

# **Energy Benchmarking in Downtown Ann Arbor**

In Partnership with the Ann Arbor 2030 District

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# Introduction

Achieving a sustainable, carbon-neutral future requires active community participation and the successful execution of targeted initiatives. Ann Arbor has taken a proactive role in these efforts, implementing policies and programs to encourage local stakeholders to adopt sustainable practices. One such initiative is the Ann Arbor Energy Benchmarking Ordinance passed in October 2021, requiring all buildings larger than 20,000 square feet to report their energy usage to the city by June 1, 2024. While this ordinance is vital for meeting Ann Arbor's net-zero emissions target by 2030, it presents challenges for some property owners who lack the tools or knowledge to comply.

Our project, conducted in partnership with the Ann Arbor 2030 District, focused on identifying and overcoming these barriers. The 2030 District is a nationwide network of urban sustainability organizations that collaborate with private and public sectors to achieve significant reductions in greenhouse gas emissions, water consumption, and transportation-related emissions. While A2Zero is taking on energy efficiency for Ann Arbor residential areas, the 2030 District is focused on larger buildings, especially those in the Downtown Development Authority (DDA) area. The DDA encompasses 67 city blocks and 271 acres, with over 50 buildings exceeding the 20,000 square-foot threshold for benchmarking.

Under the guidance of Jan Culbertson, Operations Lead for the Ann Arbor/Washtenaw 2030 District, we explored benchmarking methods and worked to address these obstacles. Key stakeholders included property managers within the DDA, sustainability advocates, and local residents, all of whom benefit from improved energy efficiency and emissions reductions.

The two phases of this project are:

1. **Energy Benchmarking Outreach and Support:** Creation of outreach materials about benchmarking and the 2030 District, conducting email correspondence with property owners, and assisting property owners with the benchmarking process using Energy Star.
2. **Benchmarking Portfolio:** A report encompassing the analyses of received benchmarking data, presented to 2030 District and external partners, highlights trends, outliers, and areas for improvement as strategic recommendations for the city's efforts.

# **Energy Benchmarking Outreach and Support**

## ***Energy Star Benchmarking***

Benchmarking is defined as measuring and comparing a building's energy consumption to similar buildings, past consumption, or a reference performance level. To do this with buildings in Ann Arbor, the 2030 District utilizes Energy Star, a free online tool provided by the U.S. Environmental Protection Agency (EPA) that allows users to track energy usage for their buildings. Through Energy Star, users can calculate the energy performance of buildings while comparing them to other similar buildings. As a result, Energy Star also makes it possible for users to identify underperforming buildings as well. Setting up buildings and uploading data to Energy Star requires many steps, so in order to best facilitate the benchmarking process for building managers, we needed to familiarize ourselves with the resource. Our team met with Jan and other members of the 2030 District in December 2023 and January 2024 to learn how to use the platform. Energy Star played a vital role in our project by enabling us to consolidate building data into a unified portfolio. Energy Star also provided us with a square footage breakdown of the different uses of large, mixed-use properties (some properties had restaurants, office space, multifamily housing, etc. all within a single property). This exact breakdown of the designated square footage for different building uses allowed us to calculate the Energy Use Intensities (EUI), which is the energy use of a building per square foot per year.

## ***Creation of Outreach Materials***

As part of our outreach materials, we created a benchmarking guide in the form of a flier using Canva to send out to buildings that were required to benchmark. Included in the flier was a concise but sufficient description of what benchmarking is, as well as criteria for which buildings and property owners were required to benchmark (see Figure 1). The flier also included a step-by-step process in terms of how building owners could go about benchmarking, beginning with joining the 2030 District. We leveraged connections to place the flier in the DDA newsletter as well as the 2030 District newsletter.

## ***Property Research and Building Outreach***

The 2030 District provided our team with a list of buildings over 20,000 square feet that required benchmarking, and we organized the properties that had not yet been benchmarked.

After compiling a unique list of properties that had yet to benchmark, we began identifying building owners for contact. We found this information to be particularly difficult to find through the internet and discovered that many property owners had contact addresses in varying US states and were not Michigan residents. Once we found the necessary phone numbers and emails of the respective owners, we wrote individual emails for each property manager informing them of the impending June 1, 2024, benchmarking ordinance and offering to guide them through the benchmarking steps via Zoom if required. Out of the over 30 emails we sent, we received responses from 10 property managers, leading to three meetings in which we walked them through setting their buildings up in Energy Star. Additionally, after our outreach, the 2030 District saw an uptick in membership and benchmarking from property managers who were able to benchmark with the available resources and did not need further guidance from us.

