Modeling Affordable Multifamily Housing Retrofit Scenarios

Minneapolis–St. Paul

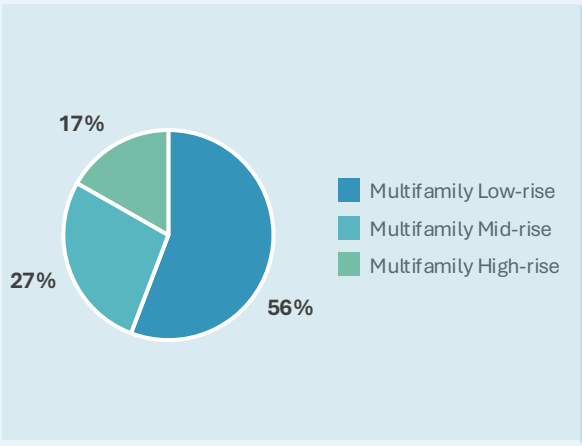
RMI and Wells Fargo Foundation hosted a series of regional workshops to foster collaboration and coordination around decarbonizing the US affordable multifamily housing market. At the Minneapolis–St. Paul workshop, RMI presented research and examples to help local stakeholders better understand the characteristics of their housing stock, the market needs, and how retrofit solutions and incentives can apply to different housing typologies. This brief summarizes those findings to help inform stakeholder action in decarbonizing the region's affordable multifamily housing stock.

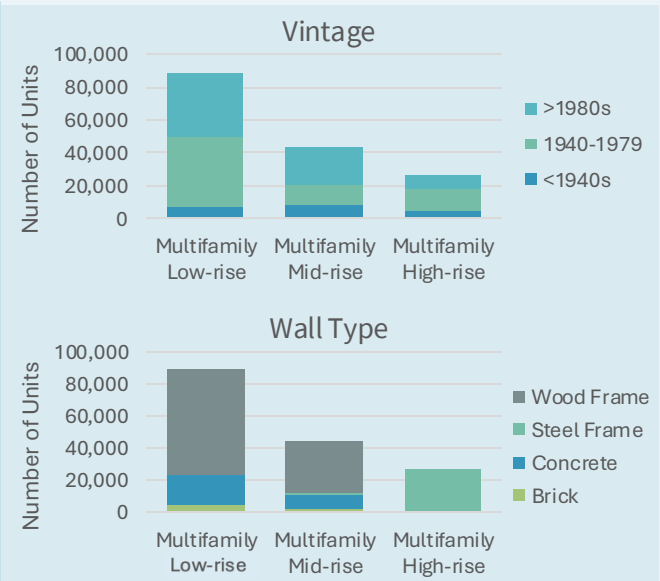
Multifamily Housing Overview

Hennepin County, serving as a proxy for the Minneapolis–St. Paul region, contains approximately **351,000 residential buildings** with **520,000 dwelling units**. Multifamily housing with five or more units accounts for about 31% (190,000) of these units, with the majority being in low-rise buildings (see multifamily building type breakdown below).

Building Types	Number of Units	Percentage
Single-family detached	286,924	55%
Multifamily with 5+ units, 1–3 stories	88,620	17%
Single-family attached	45,036	9%
Multifamily with 5+ units, 4–7 stories	43,583	8%
Multifamily with 2–4 units	28,087	5%
Multifamily with 5+ units, 8+ stories	26,634	5%
Mobile home	1,453	0%
Total	520,337	100%

MULTIFAMILY BUILDING BREAKDOWN*

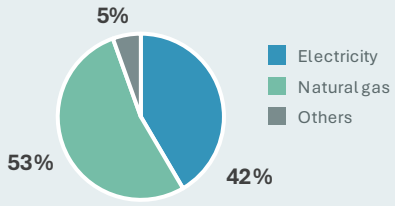




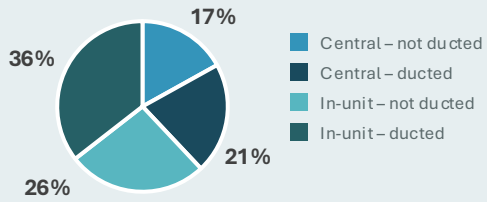
** Excluding multifamily with 2–4 units*

