

ENERGIZE DENVER

annual report

2017



DENVER
PUBLIC HEALTH &
ENVIRONMENT

CONTENTS

Executive Summary	3
Introduction	4
Building Characteristics	7
Energy Performance	8
Emissions	12
What's Next	14
Glossary	15

Appendices can be found at www.denvergov.org/EnergizeDenver.



EXECUTIVE SUMMARY

The Energize Denver Benchmarking Ordinance aims to improve the energy efficiency of large buildings in Denver, targeting reductions of 10 percent by 2020 and 30 percent by 2030. Currently, the energy used in large buildings is equivalent to 57 percent of Denver's greenhouse gas emissions. Improving the energy efficiency of buildings in Denver can be beneficial for the bottom lines of both building owners and occupants. Improving energy efficiency is also a critical way Denver will reach the climate goal of reduce greenhouse gas emissions (GHG) 80 percent by 2050 (80x50 Climate Goal).

Implementation of the Energize Denver Benchmarking Ordinance began in 2017, after being passed by City Council in December 2016. The ordinance requires all buildings over 25,000 square feet are required to annually assess and report their energy performance using the EPA's free ENERGY STAR® Portfolio Manager tool. In 2017, only buildings over 50,000 square feet were required to comply. Ninety percent of those buildings complied with the ordinance. Buildings over 25,000 square feet will be required to comply by June 1, 2018.

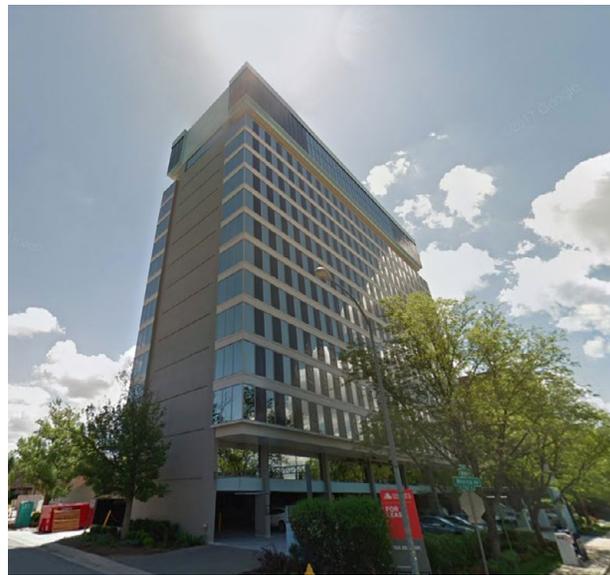
The largest building types, as measured by total square footage and number of buildings, are offices, apartments and condominiums. Denver buildings have an average ENERGY STAR® score of 68.

Achieving the overall 30 percent reduction goal in energy consumption by 2030 is possible if all buildings become as efficient as those currently performing at the 82nd percentile (as determined by energy use intensity) of the building type. The 82nd percentile is an important metric as it is the minimum percentile all buildings have to become to save 30 percent. Improving building energy efficiency will allow the building sector to help Denver meet its 80x50 Climate Goal. In addition, Denver would also see

an annual energy savings cost of \$82 million. These energy cost savings can be achieved with energy efficiency measures that provide a good return on investment.

A report from the Rockefeller Foundation and Deutsche Bank Group showed that investing an estimated \$340 million in improving building energy efficiency in Denver could result in \$1.3 billion in energy savings over 10 years – that's \$130 million per year in savings using off-the-shelf energy efficiency measures.

In 2016, 1720 S Bellaire St. already had an ENERGY STAR score of 91. However, the owners/operators realized more energy savings could be achieved, and undertook an energy savings project using property assessed clean energy (PACE) financing that cut energy consumption by 30 percent. Prado Condominiums improved its ENERGY STAR® score from 27 to 67 and saw a 38 percent reduction in energy costs. These case studies and other resources on how to improve building energy efficiency can be found in the Resource Center at denvergov.org/energizedenver.



