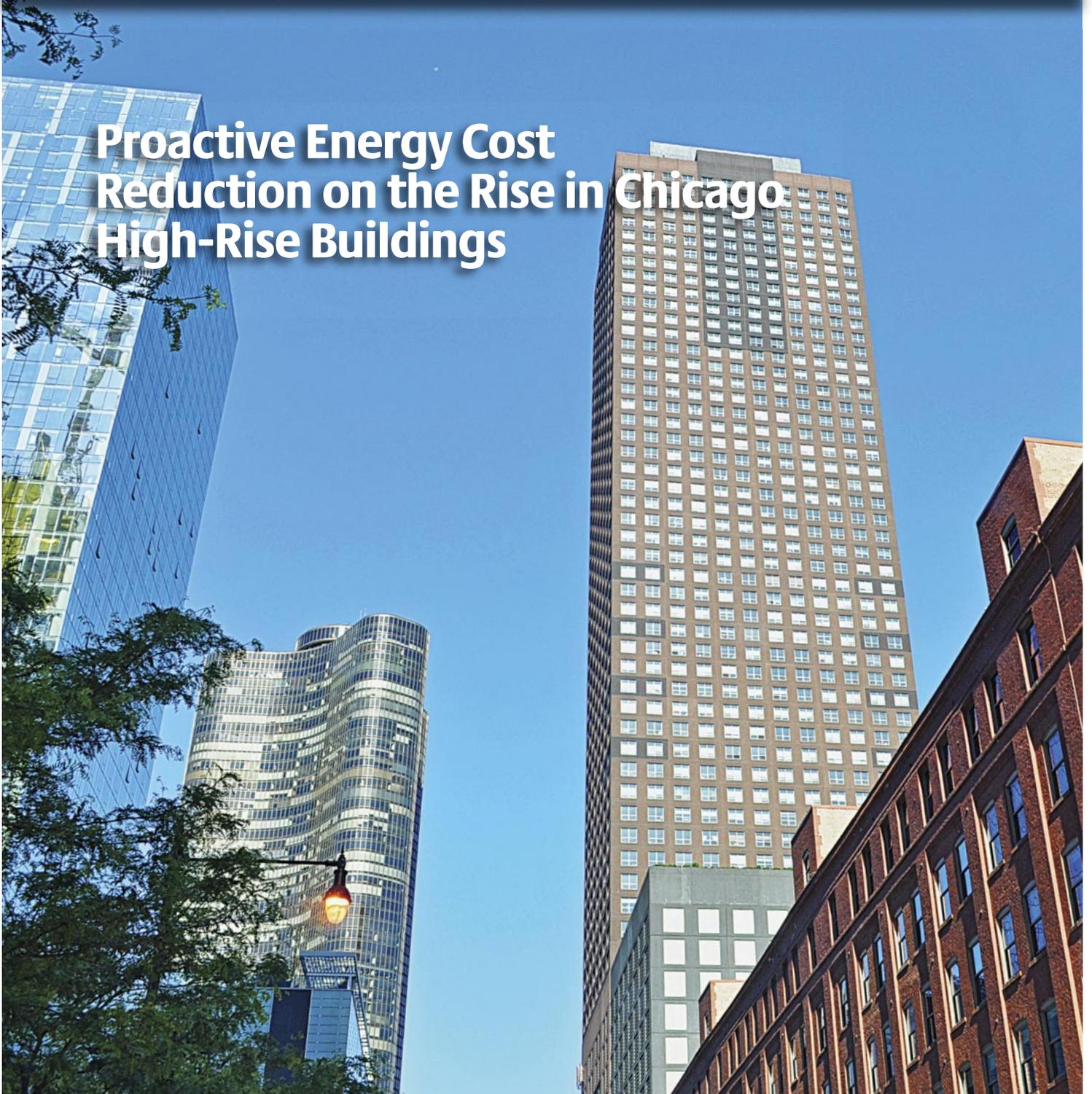


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**Proactive Energy Cost
Reduction on the Rise in Chicago
High-Rise Buildings**



Proactive Energy Cost Reduction on the Rise in Chicago High-Rise Buildings

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Over the course of the last several years, the City of Chicago has increased its focus on promoting energy efficiency for buildings of all types. Beginning with its participation in the C40 program, followed by voting to approve the Energy Use Benchmarking Ordinance 2015, the City of Chicago has not been silent about its desire to be a national leader when it comes to energy efficiency and reducing carbon emissions.

In recent years, the City of Chicago has seen an increase in the construction of new high-rise residential buildings. With the City of Chicago's push for energy efficiency, new high-rise residential buildings are held to a modern standard of energy performance and must participate in the City's sustainability program. Considering this growing focus, there is added pressure on existing high-rise residential buildings to lower their energy costs to maintain a competitive position in the market. An increasing number of building owners and managers within the City of Chicago are having energy audits performed for their high-rise residential buildings that are focused on identifying opportunities to lower energy costs while considering a practical approach that takes into account each opportunity's overall value to the building's owners and occupants.

One such building undertaking a proactive approach to lower their energy cost is the existing 474 North Lake Shore Drive high-rise condominium building located in the Streeterville neighborhood of Chicago. The proactive approach that Elara Engineering identified and ultimately implemented by the 474 North Lake Shore Drive Condominium Association has resulted in a 23% reduction in relative energy costs since 2007 which translates to a savings of \$127,920 annually.

