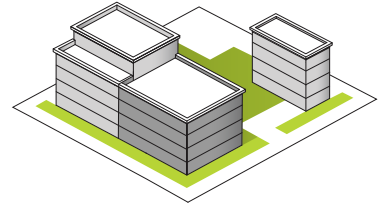









# Playbook Summary: Pre-War 4-7 Stories

These buildings, typically between 4 and 7 floors in height, are found in virtually every context, from lot-line to free standing buildings. Buildings in this typology rarely include mixed uses and/or tenant amenities. Though limited in height, the layout of these buildings can vary considerably, with different arrangements of courtyards and street-facing facades.

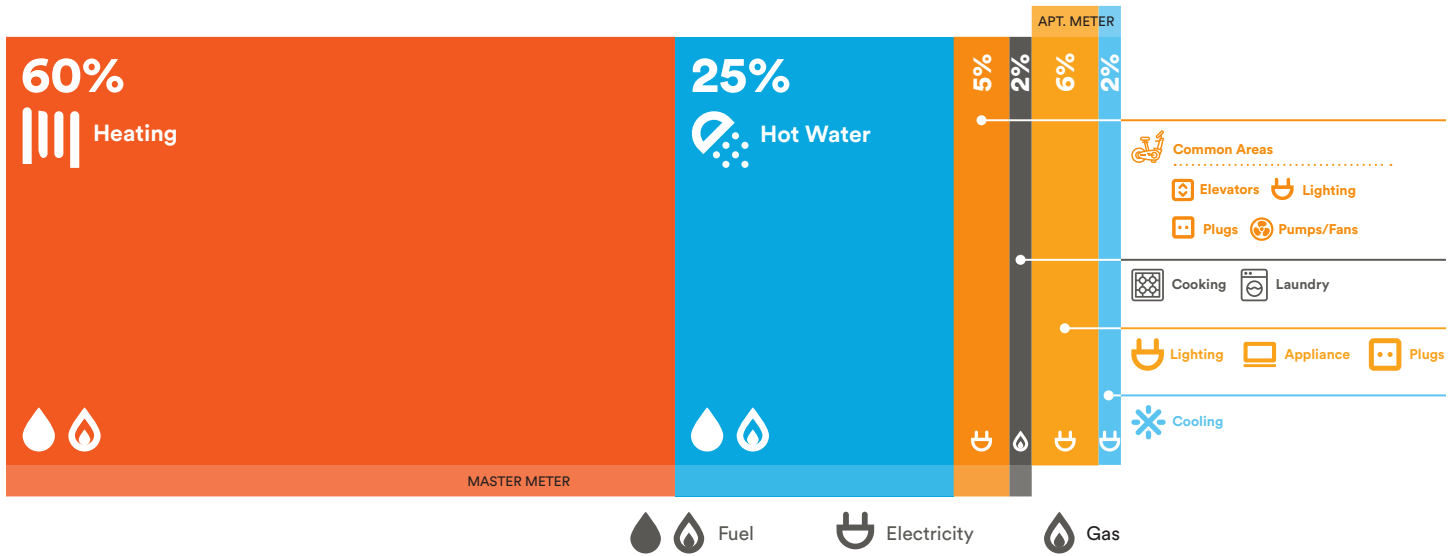
Download Full Playbook →

<https://be-exchange.org/report/lowcarbonmultifamily-prewar-low/>



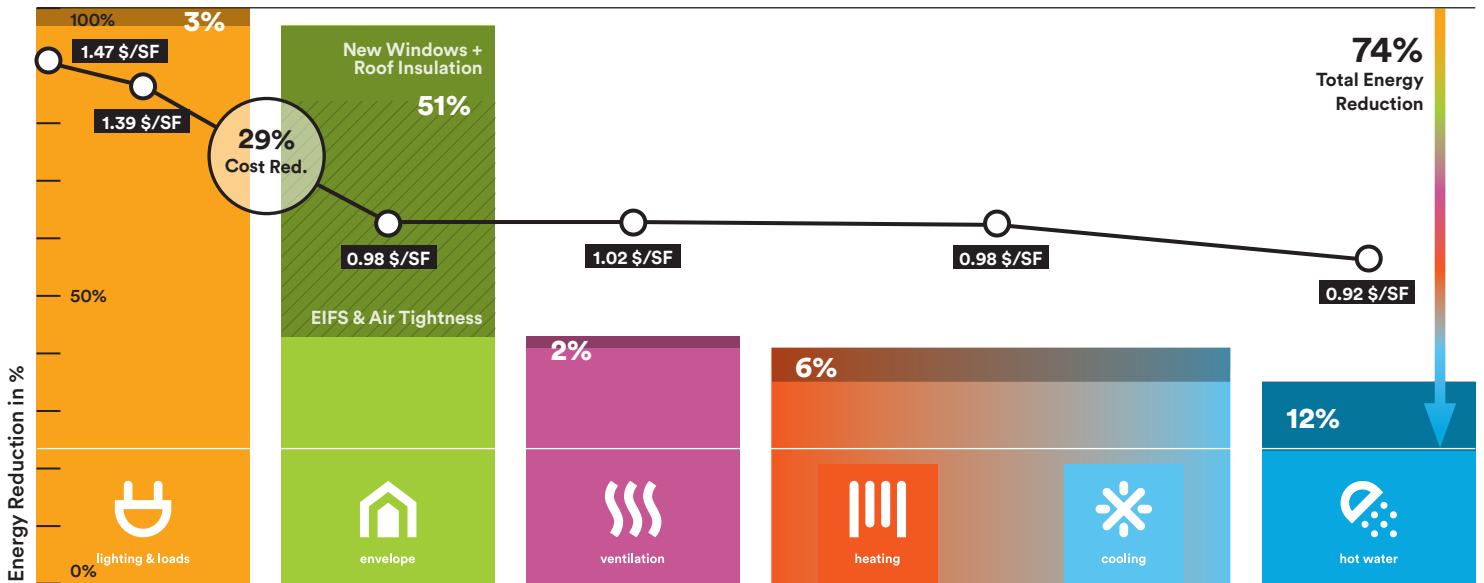
ELEMENTS		ISSUES		Retrofit Strategies		Recommended Targets	
<b>EXTERIOR WALLS</b> Typically simple load bearing masonry with punched window openings.	<ul style="list-style-type: none"> <li>- Often no insulation</li> <li>- Often no air barrier</li> <li>- Major thermal bridges at corners and parapet walls</li> </ul>		<b>ROOF</b>			Whole Building U-value 0.09 Btu/hr.ft²	
			→ Insulate Roof	→ Minimum of R-30			
<b>WINDOWS</b> Both wood and aluminum common, typically double-hung frames without thermal breaks, single glazing or weak double glazing common.	<ul style="list-style-type: none"> <li>- Little thermal resistance</li> <li>- Air leakage high</li> <li>- Major comfort issues</li> <li>- Condensation risk</li> <li>- Absorb significant solar heat</li> </ul>		<b>EXTERIOR WALL</b>				
			→ Add Interior insulation	→ Minimum of R-20			
<b>HEATING</b> Commonly one-pipe steam systems served by oil or gas fired boiler.	<ul style="list-style-type: none"> <li>- Limited control</li> <li>- Overheating common</li> <li>- High short-term maintenance costs</li> </ul>		→ Add Exterior Insulation	→ Minimum of R-10			
			<b>WINDOWS</b>				
<b>COOLING</b> Window AC units, sporadically deployed.	<ul style="list-style-type: none"> <li>- Increases whole building U-value</li> <li>- Creates drafty conditions</li> <li>- Major thermal bridge</li> <li>- Noisy, inefficient</li> <li>- Winter removal very rare</li> </ul>		→ Replace Existing Windows with High Performance Windows	→ Recommended U Value 0/167 Btu/hr.ft².F			
