

WA Commercial Building Energy Performance Standards – Revised EUI Means & Draft Targets

June 18, 2020

Presented at: webinar

Prepared by: **SBW Consulting Team**



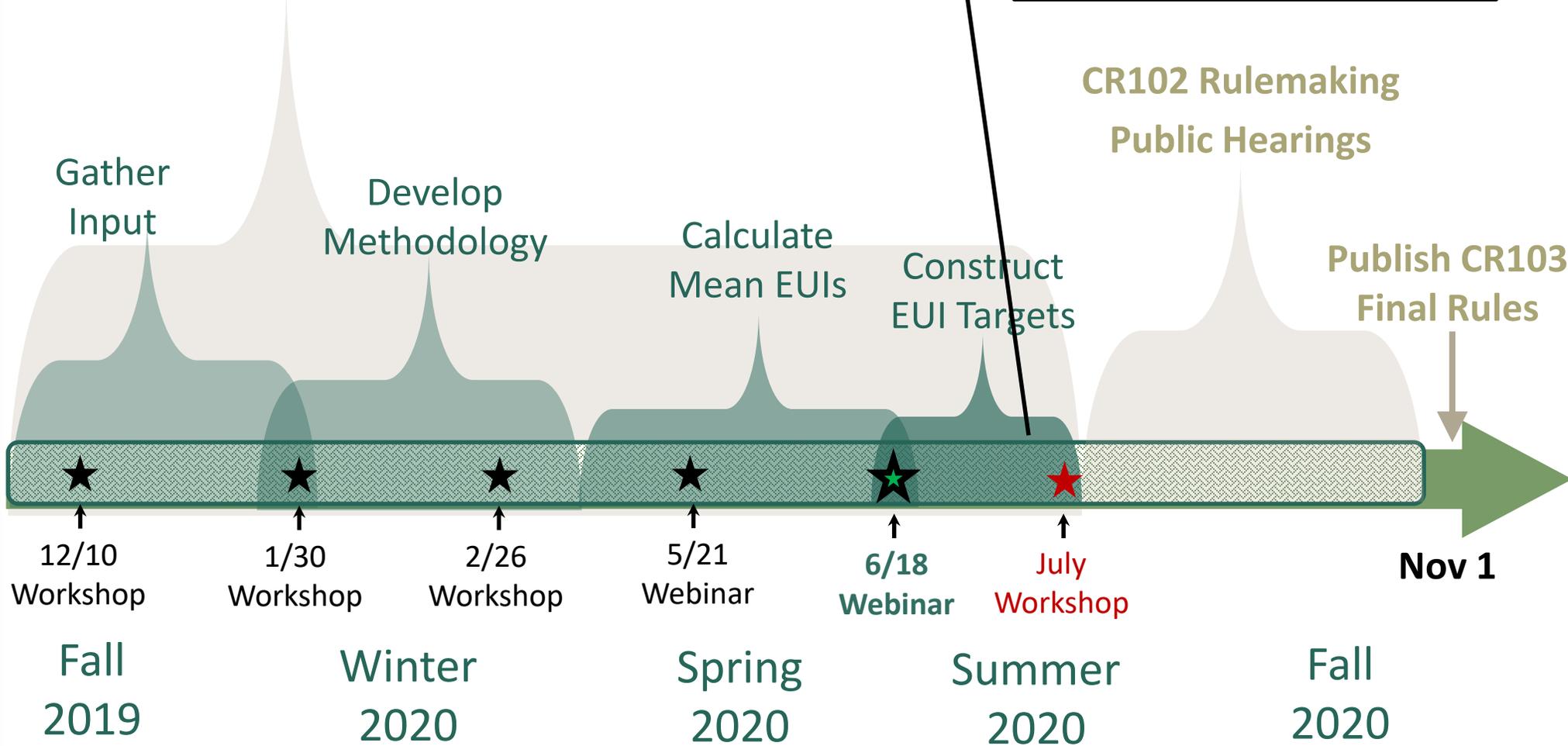
Agenda:

- EUI Target Development Process
- Revised Draft Mean EUIs
- Normalization Factor Analysis
- Draft EUI Targets Continuum
- Target Setting Considerations

EUI Target Development Process

CR101 Pre-rulemaking

**Comments due
July 2, 2020**





REVISED DRAFT MEAN EUIS

Recap of Public Input on Draft Means

- Climate zone ratios for hospitals
 - Only ASHRAE building type with 5b ratio < 4c ratio causing 5b mean < 4c mean
 - Judgement/data indicate this does not make sense so recommending same target for 4c and 5b
- Operating shifts normalization factors for hospitals
 - No data for <168 operations, develop weighted target and use factors for clinics, etc
- Medical office
 - EUI mean Medical Office (Diagnostic) corrected itself with other revisions and is what will be assigned to Energy Star Portfolio Manager Property Type Medical Office
- Refrigerated warehouses
 - No data to support factor for lower temp vs. higher temp warehouses
- Exclusion of sub 10k SF restaurants and grocery
 - Added these back in to inform targets for convenience store and fast food which building owners may use for developing weighted targets

Overview of Updated Methodology for Establishing Mean EUIs

- Calculate individual CBECS building EUIs
 - Assign an ASHRAE climate ratio to each building to convert from current climate zone to 4C and 5B
 - Calculate Each building's 4C and 5B EUI (and energy use)
 - Calculate mean EUIs for buildings in Washington's climate zones
- Calculate Mean CBSA EUIs
 - Use data from 2009, 2014, 2019 to determine an average for Washington State
- Formulaically determine that a CBSA, or a CBECS Mean EUI should be used based on relative errors of each mean
- Updated memo on [Methodology for Establishing Mean EUIs](#)

