Determining the Water Baseline for the Ann Arbor 2030 District

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A practicum submitted in partial fulfillment of the requirements for an M.S degree in the School for Environment and Sustainability at the University of Michigan
August 2020

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Faculty Advisor: Geoffrey Lewis, Ph.D., University of Michigan

Acknowledgements

I would personally like to thank the following individuals and organizations for their support, guidance, and funding of this practicum:

Ann Arbor 2030 District- Jan Culbertson
University of Michigan- Geoffrey Lewis, Ph.D., Center for Sustainable Systems
University of Michigan- Grant Dukus
University of Chicago- Carlos Sierra, Ph.D., Candidate
City of Ann Arbor- Josh MacDonald, Mike Gonzalez
City of Ann Arbor Water & Utilities Department
Building Matters- Jessica A.S Letaw
Huron River Watershed Council- Rebecca Esselman

Financial support provided by Sustaining Ann Arbor Together Grant, The Ann Arbor 2030 District and The School for Environment and Sustainability at The University of Michigan.

Ann Arbor 2030 District Summer Interns:
Haley Mayes
Steven Burres
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Sam Kass
Ashish Venumuddula
Ananya Satyawadi

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Introduction

The effects of global warming are becoming more apparent in major cities and are requiring adaptive and mitigative efforts. Many cities across the country are working towards becoming more efficient and adapting for the future changing environment. There are currently no established national benchmark averages for water use consumption in buildings. This leaves local governments and districts to create their own methods for establishing a water baseline. One metric for setting a water baseline is water use intensity (WUI), which is calculated by dividing water used in a building by building floor area. Water use intensity is a useful metric for municipalities because they can be used to set water use reduction goals and assess progress towards them in the future.

As local governments and municipalities are determining the best way to establish their water baselines, this work examines the Ann Arbor 2030 District and the process used to gather the data necessary for establishing a water baseline. The Ann Arbor 2030 District is one of 22 Districts currently operating across North America. The 2030 Districts are private/public partnerships formed to meet energy, water, and vehicle emissions reduction targets for existing buildings and new construction projects within their boundaries. The Districts were formed to create a network of high-performance districts that work together to create and improve infrastructure to mitigate and adapt to climate change. The goals of the 2030 Districts are to reduce building and infrastructure energy use, water use, and transportation carbon dioxide emissions by 50% from a baseline by 2030.

The majority of 2030 Districts use a water benchmarking method very similar to that adopted by the Ann Arbor 2030 District. It is important to examine other water benchmarking methods to understand why the WUI metric was chosen for local water benchmarking. Understanding the method that the Ann Arbor 2030 district used will help other district and city managers gain a better understanding of the options available, and the potential challenges, to calculate the water baseline, specifically as WUI, of commercial buildings within their cities.

Review of Water Use Intensity Methods

The Commercial Buildings Energy Consumption Survey (CBECS) is a national sample survey that collects data on the large building stock within the United States every four years (*Energy Information Administration (EIA)- About the Commercial Buildings Energy Consumption Survey (CBECS)*, n.d.). The information collected is for commercial buildings greater than 200,000 square feet, including energy and water-related data. The 2012 CBECS water consumption data were used to calculate the average water use intensities of 46,000 large commercial buildings across the country. CBECS provides useful insights into national averages for large buildings. For individualized benchmarking within cities that contain many buildings under 200,000 square feet, water uses by building type may vary from CBECS. Furthermore, there are a smaller number of building type categories used within CBECS when compared to the building types used within tools commonly used in 2030 Districts.