1720 S. Bellaire St.

INTRODUCTION

BACKGROUND ON THE BENCHMARKING ORDINANCE

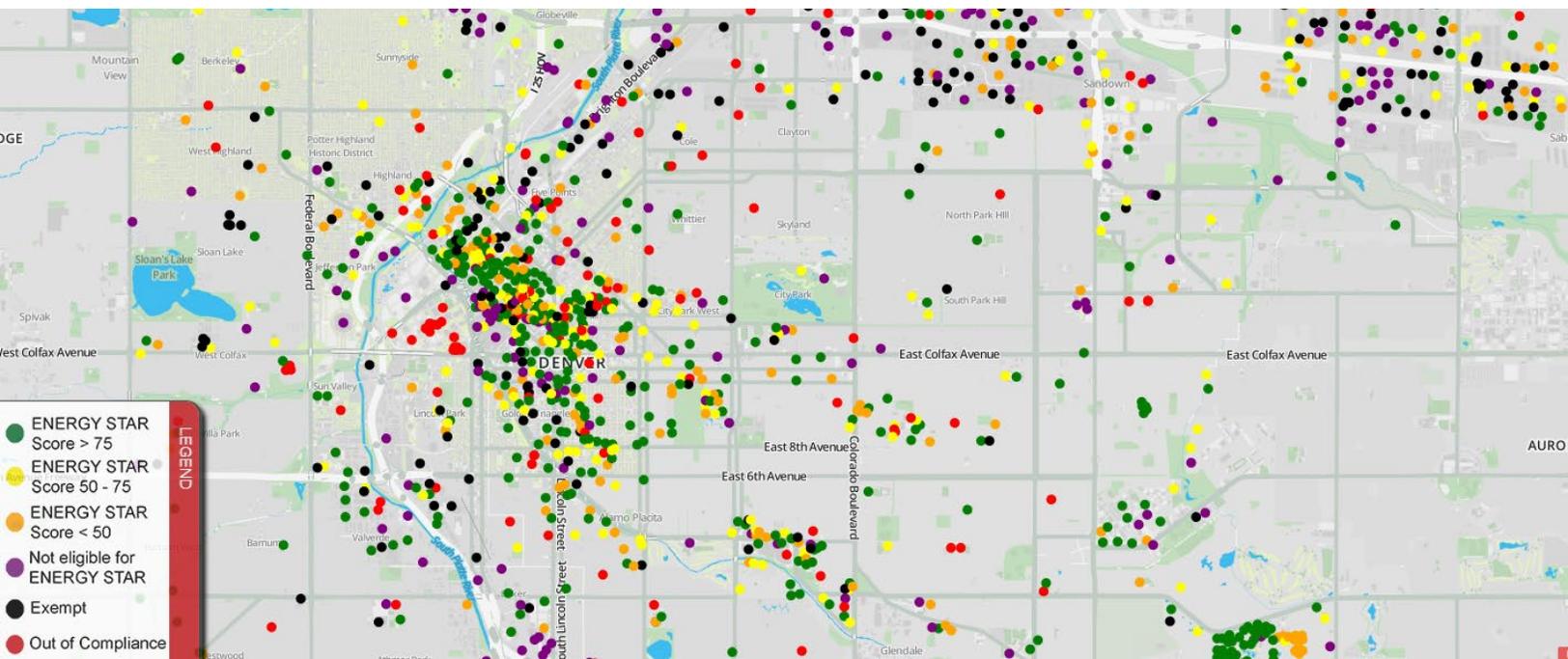
Improving building energy efficiency will help protect Denver's quality of life and also strengthen the economy. Investing an estimated \$340 million in improving building energy efficiency could result in 4,000 local jobs and \$1.3 billion in energy savings over 10 years¹. The energy used in large buildings represents 57 percent of Denver's greenhouse gas emissions.

Benchmarking the energy performance of a building is the first step to understanding and reducing energy consumption. The Energize Denver Benchmarking Ordinance, passed by

¹ United States Building Energy Efficiency Retrofits: Market Sizing and Financing Models." Rockefeller Foundation and Deutsche Bank Group. March 2012. Numbers scaled to City and County of Denver.

City Council in December 2016, buildings over 25,000 square feet to annually assess and report the energy performance using the U.S. EPA's free ENERGY STAR® Portfolio Manager® tool, an online tool to measure and track energy and waste consumption, as well as greenhouse gas emissions. Energize Denver engages with tenants to improve the energy efficiency of the spaces and also provides resources to improve efficiency of buildings. The City publishes building's energy performance annually to enable the market to better value energy efficiency, similar to the miles-per-gallon ratings for cars or nutrition labels on food. Other cities with benchmarking and transparency requirements have seen two to three percent energy savings each year from buildings subject to benchmarking ordinances.