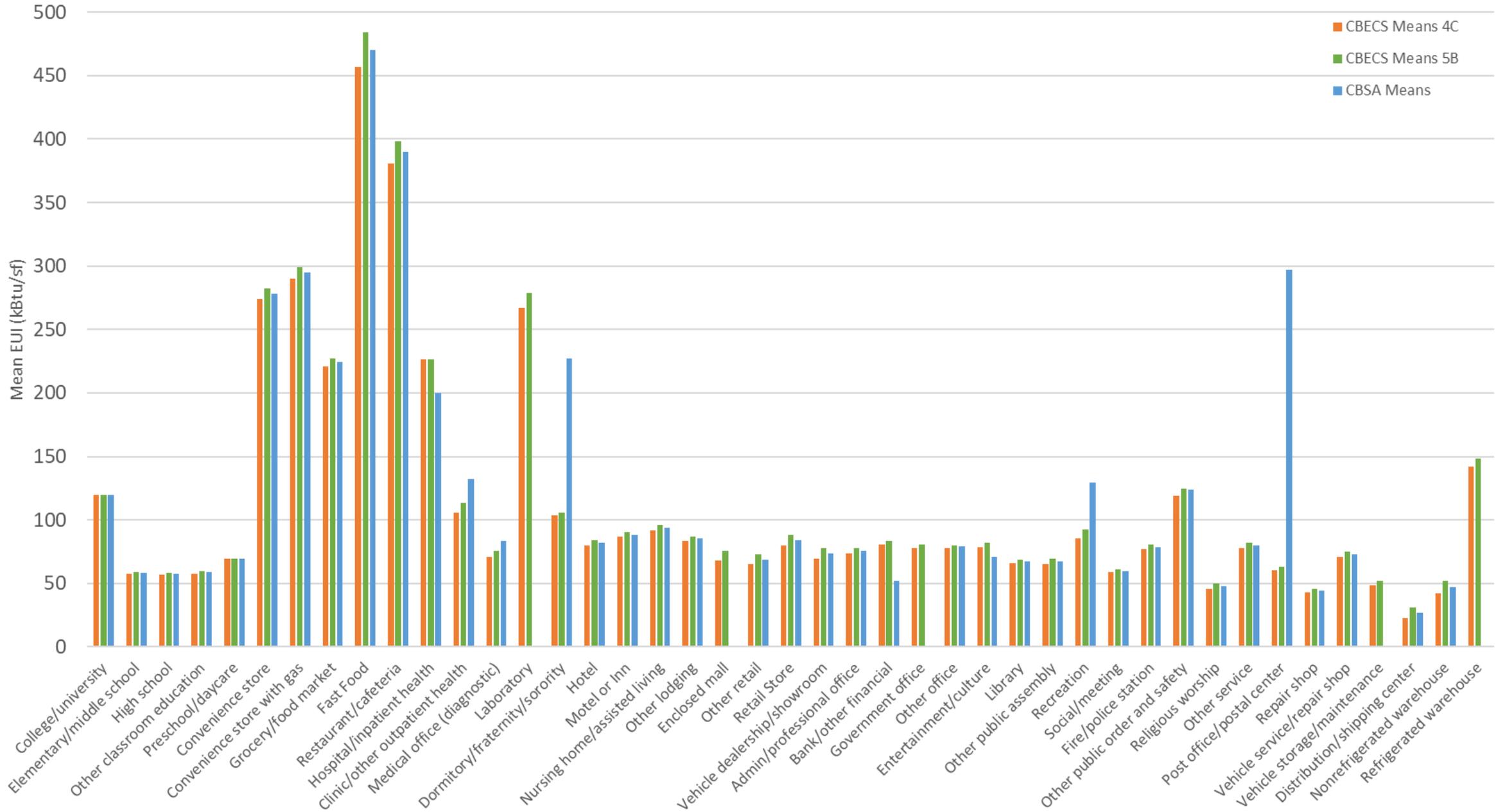
Make Climate Adjustments to Derive Zonal CBECS Mean EUIs

- ASHRAE climate zone factors
 - Use proportions established in ASHRAE 100 (IE. Office in 4C has EUI 40/39 higher than 1A)
 - Apply factors to each 2012 CBECS Buildings.
 - Can also be applied in reverse to get 4C/5B from statewide means

Table 7-2a Building Activity Site Energy Targets (EUI_{fl}) (I-P Units)

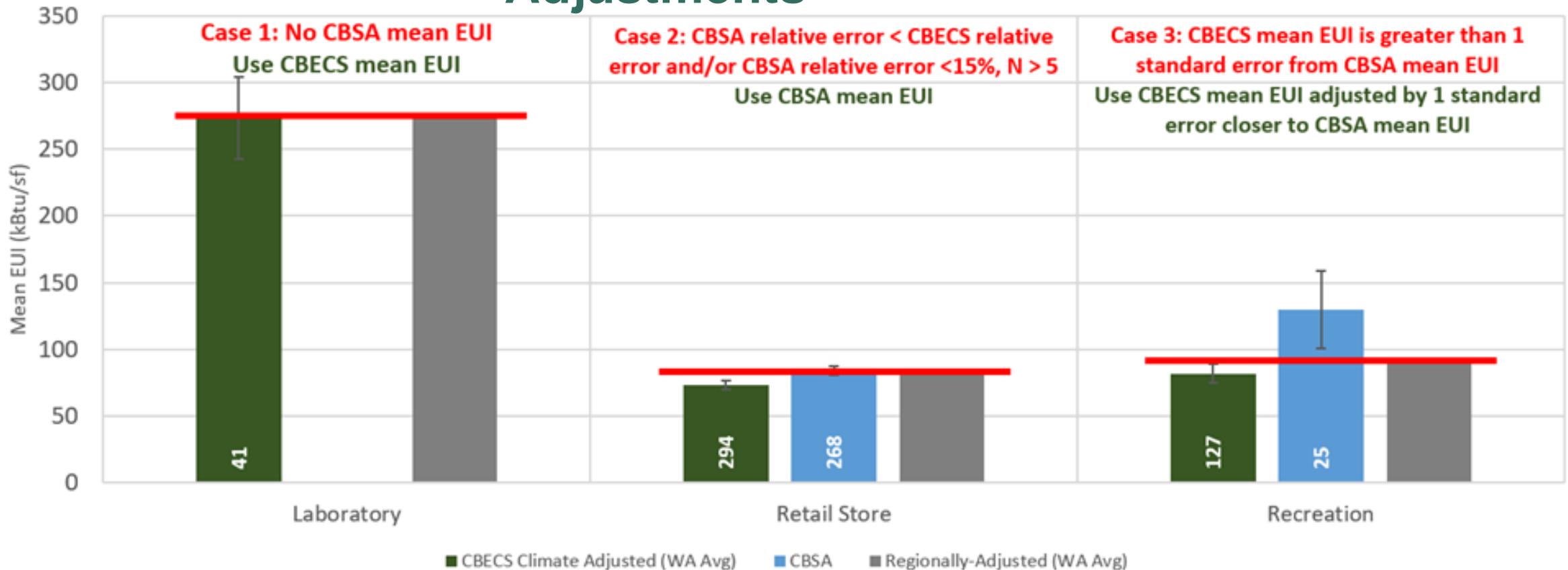
No.	Commercial Building Type	EUIs by Building Type by Climate Zone (kBtu/ft ² ·yr)									
		ASHRAE Climate Zone									
		1A	2A	2B	3A	3B Coast	3B Other	3C	4A	4B	4C
1	Admin/professional office	39	40	39	42	33	39	33	46	40	40
2	Bank/other financial	55	57	56	59	46	55	47	65	56	57
3	Government office	49	50	49	52	41	48	42	57	49	50
4	Medical office (nondiagnostic)	33	34	33	35	28	33	28	39	34	34

