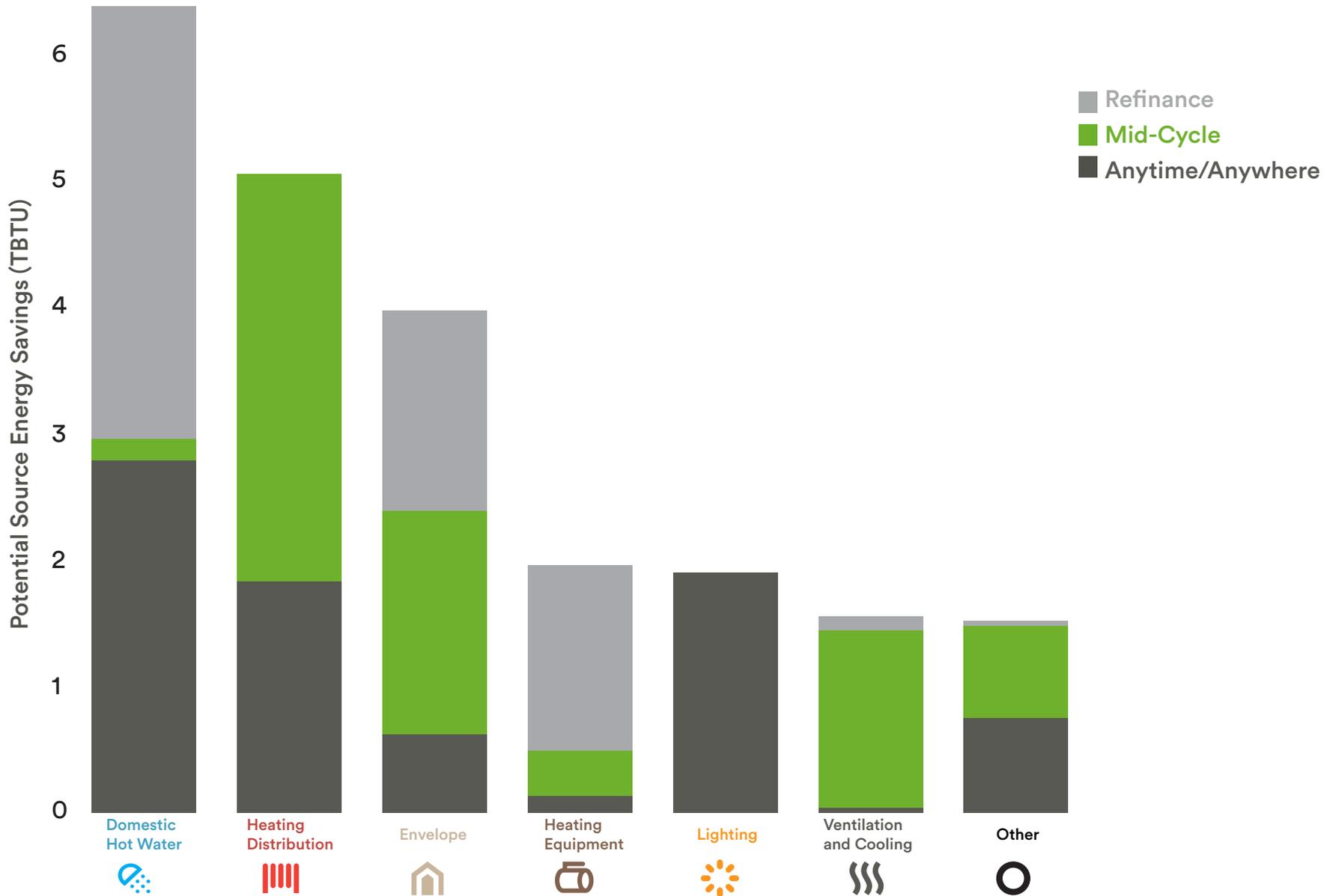


touchpoints

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 the most relevant 'pathway' milestones in a building's lifecycle, that can improve value and performance.