Figure 1: The Energize Denver Benchmarking Map, an interactive online tool showing building energy performance data submitted to the City. www.energizedenver.org



2017 REPORTING CYCLE

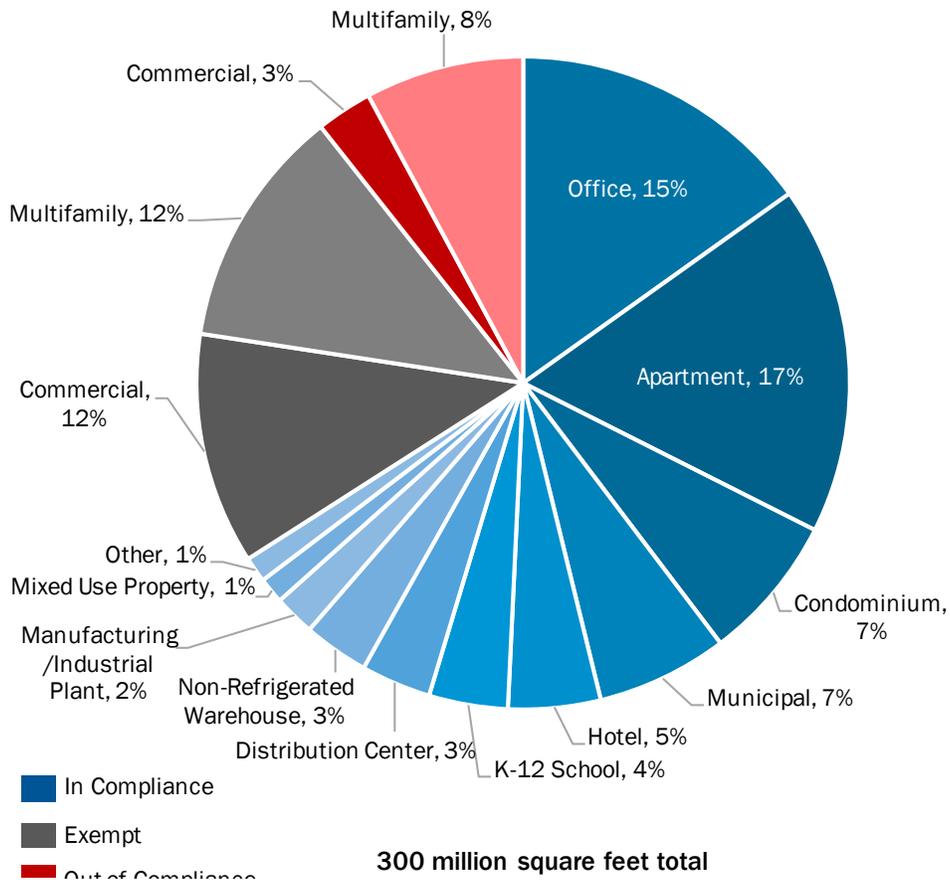
This report presents an analysis of the benchmarking reports received in the 2017 reporting cycle, which covers energy use data for calendar year 2016. Data on the energy use of buildings over 50,000 square feet and Denver municipal buildings over 25,000 square feet are included in this report. Starting June 1, 2018, buildings over 25,000 square feet in size will be required to submit an annual report.

The initial deadline for submitting building performance data was June 1, 2017. However, since this was the first year of reporting additional efforts were made to extend deadlines and provide support to as many of the covered buildings as possible. The result of these efforts was a 90 percent compliance rate based on the number of buildings that reported and passed the City’s data quality checks.

To assist owners and operators comply with the new ordinance, the City created a Help Center where questions could be answered through phone and email, held training sessions with the materials posted online, provided a directory of benchmarking service providers, and other resources. More information on these is located at www.denvergov.org/EnergizeDenver. The Benchmarking Advisory Group, consisting of stakeholders, helped guide the City in successfully implementing the ordinance.

