency and comfort.

- Point of Use (POU) Domestic Hot Water
  Providing electrically generated hot water on demand.

- LED lighting retrofits
  Long lasting, highly efficient lighting upgrades to enhance building performance and occupant well-being.

- One-Pipe Steam Optimization
  Simple measures for one-pipe steam systems to enhance efficient and comfort.

- Chilled Water Plant Optimization
  Optimized cooling for increased performance, energy savings and reduced maintenance.

- Roof Insulation
  Upgrading roof insulation to improve comfort while reducing utility bills and operation costs.
case: high performance tech primers

intro to deep-energy saving technologies + implementation best-practices
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tech overview

applicable building types
commercial implementation
anytime, at mid-cycle or refinance
fast facts
• reduces GHG emissions
• improves air quality
• reduces heating and cooling loads
• reduces maintenance costs
• reduces utility costs

costs & benefits*

GHG Savings

Tenant Experience Improvements

Utility Savings

Capital Costs

Maintenance Requirements

*Based on preliminary analysis and potential outcomes.
case: high performance tech primers
intro to deep-energy saving technologies + implementation best-practices

technology overview:
performance
benefits
compatibility
timing
case: high performance tech primers
intro to deep-energy saving technologies + implementation best-practices

implementation requirements:

components
coordination
tenant engagement
“Passive House is about more than saving energy. It’s about improving comfort, health, quality of life, and laying a foundation for communities to thrive.”

-Scott Short, CEO RiseBoro Community Partnership
Rebecca Esau AIA
Associate, Projects
re@be-exchange.org

be-exchange.org/
techprimers/

Thank you.

Building Energy Exchange

Rebecca Esau AIA
Associate, Projects
re@be-exchange.org
Why Passive House?
The Triple Bottom Line of Passive House Buildings

Environmental
- Improvement in public health outcomes
- Reduction in Carbon Footprint

Social
- Public health insurance savings
- Limited housing subsidy goes further

Economic
- Decreased operating expenses
- Decreased per unit subsidy requirements
A Comparison of Typical Annual Maintenance & Operational Expenses

Legend:
- Utilities (heat/gas/electricity)
- Water & Sewer
- Real Estate Taxes & Insurance
- Other Maintenance & Operational Expenses

Affordable Housing:
- 50%
- 25%
- 15%
- 10%

Market Rate Housing:
- 50%
- 35%
- 10%
- 5%

The pie charts illustrate the distribution of expenses for affordable and market rate housing, with each category represented by different colors and percentages.
Impact on funding: 50% reduction in gas & electric cost

Uses of Funds
- Passive House Construction
- Traditional Construction

Sources of Funds
- Passive House Construction
- Traditional Construction

Acquisition Cost
- Passive House Construction: $0
- Traditional Construction: $1,000,000

Development Cost
- Passive House Construction: $8,000,000
- Traditional Construction: $8,000,000

Operating Cost
- Passive House Construction: $500,000
- Traditional Construction: $500,000
“80 by 50” Is It Possible?

RiseBoro New Construction
"80 by 50"
NYC Deep Energy Retrofit Planning Report

Potential Site Energy Use Reductions for Your Building
75 Linden Street

- Range of savings
- Electricity
- Gas
- Oil - N/A

Today 123 kBTU/SF
LL87 Audit Package**
80x50 Package 1
80x50 Package 2
80x50 Package 3
80x50 Package 4
Renovating to the Passive Standard
Renovating to the Passive Standard

- Typical YR15 Financing Methods
- Moderate Rehab/Tenant In Place
- Underwrite to Savings
- Gap financing by NYSERDA
- Meet Passive House (PHIUS) Standard
- Bonus: Renewables/Solar
## Portfolio

<table>
<thead>
<tr>
<th>Building</th>
<th>Building Type</th>
<th>Old LL84</th>
<th>2018 LL84</th>
<th>Stories</th>
<th>Elevator</th>
<th>Total Units</th>
<th>1BD</th>
<th>2BD</th>
<th>3BD</th>
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<td>104 Grove</td>
<td>Masonry/wood joist</td>
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<td>17</td>
<td>6</td>
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<td>16</td>
<td>2</td>
<td>14</td>
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<td>Y</td>
<td>4</td>
<td></td>
<td>16</td>
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<td>14</td>
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<td>93-95 Stockholm</td>
<td>Masonry/wood joist</td>
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<td>14</td>
<td>6</td>
<td>8</td>
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<td>160 Harman</td>
<td>block/ poured concrete</td>
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<td>181 Harman</td>
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<td><strong>Total</strong></td>
<td></td>
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<td><strong>146</strong></td>
<td>14</td>
<td>117</td>
<td>15</td>
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Newer Buildings (built after 1990)

Scope of Work Diagram:

- Existing exhaust shafts shall be cleaned, airsealed & reused, TYP.
- Each bathroom and kitchen intake will be outfitted with a constant air flow regulator & fire damper. Phase work with remodel of kitchen & bath.

- New indoor, wall-mounted heads of new multi-split system, placed in all living rooms & bedrooms. Outdoor units located on the roof, TYP.

