post-1980 mid-rise senior rental housing

This tear sheet shows packages of energy conservation measures that reduce a building's greenhouse gas emissions in an effort to achieve anticipated LL97 emissions limits and to move towards carbon neutrality.

Based on the Maria Isabel affordable housing project

existing building overview

location
Bronx, NY

dwelling units
99

building area
70,460 sq. ft.

metering
gas: master
electricity: direct

heating fuel
natural gas

heating system
hydronic baseboards

cooling system
thru-wall ACs

ventilation system
rooftop exhaust fans

utility payment structure
heating: owner-paid
cooling: tenant-paid

Local Law 97 2030 emissions limits
not compliant

be ex
building energy exchange

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NYC Department of Housing Preservation & Development

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typology: post-1980, mid-rise, senior rental housing

baseline building conditions

This post-1980s mid-rise building has a typical brick masonry assembly with minimal detailing and no interior insulation and utilizes natural gas for heating plus thru-wall A/Cs for cooling, making it a strong candidate for insulated over-cladding and unitized thru-wall heat pumps.

low carbon retrofit package

Low Carbon improvements include new efficient hydronic boilers, an electric heat pump DHW system, solar PV, efficient lighting fixtures and appliances. Envelope upgrades include new roof insulation, windows, air sealing measures, and optional above grade wall R-15 EIFS over-cladding. **GHG savings for this scope of work are based on the 2030 emissions factor.**

GHG savings

RELATIVE TO BASELINE BUILDING AND BASED ON THE 2030 EMISSIONS FACTOR

no carbon retrofit package

No Carbon improvements include all 2030 measures plus additional upgrades which may supersede some 2030 measures. Improvements include energy recovery ventilation plus electrification of heating, cooking, and clothes drying resulting in whole building electrification. Envelope upgrades include new high performance windows and optional above grade wall R-15 EIFS over-cladding. **GHG savings for this scope of work are based on the 2050 emissions factor.**