Figure 2 below shows the property type breakdown for all buildings subject to the ordinance in 2017. Buildings in blue submitted complete benchmarking reports, buildings in gray are exempt, and buildings in red are out of compliance.

Figure 2: All Buildings Covered by Ordinance and Reporting Status



NOTES ON DATA ANALYSIS IN THIS REPORT

The analysis presented in this report is based on data submitted during the reporting cycle in 2017. At publication date, the City received 1,337 Portfolio Manager reports that passed the data quality checks required for compliance. Of those, 294 exemptions were approved, and 192 buildings did not comply. The data quality checks that were run on all submissions are documented in the appendix, available at www.denvergov.org/EnergizeDenver, along with the available types of exemptions and a summary of how many exemptions of each type were approved.

Energy performance analysis reports were further filtered in order to be able to make accurate summaries of the dataset with

the greatest number of buildings possible. Buildings were included in the energy analysis if they contained complete energy data including site energy use intensity (EUI) and square footage. Buildings with ENERGY STAR® scores of 100 were removed. After analyzing the distribution of EUI of the total dataset and by building type, buildings with EUIs outside the range of 5 to 500 were also removed. This ensured that averages would not be exaggerated by a small number of very energy-intense buildings and that buildings with incorrect data would not adversely affect summary metrics. The energy analysis presented in this report covers the 1,286 buildings and 212 million square feet that submitted a complete benchmarking report and passed data filtering thresholds.

BUILDING CHARACTERISTICS

Since the Energize Denver Ordinance applies to large buildings, many tax parcels have multiple individual buildings on one parcel. Compliance is required at the individual

building level, unless multiple buildings on the parcel share energy meters, in which case multiple buildings are allowed to benchmark together as one.

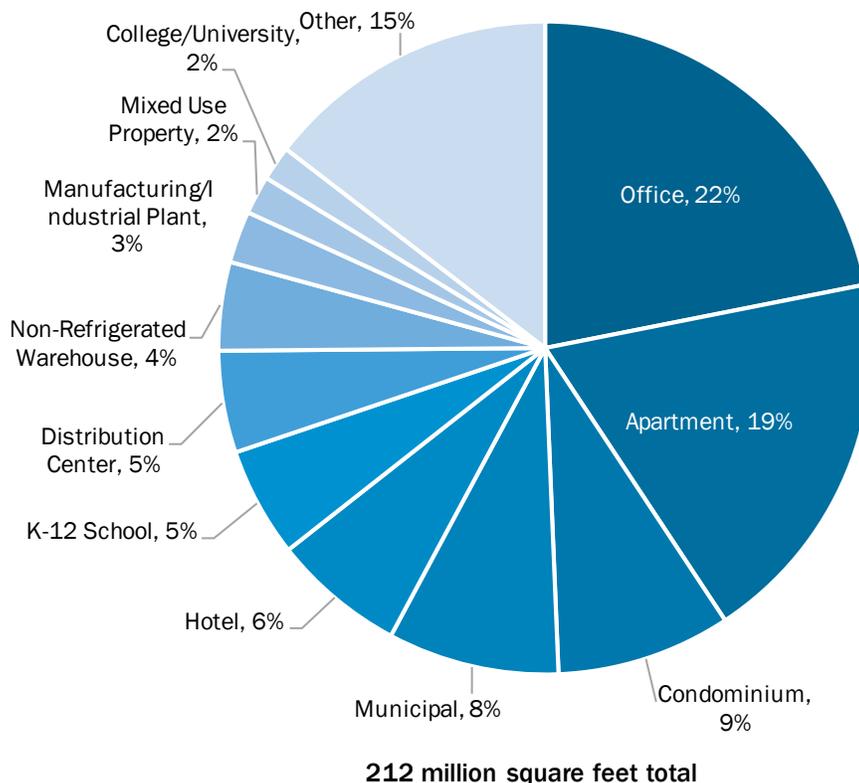
BUILDING TYPE DISTRIBUTION

Figure 3 shows the building type distribution among buildings that submitted complete benchmarking reports.