Climate-Adjusted CBECS EUI Means and CBSA Means

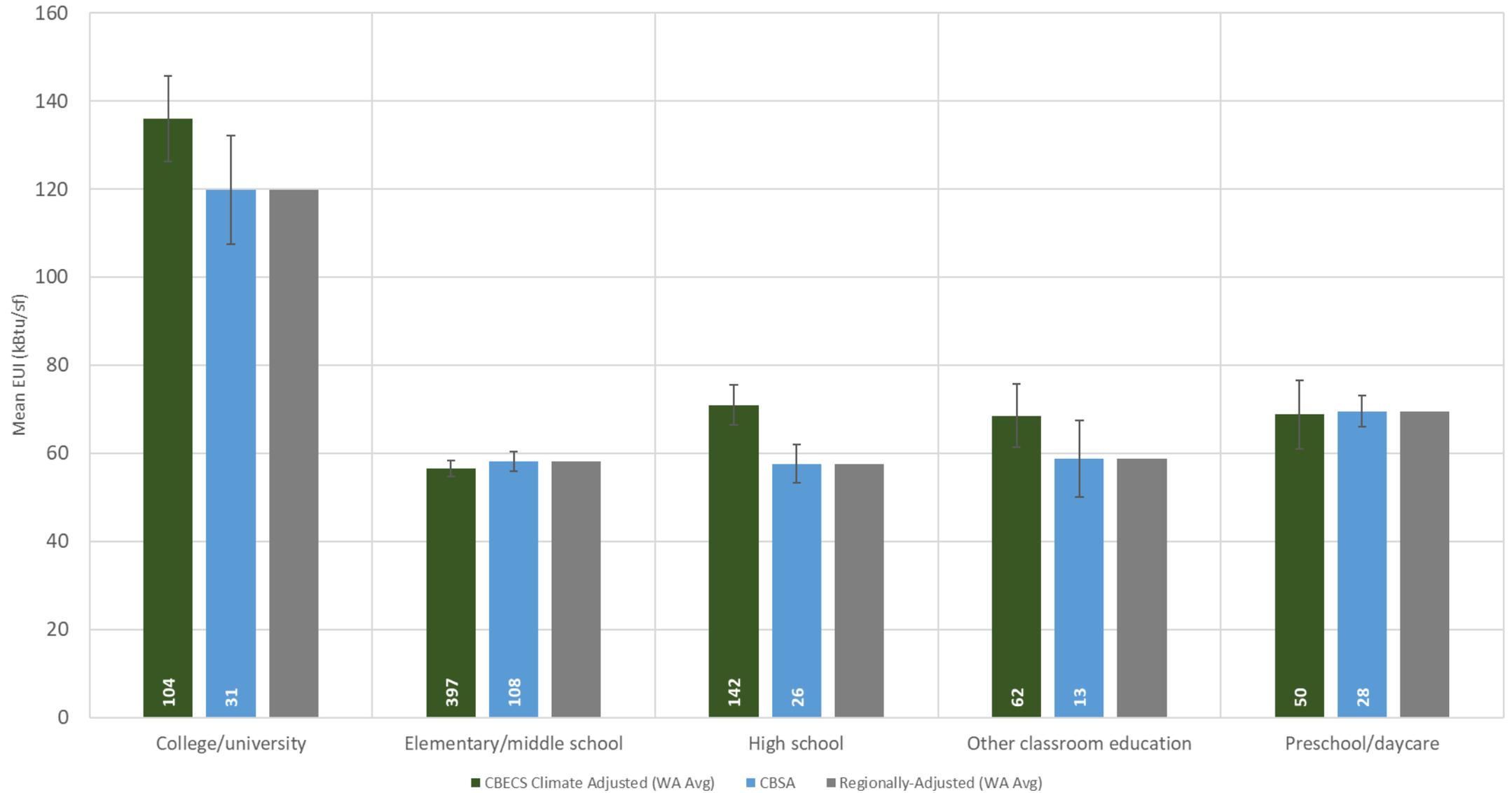