GHG savings

RELATIVE TO BASELINE BUILDING AND BASED ON THE 2050 EMISSIONS FACTOR

BUILDING SYSTEM	% OF GHG EMISSIONS	SYSTEM COMPONENTS	DESCRIPTION	ENERGY CONSERVATION MEASURES (ECMs)	ESTIMATED COST/DU*		ENERGY CONSERVATION MEASURES (ECMs)	ESTIMATED COST/DU*	ESTIMATED TOTAL COST/DU*	
envelope	n/a	Roof Insulation	Concrete deck, no insulation	■ R-38 above deck	$2,550	19%			$2,550	0% **/****
		Windows/Glazing	Estimated to be U = 0.8	■ New aluminum, double pane, low-e, argon filled, double hung	$3,500		■ New high performance, uPVC, thermally broken, casement	$4,500	$4,500	
		Air Sealing & Weatherization	Unknown	■ Door & window weatherstripping	$1,000				$1,000	
		Above Grade Walls	Uninsulated brick wall assembly	+ Optional R-15 EIFS over-cladding	$10,000		+ Optional R-15 EIFS over-cladding	$10,000	$10,000	
heating	49%	Heating	Conventional hydronic boilers with Aquastat and baseboards	■ New conventional hydronic boilers with TRVs or zone valves ■ Heat Timer boiler controls with indoor temp feedback ■ Real Time Energy Management (RTEM)	$5,450 $350 $3,600	5% +12% WITH R-15 EIFS OVER-CLADDING	■ Packaged cold-climate heat pump (PTHP) T	$9,350	$9,350 $3,600	52% **/**** +0% **/**** WITH R-15 EIFS OVER-CLADDING
cooling		Cooling	Thru-wall ACs	■ New thru-wall ENERGY STAR ACs	$2,000		(see above) PTHPs also provide cooling			
		Pumps	(2) 3HP single speed pumps	■ NEMA Premium pumps with VFDs	$250					
ventilation		Pipe Insulation	Some pipe insulation	■ New pipe insulation	$300					
		Ventilation	Common Area: passive In-unit Bath: registers only In-unit Kitchen: passive via window	■ Direct drive, variable speed EC motor central exhaust fans with timers & CAR dampers	$1,600		■ Central ERVs serving corridors ϟ T ■ Central ERVs serving apartments ϟ T	$4,700	$4,700 (see above)	
		Ductwork	In-unit: leaky	■ Clean & seal ducts; conduct testing, adjusting, & balancing	(see above)					
domestic hot water	26%	DHW	Heating hydronic boilers with Aquastat and small storage tank	■ Central air source heat pump (ASHP) with storage ϟ T	$8,050	23%	No additional recommended measures		$8,050	30%***
		Plumbing Fixtures	Standard flow fixtures	■ Low flow fixtures (WaterSense where applicable)	$600				$600	
lighting	9%	Common Area	Predominately 4' T12	■ LEDs with occupancy/vacancy sensors	$800	1%	No additional recommended measures		$800	5%***
		Exterior	High wattage metal halide	■ LEDs with photocells & timeclock	(see above)				(see above)	
		In-unit	T12 & incandescent	■ LEDs	$1,000				$1,000	
appliances	16%	Appliances	Non-ENERGY STAR refrigerators Gas stoves	■ ENERGY STAR refrigerators	$1,350	1%	■ Electric stoves ϟ T	$950	$2,300	13%
		Central Laundry	(1) Non-ENERGY STAR washer (3) ENERGY STAR washers (3) Gas dryers	■ (4) ENERGY STAR washers	$0 (per equipment lease agreement)		■ (3) Heat pump dryers ϟ T	$0 (per equipment lease agreement)	$0	
renewables		None		■ 62kW ballasted rooftop solar system	$2,750	4%	No additional recommended measures		$2,750	0%
		ASSOCIATED UPGRADES		ϟ electrical service and distribution upgrades T structural/finish upgrades including dunnage, patching, & sealing	$3,200 $10		ϟ electrical service and distribution upgrade T structural/finish upgrades including dunnage, patching, & sealing	$6,400 $4,950	$9,600 $4,950	
				2030 Emissions Factor The 2030 emissions factor reflects an electric grid powered 70% by renewable energy.	ESTIMATED TOTAL COST/DU ESTIMATED TOTAL COST/DU WITH R-15 EIFS OVER-CLADDING	$38,360 $48,360	53% 65%	**2050 Emissions Factor** The 2050 emissions factor reflects a zero-emissions electric grid powered 100% by renewable energy.	ESTIMATED TOTAL COST/DU ESTIMATED TOTAL COST/DU WITH R-15 EIFS OVER-CLADDING	$56,050 $66,050	100% 100%

* Rough order of magnitude estimated costs based on current information at the time of publication that include material, labor, and mark-up. For more information, see the *Decarbonization Roadmap for Multifamily Affordable Housing Best Practices Manual*.

** Due to the interactivity of the energy model, the GHG savings for envelope are attributed to the HVAC category for the 2050 scope.

*** Fully electrified systems in 2030 show a GHG savings increase in 2050 because of New York's electrical grid transitioning to more clean energy sources.

**** GHG savings from envelope upgrades fall to zero once all related building systems are electrified and the electric grid is fully decarbonized. However, improvements to the building envelope will reduce the need for heating and cooling, which saves energy and minimizes operating costs.

1 calculate → 2 compare → 3 develop → 4 implement

1 calculate carbon emissions

Calculate the building's annual estimated GHG emissions using the BE-Ex Carbon Calculator: www.be-exchange.org/calculator

2 compare to the LL97 emissions limits

Compare the building's current calculated GHG emissions with LL97 limits and determine what reduction is required for compliance.

