



Building Upgrades: Upfront Costs and EUI

There are many ways to reduce your building's energy use and meet your energy efficiency targets for Energize Denver. This guide covers the most common upgrade options, what they typically cost and their impact on your building's energy use intensity (EUI).

Every building is different. An energy consultant can help you figure out which improvements make the most sense for yours.

LED LIGHTING

Replacing older lighting with LED lighting is one of the simplest and most cost-effective upgrades a building can make. LEDs typically use 50-60% less electricity than older lighting technologies, and the payback period is usually three to five years.

\$ Upfront Costs: Low | **EUI Reduction:** Good | **Notes:** Low cost, fast payback.

CONTROLS UPGRADES

Controls upgrades optimize how your building's systems operate. Simple examples include installing occupancy sensors to control lighting, scheduling equipment to match occupied hours or installing programmable thermostats.

More advanced strategies include temperature or static pressure reset controls or optimized economizer operation (an HVAC option that uses outside air to help heat or cool a building when conditions allow).

A controls or recommissioning contractor can identify specific opportunities in your building. Costs are generally low relative to the savings.

\$ Upfront Costs: Low | **EUI Reduction:** Fairly good | **Examples:** Temperature or static pressure reset, economizing, scheduling, demand-controlled ventilation.



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DOMESTIC HOT WATER

When considering domestic hot water (DHW) upgrades, a good first step is reducing water use with low-cost fixtures like aerators, low-flow showerheads and pre-rinse spray valves. Adding pipe insulation, especially on circulation loops, can further reduce energy loss.

Once water use is reduced, upgrading the DHW units themselves can have a meaningful impact. Two main options to consider:

- **Condensing gas-fired water heaters** are typically 95% efficient, offering 10-25% reduction in gas use compared to conventional units. Upfront costs are low to moderate, with good EUI reduction.
- **Heat pump water heaters** eliminate gas use entirely. They come in several configurations, including split-systems, centralized plants, distributed systems and hybrid systems with gas backup. Upfront costs are moderate, with great EUI reduction.

CENTRAL PLANT AND HVAC

Heating and cooling systems represent some of the largest energy uses in a building. Upgrading them can have a significant impact on EUI. The tradeoff is that these systems are also among the most expensive to replace.

For central plant equipment like chillers and boilers, consult with a contractor and consider an energy consultant to help evaluate your options. Upfront costs are typically high, though EUI reduction can be significant.

For distributed systems like packaged rooftop units or split systems, there are four main upgrade paths:

- **High-Efficiency Like-For-Like:** Replaces existing systems with more efficient versions of the same type. Offers modest EUI reduction. Carries the lowest upfront cost of all options.
- **Heat Pumps:** All-electric systems that handle both heating and cooling. Offer excellent EUI reduction — with stronger savings for buildings on consumption-only rate schedules. Carry first costs typically 20–30% higher than like-for-like replacements, though rebates can often offset a portion of that difference.
- **Dual Fuel Heat Pumps:** A hybrid approach that uses electric heat pump operation most of the time and gas-fired backup during peak heating periods. Offer great EUI reduction. Carry higher first costs, often partially offset by rebates. Best suited for buildings subject to electric demand charges, as the gas backup avoids costs associated with electric demand penalties.
- **Window-Mounted Heat Pumps:** Plug-and-play units that mount in double-hung windows. Offer excellent EUI reduction. Carry low upfront costs with minimal installation complexity. Best suited for multifamily apartment buildings.



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Other measures worth considering: variable-air-volume conversions, variable frequency drives and premium efficiency motors on pumps and fans.

An energy consultant can help you determine the best fit for your building and rate schedule.

SOLAR PHOTOVOLTAIC SYSTEMS

Solar photovoltaic (PV) systems generate electricity from sunlight and can reduce your building's energy costs and EUI. Because solar (without battery storage) reduces electricity consumption, but not typically electricity demand, buildings on consumption-only utility rate schedules tend to see the greatest long-term cost savings.

For Energize Denver purposes, onsite solar systems located within the City and County of Denver receive a 1.5x multiplier on EUI reduction credit.

\$ Upfront Costs: Moderate to High | **EUI Reduction:** Good | **Notes:** Solar PV systems typically last 25+ years. If you have an aging roof, consider replacing it before installation.

ENVELOPE IMPROVEMENTS

Envelope improvements typically include roof replacement, added insulation and window upgrades. These measures reduce heating and cooling loads by improving how well your building retains or blocks heat.

The energy savings from envelope improvements are real, but they are relatively modest compared to the cost of the work. As a result, these improvements generally make the most sense when they are needed for other reasons, such as replacing aging infrastructure, improving occupant comfort, preparing for a rooftop solar installation or accommodating window-mounted heat pumps.

\$ Upfront Costs: High | **EUI Reduction:** Low | **Typical Drivers:** Occupant comfort, aging infrastructure, solar PV readiness.



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UPGRADE ECONOMICS AT A GLANCE

The costs, EUI reductions and savings-to-investment ratios (SIR¹) ranges in the table below are averages based on typical installations. Actual results will vary depending on your building's size, existing systems, utility rate schedule and other factors. Work with an energy consultant to get a more accurate picture for your specific building.

Improvement	Avg Cost/SF	Avg EUI Reduction	Avg SIR
Programmable Thermostats	Free–\$0.35	3.9–4.3	4.2–4.6
Controls Adjustments	\$0.10–\$0.30	2.6–3.0	14.0–16.0
LED Lighting	\$0.40–\$0.50	0.8–1.2	1.9–2.3
Domestic Hot Water	\$0.70–\$0.80	5.4–5.8	1.0–1.4
Boilers	\$2.50–\$2.75	8.1–8.5	0.3–0.5
Solar PV Systems	\$3.50–\$3.75	6.0–6.4	1.1–1.5
Insulation	\$4.00–\$4.30	2.7–3.1	0.3–0.5
Windows	\$4.50–\$4.75	5.8–6.2	0.01–0.2
High-Efficiency HVAC	\$4.50–\$4.90	7.5–7.9	0.4–0.6
Heat Pumps	\$5.85–\$6.37	19.7–20.1	0.0–0.5
Roof	\$9.50–\$10.00	1.5–1.9	0.01–0.1

¹ SIR = savings to investment ratio; the utility cost savings of an improvement over its estimated useful life, divided by the investment (first cost plus any costs associated with financing the improvement)

ENERGIZE DENVER HELP DESK

Need more information on energy-saving improvements or additional guidance from our team? Reach out to our help desk:

 Hours 8 AM–5 PM, M–F	 Phone (844) 536-4528	 Email for Buildings  25,000 sq. ft. and larger: energizedenver@denvergov.org
 Schedule a Phone Appointment: energyreporting.as.me/appointment		 5,000 – 24,999 sq. ft.: energizesmallbuildings@denvergov.org