Zero Cities Project

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City of Grand Rapids

May 23, 2018

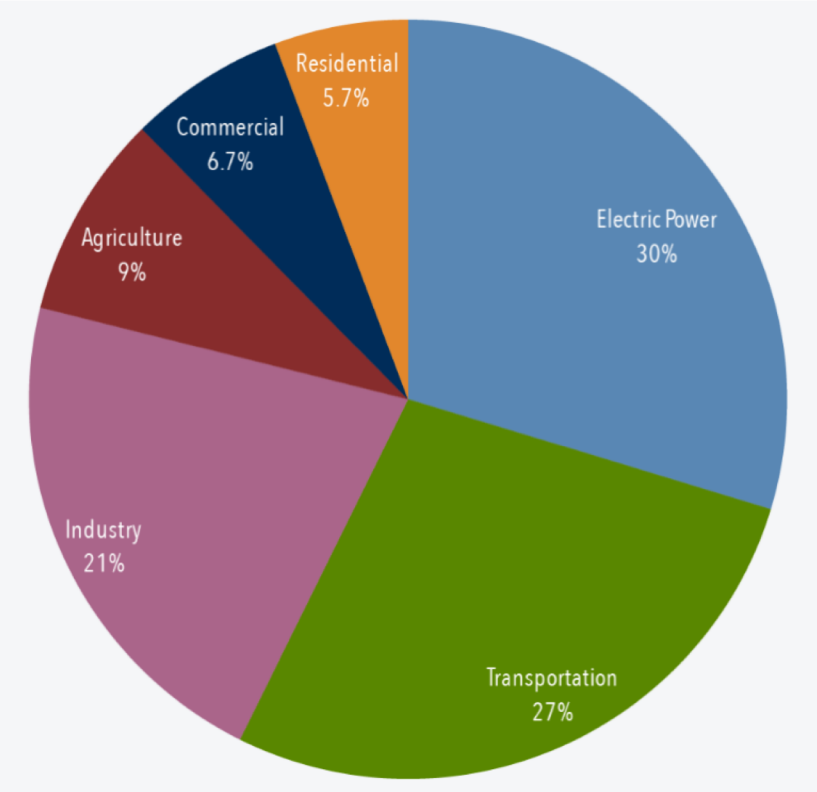
IS THE PLANET WORTH SAVING
WEGE FOUNDATION

U.S. GREEN BUILDING COUNCIL
CHAPTER
WEST MICHIGAN

Why Zero Carbon Buildings?

Need to quickly and reduce carbon pollution and phase out fossil fuels by 2050.

Buildings are a major source of U.S. emissions, and often account for half of city emissions.



U.S. EPA 2015 GHG Inventory
Source: Center for Climate and Energy Solutions

About the Zero Cities Project

- Three-year grant funded project to develop a **policy roadmap** toward a zero net carbon building sector by 2050
  - Zero net carbon: produce on-site, or procure, enough carbon free renewable energy to meet the building operations' energy consumption
- 12 U.S. cities selected to participate
- Policy process informed by technical analysis that will include community collaboration and a focus on equity
- Meant to create a plan the City will implement to achieve the zero net carbon goal by all buildings – with economic incentives and planning programs
- Thank you to USGBC West Michigan and the Wege Foundation

Michigan Radio, Zero Cities Project aims to reduce Grand Rapids' carbon footprint to zero by 2050 (Jam. 22, 2018)
GRBJ, Trending toward zero carbon, Grand Rapids is one of 12 U.S. cities selected to participate in three-year Zero Cities Project (Dec. 29, 2017)

About the Zero Cities Project

Zero Cities project goals are to:

- Help cities develop roadmaps or advance strategies to achieve carbon neutral buildings
- Focus on equitable and actionable solutions
- Share learnings w/ next wave cities

Zero Cities is a partnership with:

architecture 2030

race forward THE CENTER FOR RACIAL JUSTICE INNOVATION

MOVEMENT STRATEGY CENTER

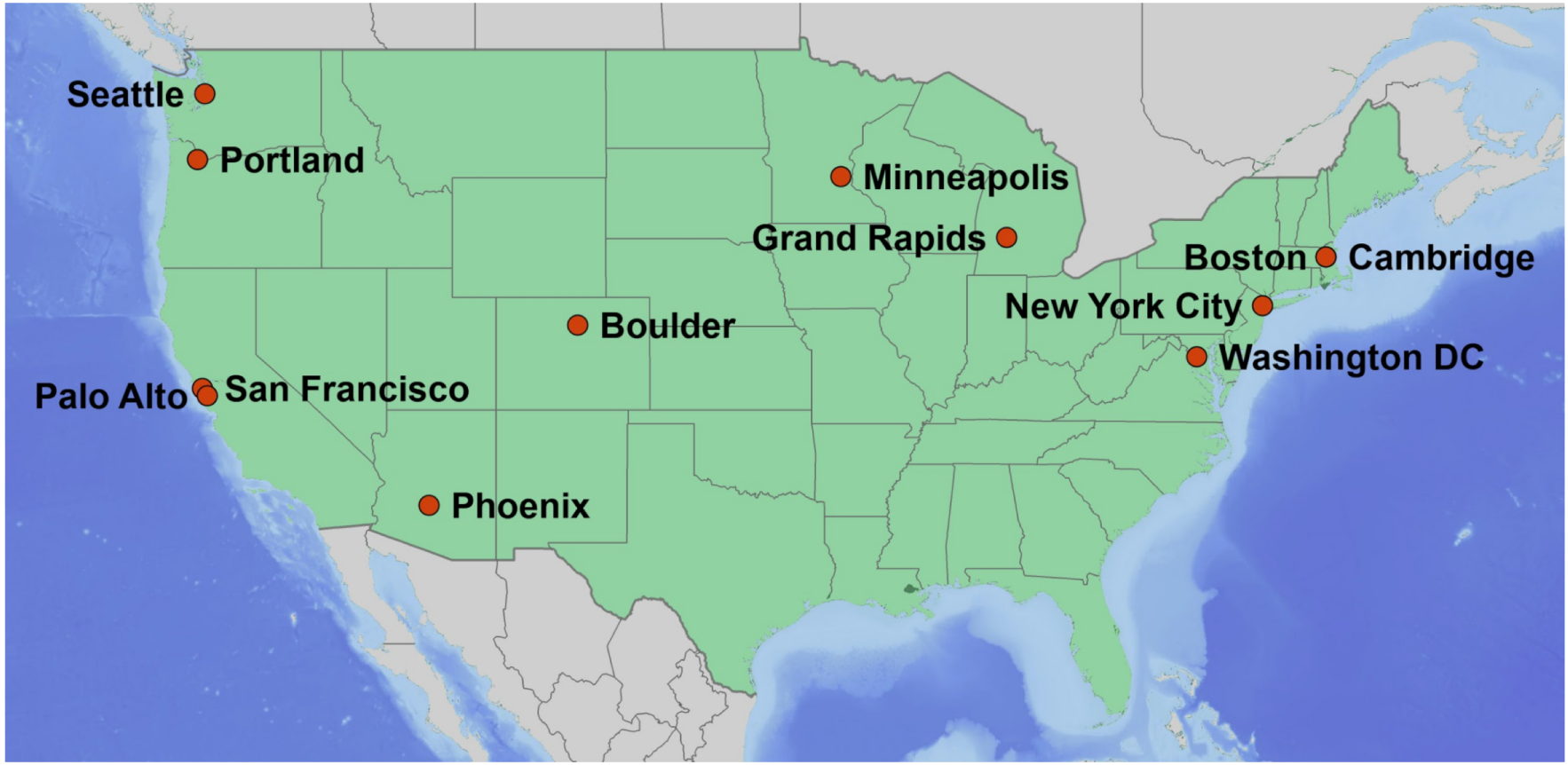
nbi new buildings institute

CNCA CARBON NEUTRAL CITIES ALLIANCE

USDN urban sustainability directors network

RESOURCE MEDIA

About the Zero Cities Network



USDN urban sustainability directors network

About the Zero Cities Network

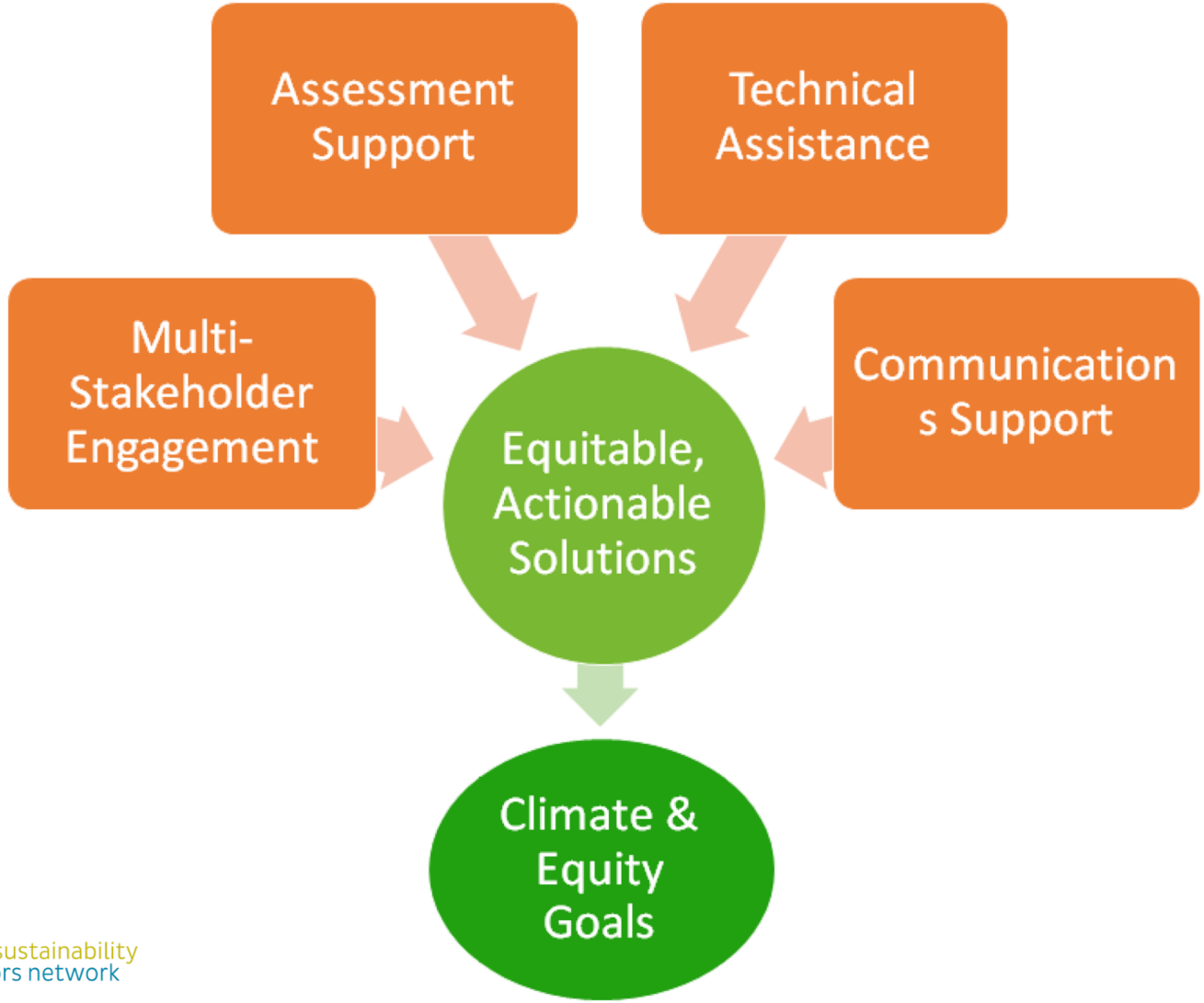
What Does a Roadmap Include?

Policies & Programs

2050 Implementation Plan

Assessments, Tools & Support

Project Framework and Approach



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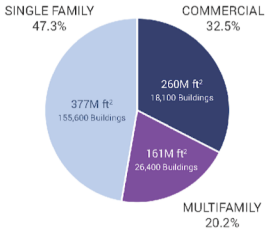
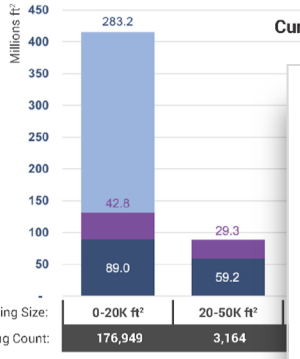
Assessment Support: Building Sector Analysis

BUILDING AREA SUMMARY

Current Building Area by Type



Current Building Area by Size



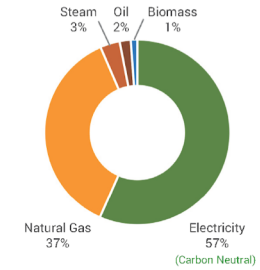
The chart above was generated from typology-level 2015 building area data from the 2017 Building Energy Use Intensity Targets study by Ecotope for the Seattle Office of Sustainability and Environment (OSE). The Building Area by Size chart (right) was generated using 2017 building area data from the King County Department of Assessments, chosen for the availability of individual property information. All energy and GHG projections that follow in this report use building area data from the Seattle OSE study.

