These case studies illustrate the impact of energy efficiency retrofits in Minnesota’s multifamily housing stock, including substantial reductions in building operating costs and increases in tenant comfort. Each offers an overview of a project, including information on cost, energy savings, rebates, and financing. They include projects across a range of scales from boiler controls in townhomes to significant upgrades involving mechanical and envelope improvements.

Affordable housing is critical for low-income Minnesota residents, but many affordable multifamily housing units are in need of repair and come with high energy bills. Increasing the energy efficiency of multifamily rental housing saves energy, improves residents’ health and comfort, and helps to maintain reasonable living costs. Improving the efficiency of these buildings also helps Minnesota meet its Conservation Improvement Program energy savings goals and contributes to the preservation of the state’s affordable housing stock.

For more information and ways to act, visit: http://www.mnshi.umn.edu/program/EE4A
To learn more about the importance of choosing healthy, non-toxic building materials for energy efficiency retrofits, visit: http://www.bgadata.org/EEHousingProducts/about/about-database
Concordia Arms is a 125-unit renovation project of a 1979 existing senior living apartment building that provides senior Section 8 housing. The project includes seven units designed for the Long-Term Homeless, with additional units serving people with disabilities and special needs. Concordia Arms consists of 124 one-bedroom units and one two-bedroom unit.

CommonBond undertook a renovation of Concordia Arms apartments with key strategies to reduce energy consumption and save on future utility costs. The project participated in Xcel Energy’s Energy Design Assistance (EDA) program to optimize energy conservation strategies. These strategies significantly reduce operation costs, helping to preserve much needed affordable housing for seniors. The goals of the project align with CommonBond’s mission to build stable homes, strong futures, and vibrant communities.

SOLUTIONS
The renovation made key improvements to address several concerns. An upgraded mechanical system was installed to maintain a consistent temperature in the corridors. The existing system, which did not provide cooling to the corridors, caused large temperature swings in the summer months.

Improvements to the building shell included new Pella® fiberglass-framed windows for energy efficiency and resident comfort. The inclusion of...
new through-wall A/C sleeves was considered critical to reduce infiltration and drafts in the apartments.

Lighting upgrades included the installation of common area LED lighting and fluorescent lighting in the apartments, saving over $20,000 a year in electricity.

In addition to the energy measures, CommonBond carried out a water conservation retrofit using low-flow toilets, showerheads, and faucets. A new EPA WaterSense®-certified, zoned, drip irrigation system around the building was also installed.

**BENEFITS**

Prior to the renovation, Concordia Arms community space had a door that went directly to the exterior courtyard. Resident Joyce Ewest noted, “People were complaining that cold air was coming directly into the dining room.”

The renovation included the addition of an airlock vestibule that not only reduces energy loss, but also provides a more comfortable community dining room where residents are served a daily meal and socialize. Ewest said, “When people come in and out of the cold, it no longer affects the people inside.”

Joyce Ewest, Concordia Arms resident

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**PROJECT SUMMARY**

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<td>PROJECT TOTALS</td>
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Rebate, energy, and cost savings reported by Xcel Energy Design Assistance program

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**THE BACKSTORY**

Concordia Arms was at risk of losing its federal subsidies because of its expiring Housing Assistance Payment (HAP) contract, the maturing of its mortgage, and minimal capacity of the former owner entity, prompting Concordia Arms, Inc. to refinance the project through Minnesota Housing Finance Agency. At a cost of $35,000 per unit (for energy and other upgrades), the preservation and rehabilitation of these existing housing units is extremely cost effective.