Energy Star Portfolio Manager, created by the EPA, is a widely used tool to benchmark building energy use and water consumption. Energy Star is updating the baseline and design targets from the 2003 Commercial Building Energy Consumption Survey (2003 CBECS) to the 2012 Commercial Building Energy Survey (2012 CBECS). Zero Tool was created to provide building professionals and 2030 District planners with a tool to determine how efficient their buildings using the 2003 CBECS (*About – Zero Tool*, n.d.) as a data source. The Zero Tool portfolio is designed to work exactly like the Energy Star Portfolio Manager but continues to use the 2003 CBECS data for those participating in the 2030 challenge so that Energy Star's switch to 2012 survey data will not change calculated EUI baselines. The 2030 Districts measure energy, water, and transportation benchmarks. Calculating the energy baseline first with Zero Tool provides the EUI by building use type, but also data on square footages and building use type by parcel. That information can then be used towards calculating the WUI by building use type. Establishing data by building use type shows which sectors utilize the most energy or water use, thus helping the Districts to work towards energy and water reductions.

There are 22 established districts in the 2030 District Network. Out of those 22 districts, 6 have established their water baseline. Most 2030 Districts have been using a method like the one chosen by the Ann Arbor 2030 District. However, some cities have opted to build their own program, including the City of Los Angeles, which formed the Existing Buildings Energy and Water Program requiring building owners to register their building and file energy and water use data annually. The City of Los Angeles was able to pass a local ordinance that requires building owners to report their energy and water use through EnergyStar Portfolio Manager, creating a systematic approach to obtaining building water and energy data for long-term performance measurement and tracking of progress toward improvement targets.

The 2030 Districts have varying levels of resources at their disposal. It can be difficult to standardize the process of establishing a water baseline because of these disparities. For example, the Cleveland 2030 District had trouble obtaining water consumption data from the city, so they went to the Cleveland Water Department to obtain data allowing it to set its water baseline using each building's usage between 2010 and 2018. The 2030 Cleveland District has been able to calculate water baselines for 92 buildings with data from EnergyStar Portfolio Manager (Cleveland 2030 District, 2019).

A Water Research Foundation report (Kiefer et al., 2015) describes a method for evaluating water use in the commercial, institutional, and industrial (CII) sector. The method is based on the use of parcel-based tax assessor data, which are based on unique identifiers assigned to parcels of land for tax purposes. Since parcel ID data are tied to a physical location, it is possible to ensure accurate representation and matching of information such as addresses that can help determine a building's use type. The report stated that data based on parcel ID can facilitate the matching of secondary information that may be useful in the future (Kiefer et al., 2015). It also states that the most reliable source of water use data is the water utility, but one complication that pertains to commercial buildings is that utility billing records provide total water use in a billing period without differentiating among end users of water within a building (Kiefer et al., 2015).

The Water Research Foundation report highlights the lack of knowledge and understanding of CII sector water use from the perspective of the municipality. There is usually insufficient data to support forecasting water demand and conservation planning (Kiefer et al., 2015). Despite these challenges, water benchmarking is a crucial goal that must be completed to set water consumption reduction targets in the 2030 Districts.

Methods

The goal of this research is to develop a standard method that is available for every District manager to use and adaptable to a variety of District sizes. The 2030 District Challenge has specific goals for participating cities to achieve that include reductions of building and infrastructure energy use, water use, and transportation carbon dioxide emissions by 50% from a baseline by 2030. This research establishes steps towards completing the goal of water use reduction by 50% from a baseline by 2030.

2.1 Steps for Establishing the Water Baseline

This is the process that was used to obtain the EUI and WUI for the Ann Arbor 2030 District. These steps will be described in detail below on how these steps were completed and best practices for establishing a water baseline.

1. Obtain Tax Assessor's Data from the City
2. Verify Square Footage and Primary Building Use by Parcel ID/Street Address
3. Format and Run Through Zero Tool to get EUIs
4. Obtain Water Data from Water Utility
5. Match Parcel IDs from Zero Tool analysis with Parcel IDs from Water Data to obtain square footage and building use type for calculation of Water Use Intensity
6. Calculate Water Use Intensity by Building Type

The Ann Arbor 2030 District was established in 2018 and includes all buildings within Ann Abor that are not single-family detached or attached structures. There are currently 4074 buildings that are included in the District. The District has committed commercial buildings to join the District that total 2 million square feet of land within the City of Ann Arbor. The map in Figure 1 shows the breakdown of commercial, industrial, non-residential, and residential buildings within the Ann Arbor District. The 2030 District did not include properties of the University of Michigan because the University of Michigan is planning to do their own analysis.