A review of the Seattle building
reveals that over two-thirds of t
residential and one-third is com
Single family buildings represe
type at over 155,000 buildings
million ft² (47%) of total buildin

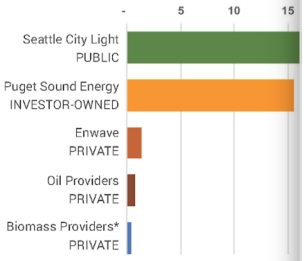
When building area is analyzed
size, it is found that small build

BUILDING ENERGY SUMMARY

Energy Fuel Mix (2015)



Energy Providers (2015)



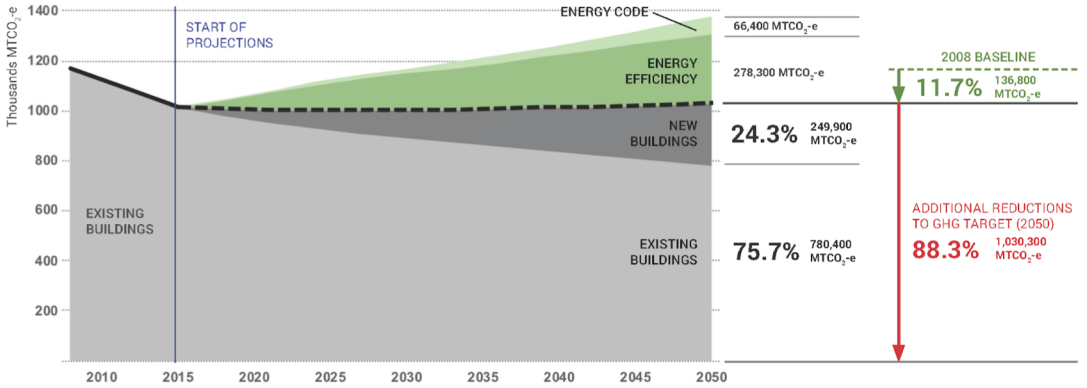
* Biomass providers are additi

The charts above were generated from a review of 2015 energy consumption data in the 2017 Building Energy Use Intensity Targets study from the Seattle Office of Sustainability and Environment (OSE).

use at over one-third. The rema
is sourced as small quantities
oil and biomass from private pr

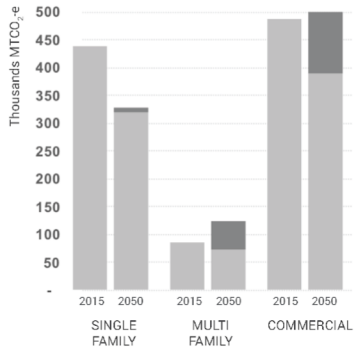
When energy use is viewed by

BUILDING GHG EMISSIONS TRENDS



The chart above is generated by applying greenhouse gas intensity factors, as reported in the 2017 study from Seattle OSE, to the previously stated energy use trends. Energy code savings and energy efficiency savings are calculated with similar application of GHG intensity factors to the savings reported in Building Energy Trends.

BUILDING GHG EMISSIONS BY TYPE



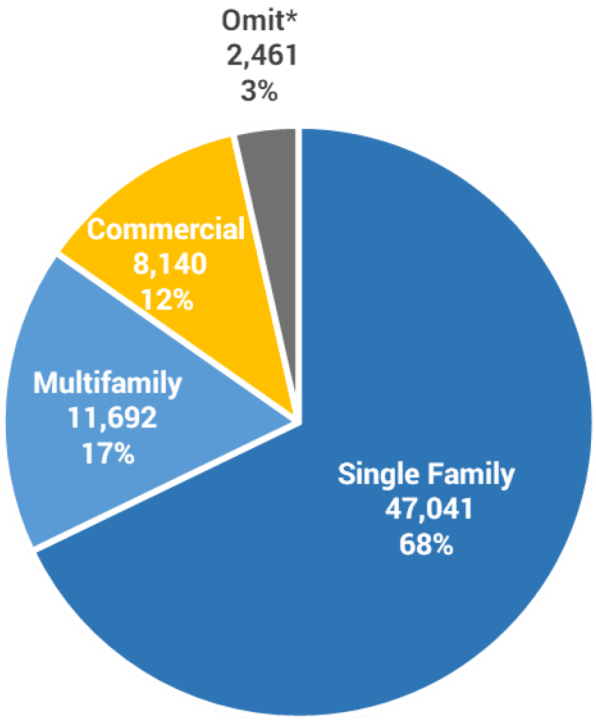
The Seattle building sector is projected to produce 11.7% less GHG emissions by 2050 compared to the 2008 baseline emissions. GHG emissions from the existing building stock are projected to decrease by nearly a third from 2008 due to increased efficiency, fuel switching, and demolition. However, the emissions contributed from new buildings are projected to overcome the existing building emissions reductions from 2015 onwards, leading to an increase in total building sector emissions by 2050.

When GHG emissions are analyzed by building type, it is found that the majority of emissions reductions from 2008 are associated with single family buildings, due to a significant reduction in energy intensity that is primarily fossil fuel based. Conversely, multifamily and commercial buildings are expected to generate more GHG emissions

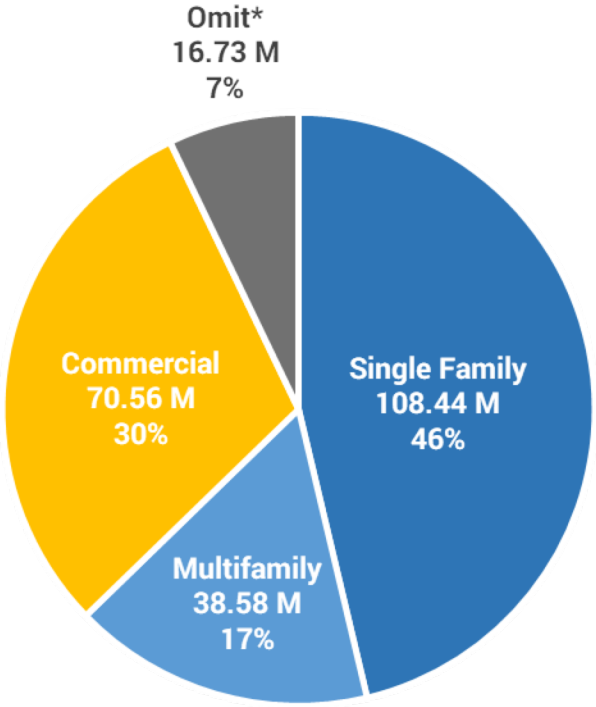
Overall, over one million metric tons of additional CO2 emissions must be reduced in order to meet the City of Seattle's carbon neutral goals. Because existing buildings are projected to contribute over 75% of GHG emissions in 2050, it is recommended that proposed policies be prioritized to specifically accelerate energy efficiency while transitioning to carbon free energy sources (via on-site or off-site procurement of renewable energy). While new buildings are projected to come online with enhanced energy efficiency, supplemental policies should be proposed to achieve even greater performance targets while ensuring that no new on-site fossil fuel based energy systems are introduced.