Develop Regionally-Adjusted Mean EUIs

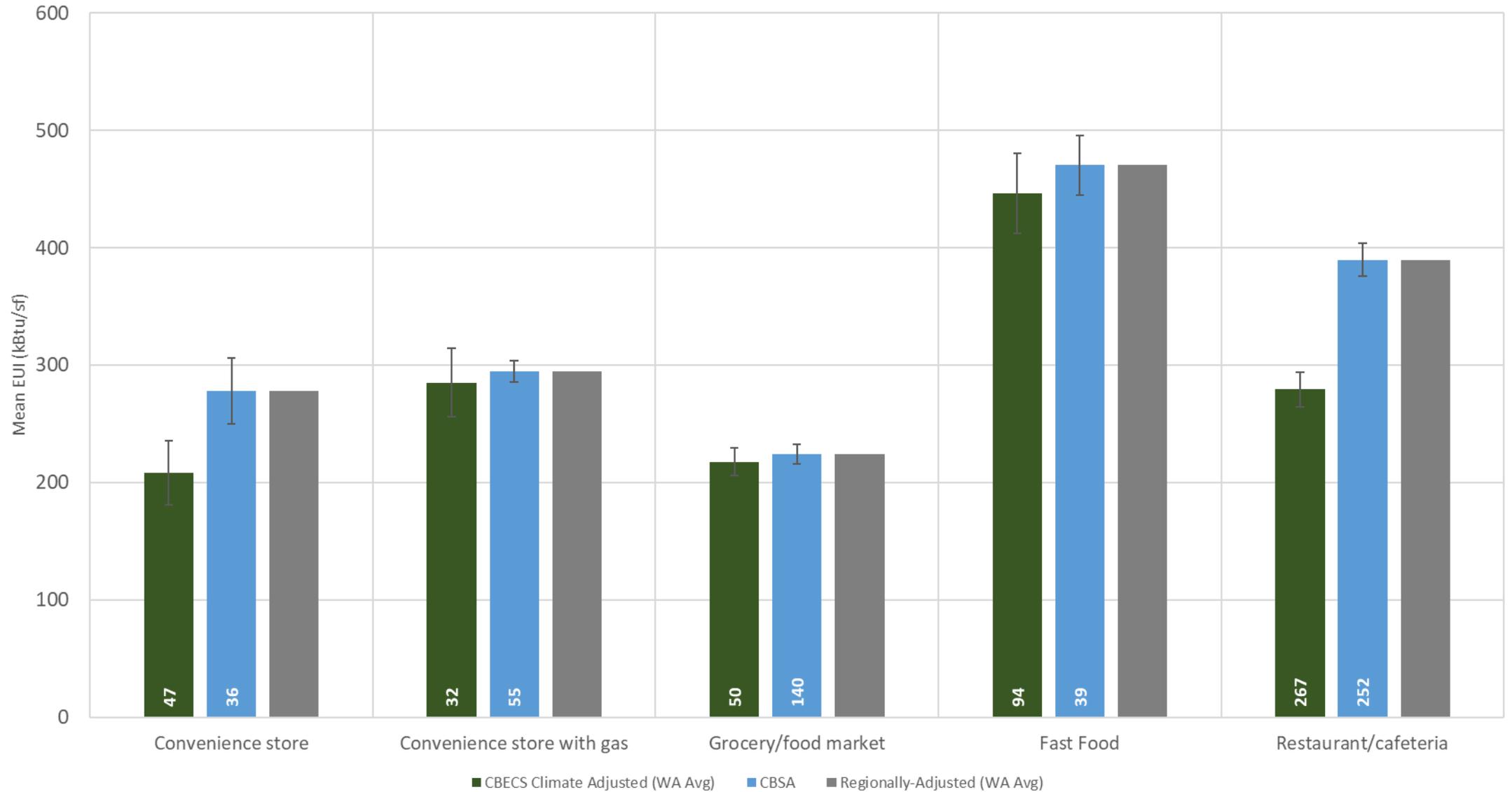
Examples of Adjustments