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Joyce Ewest, Concordia Arms resident

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Energy Efficiency in Affordable Urban Living

ELLIO T APARTMENTS, NONPROFIT HOUSING FOR FAMILIES AND INDIVIDUALS, MINNEAPOLIS, MINNESOTA

PROJECT SUMMARY

HVAC
- 95% condensing gas boilers
- ENERGY STAR® wall A/C
- ENERGY STAR® 2-speed bathroom fans

DOMESTIC HOT WATER
- 90% efficient domestic hot water

ENVELOPE
- Pella® Impervia® windows (U-0.31)
- Roof insulation (R-50)
- Air sealing

LIGHTING & APPLIANCES
- LED lighting in common areas and exterior
- ENERGY STAR® refrigerators
- Common area occupancy sensor

Elliot Apartments, a 1900s-era 24-unit apartment building for low-income families and individuals, consists of eighteen two-bedroom units and six one-bedroom units. It includes six units designated for the formerly homeless and 18 units affordable to households at 50 percent or less of area median income.

Project for Pride in Living’s (PPL) Elliot Apartments building was in need of repairs and energy efficiency updates to ensure that it could continue to provide affordable homes into the future. In particular, inefficient mechanical systems, old windows, and drafts compromised resident comfort and caused high utility bills. PPL participated in Xcel Energy and CenterPoint Energy’s Energy Design Assistance program to optimize energy conservation strategies and obtain access rebates. Energy modeling and project performance was carried out by The Weidt Group as part of the program, helping to maximize the impact of the $187,487 energy improvement investment.

SOLUTIONS

The project reduced energy use by improving efficiency and reducing demand. The heating system was replaced with a new 95 percent efficiency condensing gas boiler and new fin tube radiators. This replacement accounted for the highest portion of energy cost savings with an estimated payback of 5.3 years. New ENERGY STAR® 9.78 energy efficiency ratio (EER) wall air conditioning units reduce electric use in the cooling season. Bathroom ventilation was also updated to ENERGY STAR® exhaust fans.

PERFORMANCE OUTCOMES:

- 27% REDUCTION IN TOTAL ENERGY CONSUMPTION
- 19% DECREASE IN TOTAL ENERGY COSTS
The new hot water heaters run at 90 percent efficiency due to a dual tank system, which decreases energy use by running one boiler during the summer. The second boiler only fires when demand requires additional heating. The boiler sequencing can be reversed, extending the life span of the equipment and providing redundancies if one boiler were to fail. In addition, recirculation pumps were installed to keep the water ready for use rather than sitting idle and cooling in the supply lines.

Lighting energy use was decreased by placing occupancy sensors in storage, mechanical/electrical, and laundry rooms. Incandescent fixtures in both the exterior and interior were replaced with LED lights. The LED package is expected to reduce electric bills by 60 percent.

The old windows and high infiltration rates were responsible for 66% of the energy losses through the envelope. New windows and air sealing helped to drive down overall energy demand.

**Benefits**

Excluding the windows, the project has a seven and a half year payback (26 years with the windows). In addition to energy and cost savings, resident comfort has been improved. Prior to the renovation, tenants regularly complained about cold and drafty units due to old windows with aluminum framing. The new windows have removed the draftiness felt in the units. Furthermore, the new windows have helped to mitigate noise coming from the interstate, located less than a block away.

**Background**

The building is one of 10 buildings included in PPL’s DECC Recapitalization Project funded by Minnesota Housing, the City of Minneapolis, and grants. The project refinanced, renovated, and stabilized 10 existing affordable apartment buildings, preserving affordability in a south Minneapolis neighborhood.

The renovation of the building was a good fit for PPL, which has a long history of housing development and works to provide energy efficient and healthy indoor environments for low- and moderate-income families.

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Aeon’s Sienna Green I Apartments is a 120-unit, moderate renovation project of a 1965, five-building apartment complex in suburban Saint Paul. Formerly known as the Har Mar Apartments, the development provides rents affordable for households earning 50 percent of the area median income (AMI), and has 17 units without income restrictions. The project also includes six units designated for individuals transitioning out of homelessness earning 30 percent or less of the AMI. The renovation was the first phase of a project that included construction of a 50-unit apartment building consisting of one- two- and three-bedroom apartments to serve area families.