LOW-RISE MULTIFAMILY

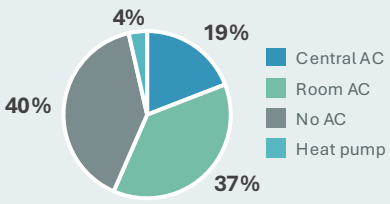
Heating Fuel



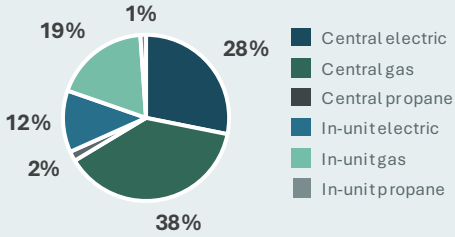
Heating System & Duct Type



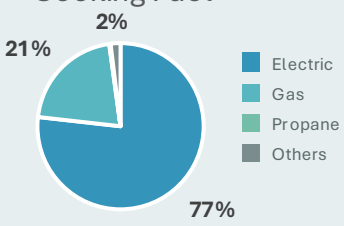
Cooling Type



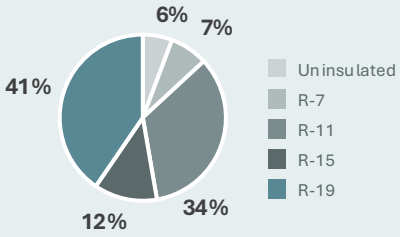
DHW System & Fuel Type



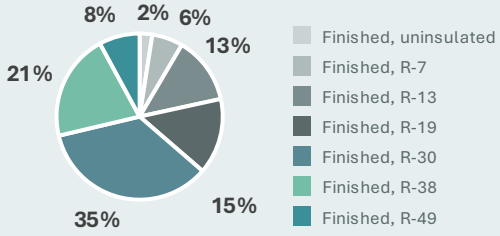
Cooking Fuel



Wall Insulation

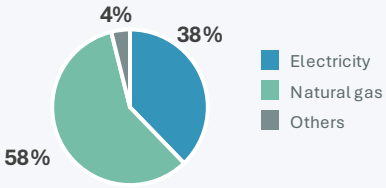


Roof Insulation

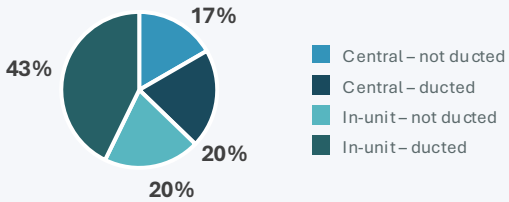


MID-RISE MULTIFAMILY

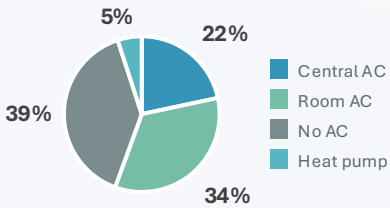
Heating Fuel



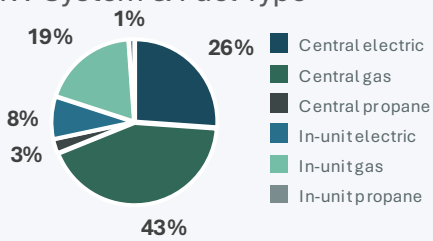
Heating System & Duct Type



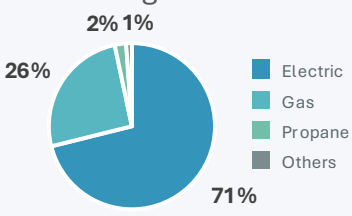
Cooling Type



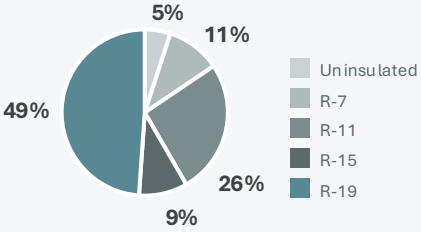
DHW System & Fuel Type



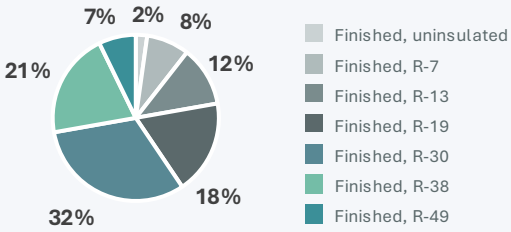
Cooking Fuel



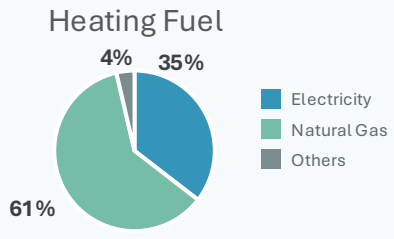
Wall Insulation

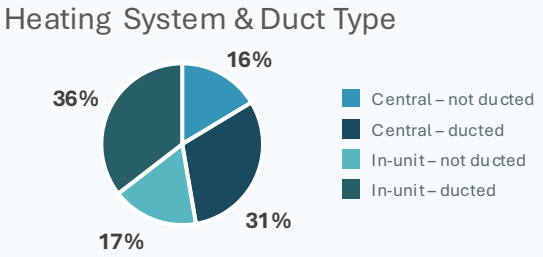


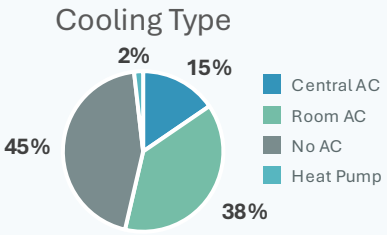
Roof Insulation

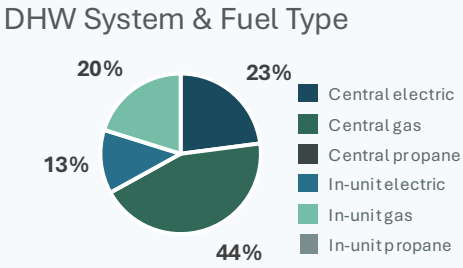


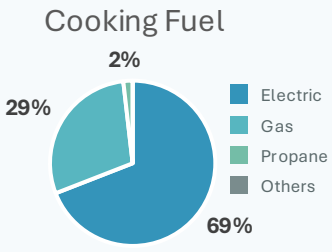
HIGH-RISE MULTIFAMILY

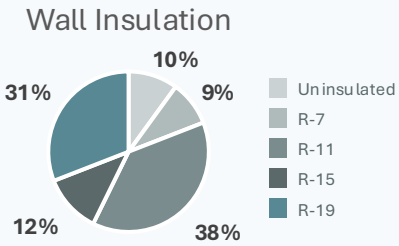


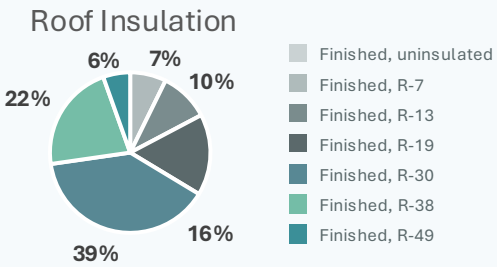












The pie charts on the previous page and above show the characteristics of multifamily buildings in the Minneapolis–St. Paul region. While there is some variation across building types, many major characteristics are similar, indicating that there may be opportunities to streamline retrofit approaches across building types.