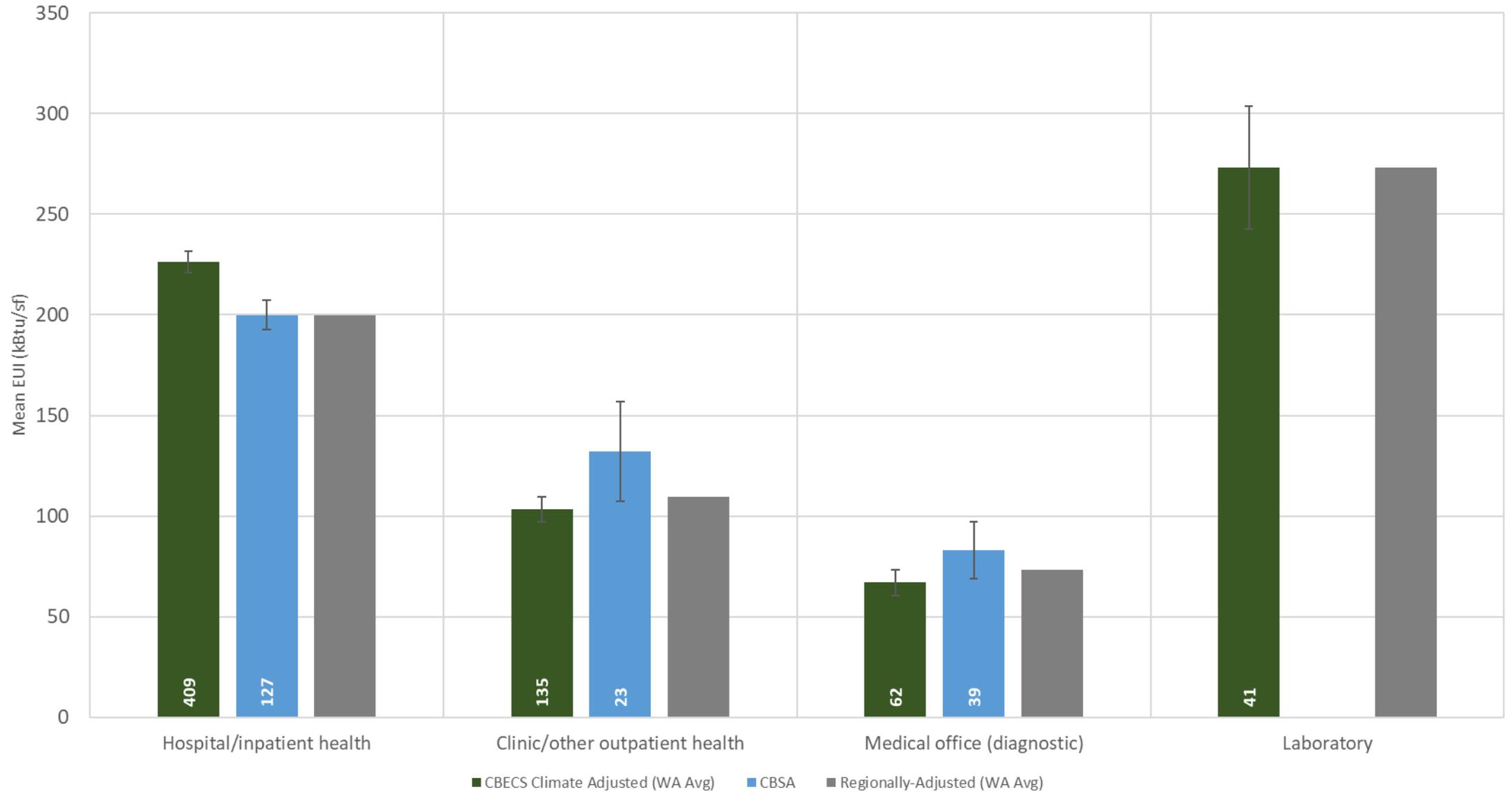
Education



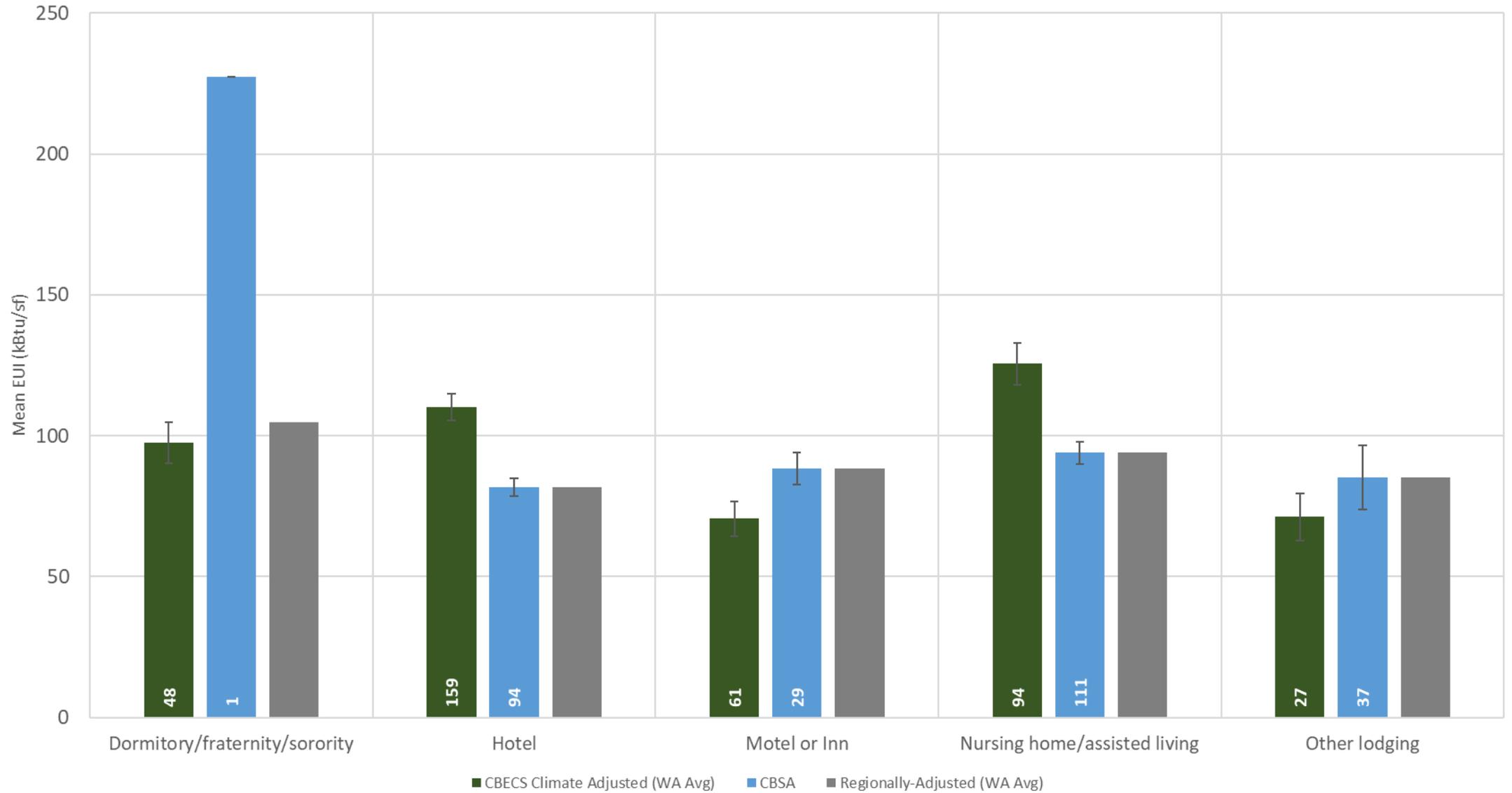
