

post-1980 high-rise rental

Based on the Two Bridges 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
New York, NY

dwelling units
198

building area
182,828 sq. ft

metering
gas: master
electricity: direct

heating fuel
natural gas & oil

heating system
steam PTACs

cooling system
PTACs

ventilation system
rooftop exhaust fans








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

Local Law 97
2030 emissions limits
not compliant



NYSERDA
Supported



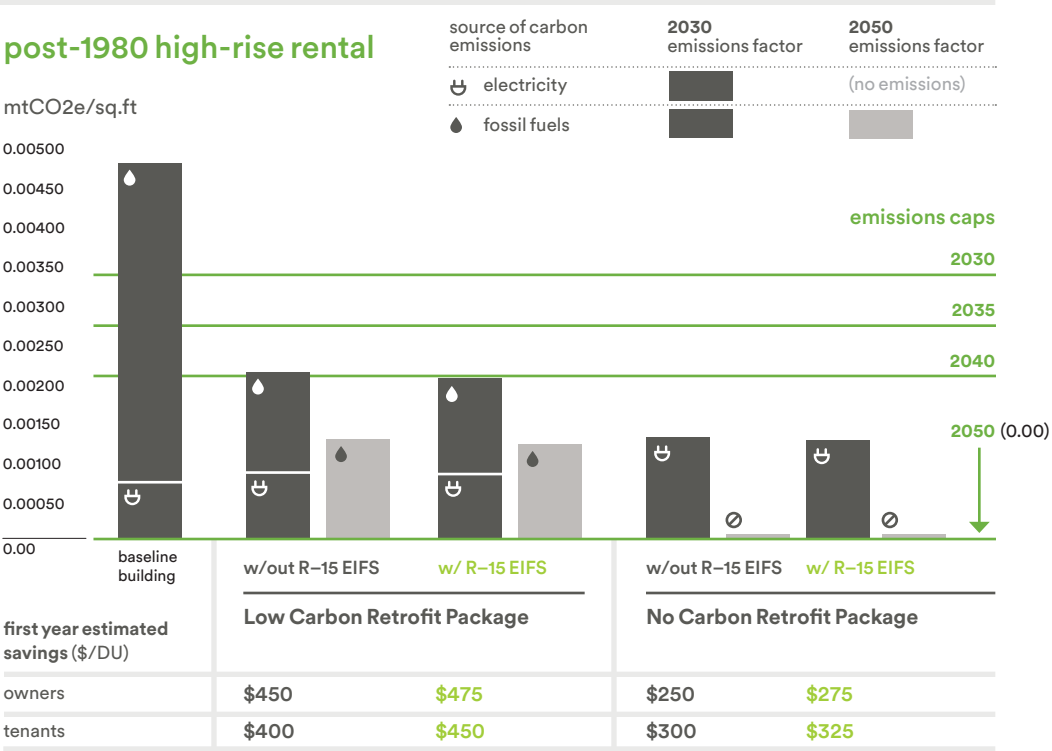
| baseline building conditions | | | | | | low carbon retrofit package | | | | | | GHG savings | | no carbon retrofit package | | | | | | GHG savings | |
|---|---|------------------------------|---|---|--|---|--|-----|--------------------|--------------------------|---|--|--------------------|---|--|----------|--------------------|--------------------------|--|--|--|
| This post-1980, high-rise building has a brick masonry assembly with moderate wall insulation. Its standalone nature, poor roof insulation, and leaky windows, however, make it a good candidate for full envelope upgrades. PTACs for heating and cooling provide an opportunity for packaged terminal heat pumps (PTHPs). | | | | | | Low Carbon improvements include air source heat pumps for domestic hot water, LED lighting, ballasted rooftop solar PV, and ENERGY STAR refrigerators and washers. Envelope upgrades include new R-32 rigid 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. | | | | | | 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 packaged terminal heat pumps in existing PTAC sleeves for heating and cooling, which contribute to 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. | | | | | | 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* | ENERGY CONSERVATION MEASURES (ECMs) | | ESTIMATED COST/DU* | ESTIMATED TOTAL COST/DU* | ENERGY CONSERVATION MEASURES (ECMs) | | ESTIMATED COST/DU* | ESTIMATED TOTAL COST/DU* | | | |
|  envelope | n/a | Roof Insulation | Concrete deck, 3” rigid insulation | ■ Above deck, R-39 insulation | | \$950 | 6% | | | | | ■ New uPVC, thermally broken, casement | \$11,050 | \$11,050 | 0% **/**** | | | | | | |
| | | Windows/Glazing | Aluminum, sliding, double glazed | ■ New aluminum, double pane, low-e, argon filled, double hung | | \$8,650 | | | | | | | | | | | | | | | |
| | | Air Sealing & Weatherization | Leaky windows & doors | ■ Door & window weatherstripping | | \$1,000 | | | | | | | | | | | | | | | |
| | | Above Grade Walls | Brick wall assembly with 3” insulation | + Optional R-15 EIFS over-cladding | | \$16,800 | | | | | | | | | | | | | | | |
|  heating | 63% | Heating | Scotch marine steam boiler and steam packaged terminal ACs | ■ Boiler replacement, weatherization of PTACs ■ Heat Timer boiler controls with indoor temp feedback ■ Real Time Energy Management (RTEM) | | \$3,000 \$300 \$300 | 34% +2% WITH R-15 EIFS OVER-CLADDING | | | | | ■ Packaged cold climate heat pumps (PTHPs) | \$17,900 | \$17,900 | 65% **/**** +0% **/**** WITH R-15 EIFS OVER-CLADDING | | | | | | |
| | | Cooling | Apts: PTACs, Common Area: AHU | ■ No additional recommended measures | | | | | | | | | | | | | | | | | |
| | | Pumps | None | | | | | | | | | | | | | | | | | | |
| | | Pipe Insulation | Piping mostly insulated | ■ New pipe insulation | | \$300 | | | | | | | | | | | | | | | |
| | | Ventilation | Belt driven rooftop exhaust fans | ■ Direct drive, variable speed EC motor central exhaust fans with timers & CAR dampers | | \$1,600 | | | | | | | | | | | | | | | |