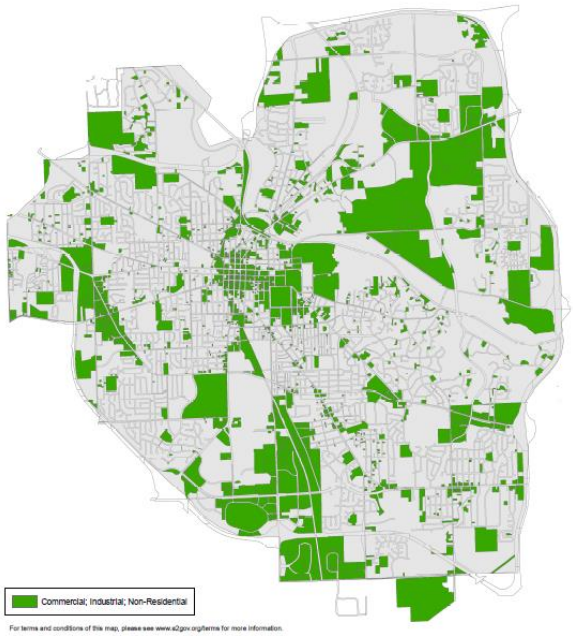

Figure 1: City of Ann Arbor Boundary Map; Green areas represent commercial, industrial, and non-residential, Grey Areas are residential

The Ann Arbor 2030 District utilized the parcel-based tax assessor data for similar reasons as described in the Water Research Foundations report. The parcel-based tax assessor data allows the Ann Arbor 2030 District to match data calculated from the EUI with the WUI data that are provided by the City of Ann Arbor's Water and Utility Department. The matching of data will allow for the WUI data to have a square footage and building use type, which will be used to finalize the WUIs by building type.

2.2 Zero Tool

Zero Tool, an online tool developed by Architecture 2030, is used during design to evaluate a building's energy use intensity (EUI) (*About – Zero Tool*, n.d.). To obtain the square footage and building use types needed to calculate building water use intensities, we elected to use the Zero Tool. Zero Tool calculates EUIs for each building but also provides property use types and square footage for each parcel ID that are used to calculate WUIs by property type. Zero Tool uses the same property type use definitions as Energy Star Portfolio Management (*Use Portfolio Manager | ENERGY STAR Buildings and Plants | ENERGY STAR*, n.d.). For a complete list of all

the property types the Ann Arbor 2030 District used in the Zero Tool format please refer to Appendix A.

To determine the water use intensity by building use type, the building use needed to be identified. This was done by first calculating the energy use intensities (EUIs) of the commercial buildings that are included within the Ann Arbor 2030 District (See Figure 1 below). The EUI was found using Zero Tool. This tool allowed us to identify the EUI per building.

The EUI was calculated first because the Zero Tool format would facilitate in obtaining primary building use types that are present in the district, square footages and parcel ID's that would be used to gain water consumption data for each building. Because the EUI and WUI data will both be tied to parcel ID's from the City of Ann Arbor's tax assessor's database this will facilitate easier data manipulation and the ability to trace data. The WUIs were calculated for the Ann Arbor 2030 District, with the support of the City of Ann Arbor. Single-family properties were included within the established 2030 District boundary for the City of Ann Arbor to view but were not included in data calculations for the Ann Arbor 2030 District.

2.3 Tax Assessor's Database

This study began by collecting tax assessor data provided by the City of Ann Arbor's Finance and Administrative Services on buildings that were within the 2030 District. There were approximately 30,000 records in the tax assessor's database that each contained the parcel number, property address, zip code, zoning, and building square footage. We kept the parcel numbers, property address, city, zip code, owner and square footage of the building because the Zero Tool platform requires a building ID, zip code, square footage, primary building use, gross floor area and gross floor area units (ft^2). The building ID can be any unique identifier, and we input the parcel ID as the building ID. The parcel ID was an important identification tool for the water baseline, because it allowed the Zero Tool data to be matched with the water consumption data. The property address and owner parameters are solely for 2030 District

managers who will work with building owners to provide them information about their building's EUI and WUI.