Sienna Green I Apartments were in need of significant upgrading. The project undertook replacement of all major mechanical systems, and improved the building envelope. The project team took on the challenge of maximizing the investment with pre-design assistance from the Center for Energy and Environment and Xcel’s Energy Design Assistance program. The project included improvements to the envelope, mechanical, and plumbing.

**PROJECT SUMMARY**

**HVAC**
- Condensing gas boilers (95% efficiency)
- High-efficiency common area heating (90% AFUE)
- ENERGY STAR® wall air conditioning units (9.4 EER)
- ENERGY STAR® bath exhaust, 2-speed fans

**ENVELOPE**
- R-40 roof assembly with a white membrane
- Building air sealing
- Fiberglass framed double pane low E with argon windows (U-0.3)

**LIGHTING & APPLIANCES**
- CFL unit and common area lighting
- ENERGY STAR® refrigerators

**DOMESTIC HOT WATER**
- High-efficiency domestic hot water

**SOLUTIONS**

Due to the poor condition of the existing mechanical systems, their replacement was a forgone conclusion. Thus decision making focused on finding additional incremental energy and cost savings above code minimums. The existing boilers were original to the buildings. The buildings were overheated due to multiple controls and thermostats. New 95 percent efficient condensing gas boilers now feed the...
CASE STUDY: Moderate Renovation for Affordable Suburban Living  
SIENNA GREEN I

“...preserving and investing in existing buildings is a key part of sustainability.”
— James Lehnhoff, Aeon, Vice President of Housing Development

PROJECT OVERVIEW

DEVELOPER/OWNER Aeon
UNITS 120 BUILDINGS 5
YEAR OF CONSTRUCTION 1965
YEAR OF RENOVATIONS 2010
UTILITY PROVIDER Xcel Energy
ELECTRICITY/GAS Master-metered
HEATING Hot water boiler
COOLING Through-wall A/C units
UTILITY PAYMENT STRUCTURE Owner-paid heat and hot water

PROJECT SUMMARY

INCREMENTAL ENERGY IMPROVEMENT COST | Rebate | ANNUAL COST SAVINGS | ANNUAL ENERGY SAVINGS
--- | --- | --- | ---
HIGH-EFFICIENCY BOILER | $76,045 | $4,676 | $5,082 | 466,200 kBtu
>92% EFFICIENT WATER HEATER | $6,430 | $872 | $1,864 | 171,000 kBtu
PROJECT TOTALS | $82,475 | $5,548 | $6,946 | 637,200 kBtu

Rebate, energy, and cost savings reported by Xcel Energy Design Assistance program

For more information and ways to act, visit: [http://www.mnshi.umn.edu/program/EE4A](http://www.mnshi.umn.edu/program/EE4A)
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baseboard radiators controlled in the units by thermostats. They provided the largest portion of total cost savings with an estimated payback of 15 years without incentives. New ENERGY STAR® wall air conditioning units (EER 9.4) and sleeves were also installed.

The new domestic hot water heaters run at more than 92 percent efficiency and replace heaters of various ages and efficiencies. The incremental cost of improving the efficiency from a code based 80 percent to high efficiency was $6,430. The resulting annual energy cost savings of $1,864 produces a payback of 3.4 years.

BENEFITS

Sienna Green I received an incentive for energy-efficient construction for the improvements made to the building shell, which improved resident comfort in addition to providing energy and cost savings. Measures included insulation upgrades and window replacement of the original single-pane windows, which had failed.

The lighting retrofit included indoor and outdoor common areas, and the installation of new ENERGY STAR® fixtures and of CFLs in the remaining fixtures in the units. The lighting upgrades not only reduced energy costs with short paybacks of a few months to a year, but also improved the quality of light in the units and across the development.

BACKGROUND

Aeon’s Sienna Green I was a sustainable development pilot project. In addition to producing energy and cost savings, the renovation significantly improved the quality of the indoor environment. The project transformed existing, sprawling parking lots into a vibrant apartment community surrounded by green spaces laced with rain gardens and a new play area.