BUILDING STOCK TOTALS

BUILDING QUANTITIES



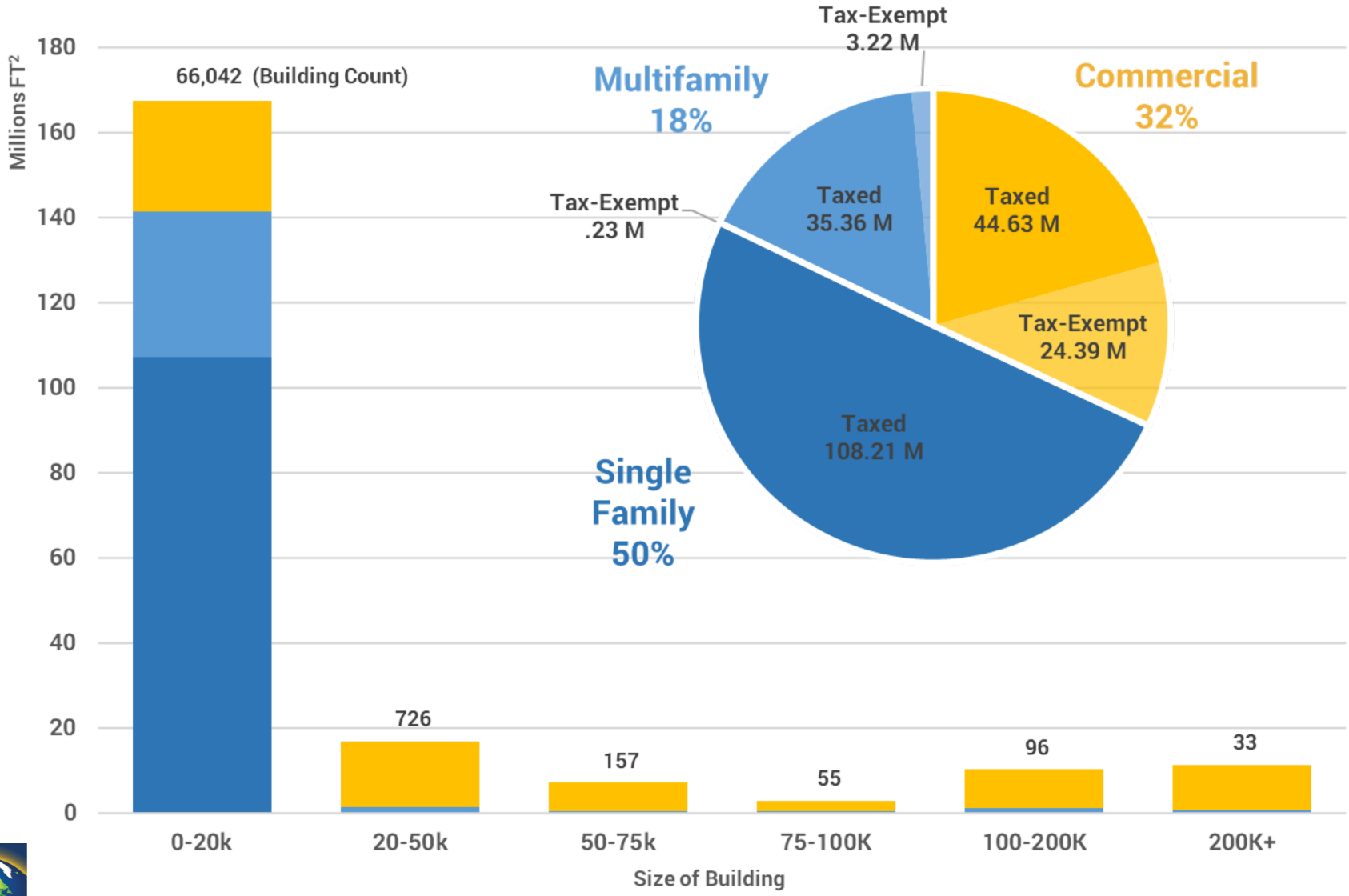
BUILDING GROSS FLOOR AREA (FT^2)



* Buildings omitted from this study include those designated as parking areas or industrial use (primarily process energy)

