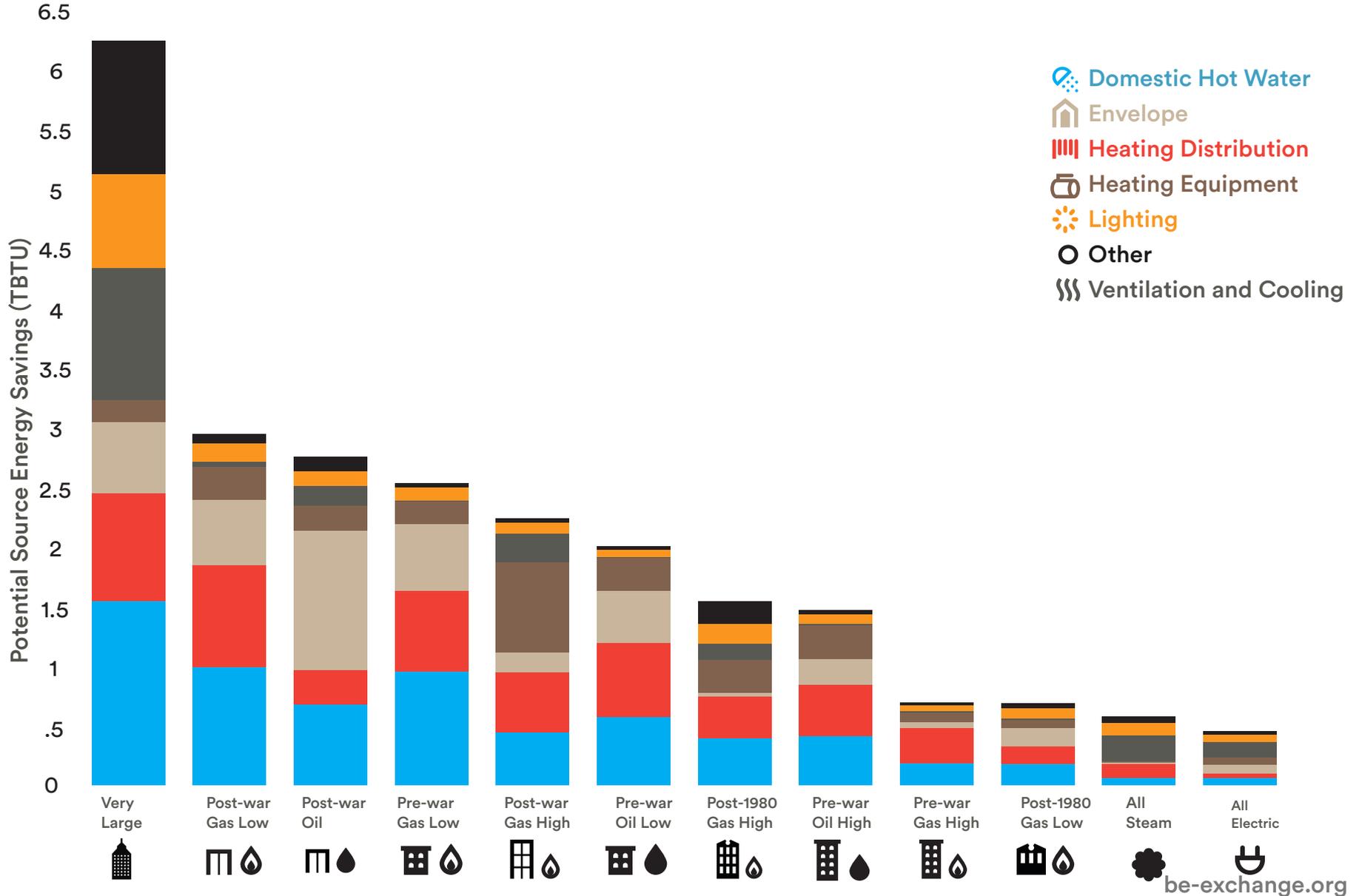


opportunities

Distribution of Energy Savings from ECM Categories by Segment



data into action



ECM packages: touchpoints

Key implementation milestones in building lifecycle

Anytime/Anywhere

lower cost,
simple measures

Midcycle Retrofit

low to medium costs,
mid-level measures

Substantial Retrofit

longer-term investment,
deeper savings

Tenant Turnover

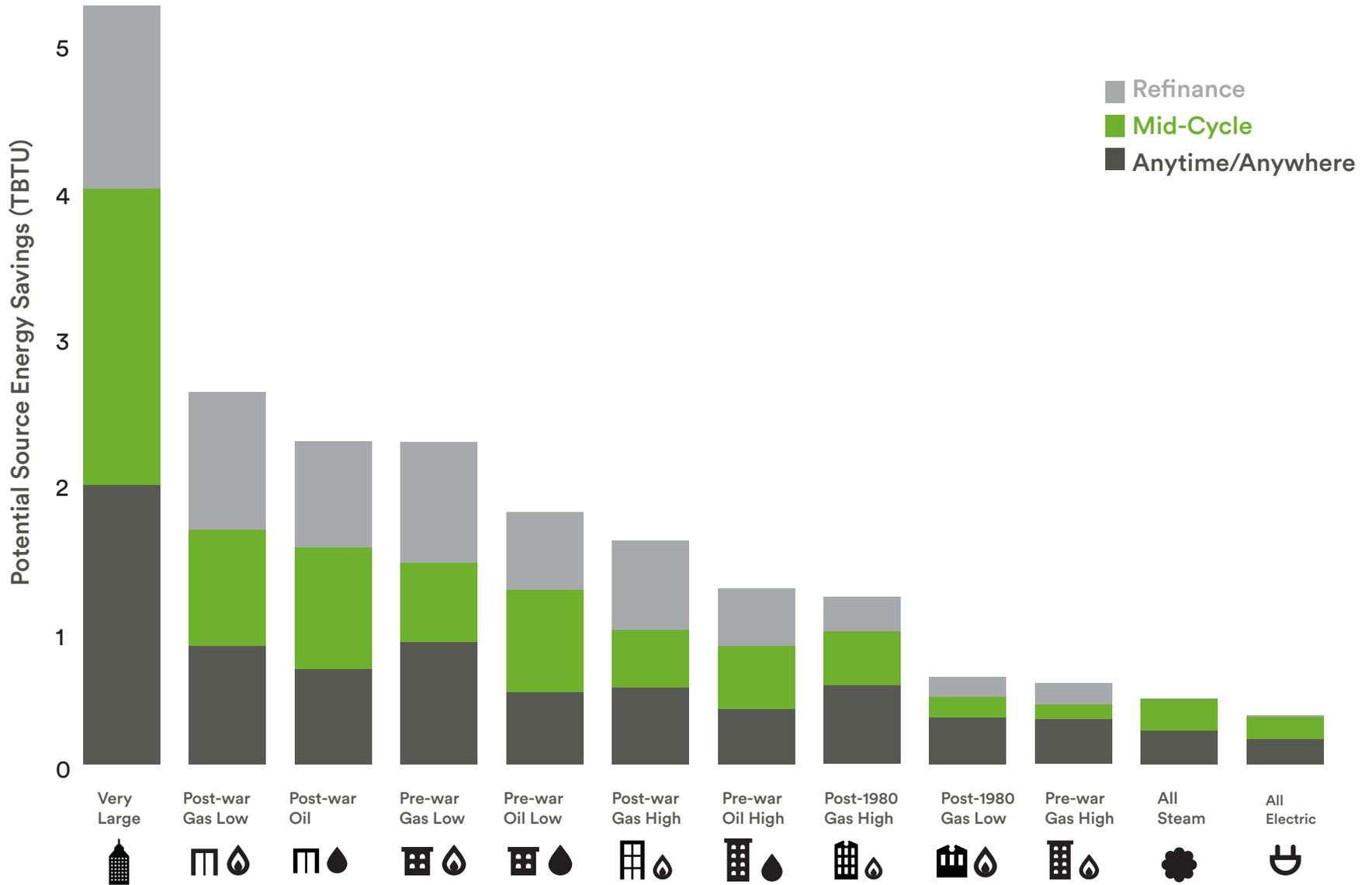
requires tenant unit access

Equipment Replacement

lifecycle and energy
upgrade opportunities

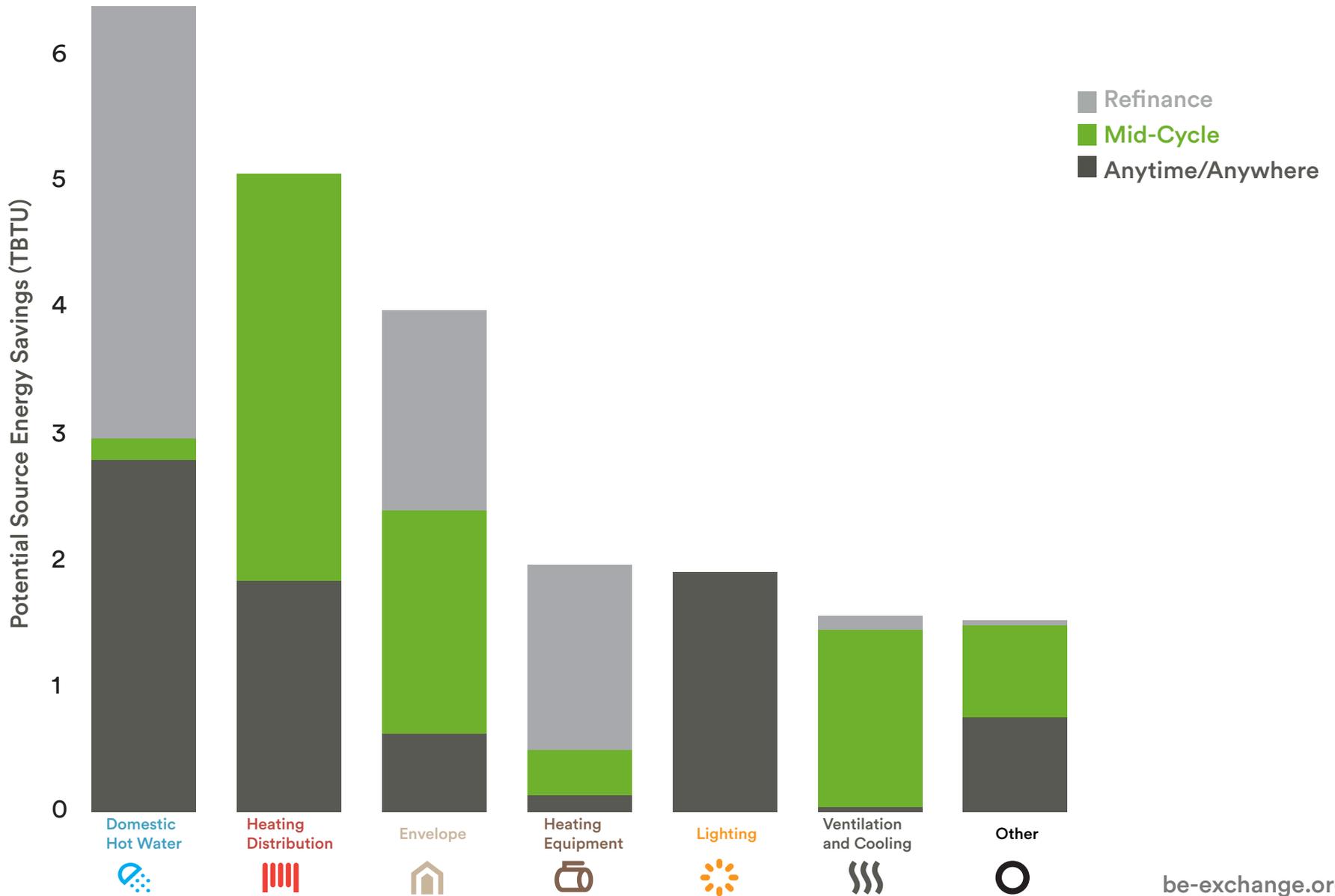
touchpoints

Savings by Touchpoint for each Segment



touchpoints

Savings by Touchpoint for each Category



ECM packages

“Tear-sheets” for each building typology

retrofit packages: post-war gas low-rise

This tear-sheet shows 'packages' of energy conservation measures, for key milestones in a building's lifecycle, that can reduce utility bills, maximize energy savings, and improve value and performance.

