Passive House Strengthens the Bottom line

NESEA Conference
November 3, 2016

One City: Built to Last

What is Passive House?

A building constructed to "Passive House" standards must meet strict energy efficiency criteria for its insulation, space heating and cooling, and primary energy demand within the building. These standards require minimizing heating and cooling loads through substantial insulation; the "passive" use of solar heat and internal heating sources, such as people and electrical equipment, to heat the building; solar shading to cool the building; and heat recovery systems for space heating that is required. Because the building is essentially airtight, a continuous supply of low volume filtered fresh air must also be supplied to living and working spaces, and stale air regularly exhausted from spaces with high-efficiency heat exchange to minimize heating losses.

Passive House standards can be applied to both new construction and renovations. For the renovation of existing buildings, the performance standard is slightly more lenient, but still results in a roughly 90 percent reduction in average heating and cooling energy usage and up to a 75 percent reduction in primary energy usage. A Passive House building can also be any type of building, including an apartment building, a school, an office building, a factory, a supermarket, or a single-family house.

Case Study: Knickerbocker Commons Affordable Housing

803 Knickerbocker Avenue, Brooklyn
Architect: Chris Benedict, R.A.
Owner: Ridgewood Bushwick Senior Citizen's Council
General Contractor: Galaxy Construction
Construction Cost: $180/square foot
No. of Units: 24

Knickerbocker Commons, the first mid-sized apartment building designed to Passive House standards in the United States

Knickerbocker Commons, a six-story residential building containing 24 units of affordable housing, is the country's first mid-sized apartment building to conform to Passive House design standards. To achieve the strict Passive House standards, each rental unit in Knickerbocker Commons has its own ventilation system and small radiators for heating and airtight window air conditioning units for cooling. In addition, the building features triple-paned windows and a sculpted exterior that shade windows from the sun in the summer and maximize exposure in the winter. According to the project's architect, Chris Benedict, the building will use 85 percent less energy than is typically required to heat a New York City apartment building in the winter.

The apartment is located in the Bushwick neighborhood of Brooklyn and was developed through HPD's Low Income Rental Program. Of the 24 units, six units will be rented to households earning up to 30 percent of Area Median Income (AMI), five units will be rented to households earning up to 50 percent of AMI, 12 units will be rented to households earning up to 60 percent of AMI, and one unit will be set aside for a building superintendent. In addition to the residential units, the project includes almost 5,000 square feet of community facility space.