## **Benchmarking Portfolio**

### ***Data Collection Using Energy Star***

By mid-August, a sufficient number of buildings had benchmarked their data with the city in Energy Star, enabling us to compile the data and begin analyses. Of the 72 buildings in our portfolio, 44 uploaded complete data for at least 2023. Among these, 29 buildings exceeded 20,000 square feet, and 16 voluntarily submitted data early. This comprehensive data set included electricity meters obtained through DTE and gas meters sourced from DTE or Constellation Gas. Using these meters and square footage, we utilized Energy Star to calculate the EUI for each building in our portfolio. Lastly, before downloading the data, we conducted data quality checks on outlier buildings within Energy Star to ensure that there were no errors with gas or electricity meters.

### ***Setting Target Energy Use Intensities (EUIs)***

Benchmarking compares performance to the city's declared energy goals in addition to evaluating energy use in relation to other buildings. For each of the 44 buildings with full 2023 data, we determined a unique target EUI, a figure that indicates the EUI value that the building should have in order to comply with the city's climate goals. Developed by Architecture 2030, the Zero Tool supports the establishment and tracking of net-zero goals for buildings. To

generate target EUIs, we input key parameters such as zip code (to account for climate variations), building type (e.g., office or multifamily housing), square footage, and the target energy reduction. For Ann Arbor in 2023, the target energy reduction from the 2003 baseline was 35%. Accordingly, we calculated a target EUI that was 35% lower than the 2003 value for each building.

### ***Portfolio Overview***

Our analysis began with an examination of basic building information to gain a comprehensive understanding of the portfolio. A pie chart illustrating the portfolio by property type revealed that office buildings and multifamily housing constituted the majority, with 14 and 12 buildings, respectively (see Figure 2). This insight enabled us to focus our analysis on these two types. Additionally, we created a histogram of building ages, categorized by decade of construction. The results indicated a wide age range, with some buildings dating back to the 19th century and others constructed within the past five years.

### ***Energy Data Analysis and Findings***

Using the complete datasets, we analyzed energy data in R and created visualizations to evaluate energy efficiency in Ann Arbor's downtown buildings. Our first figure was a scatter plot showing the relationship between the year built (x-axis) and 2023 EUI (y-axis) for portfolio buildings (see Figure 2). To enhance interpretability, point sizes varied based on gross floor area (GFA), and a color-coded variable indicated whether buildings met their 2023 target EUI. Red points represented buildings above their target EUI, while green points indicated those below. The abundance of red points underscored that most buildings in our portfolio—and likely in the Downtown Development Authority (DDA) area—failed to meet energy efficiency targets. However, the presence of nine green points demonstrated the feasibility of achieving these goals.

Subsequent figures focused on office buildings and multifamily housing, comparing each building's site EUI to its target EUI through grouped bar charts (see Figures 3 and 4). Green bars represented target EUI, while gray bars depicted 2023 site EUI. These charts revealed that office buildings performed better overall, averaging 12% above their target EUI compared to multifamily housing's 86% excess. Factors such as remote work trends may explain this

disparity, though further research is needed. Notably, significant outliers within office buildings, such as one with an EUI exceeding 150, indicate areas requiring targeted interventions.

The final analysis estimated potential CO<sub>2</sub> and financial savings for the portfolio. We aggregated electricity usage (in kWh) and gas consumption (in CCF) for all buildings and converted these values to British Thermal Units (kBtu). Dividing total kBtu by energy expenditures yielded average costs of \$0.01 per kBtu for gas and \$0.03 for electricity. Next, we calculated “excess energy” by subtracting each building’s target EUI from its site EUI and multiplying the result by GFA. Using specific cost coefficients for multifamily and office buildings, we estimated that buildings exceeding their targets could collectively save \$1,276,804 annually. Additionally, achieving target EUIs could prevent 5,892 tons of CO<sub>2</sub> emissions annually. These findings highlight the significant environmental and financial benefits of improved energy efficiency.

## Outcomes and Recommendations

Our Graham Scholars group amplified awareness of benchmarking deadlines, processes, and the 2030 District’s mission through outreach materials, including a flier. We assisted multiple buildings with benchmarking via email correspondence and meetings. We analyzed data to create graphs and estimations as a part of a report and presentation for the 2030 District and external stakeholders and shared our strategic recommendations for their approach to decarbonization in downtown Ann Arbor.