2.3.1 Data Collection for Zero Tool

Zero Tool requires a specific format to process the data accurately. Data from the tax assessor's database was formatted in a Zero Tool compatible .csv file. An example is shown in Figure 2, which shows good and bad data entry. A bad data entry will result in errors. The building identification can be any input, but it is efficient to use the parcel ID provided by the tax assessor's database for easy cross-referencing of EUI and WUI data.

Any Text	*Two Letter Abbreviation*	*Five Numbers Only*	*Use Spreadsheet*	*Numbers Only*	*Only "sq.ft" or "sq.m"*	
Building ID	**State**	**Postal Code**	**Primary Building Use**	**Gross Floor Area (GFA)**	**GFA Units**	
100035	NY	10001	FastFoodRestaurant	20000	sq.ft	<--Good
100035	New York	10001-9575	Fast Food Restaurant	20000.54	ft2	<--Bad

Figure 2: Zero Tool Data Entry Example

2.3.2 Identifying Building Square Footage

Various methods were used to identify the primary building use. Parcel IDs attached to a street address provided in the Tax Assessor's database were used to identify the primary building use. The city of Ann Arbor's Online Assessment and Property Tax Data Tool (*Welcome | BS&A Online*, n.d.) allowed for searching of properties by parcel ID or street address. This tool provided information on the footprint and number of stories and allowed verification of the square footage data provided in the original tax database.

Google Street View was used to verify the existence and use of the building. Addresses classed as nonprofits, schools, or churches were tax-exempt and did not have square footages attached to the parcel code or street address in the tax assessor's data. For buildings that were missing square footage, the Washtenaw County GIS Mapper (*Geocortex Viewer for HTML5*, n.d.) and online property and parcel data search tools such as landgrid.com were used to identify and

characterize the size of the building. If square footages could still not be identified, the property owner was contacted to provide the square footage of the building.

2.3.3 Establishing Primary Building Use Type

Every building within the tax assessor's datasheet was checked to identify the primary building use type, using the building types in Zero Tool. Then the datasheet was uploaded to the Zero Tool website to determine the building EUIs. Through this process we identified the primary building use types with parcel IDs that could then be matched to water consumption data with parcel IDs.

Establishing the primary building use type can be challenging because Zero Tool has fewer building use types that EnergyStar Portfolio does. Zero Tool does not include building types such as manufacturing or car washes, which can have large water use intensities. The Ann Arbor 2030 District opted to include manufacturing and car wash categories in WUI calculations. Because WUI data are not dependent on the Zero Tool format for calculations like the EUI data is, it is possible to add more categories in the WUI data. When establishing primary building use types for the water consumption data, it is up to the water utility serving the District to determine if adding extra building types or regrouping categories will provide a better representation for the WUI of their city or district.

Another important aspect when establishing the primary building use type is error checking. It is important to standardize the process and assumptions used to determine the building use type and how the buildings are categorized. This is also why the parcel ids were useful because we could pinpoint a building and double check the use if the WUI seemed incorrect. For example, the City of Ann Arbor has 5 library branches that are within the 2030 District, but only three libraries were recorded in the Ann Arbor 2030 District data set. This is because the other two libraries are in strip malls and their primary use is categorized as such.

The primary building types that the Ann Arbor 2030 District used were grouped to match the CBECS categories, which can be found in Appendix C. A comparison between the Ann Arbor 2030 District WUI and CBECS WUI can be found in Figure 4.