			<b>AIR TIGHTNESS</b>				
<b>DOMESTIC HOT WATER</b> Heat exchange at steam boiler with constant recirculation loop.	<ul style="list-style-type: none"> <li>- Requires running steam boiler in shoulder and cooling seasons</li> </ul>		→ Ensure Air Sealing as part of Exterior Wall and Window Upgrades	→ Recommended airtightness 1.0ACH			
			→ Building-Wide VRF System	→ Heating: 3.3 COP @ 47°F Cooling: 4.4 COP			
<b>VENTILATION</b> Natural ventilation only.	<ul style="list-style-type: none"> <li>- No direct fresh air introduction</li> <li>- No exhaust from bathrooms or kitchens</li> </ul>		→ Mini Split Heat Pumps	→ Heating: 3.3 COP and Cooling: 4.4 COP			
			→ Building-Wide Hydronic Loop + Hybrid ACs	→ Heating: 2.3 COP Cooling: 2.2 COP			
			→ Decentralized Energy Recovery Ventilation System	→ Sensible Heat Factor : 80% Max Fan Power 0.76 W/cfm			
			→ Air to Water Heat Pump	→ Min. COP: >2.2			
			→ Water to Water Heat Pump	→ Min. COP: >3.1			
			<b>LIGHTING</b>				
			→ High Efficiency Common Area Lighting	→ 50% Reduction in W/SF			
			<b>PLUG LOAD</b>				
			→ High Efficiency Appliances and Smart Systems	→ 55% Reductions in Plug Loads			

# Energy Use Analysis



# Energy & Cost Reductions by Phase

■ = Energy use   
 ■ = Energy reduction per phase   
 ↓ = total Energy Reduction   
 ○ = Energy cost per SF



## Takeaways:

To meet future stringent efficiency and carbon regulations, buildings' upgrades should be approached proactively and not as a response to a system's failure or tenant's turnover. Building owners must also consider the long-term advantages of planning, scheduling, and testing based on recommended performance targets that work in concert with the envelope, HVAC systems, water, lighting controls, and other systems. Taking the initiative

to actively ensure each component is working at its intended operating capacity while providing continuing maintenance to the building's equipment is critical, cost-effective, and most likely result in health and comfort benefits.

## Resources

Other Playbooks → <https://be-exchange.org/lowcarbonmultifamily-main/>