Some of the most notable commonalities include over 50% of the multifamily units in the region being heated by natural gas, with about 40% utilizing central heating systems. The predominant source for domestic hot water systems (DHW) are fossil fuels — about 60% of units have natural gas DHW — with the majority being central systems. Even in colder climates such as Minneapolis–St. Paul, cooling is becoming a necessity in increasingly hotter summers. Roughly 40% of multifamily units, however, do not have existing air conditioning (AC) to address this need. While a decent portion of the buildings are well-insulated, there is still a large opportunity to provide better wall and roof insulation to improve building envelope performance.

Source: NREL, *U.S. Building Stock Characterization Study*

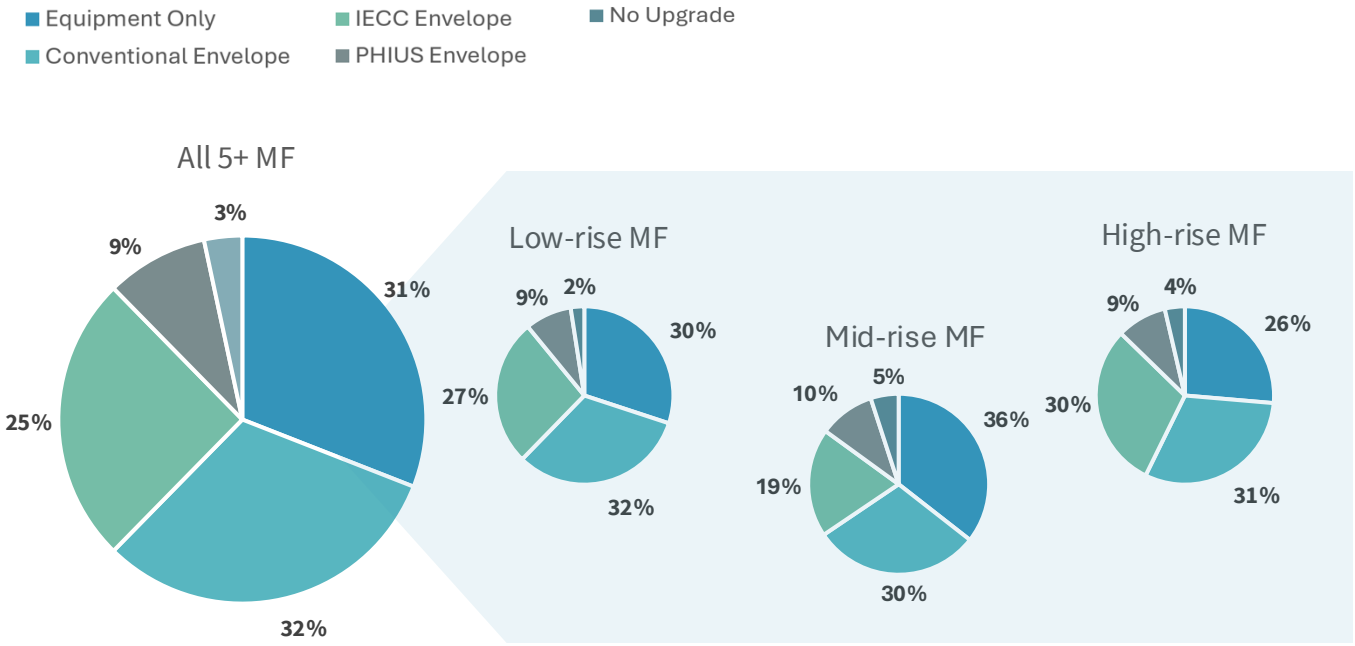
Scenario Models for Multifamily Retrofits

To understand the opportunities for scaling multifamily retrofits in Minneapolis–St. Paul, we evaluated three multifamily housing types across both subsidized and unsubsidized affordable housing scenarios. These models offer insights into the estimated costs of various recommended retrofit packages, how available incentives stack up to offset these costs, the remaining financial gap, and potential strategies for closing that gap.

For this study, we applied the data and analysis framework from the Market Guidance Report (MGR) published by the Advanced Building Construction Collaborative. The MGR evaluates four retrofit packages built on NREL's 2022 U.S. Building Stock Characterization Study [i] — All Equipment Swap-Out (Equipment Only), Conventional Envelope (Light Envelope), IECC Envelope, and Phius Envelope. The analysis from this study includes the assignment of these retrofit packages to the US residential building stock, based on the buildings' existing conditions, outlining a pathway to achieving zero-carbon alignment (ZCA).[ii] These four retrofit packages represent the minimum level of intervention needed to reach ZCA. However, given the predominance of the Equipment Only, Light Envelope, and IECC Envelope retrofit packages, we focused on these three approaches in the following models.

Based on this data, **31% of multifamily with 5+ units** in Minneapolis–St. Paul need an **Equipment Only** retrofit package to meet ZCA, with **66%** needing some level of **envelope intervention**.