Food Sales and Food Service



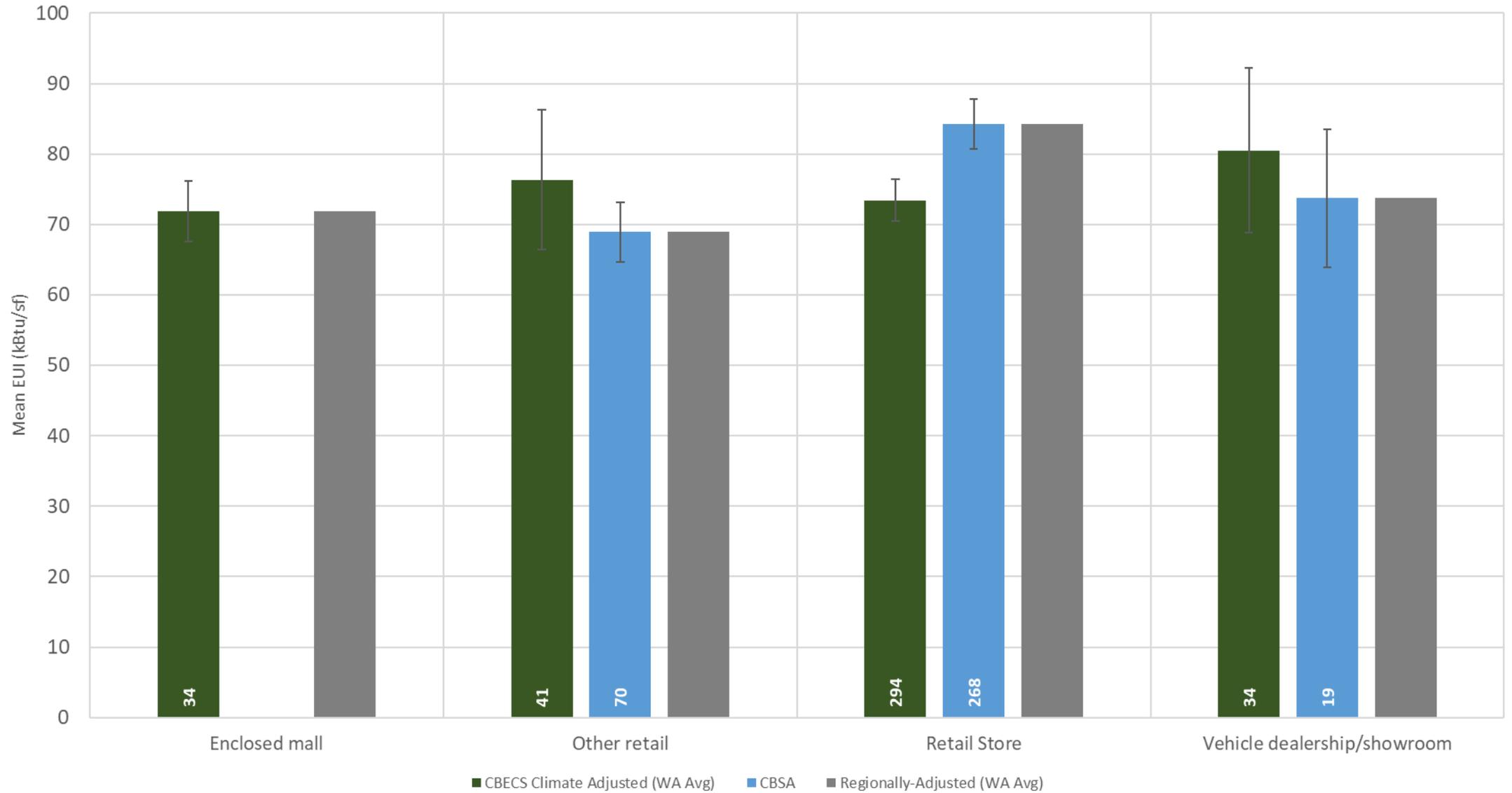
Healthcare and Laboratory