Typical Building Characteristics

Age	1947–1979
Height	7 stories or fewer
Size	--
Facade	Masonry
Construction	--
Heating System	Hydronic baseboard or fan coil
Heating Fuel	Gas
Ventilation System	Central ventilation or natural ventilation
Cooling	Through-wall AC

post-war gas low-rise

Energy Conservation Measure	Building Touchpoint				Equipment Replacement				Payback (years)	Cost per SF	Energy Savings per SF
	Anytime/ Anywhere	Midcycle Retrofit	Refinancing/ Substantial Retrofit	Tenant Turnover	Boiler	Water Heater	Chiller	Domestic Hot Water			
Install Exhaust Fan Timers	*	*	*					⌋	4.9	\$	■
Install Demand Control Ventilation			*					⌋	20.6	\$\$	■
Install Submetering		*	*						2.2	\$\$\$	■
Install Solar/Photovoltaic		*	*						16.8	\$\$\$	■
Upgrade Motors		*	*					⌋	5.7	\$\$	■
Upgrade lights		*	*					⌋	2.8	\$	■
Sensors		*	*						4.2	\$	■
Burner Measures			*					⌋	6.5	\$\$	■
Boiler Measures			*					⌋	34.7	\$\$\$\$	■
TRVs and Zones		*	*	*				⌋	6.5	\$\$\$	■
Controls and Thermostats		*	*	*				⌋	2.5	\$\$	■
Insulate Condensate Tank	*	*	*	*				⌋	2.5	\$	■
Insulate Pipes	*	*	*	*				⌋	2.0	\$	■
Install or Upgrade Master Venting	*	*	*	*				⌋	2.9	\$\$	■
Replace Windows and Glazing			*					⌋	62.0	\$\$\$\$	■
Increase Insulation - Wall			*					⌋	36.5	\$\$\$\$	■
Increase Insulation - Roof			*					⌋	34.2	\$\$\$\$	■
Air sealing	*	*	*					⌋	6.1	\$\$	■
Add Window Films		*	*					⌋	75.2	\$\$\$\$	■
Separate DHW from Heating			*					⌋	6.4	\$\$\$	■
Install Low-Flow Showerheads	*	*	*	*				⌋	0.9	\$\$	■
Install DHW Controls	*	*	*	*				⌋	0.6	\$	■
Low Flow Aerators	*	*	*	*				⌋	1.4	\$\$	■
Insulate Pipes and Tank	*	*	*	*				⌋	6.0	\$	■



Turning Data Into

Energy Conservation Measure

- ⌋ Domestic Hot Water
- ⌋ Envelope
- ⌋ Heating Equipment
- ⌋ Lighting
- ⌋ Heating Distribution
- ⌋ Other
- ⌋ Ventilation & Cooling

Equipment Replacement

- ⌋ Windows
- ⌋ Ventilation Fans
- ⌋ Domestic Hot Water Heater
- ⌋ Roof
- ⌋ Chiller
- ⌋ Boiler

Cost per Square Foot

- \$ <\$0.05
- \$\$ \$0.05-\$0.25
- \$\$\$ \$0.26-\$1.00
- \$\$\$\$ >\$1.00

Energy Savings per SF (kbtu)