RETROFIT NEEDS TO ACHIEVE ZCA, BY BUILDING TYPE



I. Details of each retrofit package can be found in the Market Guidance Report.

II. Attributes of zero-carbon aligned (ZCA) buildings include: (1) has no on-site fossil fuel use, (2) has a low baseline power demand, (3) will get all energy from carbon neutral sources, and (4) can minimize grid impact when needed.

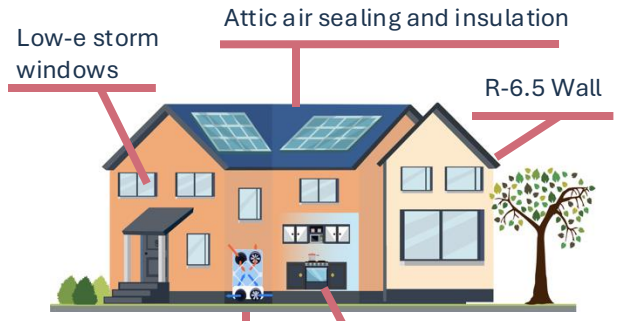
Retrofit Packages Explained

Package 1: All Equipment Swap-Out (Equipment Only)

- Heat pump (ASHP, MSHP or VRF) + duct sealing/insulating
- Heat pump water heater
- Major appliances: all-electric, Energy Star
- 100% LED Lighting

Package 2: Conventional Envelope (Light Envelope)

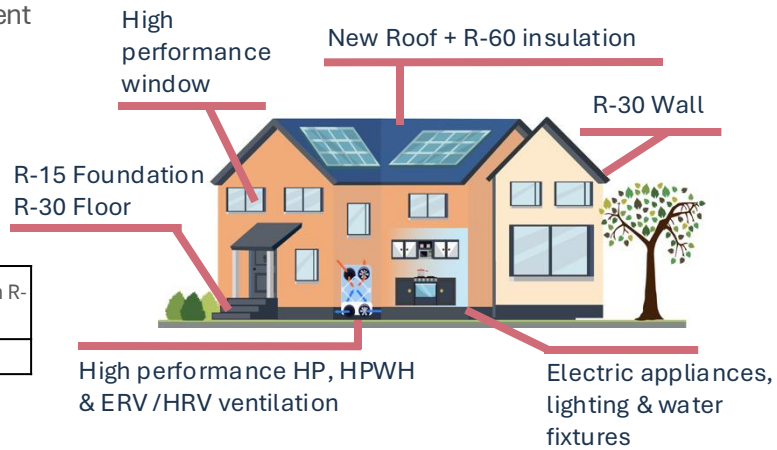
- All measures included in the Equipment Only package
- Energy/Heat Recovery Ventilator (ERV/HRV)[iii]
- Attic/roof air sealing and insulation (IECC)
- R-6.5 continuous wall insulation with residing[iv]
- Low-e storm windows



Package 3: IECC Envelope

- All measures included in the Equipment Only package
- Energy/Heat Recovery Ventilator (ERV/HRV)
- IECC Envelope

Window U-Value	Roof R-Value	Wall R-Value	Floor R-Value	Foundation R-Value
0.3	60	30	30	15



iii. ERV/HRV are added based on airtightness level. Given the small building size for low-rise, we assumed in-unit ERV for the Light Envelope package to be covered by the tenant (no ERV for Equipment Only). We assumed mid-rise and high-rise receive central ERV.

iv. R6.5 continuous insulation only for buildings built before 1990 with existing insulation < R19.

RMI WELLS FARGO

Scenario Models

Scenario 1: Low-rise, Central Gas Heating & DHW

OVERVIEW OF BASELINE CONDITION

Building Type	Low-rise
Wall Structure	Wood Frame
Number of Units	12
DHW	Central Gas
Heating	Central Gas
Duct	No Duct
Cooling	No AC
Avg Unit Size	779 sq.ft.
Number of Floors	3
Total Roof Area	3,566 sq.ft.
Metering Type	Electricity: Tenant Metered Gas: Master Metered

RETROFIT PACKAGE ONLY

	Equipment Only		Light Envelope		IECC Envelope	
	Subsidized	Unsubsidized	Subsidized	Unsubsidized	Subsidized	Unsubsidized
Capital Impacts						
Efficiency Measure Cost	$401,350	$401,350	$1,274,930	$1,274,930	$1,578,181	$1,578,181
Efficiency Measure Incentives	$244,348	$254,348	$265,348	$275,348	$313,348	$323,348
Net Capital Cost	**$157,002**	**$147,002**	**$1,009,582**	**$999,582**	**$1,264,833**	**$1,254,833**
Operational Impacts (over 30 years)						
Present Value of Tenant Bill Impacts	$21,239	$21,239	$3,297	$3,297	$4,118	$4,118
Present Value of Owner Bill Impacts	($37,818)	($37,818)	($6,444)	($6,444)	$34,668	$34,668
Present Value of Total Project Impacts	**$194,820**	**$184,820**	**$1,016,026**	**$1,006,026**	**$1,230,165**	**$1,220,165**