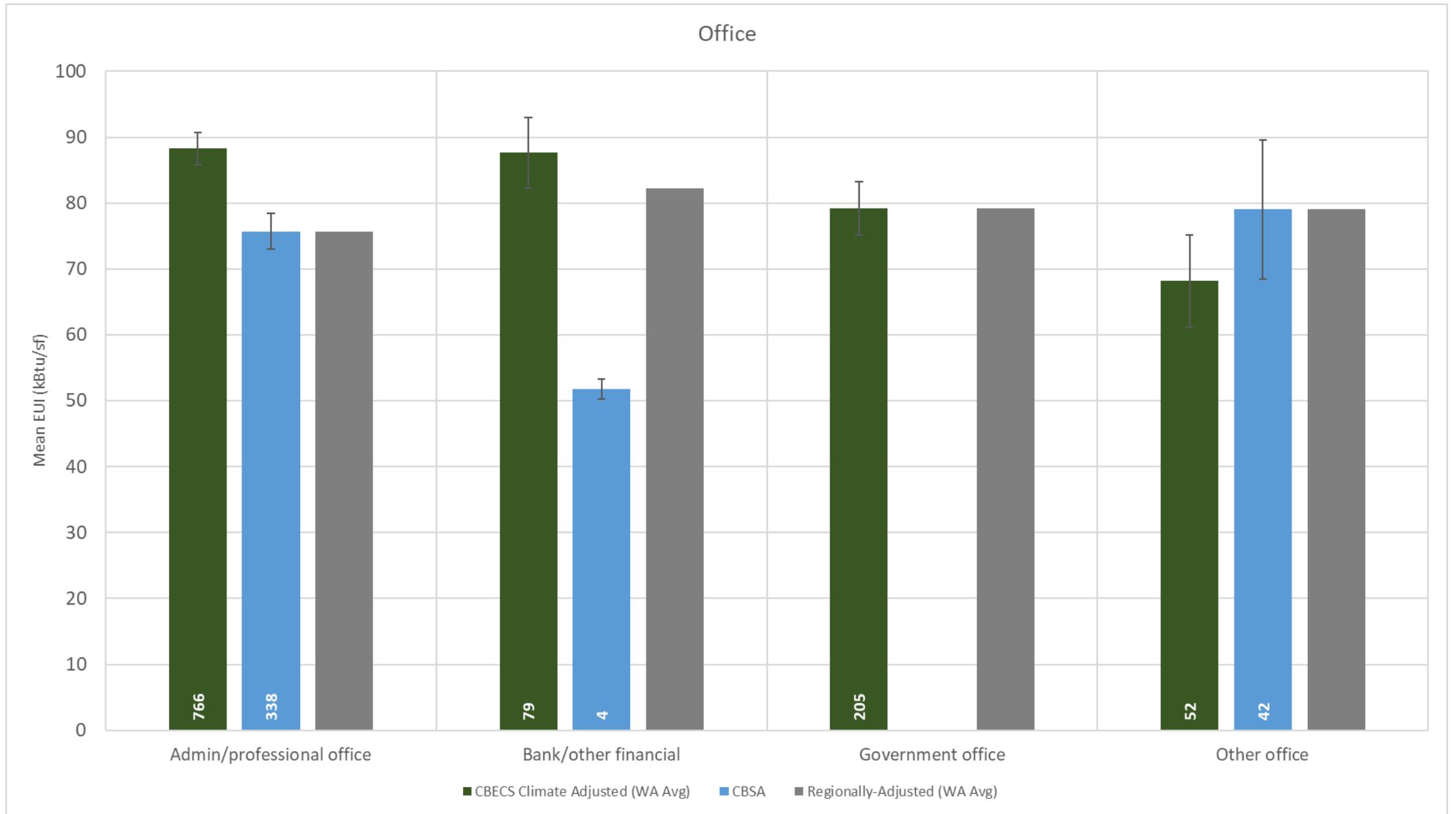


Lodging

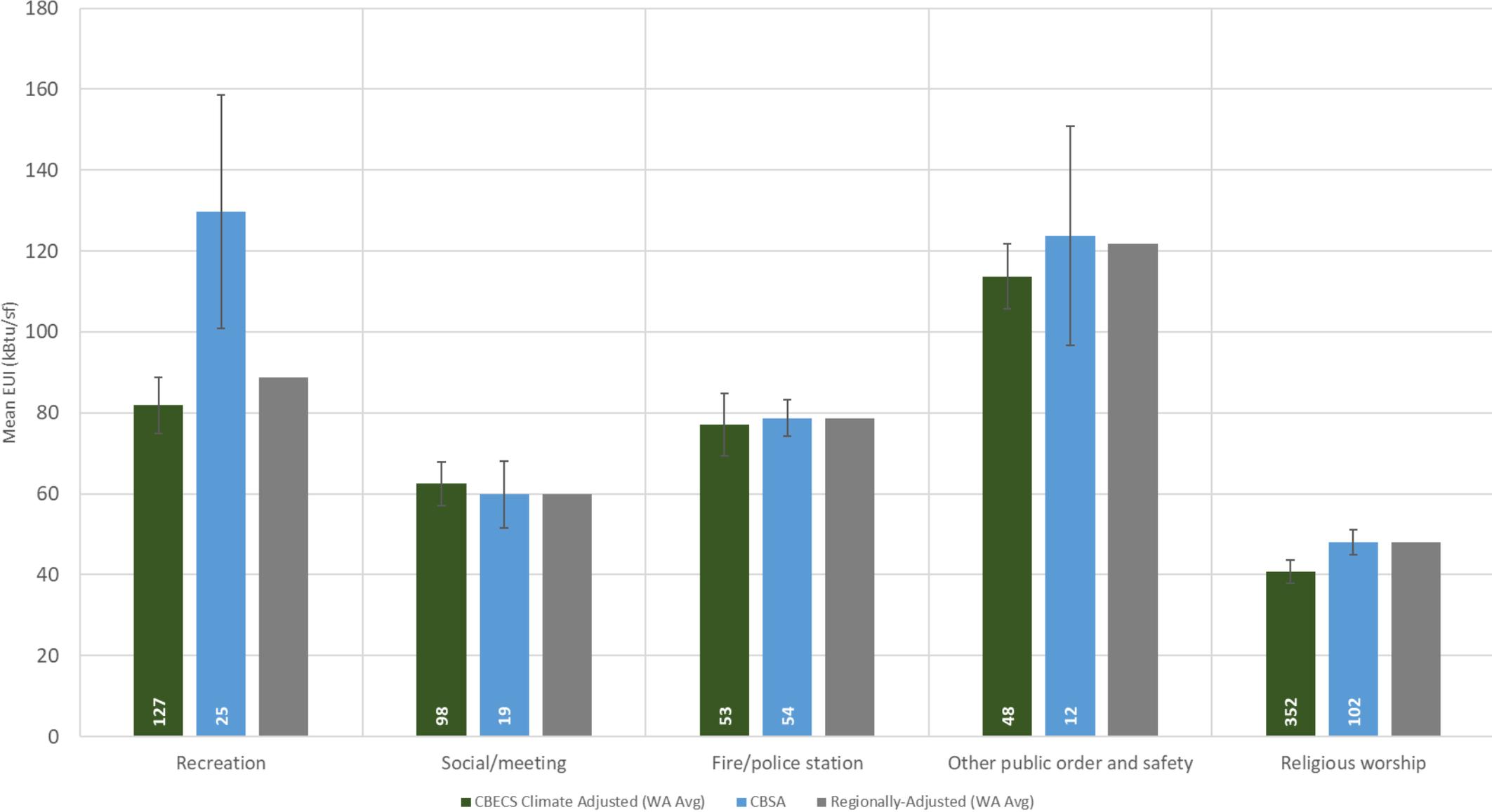


Mercantile