Typical Building Characteristics

Age	1947–1979
Height	7 stories or fewer
Facade	Masonry
Heating System	Hydronic or two pipe
Heating Fuel	Gas or dual fuel
Ventilation System	Central ventilation and natural ventilation
Cooling	Through-wall or window

Segment Characteristics

Size	1,032 properties; 15 square feet
Area	9% of all covered m
Potential Savings	12% of all potential

Typical Retrofit Costs		
Touchpoint	Anytime/Anywhere	Midcycle Retrofit
Description	Lower cost; simple measures	Low to medium cost
Cost	\$14,560	\$70,000
Savings	\$5,200	\$10,000
ROI	2.8	7.0

All costs and savings reflect a 100 uni, 1000,000 SF building

Turning Data Into Action

building retrofit 'packages': post-war

post-war gas low-rise

Building Touchpoint

Energy Conservation Measure	Anytime/Anywhere	Midcycle Retrofit	Refinancing/Substantial Retrofit	Tenant Turnover	Payback (years)	Cost per SF	Energy Savings per SF
⚙️ Install Exhaust Fan Timers	•	•	•		5.0	\$	■
○ Install Submetering		•	•		2.0	\$\$\$	■
○ Install Solar/Photovoltaic			•		17.0	\$\$\$\$	■
○ Upgrade Motors		•	•		5.5	\$\$	■
⚙️ Upgrade lights		•	•		2.5	\$	■
⚙️ Install Lighting Sensors		•	•		4.0	\$	■
⚙️ Upgrade Burner		•	•		6.5	\$\$	■
⚙️ Upgrade Boiler			•		>20	\$\$\$\$	■
⚙️ Install TRVs and Zone Control		•	•		6.5	\$\$\$	■
⚙️ Install Heating Controls and Thermostats		•	•		2.5	\$\$	■
⚙️ Insulate Condensate Tank	•	•	•		2.5	\$	■
⚙️ Insulate Pipes	•	•	•		2.0	\$	■
⚙️ Install or Upgrade Master Venting		•	•		3.0	\$\$	■
🏠 Replace Windows and Glazing			•		>20	\$\$\$\$	■
🏠 Increase Wall Insulation			•		>20	\$\$\$\$	■
🏠 Increase Roof Insulation			•		>20	\$\$\$	■
🏠 Complete Air sealing	•	•	•		6.0	\$\$	■
⚙️ Separate DHW from Heating			•		6.5	\$\$\$	■
⚙️ Install Low-Flow Showerheads	•	•	•	•	1.0	\$\$	■
⚙️ Install DHW Controls	•	•	•		0.5	\$	■
⚙️ Install Low Flow Aerators	•	•	•	•	1.5	\$\$	■
⚙️ Insulate Pipes and Tank	•	•	•		6.0	\$	■

Energy Conservation Measure	Cost per Square Foot	Energy Savings per SF (kbtu)	Notes
⚙️ Ventilation & Cooling	\$ <\$0.05	■ 0–3	This list of Energy Conservation Measures (ECM) is based on LL87 audit data and therefore may be incomplete. Suggested ECM's for each Building Touchpoint are representative, and not necessarily applicable to every building. Variety in specific building systems and condition of equipment must be considered in determining the appropriate packages of ECMs for individual buildings. The first step of any upgrade should be to work with a qualified service provider to develop a scope of work appropriate for your building.
○ Other	\$\$ \$0.05–\$0.25	■ 3,1–8	
⚙️ Lighting	\$\$\$ \$0.26–\$1.00	■ 8,1–12	
⚙️ Heating Equipment	\$\$\$\$ >\$1.00	■ >12	
⚙️ Heating Distribution			
🏠 Envelope			
⚙️ Domestic Hot Water			