RETROFIT PACKAGE WITH SOLAR

	Equipment Only		Light Envelope		IECC Envelope	
	Subsidized	Unsubsidized	Subsidized	Unsubsidized	Subsidized	Unsubsidized
Capital Impacts						
Efficiency Measure Cost	$401,350	$401,350	$1,274,930	$1,274,930	$1,578,181	$1,578,181
Efficiency Measure Incentives	$244,348	$254,348	$265,348	$275,348	$313,348	$323,348
Solar System Cost	$54,000	$54,000	$54,000	$54,000	$54,000	$54,000
Solar System Incentive	$26,463	$26,463	$26,463	$26,463	$26,463	$26,463
Net Capital Cost	**$184,539**	**$174,539**	**$1,037,118**	**$1,027,118**	**$1,292,370**	**$1,282,370**
Operational Impacts (over 30 years)						
Present Value of Tenant Bill Impacts	$21,239	$21,239	$3,297	$3,297	$4,118	$4,118
Present Value of Owner Bill Impacts	$16,754	$16,754	$48,129	$48,129	$89,240	$89,240
Present Value of Total Project Impacts	**$167,784**	**$157,784**	**$988,990**	**$978,990**	**$1,203,130**	**$1,193,130**

FINDINGS: LOW-RISE, CENTRAL GAS HEATING & DHW

Package 1: Equipment Only

- The retrofit cost for both the subsidized and unsubsidized scenarios is about $400K for the 12-unit low-rise building, with incentives stacking up to about $250K depending on the scenarios. This equates to roughly $150K of net capital cost.
- While tenants will get $21K ($1.8K/unit) of bill savings over 30 years from high efficiency electric appliances, owner will see $38K increase in operation cost from electrifying central heating and DHW system without envelope improvement. Even with solar and if the owner can capture the utility savings from the tenants, there is still about a $150K gap to fill.

Package 2: Light Envelope

- The retrofit cost for both scenarios is about $1.3M and the incentives are about $270k depending on the scenarios. This brings the net capital cost to about $1M.
- There is less tenant bill savings due to the in-unit ERV for the Light Envelope Package. Owner operational cost increase is much lower due to the envelope improvement. Even with the tenant bill savings and solar, there is still a large gap to fill. It would make the most sense for the owner to do a Light Envelope retrofit during a substantial rehab when residing and re-roofing are already planned so that the energy efficiency measures are realized as incremental costs.
- There are also many benefits to envelope improvements beyond just energy savings that should be considered as part of this investment, including passive survivability, better thermal comfort, and better indoor air quality.

Package 3: IECC Envelope

- The retrofit cost for both scenarios is about $1.6M and the incentives are about $320K depending on the scenarios. This brings the net capital cost to about $1.3M.
- While the owner will finally see bill savings from the IECC Envelope Package, the total gap remains large. It would still make the most sense for the owner to do an IECC Envelope retrofit during a substantial rehab.

Scenario 2: Mid-rise, Central Gas Heating & DHW

OVERVIEW OF BASELINE CONDITION

Building Type	Mid-rise
Wall Structure	Wood Frame
Number of Units	67
DHW	Central Gas
Heating	Central Gas
Duct	No Duct
Cooling	No AC
Avg Unit Size	866 sq.ft.
Number of Floors	5
Total Roof Area	14,315 sq.ft.
Metering Type	Electricity: Tenant Metered Gas: Master Metered

RETROFIT PACKAGE ONLY

	Equipment Only		Light Envelope		IECC Envelope	
	Subsidized	Unsubsidized	Subsidized	Unsubsidized	Subsidized	Unsubsidized
Capital Impacts						
Efficiency Measure Cost	$1,700,402	$1,700,402	$5,534,159	$5,534,159	$6,903,806	$6,903,806
Efficiency Measure Incentives	$1,339,022	$1,314,022	$1,339,022	$1,510,022	$1,607,022	$1,582,022
Net Capital Cost	**$361,380**	**$386,380**	**$4,195,137**	**$4,024,137**	**$5,296,784**	**$5,321,784**
Operational Impacts (over 30 years)						
Present Value of Tenant Bill Impacts	$223,350	$223,350	$202,448	$202,448	$205,574	$205,574
Present Value of Owner Bill Impacts	($264,855)	($264,855)	($154,055)	($154,055)	$132,625	$132,625
Present Value of Total Project Impacts	**$626,235**	**$651,235**	**$4,349,192**	**$4,178,192**	**$5,164,159**	**$5,189,159**

RETROFIT PACKAGE WITH SOLAR

	Equipment Only		Light Envelope		IECC Envelope	
	Subsidized	Unsubsidized	Subsidized	Unsubsidized	Subsidized	Unsubsidized
Capital Impacts						
Efficiency Measure Cost	$1,700,402	$1,700,402	$5,534,159	$5,534,159	$6,903,806	$6,903,806
Efficiency Measure Incentives	$1,339,022	$1,314,022	$1,339,022	$1,510,022	$1,607,022	$1,582,022
Solar System Cost	$252,518	$252,518	$252,518	$252,518	$252,518	$252,518
Solar System Incentive	$125,755	$125,755	$125,755	$125,755	$125,755	$125,755
Net Capital Cost	**$488,142**	**$513,142**	**$4,321,899**	**$4,150,899**	**$5,423,547**	**$5,448,547**
Operational Impacts (over 30 years)						
Present Value of Tenant Bill Impacts	$223,350	$223,350	$202,448	$202,448	$205,574	$205,574
Present Value of Owner Bill Impacts	$35,747	$35,747	$146,547	$146,547	$433,227	$433,227
Present Value of Total Project Impacts	**$452,396**	**$477,396**	**$4,175,353**	**$4,004,353**	**$4,990,320**	**$5,015,320**

FINDINGS: MID-RISE, CENTRAL GAS HEATING & DHW

Package 1: Equipment Only

- The retrofit cost for both the subsidized and unsubsidized scenarios is about $1.7M for the 67-unit mid-rise building, with incentives stacking up to about $1.3M depending on the scenarios. This equates to roughly $400K of net capital cost.
- While tenants will get $223K ($3.3K/unit) of bill savings over 30 years from high efficiency electric appliances, owner will see a $265K increase in operation cost from electrifying central heating and DHW system without envelope improvement. Even with solar and if the owner can capture the utility savings from the tenants, there is still about a $230K gap to fill.