2.4 Water Consumption Data

The Ann Arbor Water and Utility Department provided five years of water consumption data for all buildings in Ann Arbor. The five years of data were averaged to provide a representative estimate of annual water consumption. The Ann Arbor 2030 District only includes commercial and non-residential buildings so there were many buildings that needed to be eliminated from the full data set provided by the City. Matching the parcel IDs with the Zero Tool input data allowed us to eliminate any water consumption data that were not commercial or non-residential. The water consumption data provided consumption rates that were attached to a property use type and square footage.

2.4.1 Calculating Water Use Intensity

The water use intensity is calculated by dividing total gallons of water of a building type by the floor area of that type multiplied by the years of water consumption data provided, as shown in Equation 1.

$$\text{Water Use Intensity} = \left[\frac{gal}{ft^2 * year}\right] = \frac{all\ water\ sources}{total\ building\ area}$$

Equation 1: Water Use Intensity Calculation

2.4.2 Calculating Water Consumption by Building Type

Water Consumption was calculated by taking the floor area of a building type and multiplying the total square footage of the parcel id by the total water consumption in gallons. This allows us to see the distribution of water use by building type within the 2030 District.

Results

The average water use intensities that were calculated for the Ann Arbor 2030 District are shown in Figure 3 below. Building types that had less than 3 buildings were omitted from the Figure to preserve anonymity. See Appendix B for a list of omitted primary building use types and their average WUIs.