- Offices account for 22 percent of square footage, 193 buildings
- Apartments account for 19 percent of square footage, 296 buildings
- Condominiums account for nine percent

- of square footage, 131 buildings
- Municipal buildings account for eight percent of square footage, 66 buildings
- Hotels account for six percent, of square footage, 65 buildings
- K-12 schools account for five percent of square footage, 96 buildings

Figure 3: Building Type Distribution by Square Footage, Buildings with a Complete Benchmarking Report



ENERGY PERFORMANCE

There are several metrics that can describe energy performance. The ENERGY STAR® score is a 1-100 energy efficiency scoring tool that helps assess how a building is performing compared to its peers nationwide.

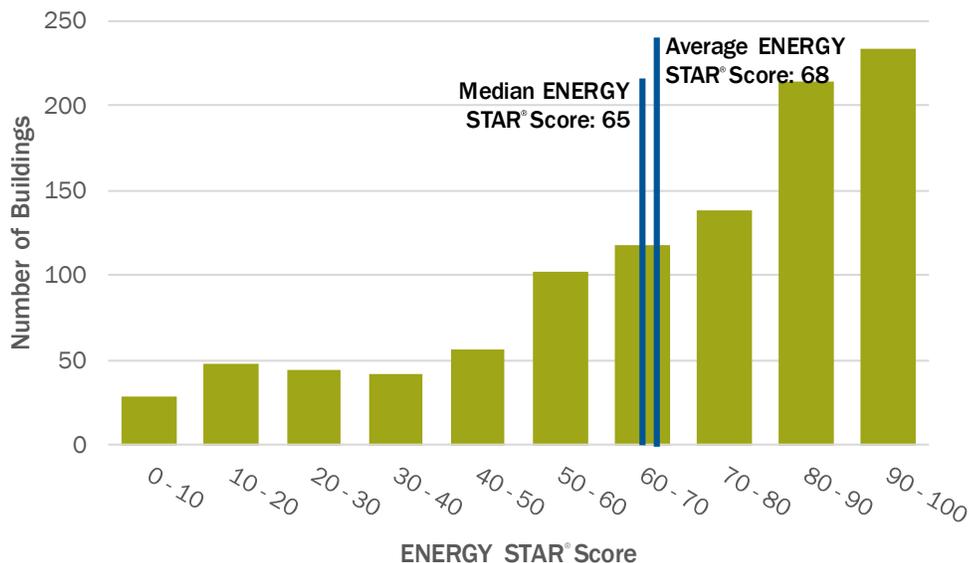
A score of 50 represents a building performing at the median while 75 means a building is a top performer, in the top quartile of similar buildings nationwide. An ENERGY STAR® score of 75 is also the minimum required in order to be eligible to earn ENERGY STAR® certification from the EPA. In this

report, 1,286 buildings are included in the analysis with 1,025 able to generate an ENERGY STAR® score, which are available for 21 property types.

The average ENERGY STAR® score of buildings in Denver is 68, above the national average of 50.

Figure 4 shows the distribution of ENERGY STAR® scores in Denver. There are many buildings that have ENERGY STAR® scores in the top quartile nationally, but there are also about 30 buildings that have an ENERGY STAR® score of 1-10.

Figure 4: ENERGY STAR® Score Distribution



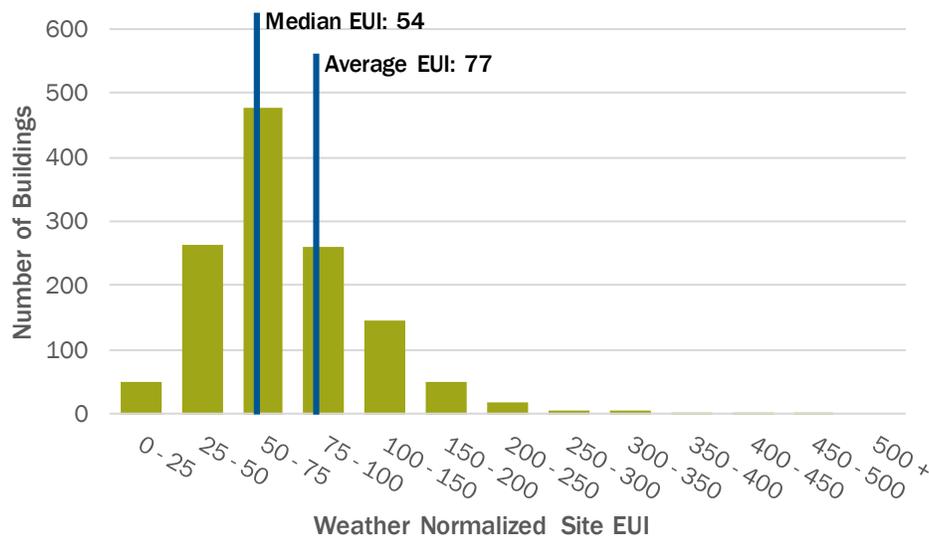
The other primary metric used to understand building energy performance is the weather normalized site energy use intensity (EUI), which is the total amount of energy used per square foot in a building. It is measured in the total energy use per square foot, per year. All buildings can use Portfolio Manager to measure the EUI—even those that cannot obtain a 1-100 score. For properties of similar size, type and operational parameters, a lower EUI will typically indicate better energy efficiency.