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building retrofit 'packages': post-war gas low-rise

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retrofit packages: post-war gas low-rise

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Typical Building Characteristics

Age	1947–1979
Height	7 stories or fewer
Facade	Masonry
Heating System	Hydronic or two pipe steam
Heating Fuel	Gas or dual fuel
Ventilation System	Central ventilation and natural ventilation
Cooling	Through-wall or window ACs

Segment Characteristics

Size	1,032 properties; 152,966,300 square feet
Area	9% of all covered multifamily buildings
Potential Savings	12% of all potential GHG reduction



Typical Retrofit Costs

Touchpoint	Anytime/Anywhere	Midcycle Retrofit	Refinance	Tenant Turnover
Description	Lower cost; simple measures	Low to medium cost; mid-level measures	Long-term investment; deeper saving	Requires tenant unit access
Cost	\$14,560	\$70,000	\$418,000	
Savings	\$5,200	\$10,000	\$31,000	
ROI	2.8	7.0	13.5	

All costs and savings reflect a 100 uni, 1000,000 SF building

ECM packages: post-war gas low-rise

post-war gas low-rise

Building Touchpoint

Energy Conservation Measure	Anytime/ Anywhere	Midcycle Retrofit	Refinancing/ Substantial Retrofit	Tenant Turnover	Payback (years)	Cost per SF	Energy Savings per SF
☺ Install Exhaust Fan Timers	•	•	•		5.0	\$	■
○ Install Submetering		•	•		2.0	\$\$\$	■
○ Install Solar/Photovoltaic			•		17.0	\$\$\$\$	■
○ Upgrade Motors		•	•		5.5	\$	■
☀ Upgrade lights		•	•		2.5	\$	■
☀ Install Lighting Sensors		•	•		4.0	\$	■
🔧 Upgrade Burner			•		6.5	\$	■
🔧 Upgrade Boiler			•		>20	\$\$\$\$	■
Install TRVs and Zone Control		•	•		6.5	\$\$\$	■
Install Heating Controls and Thermostats		•	•		2.5	\$	■
Insulate Condensate Tank	•	•	•		2.5	\$	■
Insulate Pipes	•	•	•		2.0	\$	■
Install or Upgrade Master Venting		•	•		3.0	\$	■
🏠 Replace Windows and Glazing			•		>20	\$\$\$\$	■
🏠 Increase Wall Insulation			•		>20	\$\$\$\$	■
🏠 Increase Roof Insulation			•		>20	\$\$\$	■
🏠 Complete Air sealing	•	•	•		6.0	\$	■
🔧 Separate DHW from Heating		•	•		6.5	\$\$\$	■
🔧 Install Low-Flow Showerheads	•	•	•	•	1.0	\$	■
🔧 Install DHW Controls	•	•	•		0.5	\$	■
🔧 Install Low Flow Aerators	•	•	•	•	1.5	\$	■
🔧 Insulate Pipes and Tank	•	•	•		6.0	\$	■

Energy Conservation Measure		Cost per Square Foot	Energy Savings per SF (kbtu)	Notes
☺ Ventilation & Cooling	Heating Distribution	\$ <\$.05	■ 0-3	This list of Energy Conservation Measures (ECM) is based on LL87 audit data and therefore may be incomplete. Suggested ECM's for each Building Touchpoint are representative, and not necessarily applicable to every building. Variety in specific building systems and condition of equipment must be considered in determining the appropriate packages of ECMs for individual buildings. The first step of any upgrade should be to work with a qualified service provider to develop a scope of work appropriate for your building.
○ Other	🏠 Envelope	\$ \$ \$0.05-\$0.25	■ 3.1-8	
☀ Lighting	🔧 Domestic Hot Water	\$ \$ \$ \$0.26-\$1.00	■ 8.1-12	
🔧 Heating Equipment		\$ \$ \$ \$ >\$1.00	■ >12	