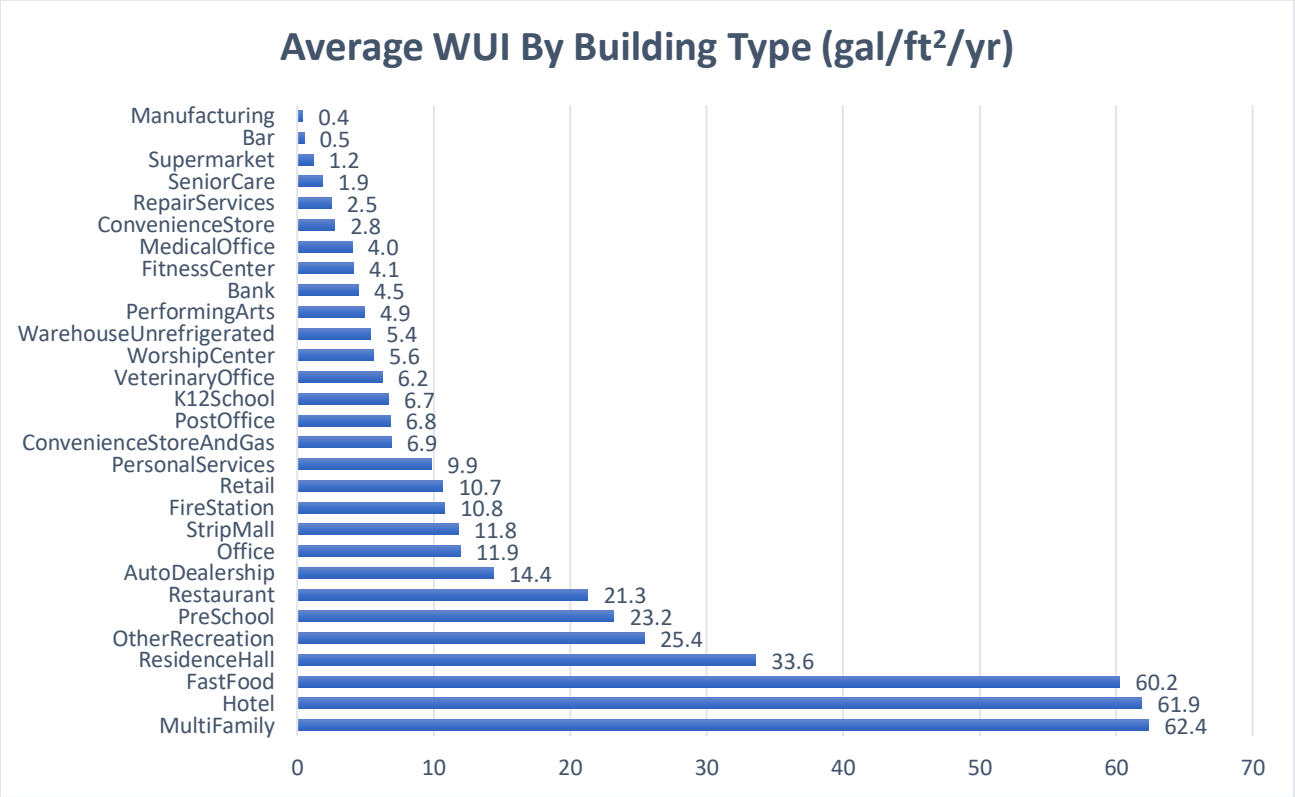

Figure 3: The Average Water Use Intensities by Building Type for the Ann Arbor 2030 District

The CBECS data provided an opportunity to compare the national average WUIs to the Ann Arbor 2030 District WUI results. The Ann Arbor 2030 District data, which used more building type categories than CBECS, were regrouped to match the CBECS building types to compare WUIs (Table 1).

Table 1: WUI Comparison of CBECS and Ann Arbor 2030 District Data

Building Type	CBECS WUI (Gallons/ft2)	AA2030 WUI (Gallons/ft2)
Education	14.6	14.7
Health care	46.5	N/A
Inpatient	49.6	N/A
Outpatient	15.6	N/A
Lodging	41.7	42.1
Mercantile	12.6	10.5
Retail (other than mall)	Data withheld	10.9
Enclosed and strip malls	11.8	10
Office	14.6	11.4
Public assembly	25.7	15.2
Public order and safety	42.1	10.2
Religious worship	Data withheld	5.6
Service	Data withheld	4.7
Warehouse and storage	3.4	4.5
Other	17.9	0.35
Vacant	Data withheld	N/A

There are some similarities and differences that are evident from the table. The CBECs data do not have WUIs for Retail (other than mall), Religious Worship, Services, and Vacant (See Appendix C for a complete list of building types), as indicated by data withheld in Table 1. CBECS data states that categories were withheld due to a relative standard error over 50% or the building category had 20 or fewer buildings *(CBECS)*, n.d.). The Ann Arbor 2030 District did not include vacant properties within the data set.

The education, lodging, and enclosed and strip malls building types are within 1% in the two data sets. The health care WUI data from the Ann Arbor 2030 District is not applicable to the WUI of the CBECS data so it was not included in the comparison table above. This can be at least partially explained by the fact that the Ann Arbor 2030 District WUI does not include the University of Michigan hospital or health system properties within the district. The University of Michigan health system provides the majority of health care buildings within the City of Ann

Arbor and the 2030 District, without this data included the WUI for the health care category is significantly lower than it would be with the University of Michigan health care properties.

The CBECs data are useful for understanding national average WUIs, but for cities that have many smaller commercial buildings, there are many property types that CBECS does not consider. This supports the need for a different calculation process than CBECS for smaller Districts and municipalities to use where more property types can be considered.

Discussion

The methods used by the Ann Arbor 2030 District were consistent with methods used by other 2030 Districts. The goal is to develop a standard method that is available for every District manager to use and adaptable to a variety of District sizes. One of the major issues is the amount of financial resources available for each District to conduct its analysis, which can vary immensely and change the set of methods that a municipality may have access to. As the Water Research Foundation stated: “The process of matching water utility data to parcel level data is wrought with practical difficulties, which can require a significant amount of resources to remedy.”

The Ann Arbor 2030 District performed the most time-intensive and tedious task, determining all building use types by parcel, through funding of summer interns. There were some errors in the identification steps for the primary building use that had to be corrected as we progressed through calculating the WUI for each primary building type. These errors were located when calculating the final WUIs. Parcel IDs attached to the water consumption data were cross-checked with the same IDs from the tax assessor’s database to confirm the building type for that specific parcel ID. This process improves the accounting of building types, but also increases the complexity of an already difficult task. Consistent use of these methods by all individuals that will be gathering data is important to ensure an accurate and efficient process.