- Stofo air barrier system, gold coat, mesh, gold fill, and rapid seal installed over exist facade as per manufacturer’s instructions.

- Install new windows prior to the removal of exist windows, TYP.

- Sootherm or lotusan system street facade contoured shape. Thickness ranges from 4” min & max.

- 2” x 9” rectangular supply ducts connecting to rooftop ERV units installed prior to new sootherm finish & wrapped in peel stick.

- Refrigerant & condensate lines behind new sootherm finish. Connect refrigerant to rooftop condensers & condensate to boiler room, TYP.

- All kitchens & bathrooms to be remodeled w/ new cabinetry, appliances & fixtures, TYP.

- All exist doors to be replaced w/ new door leaves, undercut all interior doors, TYP.

- Supply air ducts installed w/ constant air flow regulators, TYP.

- Install new flooring and paint walls throughout apartment, TYP.
Passive Rehab: Means & Methods

HVAC Systems (VRF and ERV)

Opportunity: Controlled, efficient distribution
Challenge: Cost, Billing, Submetering

Insulate Outside Existing Walls (Rainscreen or EIFS)

Opportunity: Run HVAC lines in new insulation - less tenant
Challenge: Lot line easements for new insulation
Opportunity: New air & moisture barrier
## Passive Rehab UTILITY analysis

<table>
<thead>
<tr>
<th></th>
<th>Electric</th>
<th>Gas</th>
<th>Oil</th>
<th>Water &amp; Sewer</th>
<th>Total Energy</th>
<th>Utility Total</th>
<th>Energy % Reduction</th>
<th>% Utility Reduction</th>
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<tbody>
<tr>
<td><strong>2014 Utilities</strong></td>
<td>$ 41,149.00</td>
<td>$ 87,486.00</td>
<td>$ 177,269.00</td>
<td>$ 194,576.00</td>
<td>$ 305,904.00</td>
<td>$ 500,480.00</td>
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<tr>
<td><strong>2018 Utilities</strong></td>
<td>$ 35,519.00</td>
<td>$ 127,992.00</td>
<td>$ 3,813.00</td>
<td>$ 143,829.00</td>
<td>$ 167,324.00</td>
<td>$ 311,153.00</td>
<td>45.30</td>
<td>37.83</td>
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<tr>
<td><strong>Modeled: WUFI Passive</strong></td>
<td>$ 40,082.49</td>
<td>$ 11,620.98</td>
<td>$ -</td>
<td>$ 107,871.75</td>
<td>$ 51,703.47</td>
<td>$ 159,575.22</td>
<td>83.10</td>
<td>68.12</td>
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Underwriting

Casa Pasiva Model Comparison

Year 1 Model
- HDC Standards
- SONYMA Standard
- Modeled

Year 1 Low COP Model
- HDC Standards
- SONYMA Standard
- Modeled

Year 1 @ 50% Savings
- HDC Standards
- SONYMA Standard
- Modeled
How Are We Doing?
Knickerbocker Commons Passive House

HDC Standards  SONYMA Standard  Modeled- eQuest  Actual Cost

FY-2016  FY-2017  FY-2018

$44,544  $45,120  $45,880  $45,120  $46,474  $47,257  $47,868

$23,510  $15,057  $15,509  $15,974

$11,849  $16,016
Mennonite United Passive House

FY-2015

- HDC Standards: $41,760
- SONYMA Standard: $42,300
- Modeled- PHPP: $11,889
- Actual Cost: $22,533

FY-2016

- HDC Standards: $43,013
- SONYMA Standard: $43,569
- Modeled- PHPP: $12,246
- Actual Cost: $15,012

FY-2017

- HDC Standards: $44,303
- SONYMA Standard: $44,876
- Modeled- PHPP: $12,613
- Actual Cost: $15,536

FY-2018

- HDC Standards: $45,632
- SONYMA Standard: $46,222
- Modeled- PHPP: $12,991
- Actual Cost: $17,242
Future: Sustainable Construction & Renovation

Local Laws- 84, 87, 31, 11, 91

Increased Data Collection

Electrifying Buildings !!!

Renewables & Net Zero
How Can We Help?

• Utility Allowance Reform
  Heat pumps & electric stove
• Utility Pricing—gas versus electric
• Retainage withheld from Contractor for Building Performance
• Energy Reserve
  Funded From Developer Fee
  Performance-based
Resources

• **Architect & Designer**
  - Chris Benedict, R.A.
  - Paul Castrucci Architect

• **Utility Rebates**
  - ConEd- BQDM, LMI
  - National Grid- replacement incentives
  - DEP- MCP Program

• **NYSERDA (State)**
  - MPP Targeted
  - Gap Financing via RetrofitNY

• **NYC (local/City)**
  - Retrofit Accelerator
  - Carbon Challenge

• **3rd Party Providers**
  - Water Conservation- aerators, wireless meters
  - Renewables- Solar Tax Credit
THANK YOU
Ryan Cassidy, CPHC
Director of Construction & Sustainability
rcassidy@risebоро.org