Average weather normalized site EUI varies among the different building types in Denver due to different space uses and operational needs among these buildings. For example, since energy use is required to maintain operations

including lighting, equipment, and HVAC, hospitals have an average weather normalized site EUI of 224 compared to an average weather normalized site EUI of 49 for a non-refrigerated warehouse. For this reason, comparisons can be made within building types using EUI but not across all building types.

Figure 5 shows the weather normalized site EUI distribution in Denver. Most buildings have an EUI between 25 and 150. The section to the right shows the few buildings that have very high EUIs, and these tend to be for buildings that have energy-intensive uses. Overall Denver's median weather normalized site EUI is 54 and the average weather normalized site EUI is 77.

Figure 5: Weather Normalized Site EUI Distribution



ENERGY PERFORMANCE BY BUILDING TYPE

Figure 6 describes the energy performance of the largest building types by square footage included in this analysis. Apartments and condominiums together represent the greatest number of buildings in Denver and have average ENERGY STAR® scores of 65 and 68, respectively. Offices in Denver have the highest average score of 77, followed by K-12 schools, with an average score of 73.

A comparison to the EUI of the 82nd percentile is given because if all buildings became as efficient as the 82nd percentile within the property building type, then a total energy savings of 30 percent could be achieved. Meeting this would put Denver on track to meet the 80x50 Climate Goal. Achieving these savings would result in a total annual energy cost savings of \$82 million per year.

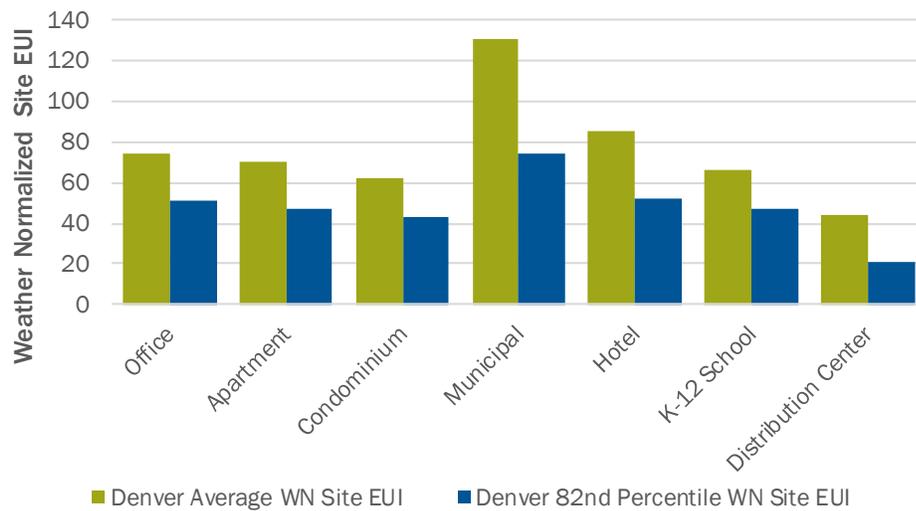
Figure 6: Energy Performance by Building Type, Top 25 Largest Building Types