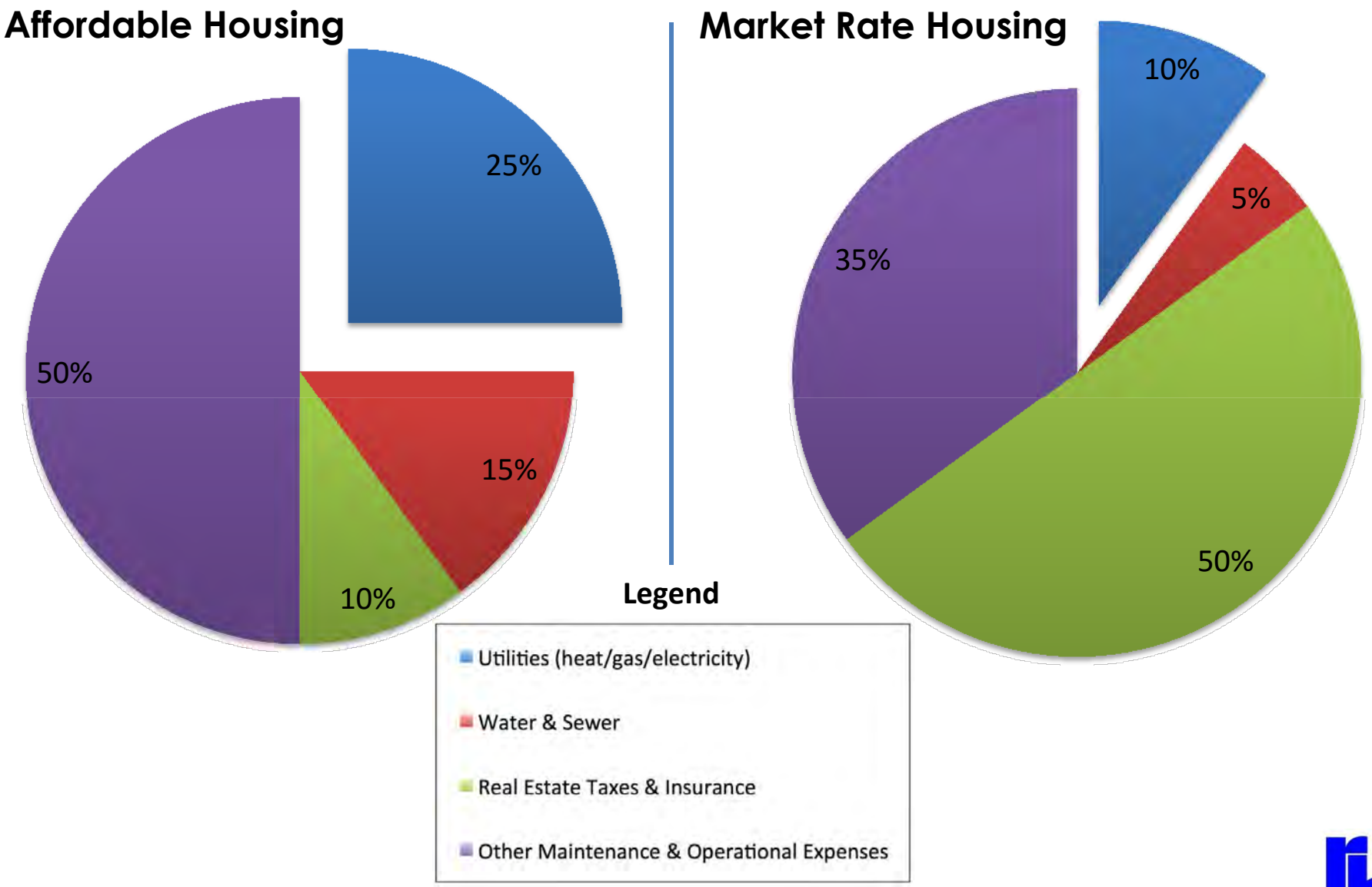
CHALLENGES OF PASSIVE building

- Public Approvals
  - Building Codes
    (Window Materials, Building/Laundry/Shaft Ventilation)
- Financing
- Construction Pricing
- Construction Execution

