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Additional Information & Appendices can be found at:  
www.denvergov.org/energizedenver
51% of Denver’s greenhouse gas emissions are from buildings.

Buildings increased energy use by 1.2% on average annually since 2016.

Benchmarked buildings cut energy use by 0.4% on average annually since 2016.

Buildings need to cut energy use 30% by 2030 to achieve the city’s climate goals.

That will save building owners $130 million per year in energy costs.
LETTER FROM THE MAYOR

Denver:

The city’s Energize Denver program started in 2016 with the passing of the Benchmarking Ordinance, requiring commercial and multifamily buildings at or over 25,000 square feet to report their energy usage annually. Three years later, Energize Denver also includes the Energy Program under the Green Buildings Ordinance, Smart Leasing, Net Zero New Construction, and Strategic Building Electrification.

The energy used in all Denver buildings accounts for 51% of Denver’s greenhouse gas emissions - the largest contributor of any sector. As part of the City’s 80x50 Climate Action Plan, we’ve set goals for commercial and multifamily buildings to reduce energy usage 10% by 2020 and 30% by 2030. Reducing energy use in large buildings is essential to meeting Denver’s overarching goal of reducing total greenhouse gas emissions 80% by 2050.

From full building HVAC system upgrades to simple operational changes, there are many avenues to improve energy performance. Have you considered updating your building’s operation schedule? Do you encourage occupants to turn off appliances and lights when they aren’t in use? Reducing energy usage within existing buildings is no easy feat, but if we all work together to make simple changes now and update larger systems when necessary, we will exceed our goals and solidify Denver as a top ten sustainable and healthy city.

Thank you for your continued efforts, support, and dedication to improving energy efficiency. We look forward to forging stronger relationships to make energy efficiency a reality for everyone across the city.

Respectfully,

Michael B. Hancock
Mayor
Commercial and multifamily buildings are responsible for 51% of the greenhouse gas (GHG) emissions in Denver. Improving our buildings’ performance through energy efficiency and strategic electrification is key to solving climate change in Denver. High performance buildings are good for the environment and climate. They also positively impact health and productivity. Shifting all buildings to high performance buildings is vital to creating a healthy, happy, resilient Denver. High performance buildings are also good for the bottom line and affordability because they lower operating expenses, improve net operating income, and can help attract tenants. Figure 1 shows an estimation of the value of high-performance commercial buildings.

Energize Denver’s objective is to ensure all buildings in Denver can access and implement measures to become high performance buildings and enable buildings to meet Denver’s 80x50 Climate Action Plan goals. The Plan’s overarching goal is to reduce Denver’s total greenhouse gas emissions 80% by 2050. There are also specific goals for energy efficiency in buildings including using 10% less energy by 2020, 30% less energy by 2030, and 50% less energy by 2050. Unfortunately, Denver is currently not on track to meet the buildings goals. Figure 2 shows the current trajectory of energy use for all buildings in Denver. Energy efficiency improvements are currently offsetting some of the approximately 2% growth in new construction building square footage added to the City each year, but it is not enough to offset all growth nor put buildings on the path to meet Denver’s goals.

Figure 2 shows historical data reported as well as projected energy use for all commercial and multifamily buildings in Denver into 2030. From 2016 to 2017 all buildings in Denver saw a reduction in energy use of 0.7%, and from 2017 to 2018 they saw an increase in energy use of 3%, yielding an average yearly increase of 1.2% from 2016 to 2018. The “Current Trajectory” represents usage if buildings continue to consume energy at the rate they have over the past two years. The Current Trajectory shows total energy use being 5% higher in 2020, and 17% higher in 2030 than it was in 2016. The “Baseline” represents 2016 energy usage for commercial buildings, which is the benchmark for the City’s goals. The “Goal Trajectory” represents what energy usage for all buildings needs to be to reduce energy consumption in buildings 10% by 2020 and 30% by 2030.