ECM packages: equipment replacement

Beyond simple 'like-for-like replacement' can shorten ROI

Boiler

upgrade burner; insulate condensate tank; upgrade/ install heating controls & sensors; install TRV's; insulate pipes and condensate tank

Roof

add roof / ceiling insulation

Domestic Hot Water

install new DHW controls; insulate pipes and condensate tank

Window

weather stripping; air sealing

equipment replacement

equipment replacement

Replacing a major piece of equipment in a building system when it reaches the end of its useful life can be a crucial opportunity for energy efficiency improvements. While a simple code-compliant, like-for-like replacement may net some savings, with additional planning and investment, a comprehensive system upgrade can maximize lifecycle savings and improve performance. Below are potential related system upgrades for several major building systems, using measures determined by an analysis of the LL87 Energy Audit data combined with expert review.

boiler

Most of NYC large multifamily buildings have boilers that provide heat and hot water to the building, either distributing the heat through steam or circulated hot water. Often, when the boiler fails, much of the auxiliary equipment connected to the boiler can be upgraded to deliver substantial additional savings.

	Baseline Measure	Potential Related Upgrades*	Total
	Replace boiler	Upgrade burner Insulate condensate tank Upgrade/Install heating controls and sensors Install TRVs Insulate pipes and condensate tank	
Cost	\$160,000	+ \$120,000	\$280,000
Annual Savings	\$11,000	+ \$19,000	\$30,000
Simple Payback	15		9

The package estimates are for a 100,000 SF, gas-heated 1-pipe steam building.

*Potential related upgrade cost reflects all measures listed. However, please note, not every measure will apply to every situation.

Turning Data Into Action

building retrofit 'packages': post-war gas low-rise

domestic hot water system

window

Building management and occupants often find a time when it is imperative to replace all of the windows in a building, or at least one or two facades of the building, for a variety of reasons. There are many different window replacement options, usually with very different energy characteristics. Going beyond the lowest cost window options, to include several other related envelope sealing measures, can provide significant energy savings and improvements in tenant comfort.

	Baseline Measure	Potential Related Upgrades*	Total
	Replace Windows	Weather stripping Air sealing	
Cost	\$290,000	+ \$10,000	\$300,000
Annual Savings	\$7,000	+ \$3,000	\$10,000
Simple Payback	40		30 year

The package estimates are for a 100,000 SF, gas-heated building.

Turning Data Into Action

building retrofit 'packages': post-war gas low-rise

roof

When a roof has passed its useful life, and simple repairs are no longer possible or cost-effective, a major capital investment must be made to replace the roof. Accompanying this replacement with additional measures could improve the lifecycle economics of this replacement.

	Baseline Measure	Potential Related Upgrades*	Total
	Replace roof	Add roof/ceiling insulation	
Cost	\$140,000	+ \$71,000	\$211,000
Annual Savings	\$0	+ \$5,000	\$5,000
Simple Payback		14	

The package estimates are for a 100,000 sf, gas-heated building. Payback only (14 years) for incremental cost of related upgrade.

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equipment replacement: boiler

boiler

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Simple Payback	15		9

The package estimates are for a 100,000 SF, gas-heated 1-pipe steam building.

path forward

Build the Potential

- Improve Energy Audits & data collection
- Case Studies - proof of concept
- Confirm outcomes & savings
- Inform policies & codes

Show the Way

- 'Tear-sheets' & BE-Ex programs
- Retrofit Accelerator
- 'Better Steam Heating' campaign
- Additional targeted campaigns -
Ventilation & sealing

Make the Business Case

- Scale the market for energy efficiency

be
ex

building
energy
exchange

thank you.

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