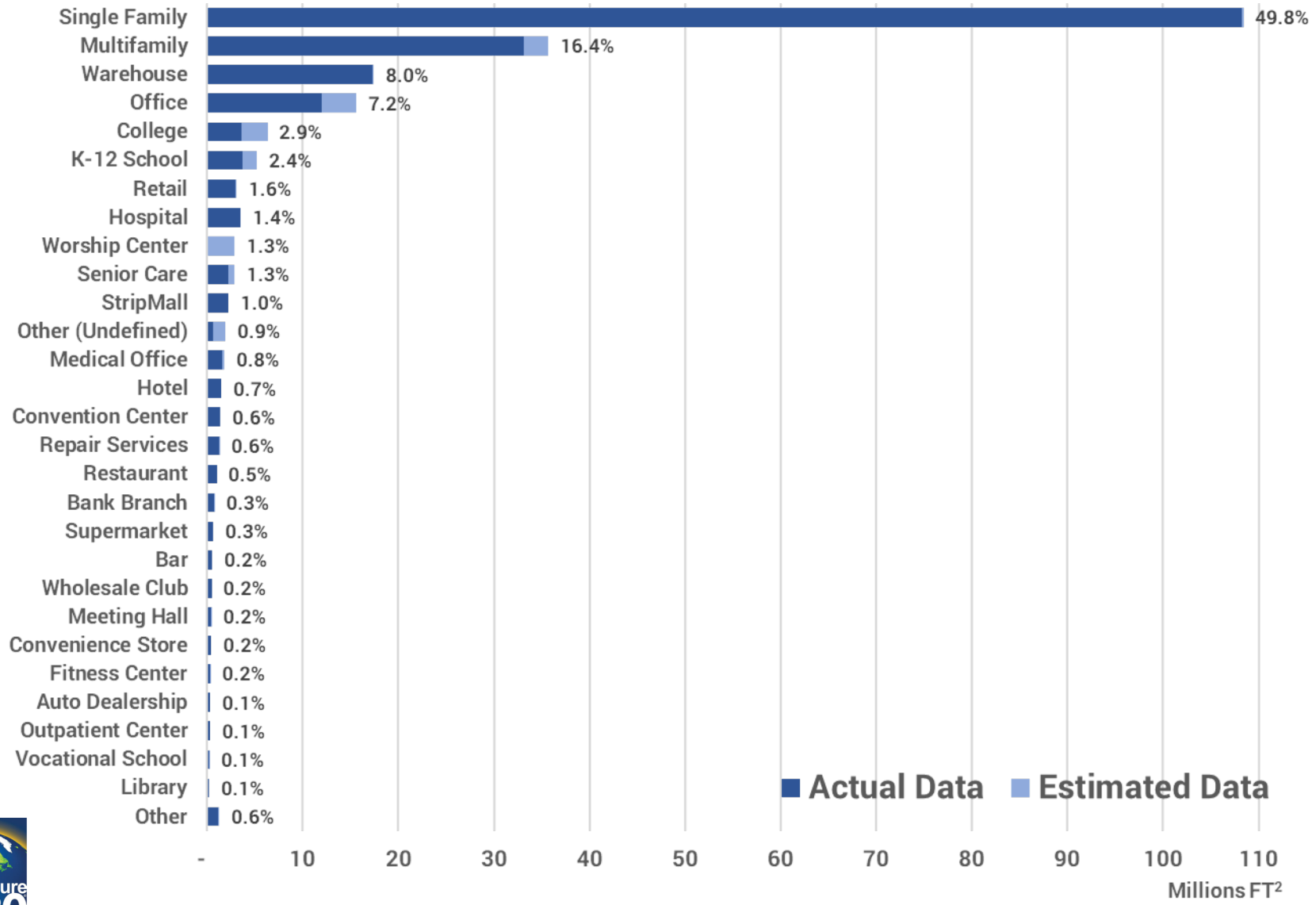
GROSS FLOOR AREA BY BUILDING SIZE

(Million FT^2)



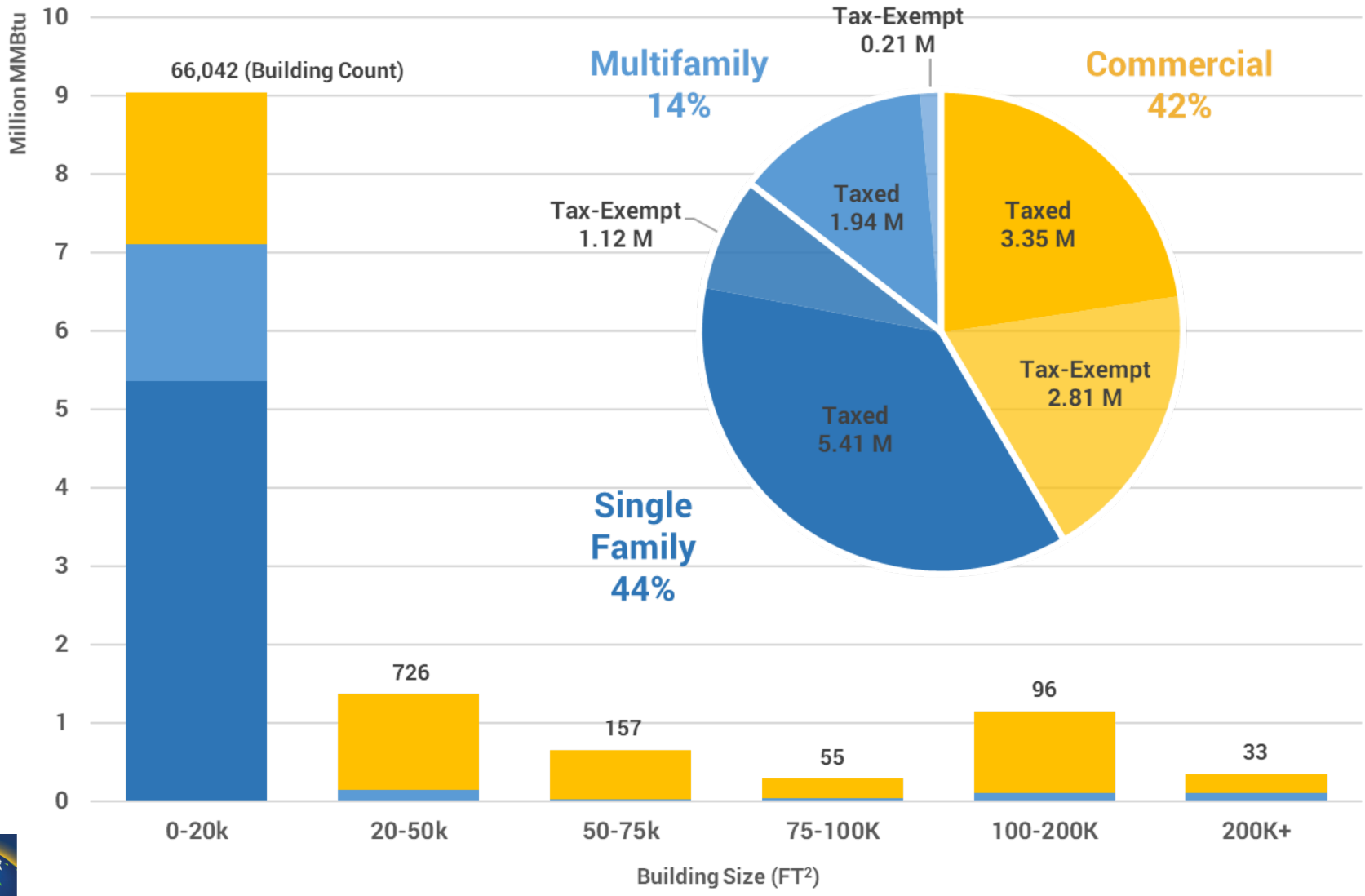
GROSS FLOOR AREA BY BUILDING TYPE

(Million FT²)



ENERGY CONSUMPTION BY BUILDING SIZE

(Million MMBtu)