Package 2: Light Envelope

- The retrofit cost for both scenarios is about $5.5M and the incentives are about $1.3M depending on the scenarios. This brings the net capital cost to about $4.2M.
- There is less tenant bill savings due to the in-unit ERV for the Light Envelope Package. Owner operational cost increase is much lower due to the envelope improvement. Even with the tenant bill savings and solar, there is still a large gap to fill. It would make the most sense for the owner to do a Light Envelope retrofit during a substantial rehab when residing and re-roofing are already planned so that the energy efficiency measures are realized as incremental costs.
- There are also many benefits to envelope improvements beyond just energy savings that should be considered as part of this investment, including passive survivability, better thermal comfort, and better indoor air quality.

Package 3: IECC Envelope

- The retrofit cost for both scenarios is close to $7M and the incentives are about $1.6M depending on the scenarios. This brings the net capital cost to about $5.3M.
- While the owner will finally see bill savings from the IECC Envelope Package, the total gap remains large. It would still make the most sense for the owner to do an IECC Envelope retrofit during a substantial rehab.

Scenario 3: High-rise, Central Gas Heating & DHW

OVERVIEW OF BASELINE CONDITION

Building Type	High-rise
Wall Structure	Wood Frame
Number of Units	116
DHW	Central Gas
Heating	Central Gas
Duct	No Duct
Cooling	No AC
Avg Unit Size	794 sq.ft.
Number of Floors	12
Total Roof Area	7,411 sq.ft.
Metering Type	Electricity: Tenant Metered Gas: Master Metered

RETROFIT PACKAGE ONLY

	Equipment Only		Light Envelope		IECC Envelope	
	Subsidized	Unsubsidized	Subsidized	Unsubsidized	Subsidized	Unsubsidized
Capital Impacts						
Efficiency Measure Cost	$2,530,959	$2,530,959	$8,141,208	$8,141,208	$9,930,073	$9,930,073
Efficiency Measure Incentives	$2,149,544	$2,124,544	$2,255,104	$2,230,104	$2,719,104	$2,694,104
Net Capital Cost	**$381,415**	**$406,415**	**$5,886,104**	**$5,911,104**	**$7,210,969**	**$7,235,969**
Operational Impacts (over 30 years)						
Present Value of Tenant Bill Impacts	$307,622	$307,622	$265,383	$265,383	$287,042	$287,042
Present Value of Owner Bill Impacts	($370,365)	($370,365)	($103,139)	($103,139)	$567,149	$567,149
Present Value of Total Project Impacts	**$751,780**	**$776,780**	**$5,989,243**	**$6,014,243**	**$6,643,820**	**$6,668,820**

RETROFIT PACKAGE WITH SOLAR

	Equipment Only		Light Envelope		IECC Envelope	
	Subsidized	Unsubsidized	Subsidized	Unsubsidized	Subsidized	Unsubsidized
Capital Impacts						
Efficiency Measure Cost	$2,530,959	$2,530,959	$8,141,208	$8,141,208	$9,930,073	$9,930,073
Efficiency Measure Incentives	$2,149,544	$2,124,544	$2,255,104	$2,230,104	$2,719,104	$2,694,104
Solar System Cost	$129,600	$129,600	$129,600	$129,600	$129,600	$129,600
Solar System Incentive	$67,997	$67,997	$67,997	$67,997	$67,997	$67,997
Net Capital Cost	**$443,018**	**$468,018**	**$5,947,707**	**$5,972,707**	**$7,272,572**	**$7,297,572**
Operational Impacts (over 30 years)						
Present Value of Tenant Bill Impacts	$307,622	$307,622	$265,383	$265,383	$287,042	$287,042
Present Value of Owner Bill Impacts	($215,542)	($215,542)	$51,684	$51,684	$721,972	$721,972
Present Value of Total Project Impacts	**$658,560**	**$683,560**	**$5,896,024**	**$5,921,024**	**$6,550,601**	**$6,575,601**

FINDINGS: HIGH-RISE, CENTRAL GAS HEATING & DHW

Package 1: Equipment Only

- The retrofit cost for both the subsidized and unsubsidized scenarios is about $2.5M for the 116-unit high-rise building, with incentives stacking up to about $2.1M depending on the scenarios. This equates to roughly $400K of net capital cost.
- While tenants will get $307K ($2.6K/unit) of bill savings over 30 years from high efficiency electric appliances, owner will see $370K increase in operation cost from electrifying central heating and DHW system without envelope improvement. Even with solar and if the owner can capture the utility savings from the tenants, there is still about a $450K gap to fill.

Package 2: Light Envelope

- The retrofit cost for both scenarios is about $8.1M and the incentives are about $2.2M depending on the scenarios. This brings the net capital cost to about $6M.
- There is less tenant bill savings due to the in-unit ERV for the Light Envelope Package. Owner operational cost increase is much lower due to the envelope improvement. Even with the tenant bill savings and solar, there is still a large gap to fill. It would make the most sense for the owner to do a Light Envelope retrofit during a substantial rehab when residing and re-roofing are already planned so that the energy efficiency measures are realized as incremental costs.
- There are also many benefits to envelope improvements beyond just energy savings that should be considered as part of this investment, including passive survivability, better thermal comfort, and better indoor air quality.