Figure 1: Determining the Value of High Performance Buildings. This infographic is based on data in a report from Stok called, The Financial Case for High Performing Buildings, which was based on an analysis of over 60 robust research studies.
Each year, commercial and multifamily buildings 25,000 square feet and larger are required to measure and report energy performance under the Energize Denver Benchmarking Ordinance. The 2019 report includes energy performance data for each building from the 2018 calendar year. For buildings over 50,000 square feet, 2019 is the third year reporting was required. For buildings 25,000 to 50,000 square feet, 2018 is the second year reporting was required. During the 2019 reporting cycle, we learned that inaccurate data was submitted for previous years (2016 and 2017) due to errors made by Xcel Energy’s system that automatically uploads energy data to Portfolio Manager. As a result, the 4.5% energy savings that the City reported last year for buildings at or over 50,000 square feet is not reflective of the actual performance of these buildings. Xcel Energy has since corrected their systems, uploaded the new data to Portfolio Manager accounts, and resubmitted 2016 and 2017 data to the City.

The new data shows that buildings over 50,000 square feet with accurate reports for all three years of benchmarking (2016, 2017, and 2018) saw just below 1% (0.8%) total weather normalized energy savings from 2016 to 2018. Buildings 25,000 to 50,000 square feet with accurate reports for both 2017 and 2018 saw 1.25% total weather normalized energy savings. All benchmarked buildings (buildings over 25,000 square feet) that have accurate reports for both 2017 and 2018 saw 0.2% total weather normalized energy savings. We conclude that benchmarked buildings are saving a small amount of energy each year – but how much varies depending on what size buildings and what timeframe is included in the analysis. As we have more years of reporting we expect we will be able to draw stronger conclusions from the data. We estimate buildings that have improved their efficiency are avoiding approximately an additional $1.1 million collectively in annual energy costs.
The following is a summary of current programs covered by Energize Denver including Benchmarking, the Energy Program, Smart Leasing, Net Zero New Construction, and Strategic Building Electrification. To learn more about our work go to www.denvergov.org/energizedenver. In addition to the current Energize Denver work, we are also developing plans to address and decrease the gap to reach our climate goals. In August 2019, Mayor Hancock and Denver City Council announced a plan to enhance Denver’s work to address climate change by launching the Climate Action Stakeholder Process. The process will examine current climate work using an equity lens, identify gaps to achieve scientifically informed goals, develop a work plan to fill identified gaps, analyze funding needs, and agree on a revenue source to fill any funding gaps. To learn more about the Climate Action Stakeholder Process, go to www.denvergov.org/climate.

**BENCHMARKING**

Benchmarking is the foundation of energy efficiency because you can’t manage what you don’t measure. Each year, by June 1, all buildings in Denver at or over 25,000 square feet are required to report their energy performance using the free ENERGY STAR® Portfolio Manager tool. The City publishes building energy performance data at www.energizedenver.org to familiarize the market with energy efficiency and enable building owners to better value high performance.

Figure 3: The Energize Denver Benchmarking Map, an interactive online tool showing building energy performance data submitted to the City (map online: www.energizedenver.org)
GREEN BUILDINGS ORDINANCE: ENERGY PROGRAM

The original citizen-led Green Roof Ordinance passed in 2017 and became Denver’s Green Buildings Ordinance (GBO) in 2018. The original purpose was to reduce Denver’s urban heat island effect by requiring green roofs and solar technology on all of Denver’s large commercial and multifamily buildings. Through a stakeholder process, the GBO now provides flexible compliance options while honoring the original vote. Denver’s GBO requires all existing buildings at or over 25,000 square feet to install a cool roof at replacement as well as choose one of the following compliance paths: green roof/space, paying for offsite green space, solar, certification, or the Energy Program.

The Energy Program is one compliance path and is a program for existing buildings to reduce energy through flexible energy efficiency and renewable energy options including: an ENERGY STAR® score 85 or higher, an energy savings of 10% to 15%, solar, certification, or energy savings + offsite solar. The building has up to five years to comply and must continue to perform each year through their Benchmarking report for 20 years or through a roof replacement (whichever is longer). The Energy Program allows a building owner to take advantage of recent energy improvement projects by selecting a baseline year from the past five years. In addition, participating buildings have up to five years to comply after enrolling in the Energy Program. The Energy Program helps building owners retain and attract tenants to healthy buildings, lower energy expenses, improve net operating income (NOI), and increase building valuation.