| | | Ductwork | In-unit: leaky | ■ Clean & seal ducts; conduct testing, adjusting, & balancing | | (see above) | | | | | | | | | | | | | | | |
|  cooling | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
|  ventilation | | | | | | | | | | | | ■ Central ERVs serving apartments ⚡ ⬆ | \$7,000 | \$7,000 | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
|  domestic hot water | 17% | DHW | Standard hydronic boilers with storage tanks | ■ Central air source heat pump (ASHP) with storage ⚡ ⬆ | | \$3,950 | 14% | | | | | | | | 19% *** | | | | | | |
| | | Plumbing Fixtures | Standard flow fixtures | ■ Low flow fixtures (WaterSense where applicable) | | \$300 | | | | | | | | | | | | | | | |
|  lighting | 6% | Common Area | Fluorescent/CFL | ■ LEDs with occupancy/vacancy sensors | | \$800 | 1% | | | | | | | | 4% *** | | | | | | |
| | | Exterior | CFL | ■ LEDs with occupancy/vacancy sensors | | (see above) | | | | | | | | | | | | | | | |
| | | In-unit | Fluorescent/CFL/Incandescent | ■ LEDs | | \$1,000 | | | | | | | | | | | | | | | |
|  appliances | 14% | Appliances | Non-ENERGY STAR refrigerators Gas stoves | ■ ENERGY STAR refrigerators | | \$1,350 | 0% | | | | | ■ Electric stoves ⚡ ⬆ | \$950 | \$2,300 | 12% | | | | | | |
| | | Central Laundry | (8) ENERGY STAR washers (4) Non-ENERGY STAR washers (12) Gas dryers | ■ (12) New ENERGY STAR washers | | \$0 (per equipment lease agreement) | | | | | | | | | | | | | | | |
| renewables | | None | | ■ 72kW ballasted rooftop solar system | | \$1,750 | 1% | | | | | No additional recommended measures | | \$1,750 | 0% | | | | | | |
| * | 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 <i>Decarbonization Roadmap for Multifamily Affordable Housing Best Practices Manual</i> . | | | ASSOCIATED UPGRADES | ⚡ electrical service and distribution upgrades | \$1,450 | | | | | ⚡ electrical service and distribution upgrade | \$22,350 | \$23,800 | | | | | | | | |
| | | | | | ⬆ structural/finish upgrades including dunnage, patching, & sealing | \$100 | | | | | ⬆ structural/finish upgrades including dunnage, patching, & sealing | \$2,400 | \$2,500 | | | | | | | | |
| ** | Due to the interactivity of the energy model, the GHG savings for envelope are attributed to the HVAC category for the 2050 scope. | | | | 2030 Emissions Factor | \$26,800 | 56% | | | | 2050 Emissions Factor | \$74,600 | 100% | | | | | | | | |
| *** | 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. | | | | 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. | | | | | | | | | | |
| **** | 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. | | | | | | | | | | | | | | | | | | | | |
| | | | | | | ESTIMATED TOTAL COST/DU WITH R-15 EIFS OVER-CLADDING | \$43,600 | 58% | | | | | | | ESTIMATED TOTAL COST/DU WITH R-15 EIFS OVER-CLADDING | \$91,400 | 100% | | | | |

Decarbonization Roadmap for Multifamily Affordable Housing



carbon emissions intensity: post-1980 high-rise rental

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



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

The *Low Carbon* retrofit package for high rise buildings complies with 2030 emissions limits, because improvements to the envelope and ventilation system can significantly reduce their energy use. Replacing steam PTACs with cold-climate PTHPs is a simple future retrofit project. Over-cladding, especially if it can offset LL11 costs, can yield additional savings and allow for conversions from exhaust-only ventilation to ERVs.