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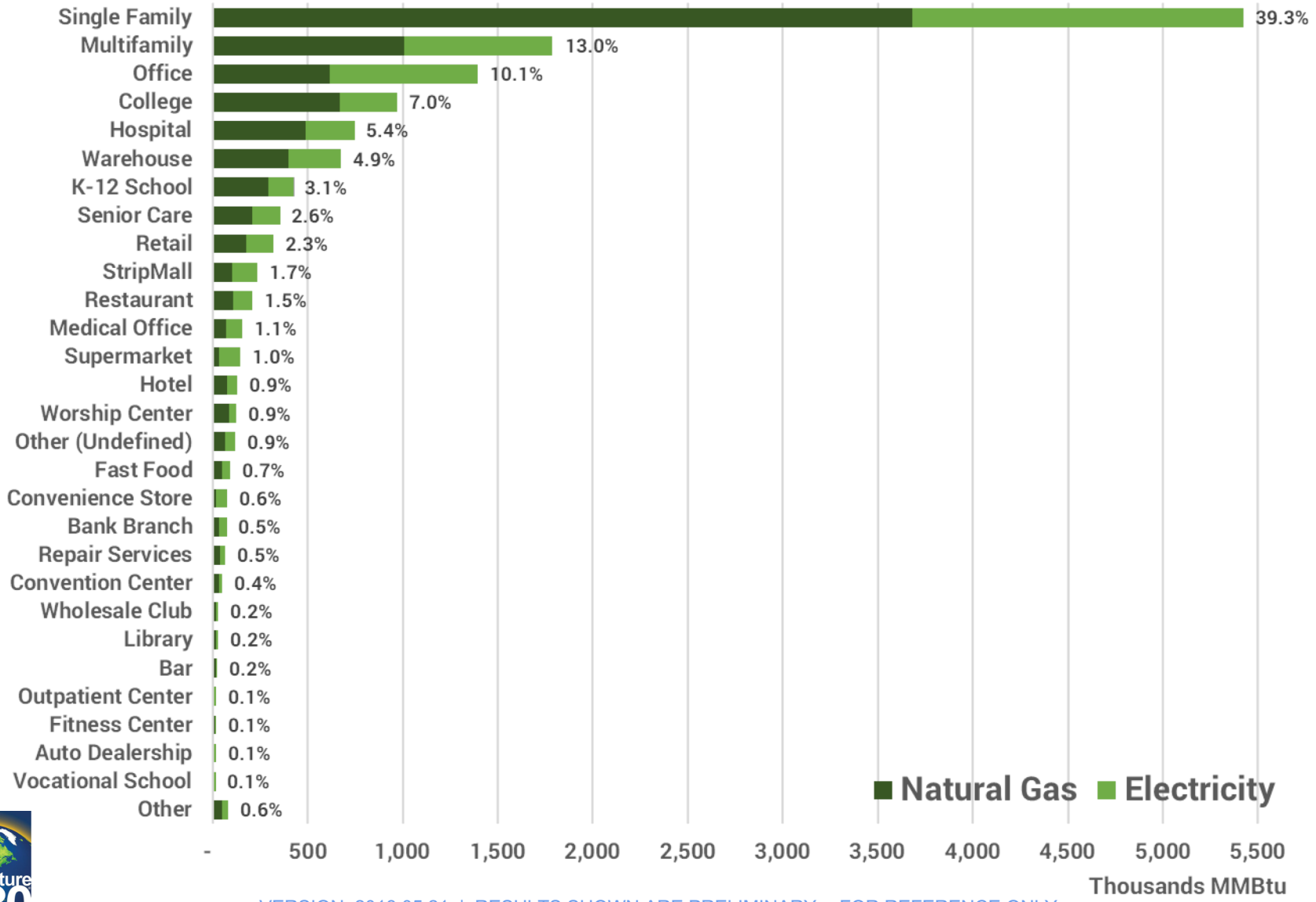
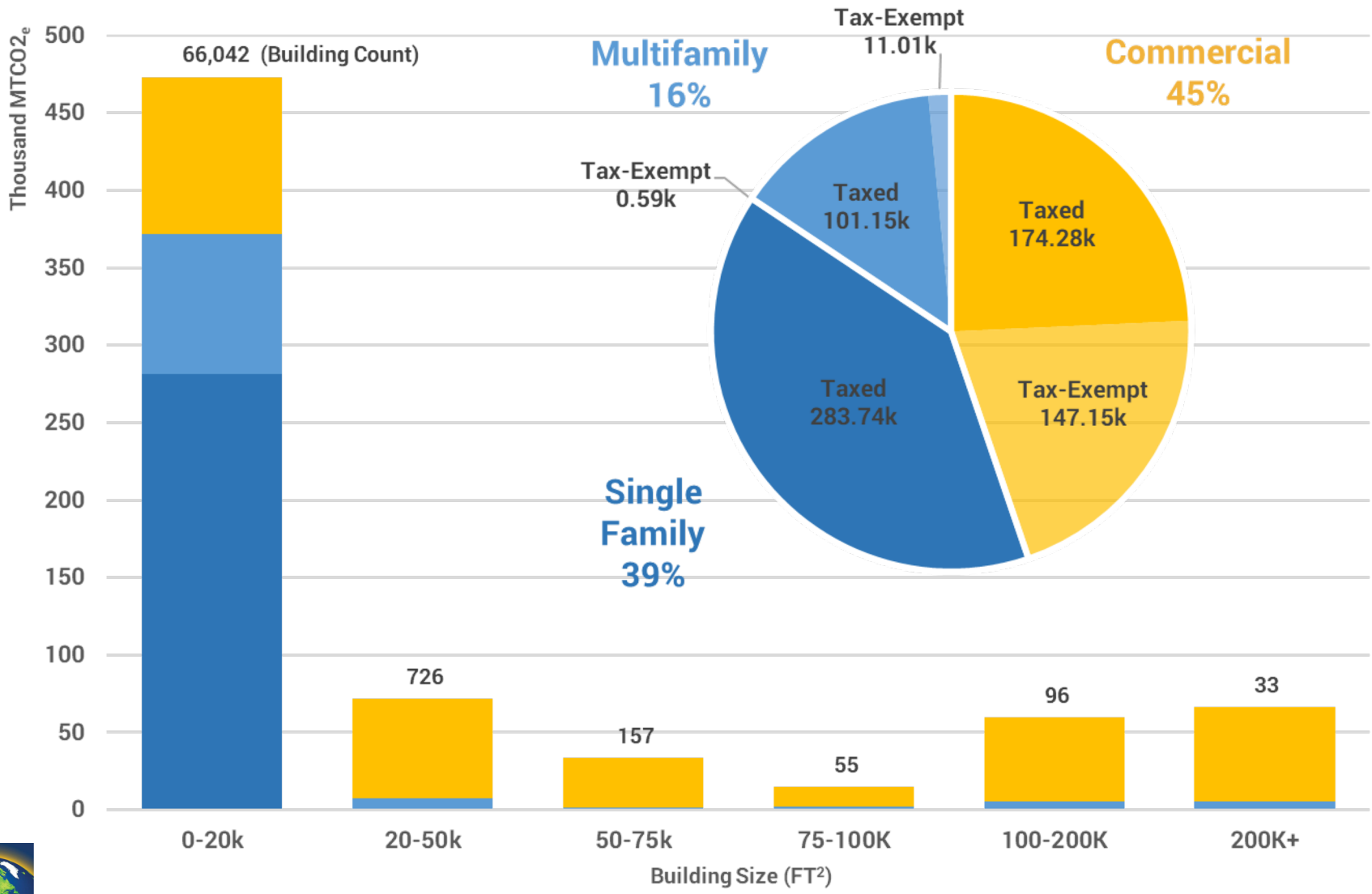


GHG EMISSIONS BY BUILDING SIZE

(Thousand $MTCO2_e$)