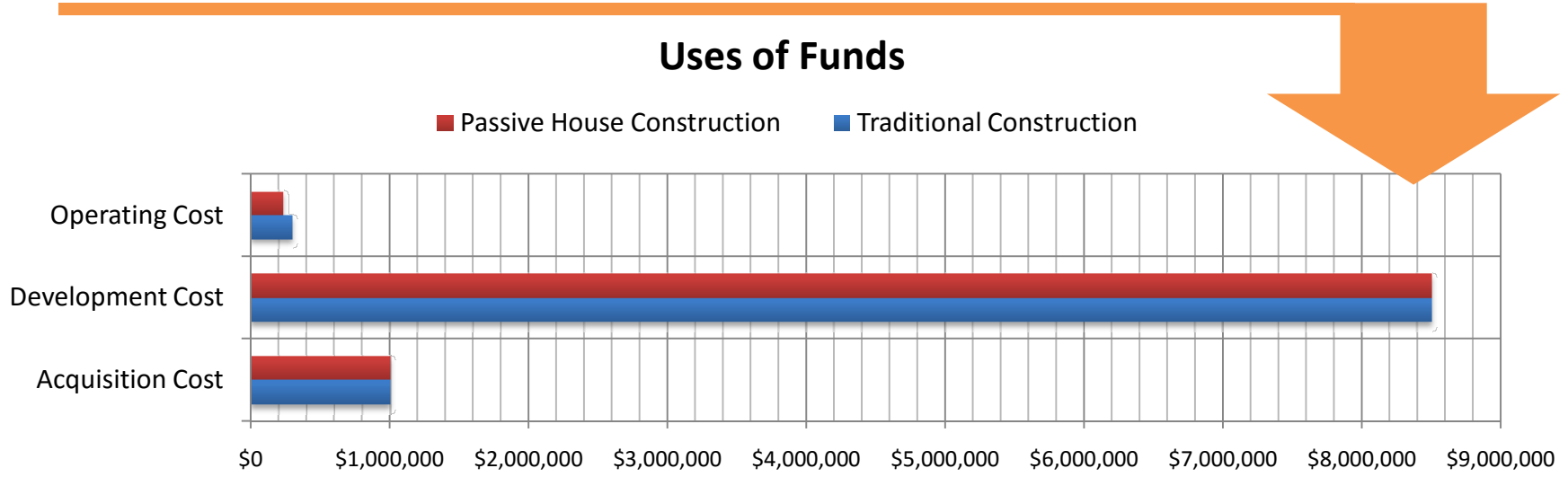
BENEFITS OF PASSIVE building

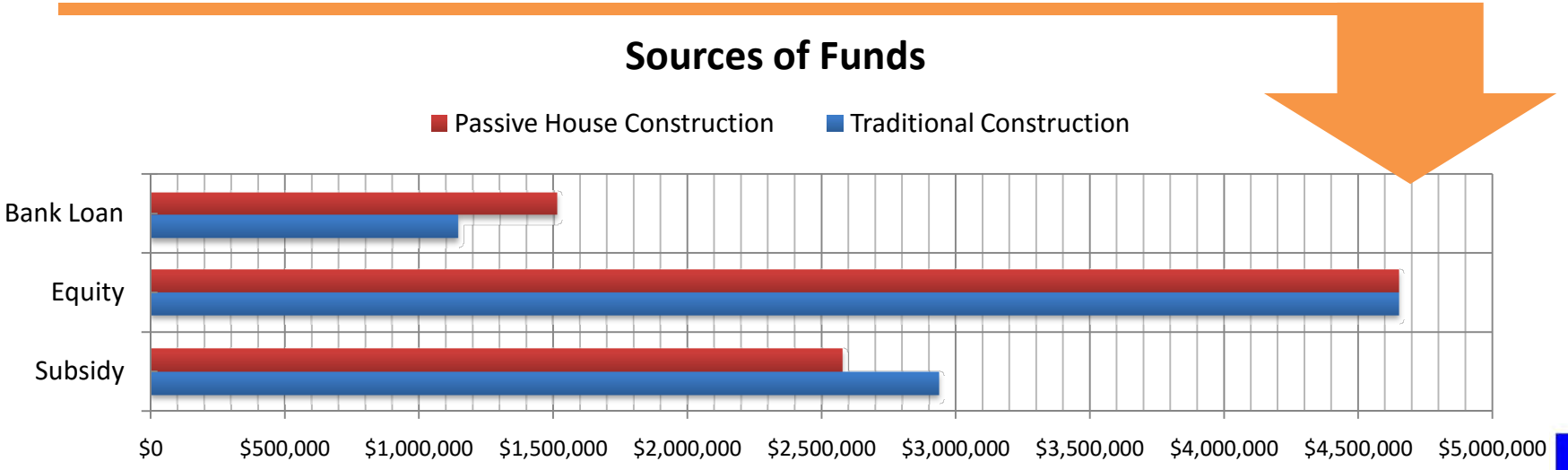
- Quality of Life
- Innovation
- Environmental
- Economic