Package 3: IECC Envelope

- The retrofit cost for both scenarios is close to $10M and the incentives are about $2.7M depending on the scenarios. This brings the net capital cost to about $7.2M.
- While the owner will finally see bill savings from the IECC Envelope Package, the total gap remains large. It would still make the most sense for the owner to do an IECC Envelope retrofit during a substantial rehab.

Available Incentives

The following tables provide examples of how available federal, state, and local incentives could apply to affordable multifamily decarbonization retrofits in the Minneapolis–St. Paul region. For a more in-depth look at how these incentives are applied and the specific requirements for accessing them, please refer to the following page on Incentive Resources.

Package 1: Equipment Only

Available Incentives per Unit (as of Oct 2024)

Incentives	Low-Rise		Mid-Rise		High-Rise	
	Subsidized	Unsubsidized	Subsidized	Unsubsidized	Subsidized	Unsubsidized
HER	$8,000	$8,000	$4,000	$4,000	$8,000	$8,000
HEAR	$8,250	$8,250	$14,000	$14,000	$9,090	$9,090
179D	$779	$779	$866	$866	$794	$794
Green Cost Share - MF EE	$3,333	-	$1,119	-	$647	-
4D AH Energy Efficiency	-	$4,167	-	$746	-	$431
Total Incentives	**$20,362**	**$21,196**	**$19,985**	**$19,612**	**$18,531**	**$18,315**

HER Covered Measures	HP, major appliances	HPWH, major appliances	HP
HEAR Covered Measures	HPWH, electrical panel & wiring	HP, electrical panel & wiring	HPWH, electrical panel & wiring, major appliances

Package 2: Light Envelope

Available Incentives per Unit (as of Oct 2024)

Incentives	Low-Rise		Mid-Rise		High-Rise	
	Subsidized	Unsubsidized	Subsidized	Unsubsidized	Subsidized	Unsubsidized
HER	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000
HEAR	$14,000	$14,000	$14,000	$14,000	$14,000	$14,000
179D	$779	$779	$866	$866	$794	$794
Green Cost Share - MF EE	$3,333	-	$1,119	-	$647	-
4D AH Energy Efficiency	-	$4,167	-	$746	-	$431
Total Incentives	**$22,112**	**$22,946**	**$19,985**	**$19,612**	**$19,441**	**$19,225**

HER Covered Measures	HPWH, major appliances, weatherization	HPWH, major appliances, weatherization	HPWH, major appliances, weatherization
HEAR Covered Measures	HP, electrical panel & wiring	HP, electrical panel & wiring	HP, electrical panel & wiring

Package 3: IECC Envelope

Available Incentives per Unit (as of Oct 2024)

Incentives	Low-Rise		Mid-Rise		High-Rise	
	Subsidized	Unsubsidized	Subsidized	Unsubsidized	Subsidized	Unsubsidized
HER	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000
HEAR	$14,000	$14,000	$14,000	$14,000	$14,000	$14,000
179D	$779	$779	$866	$866	$794	$794
Green Cost Share - MF EE	$3,333	-	$1,119	-	$647	-
4D AH Energy Efficiency	-	$4,167	-	$746	-	$431
Total Incentives	**$26,112**	**$26,946**	**$23,985**	**$23,612**	**$23,441**	**$23,225**

HER Covered Measures	HPWH, major appliances, weatherization	HPWH, major appliances, weatherization	HPWH, major appliances, weatherization
HEAR Covered Measures	HP, electrical panel & wiring	HP, electrical panel & wiring	HP, electrical panel & wiring

Solar Incentives per Building (as of Oct 2024)

Incentives	Low-rise	Mid-rise	High-rise
48E ITC	$16,200	$75,755	$38,880
Green Cost Share - Solar	$10,263	$50,000	$29,117
Total Incentives	**$26,463**	**$125,755**	**$67,997**