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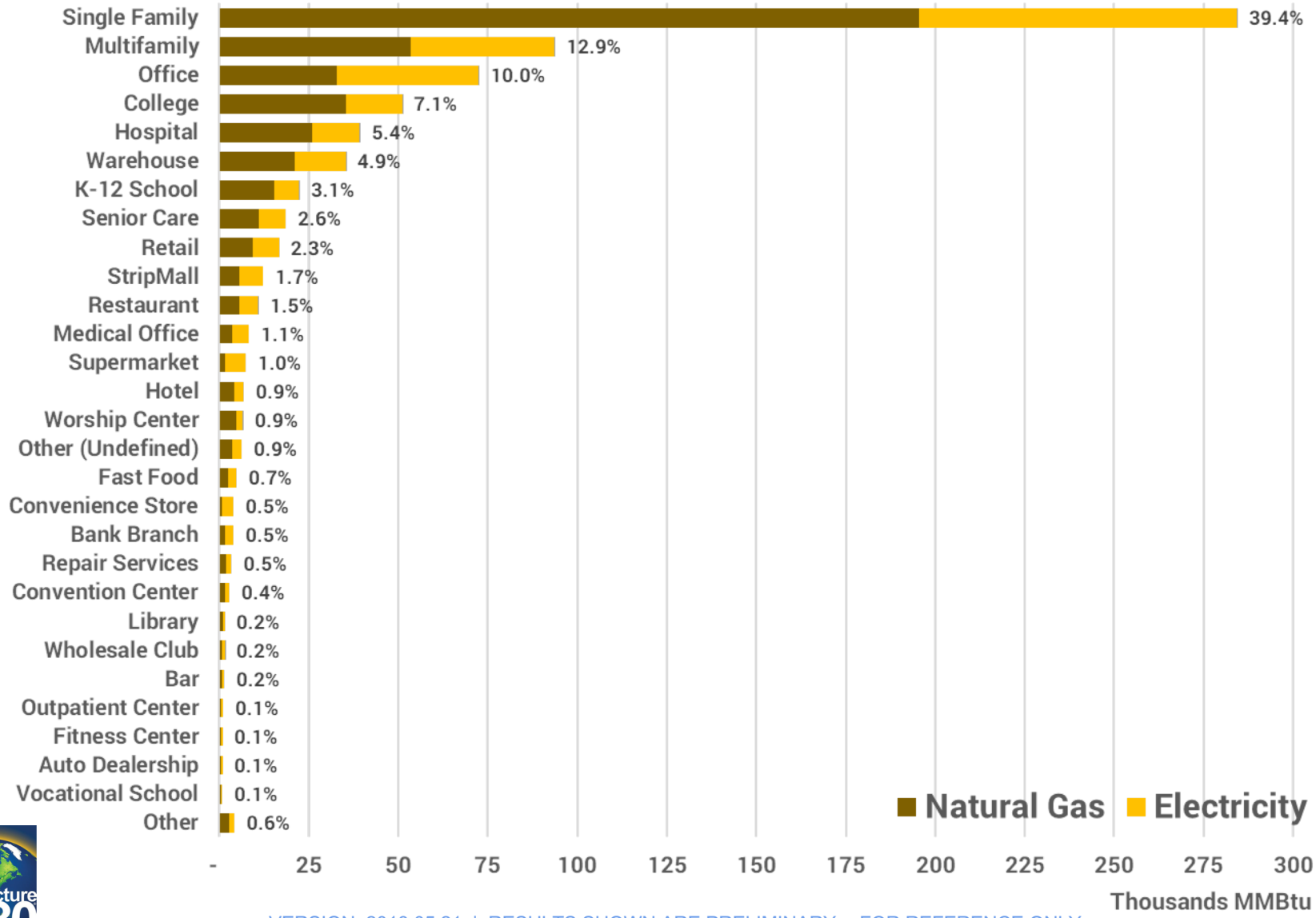


AVERAGE EUI BY BUILDING TYPE

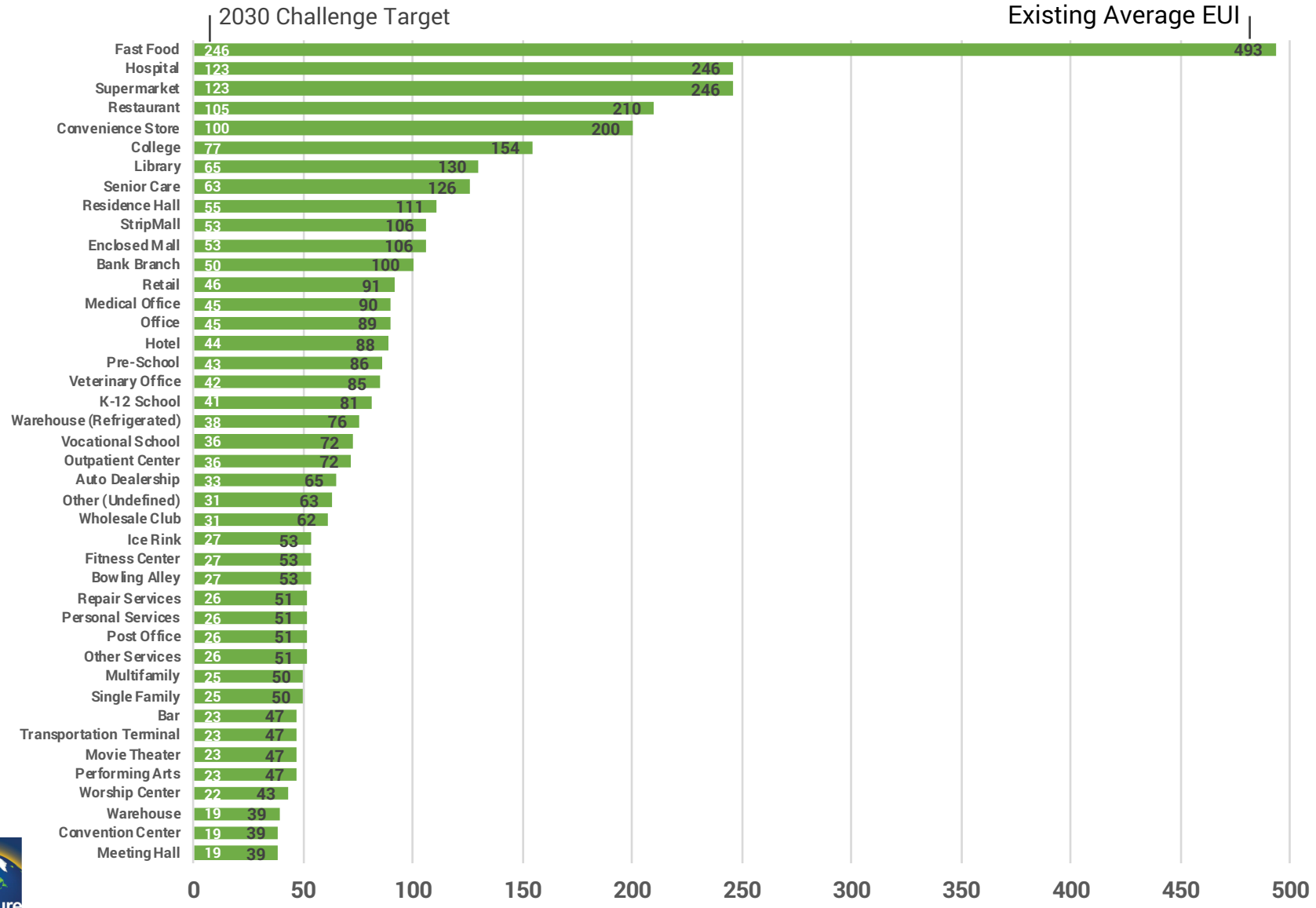
(kBTU/ft^2/year)