SMART LEASING PROGRAM

Smart Leasing refers to any activity that better aligns the interests of tenants and landlords to achieve high-performance, healthy, and energy-efficient buildings. Smart Leasing encourages all stakeholders in the leasing process to have conversations about energy efficiency, sustainability, and building performance during the pre-lease and site selection process, lease negotiation and build-out, and occupancy and operations. The Denver Smart Leasing Program provides tools, resources, and training to help real estate practitioners develop collaborative relationships and pursue energy efficiency in their buildings.
AWARDS

The Energize Denver Energy Efficiency Awards are given to the three top office buildings, multifamily buildings, and hotels that have improved their energy efficiency the most year to year. The awards are a way to recognize buildings that are leading the way towards a sustainable future and promoting high performance buildings in the City. Here are the winners!

OFFICES:

1st Place: The Tabor Center
20% energy savings

2nd Place: The Petroleum Building
19% energy savings

3rd Place: 1660 Wynkoop
13% energy savings

MULTIFAMILY (CONDOMINIUMS & APARTMENTS):

1st Place Condominium:
Residences at Neusteters
45% energy savings

1st Place Apartments (tied):
Golden Spike Apartments
26% energy savings

1st Place Apartments (tied):
Trivium Apartments
26% energy savings

HOTELS:

1st Place: The Brown Palace Hotel and Spa
21% energy savings

2nd Place: The Grand Hyatt
13% energy savings

3rd Place: Staybridge Suites Denver Stapleton
11% energy savings

For more details about the award-winning buildings, visit the Energize Denver Resource Center.

NET ZERO ENERGY NEW BUILDINGS

Denver has a goal for all new buildings to achieve net zero energy by 2035, as specified in the 80x50 Climate Action Plan. The City has six code cycles until 2035 to update the requirements to achieve Net Zero Energy New Construction of all buildings in Denver. We are currently working on developing a Net Zero Energy Implementation Plan which will lay out major milestones and required processes to achieve net zero energy in new buildings by 2035. The Implementation Plan will be heavily based on Denver stakeholder input to ensure it is accessible and achievable for all building types and stakeholders. Find out how to get involved at www.denvergov.org/energizedenver.

STRATEGIC EXISTING BUILDING ELECTRIFICATION

Today, nearly all buildings and homes in Denver are heated with natural gas, resulting in greenhouse gas emissions from on-site combustion of carbon dioxide and upstream fugitive methane emissions. Denver has a climate goal for buildings to reduce heating emissions by 25% in residential buildings and homes and 50% in commercial buildings by the year 2040. Strategic electrification of buildings is a step towards decarbonizing heating energy as we move to a 100% renewable electricity grid. We are currently developing a Strategic Existing Building Electrification Implementation Plan over the course of 2020.
DENVER'S BUILDINGS

Homes and buildings together account for the majority (63%) of Denver’s GHG Emissions as detailed in Figure 4. This, in turn, demonstrates the importance of meeting the buildings goals in Denver’s 80x50 Climate Action Plan. Denver’s ~160,000 homes represent 12% of all greenhouse gas emissions. Denver’s ~17,000 commercial and multifamily buildings are responsible for 51% of Denver’s Greenhouse gas emissions. Nearly 82% of the square footage of commercial and multifamily buildings is located in the ~3,000 large buildings at or over 25,000 square feet that are required to benchmark. That means there are also ~14,000 smaller buildings that make up the remainder of Denver’s built square footage (representing 24% of the total square footage of buildings in Denver).

The data collected through the benchmarking requirement has taught us a lot about the characteristics of buildings in Denver. Figure 5 shows the largest sectors that make up Denver’s buildings. Multifamily is the largest building sector in Denver, followed by offices, municipal and K-12 schools, warehouses, and hotels. The benchmarking requirements apply to any large building with a square footage greater than 25,000 square feet. This means that unless multiple buildings on a single parcel share the same energy meter, compliance is required at the individual building level.