A COMPARISON OF TYPICAL ANNUAL maintenance & operational expenses



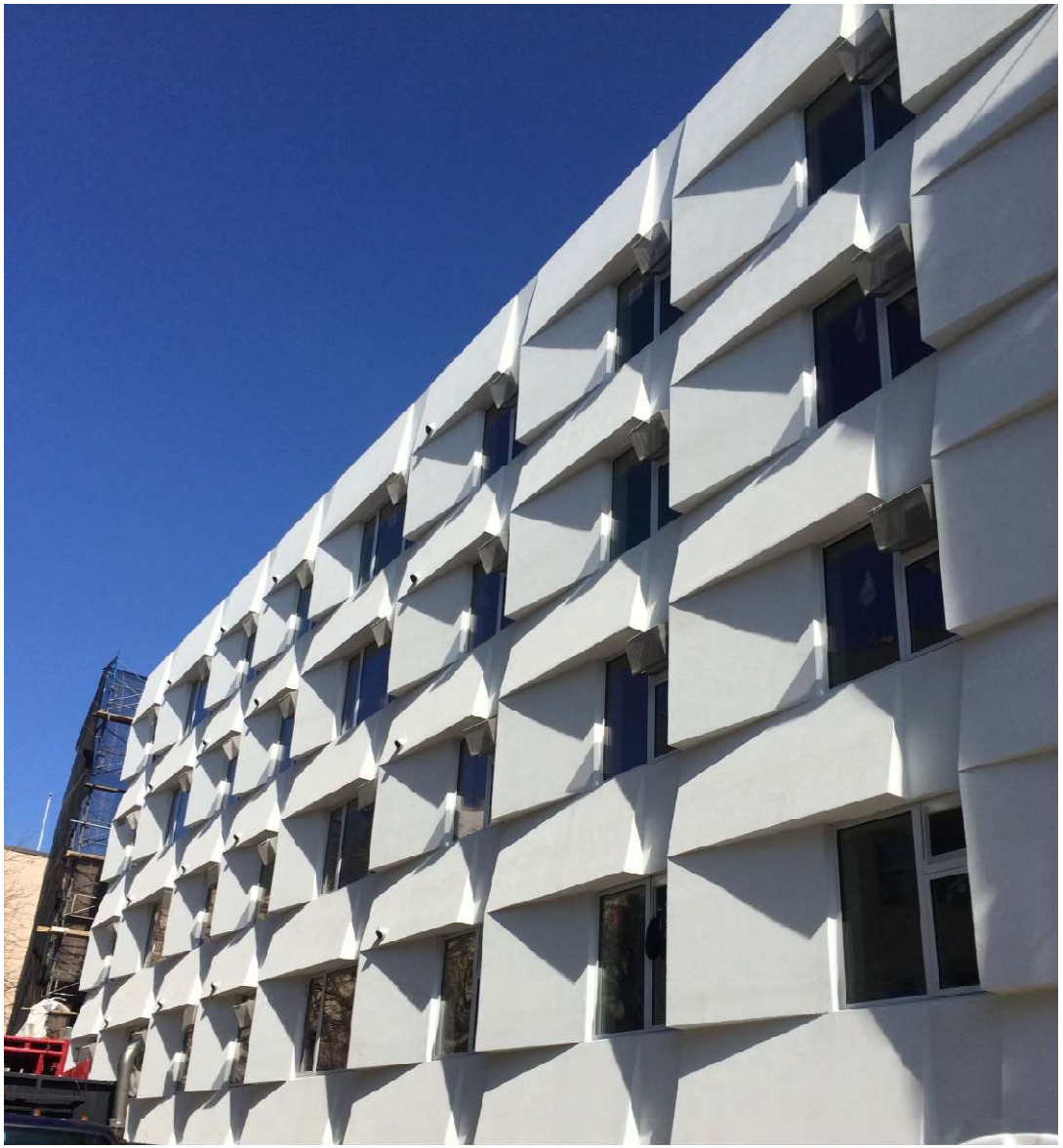
IMPACT ON FUNDING
of 50% reduction in gas and electric costs