Property Type	Average ENERGY STAR® Score	Average Weather Normalized Site EUI	Weather Normalized Site EUI of Efficient Buildings (82 nd Percentile)	Potential Cost Savings if All Buildings Became as Efficient as the 82 nd Percentile (%)	Potential Cost Savings if All Buildings Became as Efficient as the 82 nd Percentile (\$)
Office	77	74	51	19%	\$13.1 million
Apartment	65	70	47	27%	\$10.5 million
Condominium	68	62	43	26%	\$4.3 million
Municipal	62	131	74	32%	\$11 million
Hotel	63	86	52	43%	\$9.5 million
K-12 School	73	67	47	25%	\$2.5 million
Distribution Center	66	44	21	50%	\$3.5 million
Non-Refrigerated Warehouse	66	50	27	42%	\$2.7 million
Manufacturing/Industrial Plant	-	96	36	68%	\$8.6 million
Mixed Use Property	55	94	56	41%	\$2.7 million
College/University	-	82	47	47%	\$2.4 million
Hospital (General Medical, Surgical)	44	224	178	23%	\$2.8 million
Refrigerated Warehouse	57	56	30	50%	\$1.2 million
All Buildings	68	77	35	30%	\$82 million

Figure 7 shows a comparison between the median weather normalized site EUI for the top seven largest building types in Denver, and the median weather normalized site EUI for the top performing buildings within each of the building types (82nd percentile). The difference between these two values represent an opportunity for energy improvements. The greatest opportunities

appear in the municipal, hotel and distribution center building types. However, since offices and multifamily buildings (including both apartments and condominiums) represent the greatest proportion of the Denver building stock, improvements in these buildings may have a greater impact on overall energy consumption and emissions.

Figure 7: Denver Median Weather Normalized Site EUI Compared to Denver 82nd Percentile Weather Normalized Site EUI

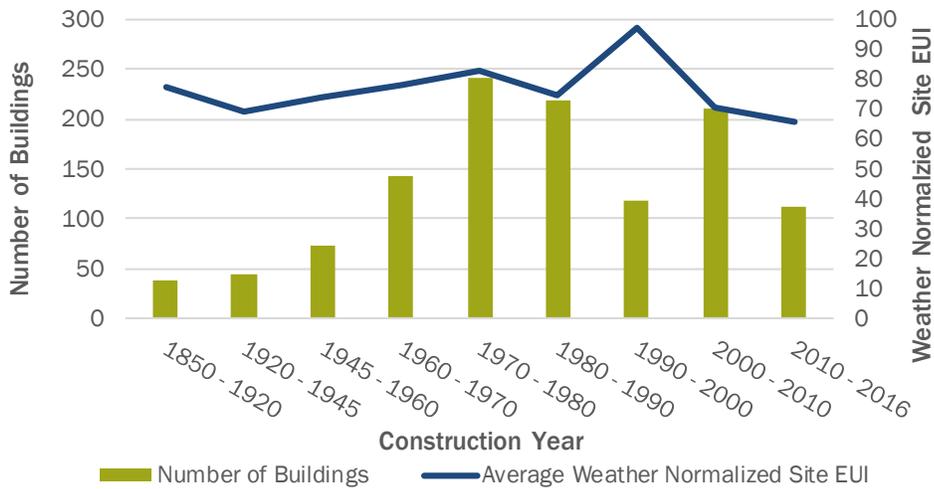


ENERGY USE AND AGE OF BUILDINGS

Figure 8 shows the average weather normalized site EUI for all buildings according to the year they were constructed. As the blue line in the graph shows, there is no clear relationship between construction year and weather normalized site EUI. Some of the oldest buildings

in Denver (in the 1920-1945 range) have lower EUIs than buildings constructed between 2000 and 2010. The selection of buildings in the 1990-2000 period shows a higher average weather normalized site EUI than any other time period, while the most recent period has the lowest average weather normalized site EUI.