Figure 4: Homes and Buildings together account for 63% of Denver’s GHG Emissions.
In 2019, building owners and property managers were required to submit 2018 building energy data in accordance with the Benchmarking Ordinance. Figure 6 shows all buildings in Denver in compliance with the Benchmarking Ordinance. The City received 2,461 Portfolio Manager reports that passed all the data quality checks required for compliance. There were 345 exemptions approved in 2019 and 209 buildings that did not comply in the 2019 reporting cycle. The data quality checks that were run on all submissions are documented in the Appendix, along with available exemptions and a summary of how many exemptions of each type were approved.
Figure 7 shows the energy-use distribution of buildings that passed all data-quality checks. Offices represent 16% of total energy use (19% of square footage), apartments are 16% (20% of square footage) and condominiums are 7% (9% of square footage). Notably, municipal buildings represent 7% of total square footage but 13% of total energy use among the City’s largest buildings.

Figure 7: Total Energy Use by Property Type (kBtu)
ENERGY PERFORMANCE

Energy Use Intensity (EUI), which measures the total amount of energy used per square foot in a building, and an ENERGY STAR® score (1-100) are both used to measure energy performance for Energize Denver. For the energy performance analysis, buildings were only included in the analysis if they contained complete energy data including site EUI and square footage. Buildings with ENERGY STAR scores of 100 were removed. Buildings with EUIs outside the range of 5 to 500 were also removed. This ensures that averages are not exaggerated by abnormally energy-intensive buildings, and that buildings with incorrect data do not adversely affect summary metrics. The summary analysis presented in this report covers 2,366 buildings that have complete benchmarking reports that passed additional quality checks, representing nearly 275 million square feet of properties. In addition, buildings that showed energy usage change from one year to the next by more than 50% for any one fuel type were removed from the year over year analysis. With this additional filter, 885 properties were analyzed in the three year (2016, 2017, and 2018) year over year comparison.

2018 ENERGY STAR® SCORES DISTRIBUTION

In the ENERGY STAR® scoring system, a score of 50 represents a building performing at the national median while 75 or higher 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 to be eligible to earn ENERGY STAR certification from the Environmental Protection Agency (EPA). In 2018, the EPA updated the metrics for how the ENERGY STAR score is calculated to align more closely with the current national average for building performance. As a result, Denver’s

![Distribution of ENERGY STAR® Scores by Total Building Count](image-url)
overall ENERGY STAR scores dropped; however, they are still above the national median of 50. The average ENERGY STAR score of buildings in Denver is 63 while the median score is 68. Figure 8 shows the distribution of ENERGY STAR scores in Denver and the number of buildings in each score range.

Figure 9 shows the average ENERGY STAR® score by construction year in Denver. There is no strong correlation between building age and energy performance. Buildings built prior to 1920 scored only a point worse than buildings built in the 1990s. Buildings built in the 2000s are worse than buildings built in the 1960s or 1980s. Buildings built in the last decade do perform best, which makes sense because energy codes have been implemented and are getting more rigorous each year.

YEAR OVER YEAR COMPARISON

Weather Normalized (WN) Site EUI measures the total amount of energy used per square foot in a building adjusted for variations in weather. Figure 10 shows WN Site EUI of the largest property types in the City for buildings that have reports for all three years of benchmarking (2016, 2017, and 2018). Municipal buildings have the highest average Site EUI of these property types; this is due to the energy intensity of the convention center and buildings at the airport. Most notably, hotels have seen just over a 4% decrease in WN site EUI, and both apartments and condominiums have seen over a 3% reduction in WN Site EUI since 2016.

ENERGY PERFORMANCE BY BUILDING TYPE

Figure 11 details the energy performance of the largest building types by square footage. Apartments and Offices are the most common building types in Denver. A comparison to the EUI of the 77th percentile is given because if all buildings became as efficient as the 77th percentile, then a total energy savings of 30 percent would be achieved across all buildings, putting Denver on track for all buildings to use 30% less energy by 2030. If all buildings met this performance percentile it would result in an estimated annual energy cost savings of approximately $130 million.
### Figure 10: Average Weather Normalized Site EUI by property type for buildings with three years of Benchmarking Data

<table>
<thead>
<tr>
<th>Property Type</th>
<th>Average ENERGY STAR® Score</th>
<th>Average Weather Normalized Site EUI</th>
<th>Weather Normalized Site EUI (at 77nd percentile)</th>
<th>Percent Savings if All Buildings in Type met 77nd percentile</th>
<th>Cost Savings if All Buildings in Type met 77nd percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apartment</td>
<td>69</td>
<td>67.4</td>
<td>51.2</td>
<td>23%</td>
<td>$12,416,395</td>
</tr>
<tr>
<td>Office</td>
<td>64</td>
<td>77.2</td>
<td>53.0</td>
<td>27%</td>
<td>$21,657,443</td>
</tr>
<tr>
<td>Condominium</td>
<td>73</td>
<td>62.8</td>
<td>45.1</td>
<td>28%</td>
<td>$6,388,547</td>
</tr>
<tr>
<td>Municipal</td>
<td>54</td>
<td>133.6</td>
<td>80.1</td>
<td>41%</td>
<td>$20,027,089</td>
</tr>
<tr>
<td>Distribution Center</td>
<td>55</td>
<td>47.0</td>
<td>30.3</td>
<td>34%</td>
<td>$3,679,093</td>
</tr>
<tr>
<td>K-12 School</td>
<td>52</td>
<td>69.3</td>
<td>52.9</td>
<td>21%</td>
<td>$3,005,033</td>
</tr>
<tr>
<td>Hotel</td>
<td>65</td>
<td>87.1</td>
<td>64.7</td>
<td>35%</td>
<td>$8,435,888</td>
</tr>
<tr>
<td>Non-Refrigerated Warehouse</td>
<td>54</td>
<td>50.8</td>
<td>32.7</td>
<td>36%</td>
<td>$2,801,826</td>
</tr>
<tr>
<td>Manufacturing/Industrial Plant</td>
<td>40</td>
<td>104.2</td>
<td>47.5</td>
<td>61%</td>
<td>$10,626,935</td>
</tr>
<tr>
<td>MIXED USE PROPERTY</td>
<td>56</td>
<td>81.2</td>
<td>59.4</td>
<td>32%</td>
<td>$3,317,649</td>
</tr>
<tr>
<td>College/University</td>
<td>78</td>
<td>86.7</td>
<td>60.8</td>
<td>35%</td>
<td>$2,772,171</td>
</tr>
</tbody>
</table>

### Figure 11: Average ENERGY STAR® scores, EUI, and percentile savings of the largest building types in Denver (by square footage) for buildings with three years of Benchmarking Data
FUTURE GOALS / NEXT STEPS

The Energize Denver team looks forward to continuing our energy efficiency and climate change work in 2020, which will be the fourth consecutive year of reporting and the first with three years of data on all buildings over 25,000 square feet. Additional analysis of the benchmarking data can be found in the appendices for this document at www.denvergov.org/energizedenver.

Energize Denver will scale up our work on Existing Building Strategic Electrification in 2020. If you are interested in advising the City on next steps in our Energize Denver work, please join our Energize Denver Advisory Group of stakeholders who meet monthly to help City staff determine next steps. To join, send an email to energizedenver@denvergov.org.

Look for more details on progress with this program in next year’s annual report, or at www.denvergov.org/energizedenver.
GLOSSARY

ENERGY STAR® Score: The Environmental Protection Agency’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. Additional information can be found at www.energystar.gov.

EPA: U.S. Environmental Protection Agency

GHG: Greenhouse gas emission

kBtu: Btu is the British thermal unit; “k” stands for kilo, and thus 1 kBtu equals 1,000 Btu, or the amount of heat it takes to raise the temperature of 1,000 pounds of water by 1 degree Fahrenheit.

C-PACE: Property Assessed 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, normalized for weather. 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 EUIs can be compared year over year — even if a very cool summer is followed by a very warm one.