Building Use Type	Average EUI
Auto Dealership	65
Bank Branch	100
Bar	47
Bowling Alley	53
College	154
Convenience Store	200
Convention Center	39
Enclosed Mall	106
Fast Food	493
Fitness Center	53
Hospital	246
Hotel	88
Ice Rink	53
K-12 School	81
Library	130
Medical Office	90
Meeting Hall	39
Movie Theater	47
Multifamily	50
Office	89
Other (Undefined)	63

Building Use Type	Average EUI
Other Services	51
Outpatient Center	72
Performing Arts	47
Personal Services	51
Post Office	51
Pre-School	86
Repair Services	51
Residence Hall	111
Restaurant	210
Retail	91
Senior Care	126
Single Family	50
Strip Mall	106
Supermarket	246
Transportation Terminal	47
Veterinary Office	85
Vocational School	72
Warehouse (Refrigerated)	76
Warehouse	39
Wholesale Club	62
Worship Center	43

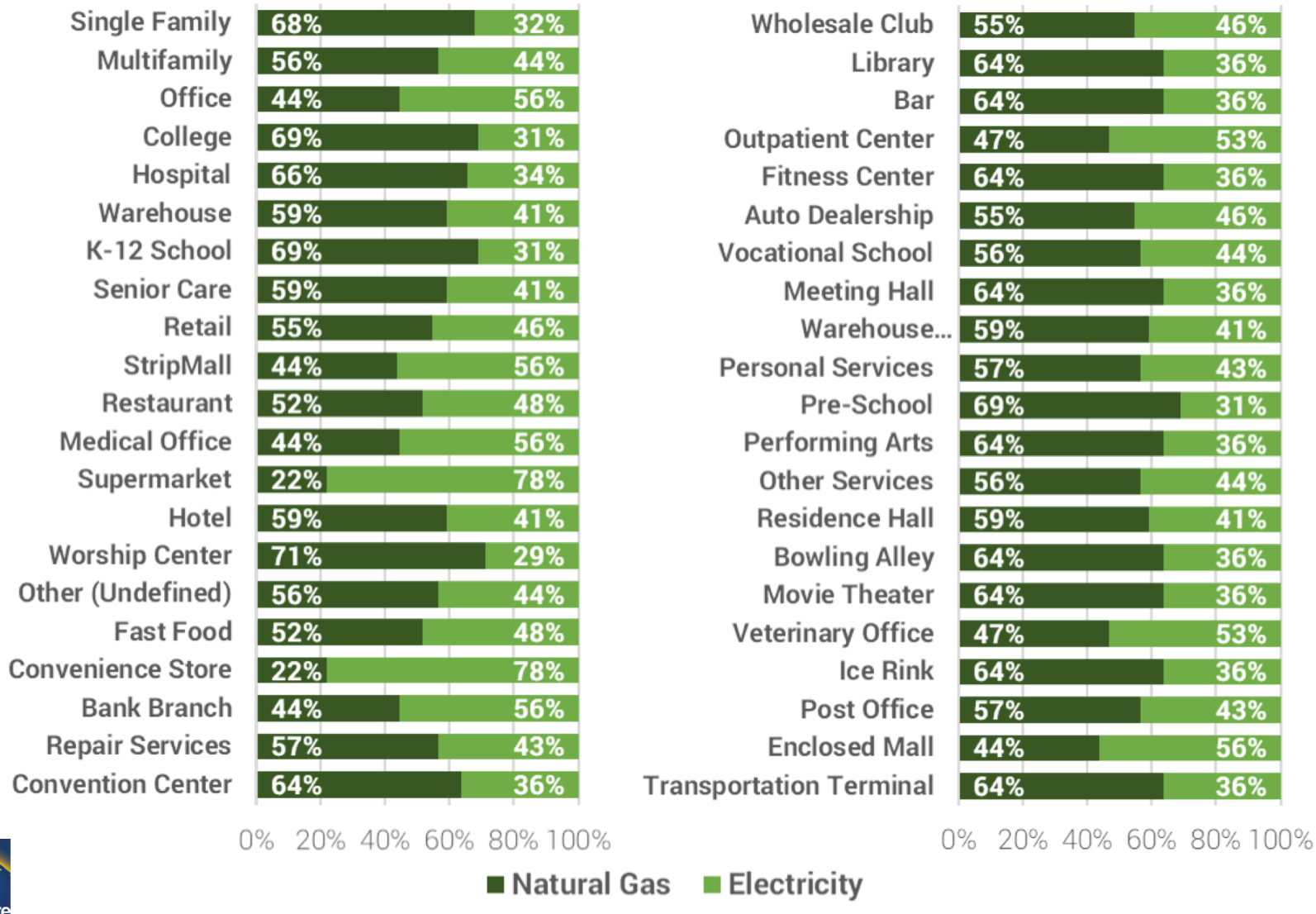
AVERAGE ENERGY USE INTENSITY

(kBTU/ft^2/year)



ESTIMATED FUEL MIX BY SPACE TYPE

(Listed in descending order of total energy consumption)



PROJECTIONS METHODOLOGY

1. **Develop Population Projections to 2050**
   - Historical data + Growth Projections
2. **Project Total Building Area & New Construction to 2050**
   - Total Area = Existing – Demolition + New Construction
3. **Project Building Energy Consumption to 2050**
   - (New Area * Code EUI) + (Existing Area * Current EUI)
4. **Project Building Energy GHG Emissions to 2050**
   - Energy Consumption * GHG Emissions Factors

Assessment Support: Building Sector Analysis

NEXT STEPS:

Complete Projections to 2050

- ➔ Change in Building Area
- ➔ Added New Building Energy Consumption
- ➔ Reduced Existing Building Energy Consumption
- ➔ Change in Electricity Grid Carbon Intensity

Assess Impact of Potential Policies at Building Intervention Points

- ➔ Renovations/Reclassification
- ➔ Building Maintenance Cycles
- ➔ Building Sales & Lease
- ➔ Time-Certain Mandates

Aligned to Capital Improvement Cycles

Thank you!

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