CASE studies

	extra	credit	unit	amount	$/sf
ITEMS THAT CHANGE FOR PASSIVE HOUSE					
windows fiberglass instead of aluminum	$500		157	$78,500	$2.16
ranges - electric instead of gas-no gas piping		($400)	25	($10,000)	($0.28)
eifs insulation instead of brick at façade		($10)	11,912	($119,120)	($3.28)
ac covers/sun screens	$200		157	$31,400	$0.87
ac structure bar	$5		157	$785	$0.02
reduced heating stystem		($1,750)	24	($42,000)	($1.16)
erv instead of typ exhaust only	$750		24	$18,000	$0.50
insulation completely under slab	$5		6708	$33,540	$0.92
R 40 at roof instead of R30	$1.50		6708	$10,062.00	$0.28
credit for int insulatrion		($0.75)	11912	($8,934.00)	($0.25)
					$0.00
					$0.00
total				($7,767.00)	($0.21)

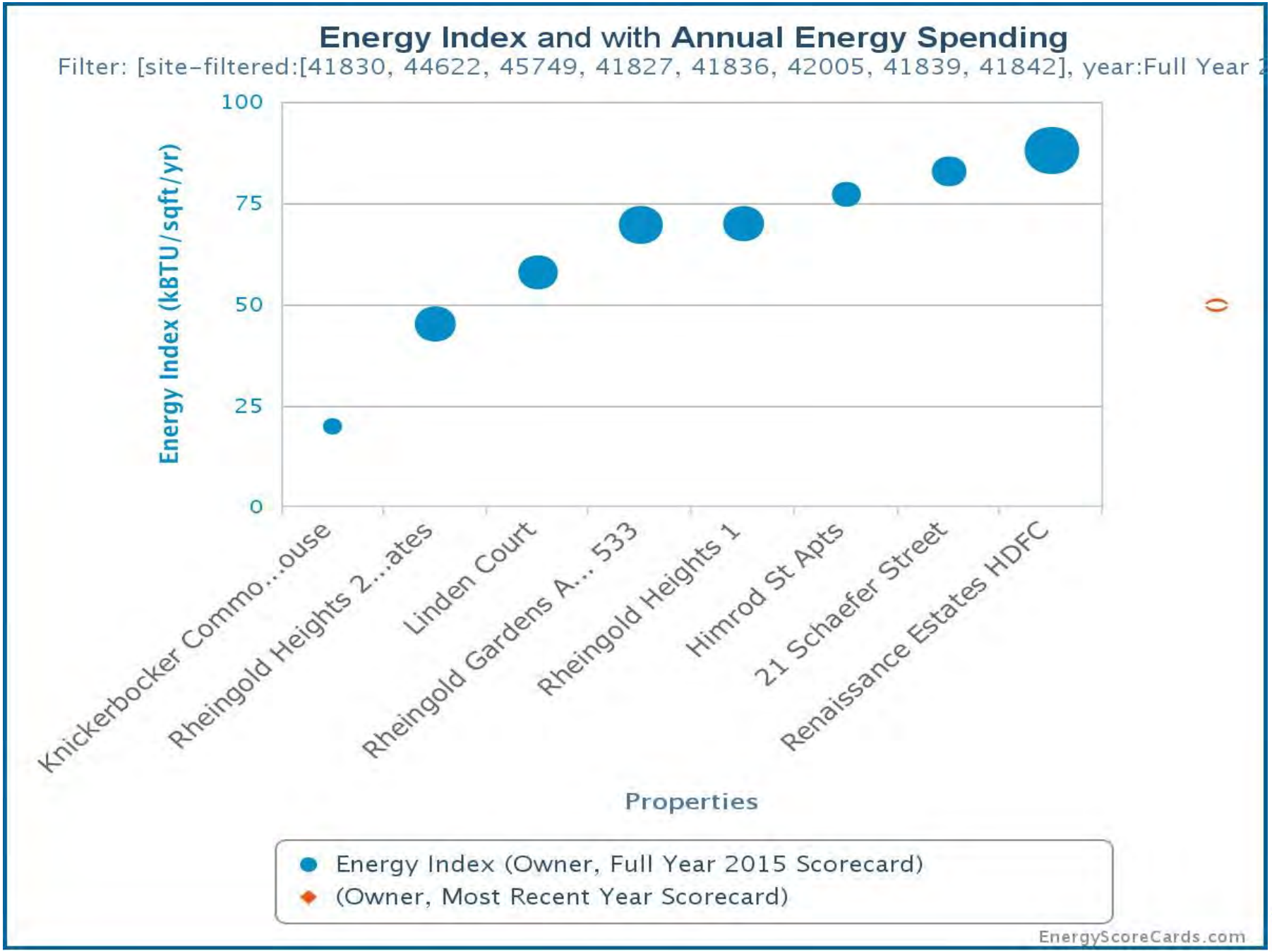


Knickerbocker Commons

EIFS Shading Functionality

Mennonite United Revival Apartments

Exterior


Energy Index and with Annual Energy Spending
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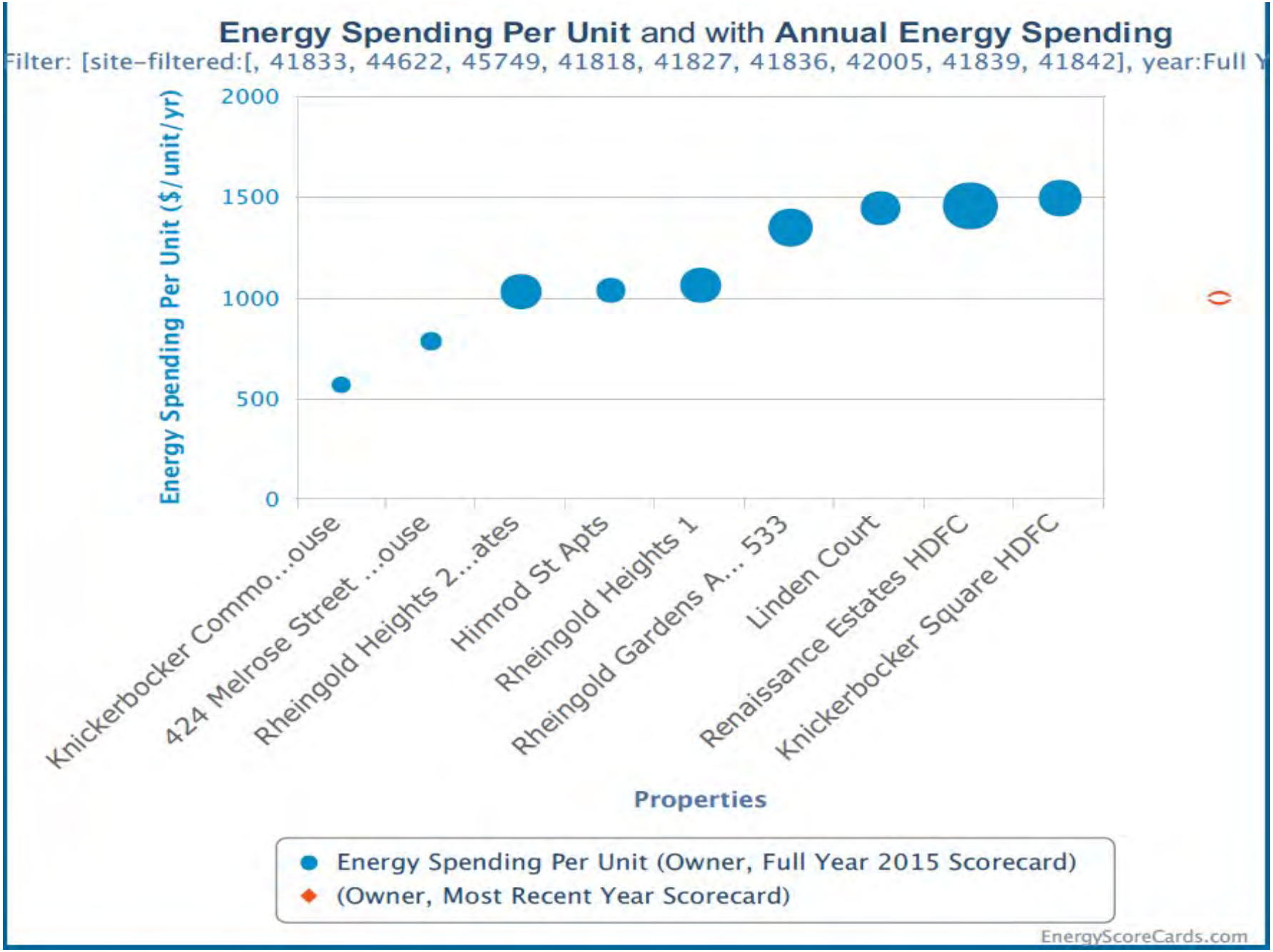
Energy Index (kBTU/sqft/yr)
100
75
50
25
0
Knickerbocker Commo...ouse
Rheingold Heights 2...ates
Linden Court
Rheingold Gardens A... 533
Rheingold Heights 1
Himrod St Apts
21 Schaefer Street
Renaissance Estates HDFC
Properties
Energy Index (Owner, Full Year 2015 Scorecard)
(Owner, Most Recent Year Scorecard)
EnergyScoreCards.com