The Zero Tool categories are necessary to determine the EUI and from calculating the EUI, the parcel ids now have square footage and property use types that can be used with the water consumption data to determine the WUIs by building type. However, the Zero Tool categories may not represent the best groupings for all Districts and municipalities. The Ann Arbor 2030 District, for example, decided to add manufacturing and car washes as building use types for the WUI calculations. Zero Tool would include a car wash business under the Other Services category. It is important for all cities to determine whether the building use groups are appropriate for their own WUI data.

Conclusion

The method used by the Ann Arbor 2030 District calculated water use intensities of the primary building uses within the District. The objective of this research was to help the Ann Arbor 2030 District establish a water baseline to measure progress towards water reduction goals. The multi-step process of calculating the EUI and then the WUI data provided the data necessary to determine property use types for water consumption per building. This required vast amounts of data manipulation along with trial and error in processing information from the City of Ann Arbor. Not only was the objective of the research met, but the methods used in this work are applicable in other Districts that are seeking to calculate WUIs to set water baselines and measuring progress towards District water use reduction goals.

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Appendices

Appendix A: Primary building use types from Zero Tool established for the Ann Arbor 2030 District and count of primary building use type

Table 1: Ann Arbor 2030 District Primary Building Use Types from Zero Tool

Primary Building Type	Count of Primary Building Use
MultiFamily	725
Office	351
Retail	132
Restaurant	124
ResidenceHall	83
WorshipCenter	62
MedicalOffice	54
Hotel	52
RepairServices	47
Bank	28
WarehouseUnrefrigerated	28
StripMall	27
ConvenienceStoreAndGas	23
FastFood	23
PersonalServices	21
Supermarket	15
ConvenienceStore	13
PreSchool	13
K12School	12
OtherRecreation	11
FitnessCenter	9
AutoDealership	8
Manufacturing	8
SeniorCare	8
DistributionCenter	6
PerformingArts	6
SelfStorageFacility	6
VeterinaryOffice	6
EnclosedMall	5
FireStation	4
PostOffice	4
Bar	3
CarWash	2
EnergyStation	2
Library	2
OtherEducation	2
SwimmingPool	2
Barracks	1
BowlingAlley	1

College	1
Courthouse	1
Hospital	1
IceRink	1
MeetingHall	1
MovieTheater	1
Museum	1
OtherEntertainment	1
OtherPublicService	1
OtherTechonology	1
RollerRink	1
TransitCenter	1
TransportationTerminal	1

*The primary building type is stylized to reflect exactly how you would categorize it for input into Zero Tool.

Appendix B: Omitted Buildings with Primary Building Count less than 3

Table 2: Omitted Buildings with Primary Building Count less than 3

Primary Building Use	Count of Primary Building
CarWash	2
EnergyStation	2
Library	2
OtherEducation	2
SwimmingPool	2
Barracks	1
BowlingAlley	1
College	1
Courthouse	1
Hospital	1
IceRink	1
MeetingHall	1
MovieTheater	1
Museum	1
OtherEntertainment	1
OtherPublicService	1
OtherTechonology	1
RollerRink	1
TransitCenter	1
TransportationTerminal	1

Appendix C: Building Type Definitions from the Commercial Buildings Energy Consumption Survey (*Commercial Buildings Energy Consumption Survey (CBECS)—U.S. Energy Information Administration (EIA)*, n.d.)