Figure 8: Construction Year Compared to Weather Normalized Site EUI



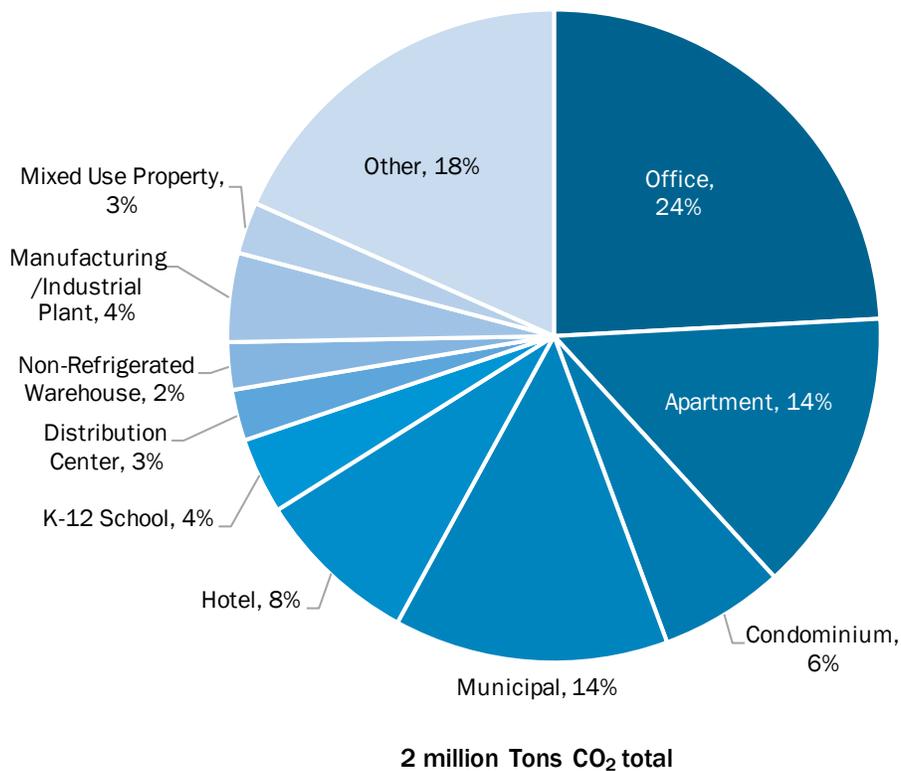
EMISSIONS

GREENHOUSE GAS EMISSIONS

Figure 9 shows the GHG emissions distribution by building type. This graph shows a similar distribution to the square footage distribution graph. However, the proportions differ. For example, while apartments and

condominiums comprise 28 percent of the total square footage in the dataset, they represent 20 percent of total GHG emissions. Conversely, municipals represent eight percent of the total square footage but 14 percent of total GHG emissions.

Figure 9: Greenhouse Gas Emissions by Building Type



WHAT'S NEXT

Achieving a compliance rate of 90 percent in the first year of reporting involved the cooperation and efforts of many stakeholders and staff involved in implementing the Energize Denver Benchmarking Ordinance – many thanks to all who were involved. The energy performance data reported through

Energize Denver allows building owners and managers as well as the City to more deeply understand and set goals to further building energy efficiency and sustainability in Denver. We look forward to continued success as we phase in all buildings over 25,000 square feet in 2018.

GLOSSARY

ENERGY STAR® Score: EPA's 1-100 ENERGY STAR® score is an external benchmark for assessing the performance of commercial buildings. The ENERGY STAR score, expressed as a number on a simple 1 - 100 scale, rates performance on a percentile basis: buildings with a score of 50 perform better than 50 percent of their peers; buildings earning a score of 75 or higher are in the top quartile of energy performance (energystar.gov).

EPA: U.S. Environmental Protection Agency.

GHG: greenhouse gas emission.

kBtu: British thermal unit, the amount of heat it takes to raise the temperature of one pound of water by one degree Fahrenheit.

PACE: Property Assess Clean Energy, a simple and effective way to finance energy efficiency, renewable energy, and water conservation upgrades to buildings.

Portfolio Manager: An online tool developed by the U.S. EPA that is used nationwide to measure and track energy and water consumption, as well as greenhouse gas emissions.

Weather Normalized Site Energy Use Intensity (EUI): The total amount of energy used per square foot in a building. The energy is a sum of all the fuel types used in the building, including electricity, natural gas, fuel oil and steam, which are converted to kBtu, summed together, and then divided by the total square footage of the building. The higher the EUI, the more energy is used per square foot of space. The data is then weather normalized so that EUI's can be compared year over year - even if a very cool summer is followed by a very warm one.



DENVER

PUBLIC HEALTH &
ENVIRONMENT

denvergov.org/PublicHealthandEnvironment | twitter.com/DDPHE