Incentive Resources

Subsidies	Incentive Range ($ per unit or as noted)		Incentive Type	Ranges and Requirements	Affordability Requirements
	Low	High			
Home Energy Efficiency Rebate (HER)	$4,000	$8,000	Federal	Modeled, lesser of $4,000/unit or 80% of project cost for building-wide savings between 20% and 35%; lesser of $8,000/unit or 80% of project cost for 35%+ building-wide savings — measures may include insulation, air sealing, windows, DHW.	Not less than 50% of dwelling units are occupied by households <80% AMI
Home Electrification and Appliance Rebate (HEAR)	-	$14,000	Federal	Energy star appliances: $8,000 for heat pump HVAC, $1,750 for heat pump water heater, $840 for electric stove/cooktop , $840 for heat pump clothes dryer, $4,000 for breaker box, $2,500 for electric wiring, $1,600 for weatherization (insulation, air sealing, ventilation); $14,000 max. consumer rebate.	Low Income: <80% AMI for 100% cost coverage Moderate Income: 80%-150% AMI for 50% cost coverage
45L Tax Credit	$500	$5,000	Federal	Properties certified to Energy Star standards could earn between $500 and $2,500 per unit depending on whether they are paying prevailing wage. Properties certified for the Zero Energy Ready Home standard could earn between $1,000 and $5,000 per unit depending on whether they pay prevailing wages.	N/A
179D Tax Deduction	$0.50/ft^2	$5.00/ft^2	Federal	$0.50/ft^2 for 25% site EUI reduction, plus $0.02/ft^2 for each percentage point of savings above 25%, up to a maximum $1/ft^2 for 50% savings.	N/A
48E Clean Energy Investment Tax Credit (ITC)	30% of the solar cost	70% of the solar cost	Federal - Solar	The commercial renewable tax credit includes an adder that can stack up to 70% ITC: 30% base tax credit if the project started between 2023 and 2033, 10% bonus for "Domestic Content," 10% bonus for "Energy Communities," 20% bonus for projects financially benefitting low-income communities or 10% bonus for projects in low-income or Tribal communities. To meet the conditions of a Category 3 facility, the financial benefits of the electricity produced by the facility must be allocated equitably among the occupants of a qualified residential property. At least half of the financial value of the energy produced by the facility must be equitably allocated to the property's low-income occupants under the covered housing program or other affordable housing program.	A "qualified low-income residential building project" is defined as a residential rental building which participates in a covered housing program (i.e., HUD-assisted housing for groups in need. See: 24 CFR § 5.2003 for the full definition).
Green Cost Share - Solar	20 cents per kWh-AC	40 cents per kWh-AC (max $50,000)	Local	Eligible properties must be located in the City of Minneapolis and fall under an eligible building typology. There are three incentive categories: Base (20 cents per kWh-AC), Environmental Justice (35 cents per kWh-AC), and Affordable Housing (40 cents per kWh-AC). Properties can only fit into one category, and the maximum incentive for each category is $50,000.	To be eligible for the affordable housing category, the property must qualify for an affordable housing or utility bill program such as Minneapolis 4d Affordable Housing Incentive Program, Low Income Rental Classification, Income Qualified Solar Rewards, Minnesota Energy Assistance Program, or the Weatherization Assistance Program.
Green Cost Share - Commercial & Multifamily Energy Efficiency	$20,000 per building	$75,000 per building	Local	All eligible properties must be located in the City of Minneapolis and fall under an eligible building typology. There are four incentive categories: Base (20% up to $20,000), Environmental Justice (30% up to $30,000), Affordable Housing (40% up to $40,000), or Energy Benchmarked Buildings (25% up to $75,000). Eligible properties must electrify a piece of gas equipment or qualify for an Xcel or CenterPoint utility rebate. Minimum guidelines provide more detail on the measures covered under the energy efficiency incentive.	For the affordable housing category, the property must qualify for an affordable housing or utility bill program such as Low-Income Rental Classification, Income Qualified Solar Rewards, Minnesota Energy Assistance Program, or the Weatherization Assistance Program. Energy benchmarked buildings must be greater than 50,000 square feet as per the City's energy benchmarking ordinance.
Green Cost Share - 4d AH Energy Efficiency	-	$50,000 per building	Local	Projects must either switch form gas to electric (appliances, cold climate heat pumps, or water heater heat pumps), make energy efficiency upgrades (ventilation, knob and tube wiring, furnace room, or asbestos removal), or qualify for an Xcel or CenterPoint utility rebate. Minimum guidelines provide more detail on the measures covered under the energy efficiency incentive.	All eligible properties must be located in the City of Minneapolis and enrolled in the 4d affordable housing incentive program.

Note: This table provides a high-level overview of all the incentives considered in the scenario models for your reference. It is not meant to be exhaustive nor serve as a complete incentive stacking guide. Each project is unique and will require its own specific analysis.

Key Assumptions and Notes

Scenario Models

- Our scenario models utilize the data from the MGR. The results and assumptions, including the energy use intensities, energy savings, equipment performance, and building characteristics, etc., are all based on the MGR data. The scenario models are based on the average of all modeled units in the MGR dataset that meets the scenario models stated typology. Energy savings can vary depending on other existing conditions such as number of units, unit sizes, etc. These results serve as a reference and are NOT meant to represent every building and DO NOT capture all the nuances in a project.
- Solar PV potential is estimated based on the MGR data and sized using NREL's PVWatts Calculator. Solar PV costs are estimated using LBL's *Tracking the Sun* 2023 Report.
- Utility bill impact is estimated using US EIA's 2022 average residential and commercial electricity and natural gas rate in Minnesota.
- Retrofit Package cost varies widely depending on location, climate, building type, existing condition, and system type. For the analysis, we assumed a price range of $20k–$45k for Equipment Only, $70k–$110k for Light Envelope, and $80k–$135k for IECC Envelope. These are estimates and are not meant for actual project pricing.

Incentives

- Projects are not allowed to stack HER and HEAR for the same measures. This analysis tries to optimize the incentives from HER and HEAR accounting for the energy savings of measures to meet HER's 20% or 35% target. Based on the savings, only the IECC Envelope Package is able to maximize both HER and HEAR in all of the scenario models.
- This analysis assumes 100% of the solar outputs goes to the owner meter and the project only receives 30% ITC.
- For both Light Envelope and IECC Envelope Packages, we assumed the low-rise scenarios qualifies for Affordable Housing category for Green Cost Share, and the mid-rise and high-rise scenarios qualify for Energy Benchmarked Buildings category as the buildings are larger than 50,000 sq.ft. Each project should determine which category is most suitable.
- Unsubsidized affordable housing can also qualify for the 4d Affordable Housing Tax Credit. While not explicitly included in the scenario models, with a 4% discount rate, we estimated a low-rise building with a property value of $1.4M can receive about an NPV of $11K over 10 years, a mid-rise building with property value of $8.3M can receive $67K, and a high-rise building with property value of $12M can receive about $102K.