Our recommendations for the 2030 District and the DDA include:

1. **Prioritize Multifamily Housing:** Focus on reducing EUIs in multifamily housing, identify the sources of inefficiencies, and conduct targeted research to address these challenges.
2. **Address Outliers:** If individual buildings should be prioritized before entire groups, efforts should focus on buildings with exceptionally high EUIs exceeding 150 to maximize potential energy and emissions reductions.
3. **Reinstate the DDA Energy Conservation Program:** This program previously provided over \$10,000 for buildings looking to implement energy efficiency upgrades. Successes

from buildings that participated in the program highlight its potential to help buildings and groups that are lagging behind.

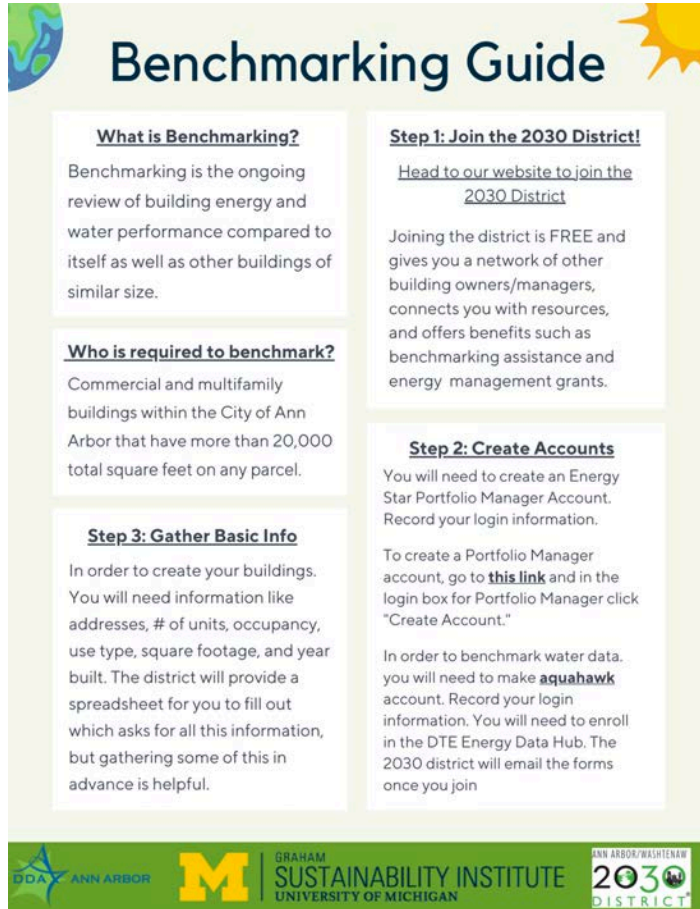
Our team gained invaluable experience working directly with stakeholders on energy issues. Our understanding of energy benchmarking tools and strategies for engaging diverse stakeholders deepened significantly. Additionally, our group members improved our data analysis and visualization skills using software like Excel and R. Moving forward, the findings and recommendations from this project can serve as a foundation for more targeted efforts to achieve Ann Arbor's 2030 net-zero emissions goals, ensuring broader participation and tangible environmental benefits.

## **Acknowledgements**

This project was made possible by the incredible mentorship of Jan Culbertson. Jan's decades of experience, her patient guidance, and her genuine enthusiasm all shined through during this past year, and it allowed us to succeed in this project. Thank you, Jan. We also want to thank LalitAditya Akkaraju and Vishal Swamy of Novi High School. Working with Harrison over the summer and this fall on the data analysis, LalitAditya and Vishal provided meaningful contributions to this project and showed an incredibly inspiring passion for this work. We can't wait to see where you go. And lastly, thank you to Bridget Gruber and the entire Graham staff for providing us with guidance and support throughout the entire program.

# Appendix:

Figure 1:



**Benchmarking Guide**

**What is Benchmarking?**  
Benchmarking is the ongoing review of building energy and water performance compared to itself as well as other buildings of similar size.

**Who is required to benchmark?**  
Commercial and multifamily buildings within the City of Ann Arbor that have more than 20,000 total square feet on any parcel.