- 0-3
- 3.1-12
- 12.1-30
- >30

ECM packages: post-war gas low-rise

post-war gas low-rise

Energy Conservation Measure	Building Touchpoint				Equipment Replacement						Payback (years)
	Anytime/ Anywhere	Midcycle Retrofit	Refinancing/ Substantial Retrofit	Tenant Turnover							
 Install Exhaust Fan Timers	•	•	•								4.9
 Install Submetering		•	•								2.2
 Install Solar/Photovoltaic			•								16.8
 Upgrade Motors		•	•								5.7
 Upgrade lights		•	•								2.8
 Sensors		•	•								4.2
 Burner Measures			•								6.5
 Boiler Measures			•								34.7
 TRVs and Zones		•	•	•							6.4
 Controls and Thermostats		•	•	•							2.5
 Insulate Condensate Tank	•	•	•								2.5
 Insulate Pipes	•	•	•								2.0
 Install or Upgrade Master Venting	•	•	•	•							2.9
 Replace Windows and Glazing			•								62.8
 Increase insulation - Wall			•								36.0
 Increase insulation - Roof			•								33.3
 Air sealing	•	•	•								5.7
 Separate DHW from Heating			•								6.4
 Install Low-Flow Showerheads	•	•	•	•							0.9
 Install DHW Controls	•	•	•								0.6
 Low Flow Aerators	•	•	•	•							1.4
 Insulate Pipes and Tank	•	•	•								6.0

ECM Package Totals*

Cost (sum for 100000 SF)	\$20,800	\$79,200	\$543,000	\$55,300
Savings (sum for 100000 SF)	\$11,700	\$27,300	\$41,200	\$19,300
Payback (years)	1.8	2.9	13.2	2.9

*For a typical 100 unit, 100,000 SF building

ECM packages: equipment replacement

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

Boiler

burner upgrades; controls;
sensors; TRV's; insulation;
inflate condensate tank

Domestic Hot Water

separate boiler for domestic
water; new controls;
insulation

Roof

roof / ceiling insulation;
sealing airshafts; consider
solar options

Window

weather stripping; air sealing
windows, doors, a/c's

Ventilation Fans

car dampers; VFD's; exhaust
fan timers; demand control
ventilation; insulate ducts

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. 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

Over [XX%] 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 controls and sensors Install TRVs	
Cost	\$161,900	+ \$116,700	\$278,400
Annual Savings	\$12,700	+ \$29,400	\$42,100
Simple Payback	12.8 year	--	6.6 year

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

domestic hot water system

After space heating, domestic water heating (for showers, baths, dishwashing, etc.) is usually the largest energy consumer in multifamily buildings, often representing [XX%] of the total common area consumption. Additionally, in many buildings, the same boiler provides for water and space heating, which requires firing up a much larger boiler. During summer and shoulder months, buildings have dramatically higher energy losses from oversized boilers. In some cases, installing a smaller, separate boiler for domestic water heating in summer can be very cost-effective. However, the authors, in consultation with members of the advisory committee, believe that this measure is over-recommended in the LL87 audits, and often does not have the savings that some auditors project.

	Baseline Measure	Potential Related Upgrades*	Total
	Replace boiler	Install new DHW controls Insulate pipes and condensate tank	
Cost	\$45,500	+ \$6,900	\$52,500
Annual Savings	\$10,400	+ \$4,600	\$15,000
Simple Payback	4.4 year	--	3.5 year

The package estimates are for a 100,000 SF, gas-heated 1-pipe steam building; domestic hot water tied to the boiler.

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



Turning Data Into Action

Window

Building management and occupants often find a time when it is imperative to replace all 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 characteristics as well as aesthetic issues. Going beyond the lowest cost window to include several other related envelope sealing measures, can provide significant savings and an improvement in tenant comfort.

	Baseline Measure	Potential Related Upgrades*	Total
	Window replacement	Weather stripping Air sealing of windows, room ACs and exterior doors	
Savings	\$288,800	+ \$10,000	\$298,800
Payback	\$7,900	+ \$2,200	\$10,000
	36.7 year	--	29.7

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

equipment replacement

equipment replacement: boiler

boiler

The majority 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 controls and sensors Install TRVs	
Cost	\$161,900	+ \$116,700	\$278,400
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Simple Payback	12.8 year	--	6.6 year

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
- Pilot projects - proof of concept
- Confirm outcomes & savings
- Inform policies & codes

Show the Way

- Retrofit Accelerator
- 'Better Steam Heating' campaign
- Additional targeted campaigns

Make the Business Case

- Create market for energy efficiency

be
ex

building
energy
exchange

thank you.

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