Energy Spending Per Unit and with Annual Energy Spending
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Energy Spending Per Unit ($/unit/yr)
2000
1500
1000
500
0
Knickerbocker Commo...ouse
424 Melrose Street ...ouse
Rheingold Heights 2...ates
Himrod St Apts
Rheingold Heights 1
Rheingold Gardens A... 533
Linden Court
Renaissance Estates HDFC
Knickerbocker Square HDFC
Properties
Energy Spending Per Unit (Owner, Full Year 2015 Scorecard)
(Owner, Most Recent Year Scorecard)
EnergyScoreCards.com

424 Melrose Street

424 Melrose Street, Brooklyn, NY, 11237

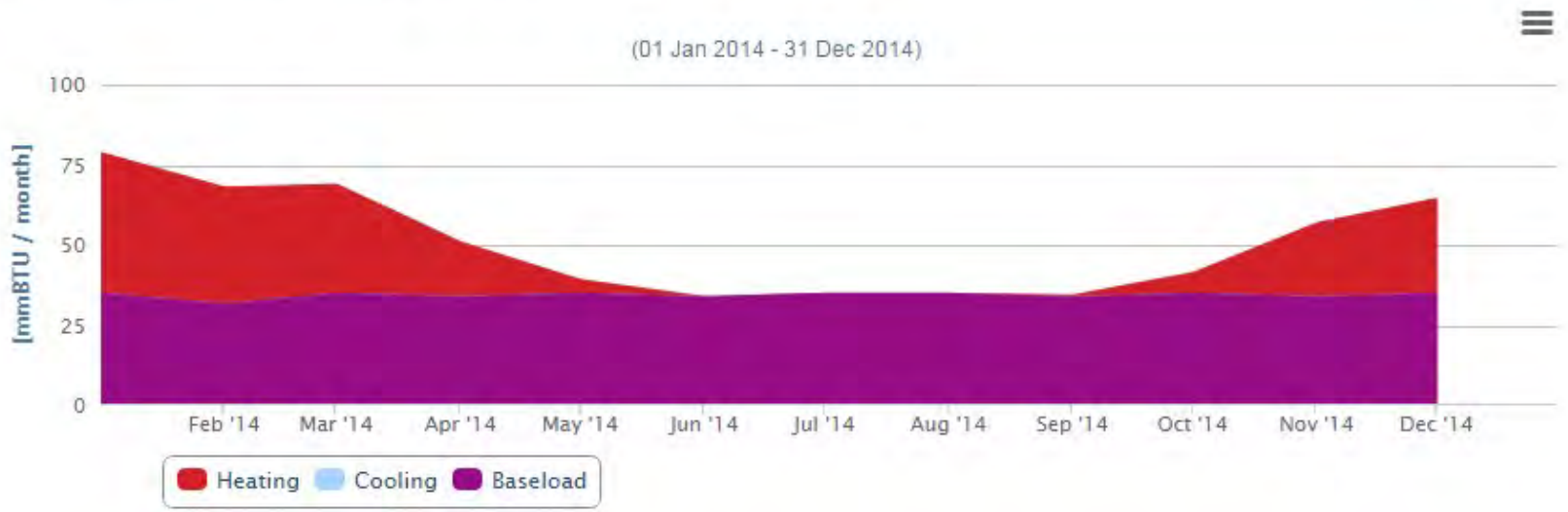
Tools

Usage and Fuel Summary

Export

Full Year 2014 - Owner	Heating	Cooling	Baseload	Usage	Rate	Spending	# of Accounts
Electricity (kWh)	7,820	0.00	51,587	59,406	$0.2028	$12,047	1
Gas (therms)	1,443	0.00	2,344	3,787	$1.10	$4,171	1
Total Energy (mmBTU)	**171**	**0.00**	**410**	**581**	**$27.90**	**$16,218**	**2**
Water (kGallons)	0.00	0.00	1,048	1,048	$12.70	$13,312	1
Total Utilities						**$29,530**	**3**

Full Year 2014 - Owner - Total Utilities



ILLUSTRATIVE PROJECT: 100 units with ELLA financing

Illustrative Project Standard Construction HPD /HDC ELLA			
SOURCES AND USES			
CONSTRUCTION SOURCES		**per DU**	**% of total**
HDC 1st Mortgage	$17,084,533	$169,154	47.23%
HDC 2nd Mortgage	$6,565,000	$65,000	18.15%
HPD 3rd Mortgage	$5,300,753	$52,483	14.65%
Reserves Funded at Conversion	$460,000	$4,554	1.27%
LIHTC Equity	$2,577,154	$25,516	7.12%
Deferred Developer's Fee	$4,183,297	$41,419	11.57%
Total Construction Sources	**$36,170,737**	$358,126	**100.00%**
GAP	-		
PERMANENT SOURCES		**per DU**	**% of total**
HDC 1st Mortgage	$740,000	$7,327	2.05%
HDC 2nd Mortgage	$6,565,000	$65,000	18.15%
HPD 3rd Mortgage	**$11,466,110**	**$113,526**	**31.70%**
LIHTC Equity	$17,181,025	$170,109	47.50%
Deferred Developer's Fee	$218,602	$2,164	0.60%
Total Permanent Sources	**$36,170,737**	$358,126	**100.00%**
GAP	-		
USES		**per DU**	**% of total**
Acquisition Cost	$1	$0	0.00%
Construction Cost	**$26,250,000**	**$259,901**	**72.57%**
Soft Cost	$5,272,628	$52,204	14.58%
Developer's Fee	$4,648,108	$46,021	12.85%
TOTAL USES	**$36,170,737**	$358,126	**100.00%**

Illustrative Project Passive Construction HPD /HDC ELLA			
SOURCES AND USES			
CONSTRUCTION SOURCES		**per DU**	**% of total**
HDC 1st Mortgage	$18,233,303	$180,528	47.29%
HDC 2nd Mortgage	$6,565,000	$65,000	17.03%
HPD 3rd Mortgage	$6,090,417	$60,301	15.80%
Reserves Funded at Conversion	$450,000	$4,455	1.17%
LIHTC Equity	$2,750,442	$27,232	7.13%
Deferred Developer's Fee	$4,465,755	$44,215	11.58%
Total Construction Sources	**$38,554,917**	$381,732	**100.00%**
GAP	-		
PERMANENT SOURCES		**per DU**	**% of total**
HDC 1st Mortgage	$2,010,000	$19,901	5.21%
HDC 2nd Mortgage	$6,565,000	$65,000	17.03%
HPD 3rd Mortgage	**$10,887,327**	**$107,795**	**28.24%**
LIHTC Equity	$18,336,282	$181,547	47.56%
Deferred Developer's Fee	$756,308	$7,488	1.96%
Total Permanent Sources	**$38,554,917**	$381,732	**100.00%**
GAP	*(0)*		
USES		**per DU**	**% of total**
Acquisition Cost	$1	$0	0.00%
Construction Cost	$28,087,500	$278,094	72.85%
Soft Cost	$5,505,466	$54,510	14.28%
Developer's Fee	$4,961,950	$49,128	12.87%
TOTAL USES	**$38,554,917**	$381,732	**100.00%**

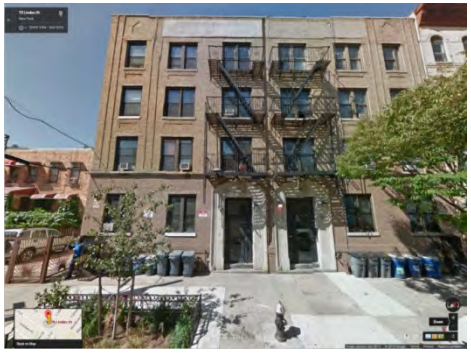
ILLUSTRATIVE PROJECT: 100 units with ELLA financing

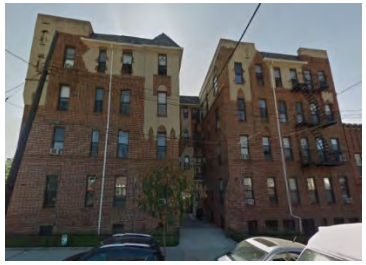
Illustrative Project Standard Construction HPD /HDC ELLA				
Expenses				
		Annual Expense	Exp per rm/du	
Suppl/Clean/Exterm		$35,400	$100	per room
Heating		**$106,200**	**$300**	**per room**
Electricity		$58,056	$164	per room
Water & Sewer		**$106,200**	**$300**	**per room**
Repairs		$65,650	$650	per unit
Legal		$15,150	$150	per unit
Accounting/Auditing		$14,000	$14,000	per project
Super & Maint Staff		$120,000	$1,321	per unit
Number of:				
F/T super(s)	1		$50,000	annual + fringe
porters	2		$35,000	annual + fringe
Elev Maint & Repairs	2	$13,200	$6,600	per elevator
Management Fee		$56,431	6.00%	of EGI
Fire and Liab Ins		$60,600	$600	per unit
LIHTC Credit Monitoring		$7,500		
Total Expenses		**$658,387**	**$1,860**	**per room**
			$6,519	**per unit**
Real estate taxes	(420c)	$0	$0	per room
Replacement Reserve		$25,250	$250	per unit
Total Annual Exp		**$683,637**	**$6,769**	**per unit**
			$1,931	**per room**

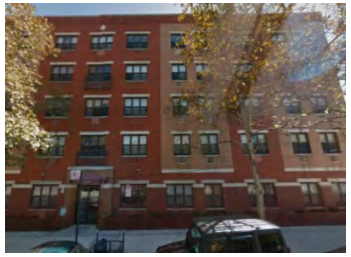
Illustrative Project Passive Construction HPD /HDC ELLA				
Expenses				
		Annual Expense	Exp per rm/du	
Suppl/Clean/Exterm		$35,400	$100	per room
Heating		**$21,240**	**$60**	**per room**
Electricity		$58,056	$164	per room
Water & Sewer		**$95,580**	**$270**	**per room**
Repairs		$65,650	$650	per unit
Legal		$15,150	$150	per unit
Accounting/Auditing		$14,000	$14,000	per project
Super & Maint Staff		$120,000	$1,321	per unit
Number of:				
F/T super(s)	1		$50,000	annual + fringe
porters	2		$35,000	annual + fringe
Elev Maint & Repairs	2	$13,200	$6,600	per elevator
Management Fee		$56,431	6.00%	of EGI
Fire and Liab Ins		$60,600	$600	per unit
LIHTC Credit Monitoring		$7,500		
Total Expenses		**$562,807**	**$1,590**	**per room**
			$5,572	**per unit**
Real estate taxes	(420c)	$0	$0	per room
Replacement Reserve		$25,250	$250	per unit
Total Annual Exp		**$588,057**	**$5,822**	**per unit**
			$1,661	**per room**

PASSIVE rehab

Property	Regulatory Entity	Building	Total Units	# of Studios	Ones	Twos	Threes	Super
Stockholm Manor	HFA	420 Stockholm	35		17	17		1
Linden Court	HCR	150 Linden	40		3	27	9	1
Knickerbocker Square	HCR	557 Knickerbocker	43			32	10	1
75 Linden	HPD	75 Linden Street	12		4	5	3	
104-110 Grove Street	HPD	104 Grove	23			16	6	1
		110 Grove	23			17	6	
116-120 Grove Street	HPD	116 Grove	16		2	14		
		120 Grove	16		2	14		
93-95 Stockholm Street	HPD	93 Stockholm	14		6	7		1
		95 Stockholm	0					
Harman Plaza	HPD	160 Harman	14			14		
		173 Harm	14			13		1
		181 Harman	14			14		
			264		34	149	34	5







PRH UTILITY analysis

	Water	Gas	Electric	Oil	Total
2015 Utilities	$308,231.17	$164,828.00	$112,691.15	$131,736.33	$717,486.65
Passive House Rehab Estimates	$246,584.94	$55,202.40	$98,158.88	$16,477.15	$416,423.36

Est. Annual Savings	**$301,063.29**
Supportable Debt based on savings	**$4,184,569.37**
Supportable Debt (per unit)	**$15,850.64**

ASSUMPTIONS

20% Water savings

38kBTU/sqft/yr or 70% savings from current usage

10% DHW savings

The 3BL of Passive Building