**Step 1: Join the 2030 District!**  
Head to our [website to join the 2030 District](#)

Joining the district is FREE and gives you a network of other building owners/managers, connects you with resources, and offers benefits such as benchmarking assistance and energy management grants.

**Step 2: Create Accounts**  
You will need to create an Energy Star Portfolio Manager Account. Record your login information.

To create a Portfolio Manager account, go to [this link](#) and in the login box for Portfolio Manager click "Create Account."

In order to benchmark water data, you will need to make [aquahawk](#) account. Record your login information. You will need to enroll in the DTE Energy Data Hub. The 2030 district will email the forms once you join

**Step 3: Gather Basic Info**  
In order to create your buildings. You will need information like addresses, # of units, occupancy, use type, square footage, and year built. The district will provide a spreadsheet for you to fill out which asks for all this information, but gathering some of this in advance is helpful.

Logos: IADA ANN ARBOR, M GRAHAM SUSTAINABILITY INSTITUTE UNIVERSITY OF MICHIGAN, ANN ARBOR/WASHTENAW 2030 DISTRICT

Figure 2:

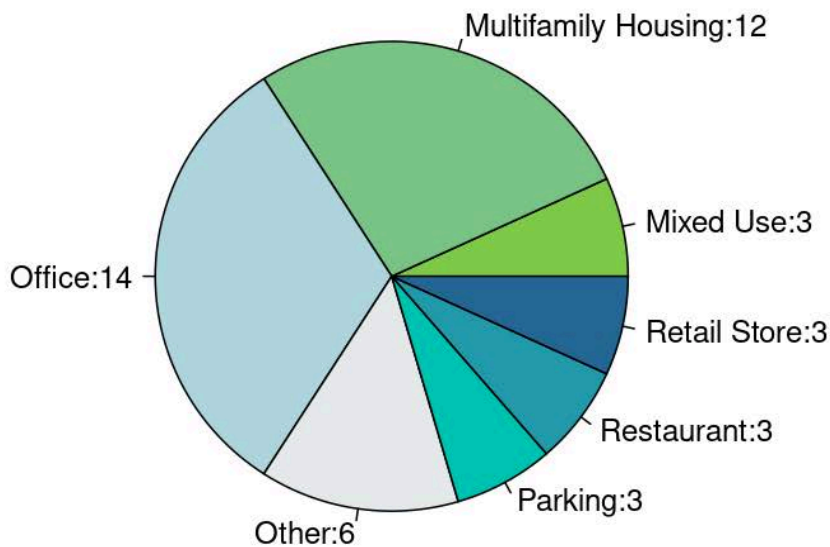




Figure 3:

### 2023 Building Energy Use Intensity (EUI) by Year Built

Circle size represents building gross floor area

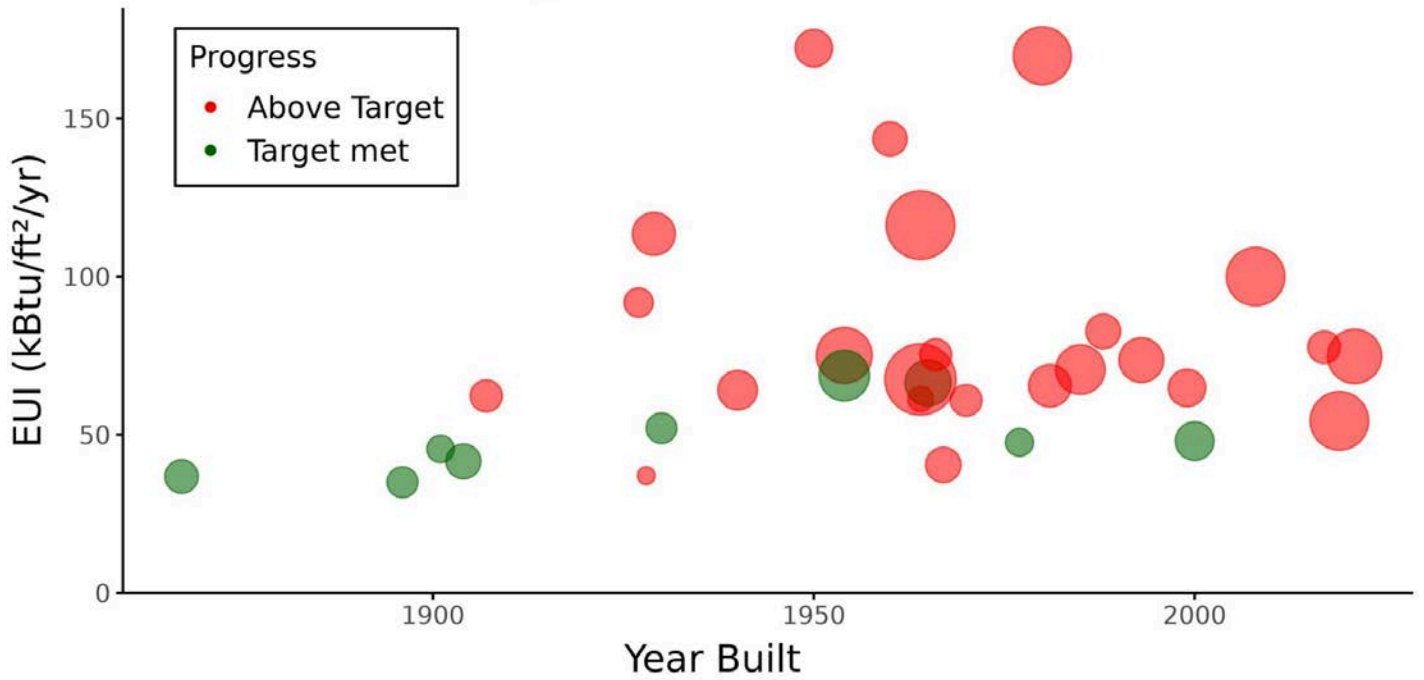


Figure 4:

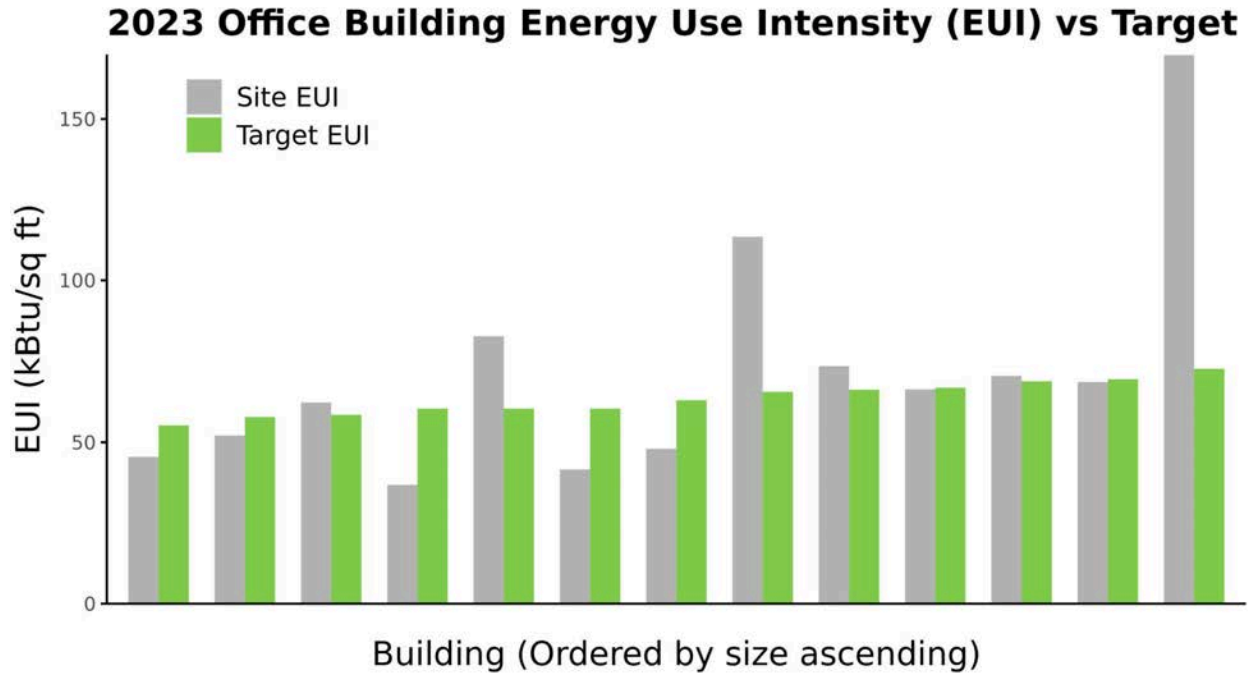


Figure 5:

