Decarbonization Roadmap for Multifamily Affordable Housing

pre-war low-rise HDFC co-op

Based on the 2023 Monterey Ave. affordable housing project





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.

existing building overview

location Bronx, NY

dwelling units 40

building area 40,850 sq. ft

metering gas: master electricity: direct

heating fuel natural gas

heating system one-pipe steam radiators

cooling system window ACs

ventilation system passive via windows

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

Local Law 97 2030 emissions limits not compliant



building energy exchange





NYSERDA Supported



baseline building conditions

energy and minimizes operating costs.

This pre-war low-rise building has a brick masonry assembly, no insulation in the walls, and minimal insulation in the roof. An attached building to one side partially limits opportunities for over-cladding, but envelope upgrades are possible, especially to windows. Lack of ventilation lends the building to the use of unitized ERV. Natural gas for heating and window ACs for cooling make Monterey a strong candidate for mini-split heat pumps.

low carbon retrofit package

Low Carbon improvements include a new scotch marine steam boiler, air source heat pump for DHW, LED lighting, ballasted rooftop solar PV, and new ENERGY STAR refrigerators. Envelope upgrades include new roof insulation, double pane 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

no carbon retrofit package

RELATIVE TO BASELINE BUILDING AND BASED ON THE 2030 EMISSIONS FACTOR NO Carbon improvements include all 2030 measures plus additional upgrades which may supersede some 2030 measures. These include split air source heat pumps for heating and cooling, energy recovery for active ventilation, and electric stoves for cooking 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.

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*		
envelop	n/a	Roof Insulation	No insulation	 R-39 roof insulation 		\$3,950	7%			\$3,950	0% ***/	
		Windows/Glazing	Aluminum, double hung	 New aluminum, double pane, low-e, argon fi 	lled, double hung	\$7,700	1 /0	 New uPVC, thermally broken, casement windows 	\$9,850	\$9,850 \$9,850		
		Air Sealing & Weatherization	Unknown	Door & window weatherstripping		\$1,000				\$1,000		
		Above Grade Walls	Brick wall assembly with interior cavity insulation	+ Optional R-15 EIFS over-cladding		\$33,850		+ Optional R-15 EIFS over-cladding	\$33,850	\$33,850		
heating	63%	Heating	Scotch marine steam boiler with one-pipe distribution	 New scotch marine steam boiler Heat Timer boiler controls with indoor temp f Real Time Energy Management (RTEM) 	feedback	\$8,750 \$800 \$1,600	9% +5%	 Mini split heat pumps, one outdoor unit per dwellin 	ag unit ∮ T \$25,350	\$25,350 \$1,600	43% **/ +0% **** WITH R-15 EIFS OVER-CLADDING	
		Cooling	Thru-wall ACs	New thru-wall ENERGY STAR ACs		\$2,700	WITH R-15 EIFS	(see above) Mini split heat pumps also provide cooling				
		Pumps	None				OVER-CLADDING					
cooling		Pipe Insulation	Some pipe insulation	 New pipe insulation 		\$300						
SSS		Ventilation	Common Area: passive Apartment: passive	No additional recommended measures		\$O		 Unitized ERVs serving corridors [*] Unitized ERVs serving apartments [*] 	\$17,200	\$17,200		
ventilation		Ductwork	No ductwork									
<i>Q</i>	17%	DHW	Tankless coils in steam boilers	 Central air source heat pump (ASHP) with store 	orage / T	\$7,650	31%	No additional recommended measures		\$7,650	41% ***	
domestic hot water		Plumbing Fixtures	Standard flow fixtures	 Low flow fixtures (WaterSense where applic 	able)	\$200	01/0			\$200	11/0	
212	6%	Common Area	Fluorescent/CFL/Incandescent	LEDs with occupancy/vacancy sensors		\$800	2%	No additional recommended measures		\$800	.3%***	
lighting		Exterior	High wattage metal halide	 LEDs with occupancy/vacancy sensors 		(see above)	2/0			(see above)	070	
ngining		In-unit	Fluorescent/CFL	LEDs		\$1,000				\$1,000		
н	14%	Appliances	Non-ENERGY STAR refrigerators Gas stoves	ENERGY STAR refrigerators		\$1,350	0%	■ Electric stoves # T	\$950	\$2,300	13%	
appliances		Central Laundry	None	 No additional recommended measures 	I recommended measures \$0							
renewables		None		 27kW ballasted rooftop solar system \$2,750 		3%	No additional recommended measures		\$2,750	0%		
* Rou of p	ugh order of magr publication that in	nitude estimated costs based on currer iclude material, labor, and mark-up. For	nt information at the time ASSOCIATED r more information, see the UPGRADES	f electrical service and distribution upgradesr structural/finish upgrades including dunnag	e, patching, & sealing	\$7,000 \$500		 electrical service and distribution upgrade structural/finish upgrades including dunnage, pat 	\$16,000 tching, & sealing \$10,650	\$23,000 \$10,650		
 ** Due to the interactivity of the energy model, the GHG savings for envelope are 			ing best Fractices Manual. Igs for envelope are	2030 Emissions Eactor	ESTIMATED	¢40.050	500/	2050 Emissions Eactor	ESTIMATED	¢107.700	40.004	
attr *** Full	ibuted to the HVA ly electrified syste	VAC category for the 2050 scope. stems in 2030 show a GHG savings increase in 2050 because of		The 2030 emissions factor reflects an electric grid powered 70% by renewable energy.	TOTAL COST/DU	40,00	52%	The 2050 emissions factor reflects a zero-emissions electric grid powered 100% by renewable energy.	TOTAL COST/DU	φΙ07,300	100%	
New York's electrical grid transitioning to more clean energy sources.			y sources.									
are savings from envelope upgrades rais 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					WITH R-15 EIFS OVER-CLADDING	\$81,900	57%		WITH R-15 EIFS OVER-CLADDING	\$141,150	100%	

GHG savings

RELATIVE TO BASELINE BUILDING AND BASED ON THE 2050 EMISSIONS FACTOR

Decarbonization Roadmap for Multifamily Affordable Housing

1 calculate

carbon emissions

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

to the LL97 emissions limits

compliance.

compare

Compare the building's current calculated GHG emissions with LL97 limits and determine

what reduction is required for

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.

source of carbon

emissions

2030

emissions factor

4 implement

building decarbonization measures

2050

emissions factor

carbon emissions intensity:

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

pre-war low-rise co-op



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

Low-rise co-ops are often a good fit for resident-paid, multi-split heat pumps; however, the *Low Carbon* retrofit package complies with 2030 emissions limits without electrifying heating, which would increase utility costs. Focusing on envelope improvements, ventilation, and electrification of cooking now can reduce utility costs while improving comfort and air quality. These buildings should develop a plan for future electrification, anticipating laws that will phase out fossil-fuel equipment.