Table 3: Building Type Definitions from CBECS

Building Type	Definition	Includes sub-categories from the CBECS questionnaire
Education	Buildings used for academic or technical classroom instruction, such as elementary, middle, or high schools, and classroom buildings on college or university campuses. Buildings on education campuses for which the main use is not classroom are included in the category relating to their use. For example, administration buildings are part of "Office," dormitories are "Lodging," and libraries are "Public Assembly."	• elementary or middle school • high school • college or university • preschool or daycare • adult education • career or vocational training • religious education
Food Sales	Buildings used for retail or wholesale of food.	• grocery store or food market • gas station with a convenience store • convenience store
Food Service	Buildings used for preparation and sale of food and beverages for consumption.	• fast food • restaurant or cafeteria • bar • catering service or reception hall • coffee, bagel, or doughnut shop • ice cream or frozen yogurt shop

Health Care (Inpatient)	Buildings used as diagnostic and treatment facilities for inpatient care.	• hospital • inpatient rehabilitation
Health Care (Outpatient)	Buildings used as diagnostic and treatment facilities for outpatient care. Medical offices are included here if they use any type of diagnostic medical equipment (if they do not, they are categorized as an office building).	• medical office (see previous column) • clinic or other outpatient health care • outpatient rehabilitation • veterinarian
Lodging	Buildings used to offer multiple accommodations for short-term or long-term residents, including skilled nursing and other residential care buildings.	• motel or inn • hotel • dormitory, fraternity, or sorority • retirement home • nursing home, assisted living, or other residential care • convent or monastery • shelter, orphanage, or children's home • halfway house
Mercantile (Retail Other Than Mall)	Buildings used for the sale and display of goods other than food.	• retail store • beer, wine, or liquor store • rental center • dealership or showroom for vehicles or boats • studio/gallery
Mercantile (Enclosed and Strip Malls)	Shopping malls comprised of multiple connected establishments.	• enclosed mall • strip shopping center
Office	Buildings used for general office space, professional office, or administrative offices. Medical offices are included here if they	• administrative or professional office • government office • mixed-use office • bank or other financial institution

	do not use any type of diagnostic medical equipment (if they do, they are categorized as an outpatient health care building).	• medical office (see previous column) • sales office • contractor's office (e.g. construction, plumbing, HVAC) • non-profit or social services • city hall or city center • religious office • call center
Public Assembly	Buildings in which people gather for social or recreational activities, whether in private or non-private meeting halls.	• social or meeting (e.g. community center, lodge, meeting hall, convention center, senior center) • recreation (e.g. gymnasium, health club, bowling alley, ice rink, field house, indoor racquet sports) • entertainment or culture (e.g. museum, theater, cinema, sports arena, casino, night club) • library • funeral home • student activities center • armory • exhibition hall • broadcasting studio • transportation terminal
Public Order and Safety	Buildings used for the preservation of law and order or public safety.	• police station • fire station • jail, reformatory, or penitentiary • courthouse or probation office
Religious Worship	Buildings in which people gather for religious activities, (such as chapels, churches, mosques, synagogues, and temples).	No subcategories collected

Service	Buildings in which some type of service is provided, other than food service or retail sales of goods	• vehicle service or vehicle repair shop • vehicle storage/ maintenance (car barn) • repair shop • dry cleaner or laundromat • post office or postal center • car wash • gas station • photo processing shop • beauty parlor or barber shop • tanning salon • copy center or printing shop • kennel
Warehouse and Storage	Buildings used to store goods, manufactured products, merchandise, raw materials, or personal belongings (such as self-storage).	• refrigerated warehouse • non-refrigerated warehouse • distribution or shipping center
Other	Buildings that are industrial or agricultural with some retail space; buildings having several different commercial activities that, together, comprise 50 percent or more of the floorspace, but whose largest single activity is agricultural, industrial/ manufacturing, or residential; and all other miscellaneous buildings that do not fit into any other category.	• airplane hangar • crematorium • laboratory • telephone switching • agricultural with some retail space • manufacturing or industrial with some retail space • data center or server farm
Vacant	Buildings in which more floorspace was vacant than was used for any single commercial activity at the time of interview.	No subcategories collected, but a question was asked to determine whether the building was completely vacant.

	Therefore, a vacant building may have some occupied floorspace.	
Note: These subcategories are not exhaustive lists of the types of buildings included in each category. For every general category, there are some "other" types of buildings that did not fit into any of these given subcategories.		