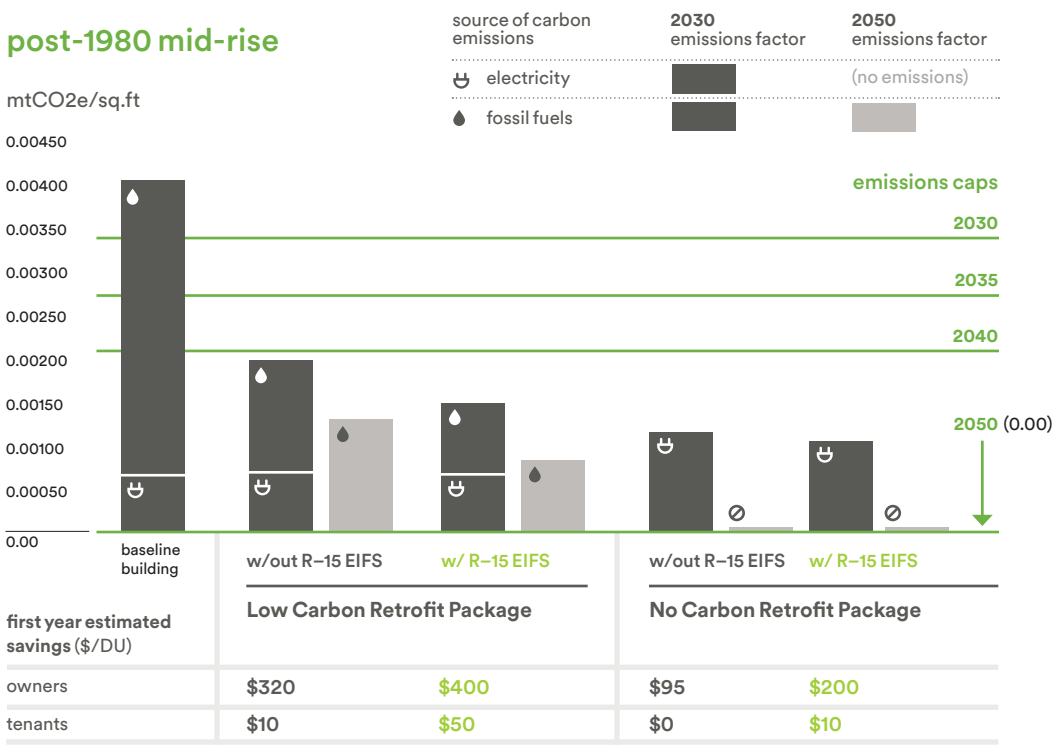
3 develop a retrofit master plan

Develop a scope of energy conservation measures (ECMs) that are selected and phased to align with building operational and system needs, and financing cycles.

4 implement building decarbonization measures

carbon emissions intensity: post-1980 mid-rise

The following graph illustrates the carbon emissions intensity associated with the *Low Carbon* and *No Carbon* retrofit packages outlined on the previous pages.



first year estimated savings ($/DU)	Low Carbon Retrofit Package		No Carbon Retrofit Package	
owners	$320	$400	$95	$200
tenants	$10	$50	$0	$10

Emissions Factors

Each scope of work is evaluated against the 2030 and 2050 emissions factors as defined under LL97:

- The 2030 emissions factor reflects an electric grid powered 70% by renewable energy.
- The 2050 emissions factor reflects a zero emissions electric grid powered 100% by renewable energy.

The *Baseline Building* shows emissions from the existing building conditions based on the 2030 emissions factor.

Emissions per Fuel Type

The graph distinguishes between the carbon emissions associated with each fuel type: electricity or fossil fuels. In 2050, when the electric grid is powered by 100% renewable energy sources, the emissions from electric equipment will be zero. The *No Carbon* scopes have zero emissions as a result.

Emissions Caps

The graph includes carbon emissions caps for the LL97 reporting periods. Note the emissions cap for 2050 is at zero.

When the emissions associated with a scope of work exceeds a specific emissions cap, the building may be subject to financial penalties.

key takeaway

Simple low-rise buildings can be a good fit for RetrofitNY-type projects, but the high costs are an impediment; whereas the *Low Carbon* retrofit package would comply with LL97 2030 emissions limits. Adding PTHPs into existing AC sleeves, while retaining the existing gas/hydronic heating system, can provide cooling to vulnerable seniors while enabling a future cost-effective phase-out of fossil-fuels when the building is overclad and/or the boiler is converted to a heat pump.