474 N. Lake Shore Drive

474 North Lake Shore Drive Condominium is a 61-story high-rise building constructed in 1991, with approximately 505 condominium units, a multi-level parking garage, and residential amenity spaces. The exterior building envelope is comprised of primarily concrete, brick, and glass. The square footage of the building is broken down as follows:

- 558,000 ft² of residential area
- 242,000 ft² of parking garage and amenity areas

Space heating for the building is accomplished via a central atmospheric hot water boiler plant which is original to the building. The boiler plant supplies hot water directly to common area air handling equipment, condominium fan coil units, and a water-to-water heat exchanger located on the 15th floor. The water-to-water heat exchanger serves air handling units (lobby, retail, fitness area, and pool), unit heaters, and fin tube radiation for the parking garage.

The building's cooling is provided by a central chiller plant located in the lower mechanical penthouse. The chiller plant consists of (1) a 455-ton centrifugal water cooled chiller which is original to the building and (2) 250-ton turbocor multiple compressor chillers which were installed in 2018. Heat rejection for the chillers is provided by a two-cell cooling tower that is also original to the building. Similar to the boiler plant, the chiller plant



➤ Packaged Pool Air Handling Unit

serves the common areas and residential fan coil system. A water-to-water heat exchanger installed in the 15th floor mechanical space serves the lower floors.

Domestic hot water for the building is provided by a total of three (3) heaters: (2) new condensing heaters installed in 2015 and (1) older non-condensing heater. A new triplex booster pump installed in 2017 system located in the basement of the building provides flow and pressure for the building's domestic cold water.

Ventilation for the building is provided by (2) makeup air units (MAUs) that provide conditioned outside air to the building in order to "make-up" for the air that is exhausted through the central exhaust systems. There are also general exhaust fans, kitchen exhaust fans, toilet exhaust fans, and dryer exhaust fans that reject air from the bathrooms, kitchens, and dryers in the residential condominium units. The exhaust system was designed to



➤ *Water-Cooled Chiller located in the Mechanical Penthouse*

be variable, so the fan speeds modulate using variable frequency drives (VFDs).

The current building control system consists of a web interfaced building automation system which governs all the mechanical equipment.

Energy Efficiency Improvements

Beginning with an energy audit prepared by Elara in 2008, the Condominium Association at 474 North Lake Shore Drive has kept a consistent focus on the energy performance of their building and continuously implemented energy conservation recommendations identified in their 2008 energy audit. Further, they have updated their energy audit multiple times including in 2011 and 2015 to continually recognize energy efficiency opportunities and to quantify the savings associated with improvements that have already been made. The following table shows the normalized natural gas and

electricity consumption for the building in 2007 prior to the energy audit and subsequent years thereafter once energy efficiency projects were initiated:

The following summarizes the energy conservation measures that Elara recommended to improve the energy performance of the building:

Energy Audit Recommendations:

- Additional VFDs on the building's dual temperature pumps
- Changes to the building's chilled water pumping strategy
- Repair of failed bathroom and kitchen exhaust dampers including the installation of VFDs on the bathroom and kitchen exhaust fans
- Sealing of openings in the Elevator Penthouse
- Phased installation of a centralized Building Automation System

- Installation of free cooling for the Elevator Penthouse

2011 Energy Audit Update Recommendations:

- Installation of condensing domestic hot water heaters
- Continued phased installation of the centralized Building Automation System
- Installation of new energy efficient lighting

2015 Energy Audit Update Recommendations:

- Installation of variable speed booster pumps
- Continued phased installation of the centralized Building Automation System
- Installation of high-efficiency chillers
- Replacement of the pool air-handling unit

- Replacement of the fitness center air-handling including converting it from constant volume reheat to variable air volume

Consistent with Elara’s recommended strategy, 474 North Lake Shore Drive chose to initially implement projects which addressed “low hanging fruit” such as controls and VFDs that have a short term payback and reduce the overall load of the building systems. This strategy paid dividends during a 2016 chiller plant replacement. Since the demand of the end user systems (i.e. air handling units, exhaust fans, etc.) was reduced as part of the initial energy efficiency projects, 474 North Lake Shore Drive was able to install new chillers that were smaller in capacity than the existing chillers; resulting in both lower initial and operating costs. The savings associated with this allowed the Condominium Association to fund other energy efficiency upgrades. In total, the above recommendations represented an incremental

Year	Electricity		Natural Gas		Cost	
	Consumption (kWh)	% Change from 2007	Consumption (therms)	% Change from 2007	\$	% Change from 2007
2007	4,225,611	--	329,868	--	\$561,090	--
2009	3,831,922	-9%	338,717	3%	\$536,949	-7%
2013-2014	3,188,442	-25%	307,989	-7%	\$465,370	-17%
2018	2,756,500	-35%	293,822	-11%	\$433,170	-23%

cost of \$900,000 with a payback of less than 10 years and were all implemented by the Condominium Association at 474 North Lake Shore Drive. Additionally, \$58,275 was obtained through utility incentive programs to assist in funding the projects as a result of the energy efficiency improvements implemented.

The proactive approach taken by the building’s management team and the Condominium Association at 474 North Lake Shore Drive has lowered their energy

costs and allowed them to invest further in energy efficiency and other beautification projects that have further enhanced the overall value of their building. With their continued efforts, 474 North Lake Shore Drive serves as an excellent example of energy conservation efforts applied and savings realized without significant inconvenience to building occupants or large-scale capital costs. 



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