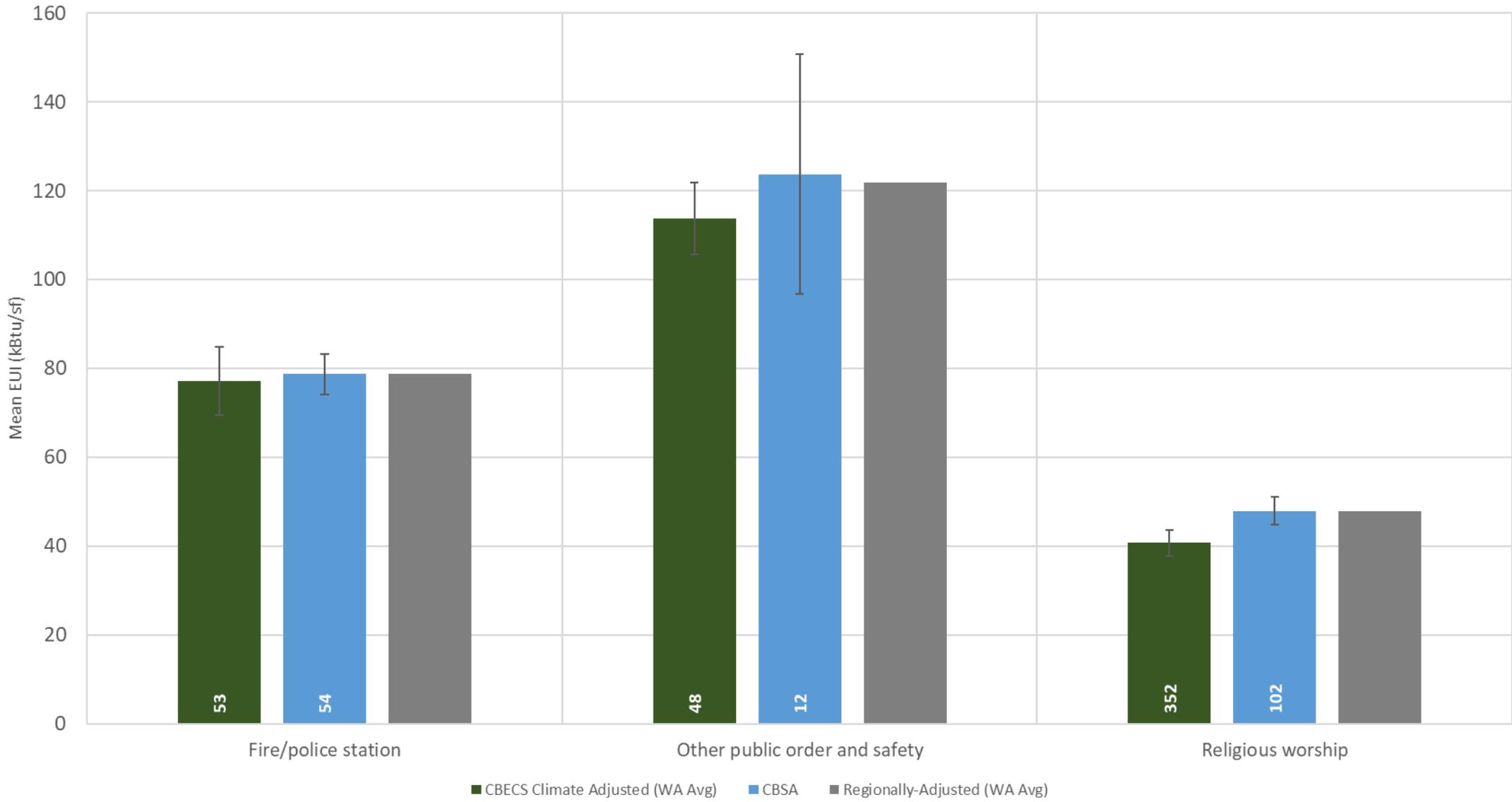


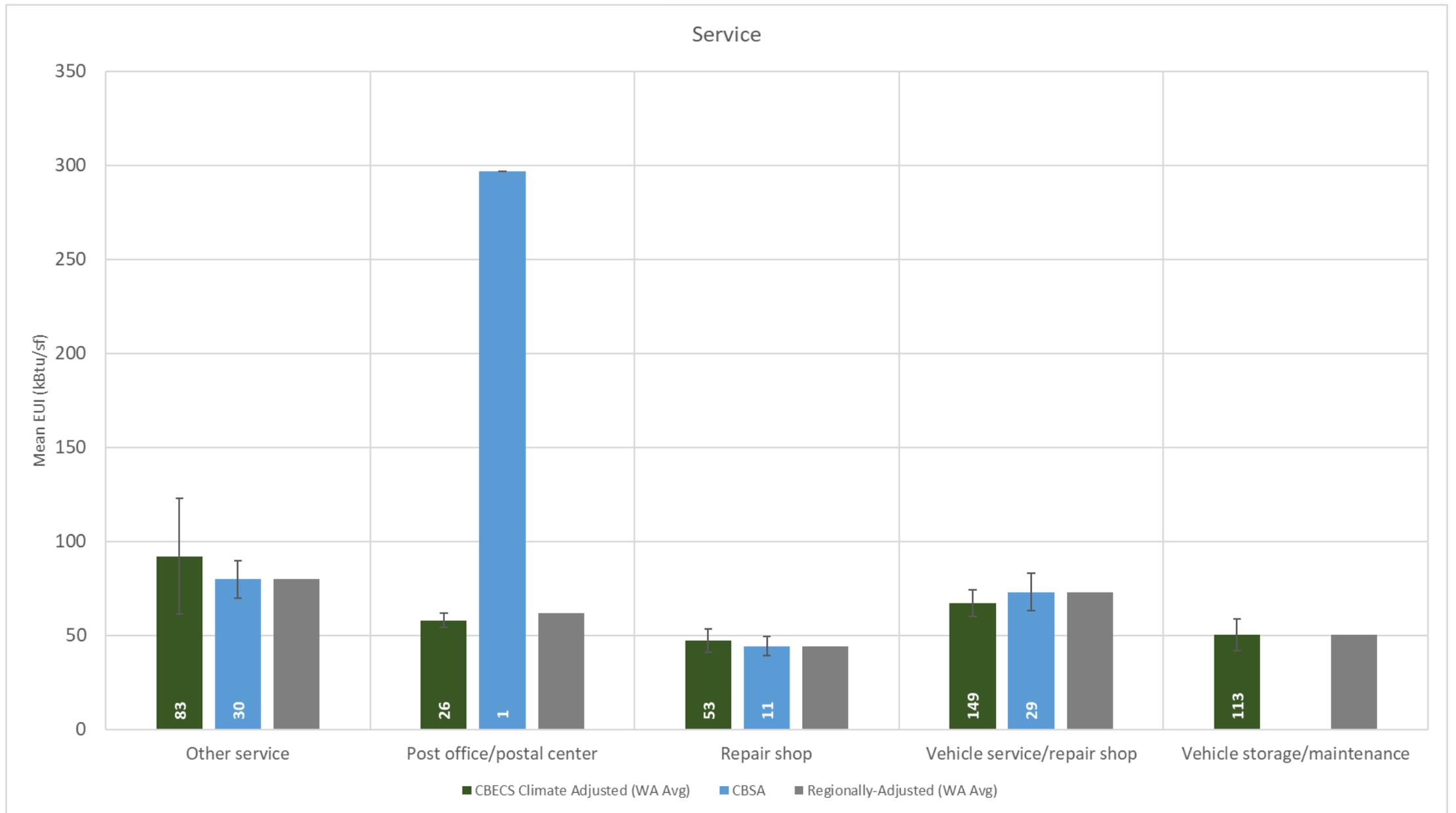


Public Assembly

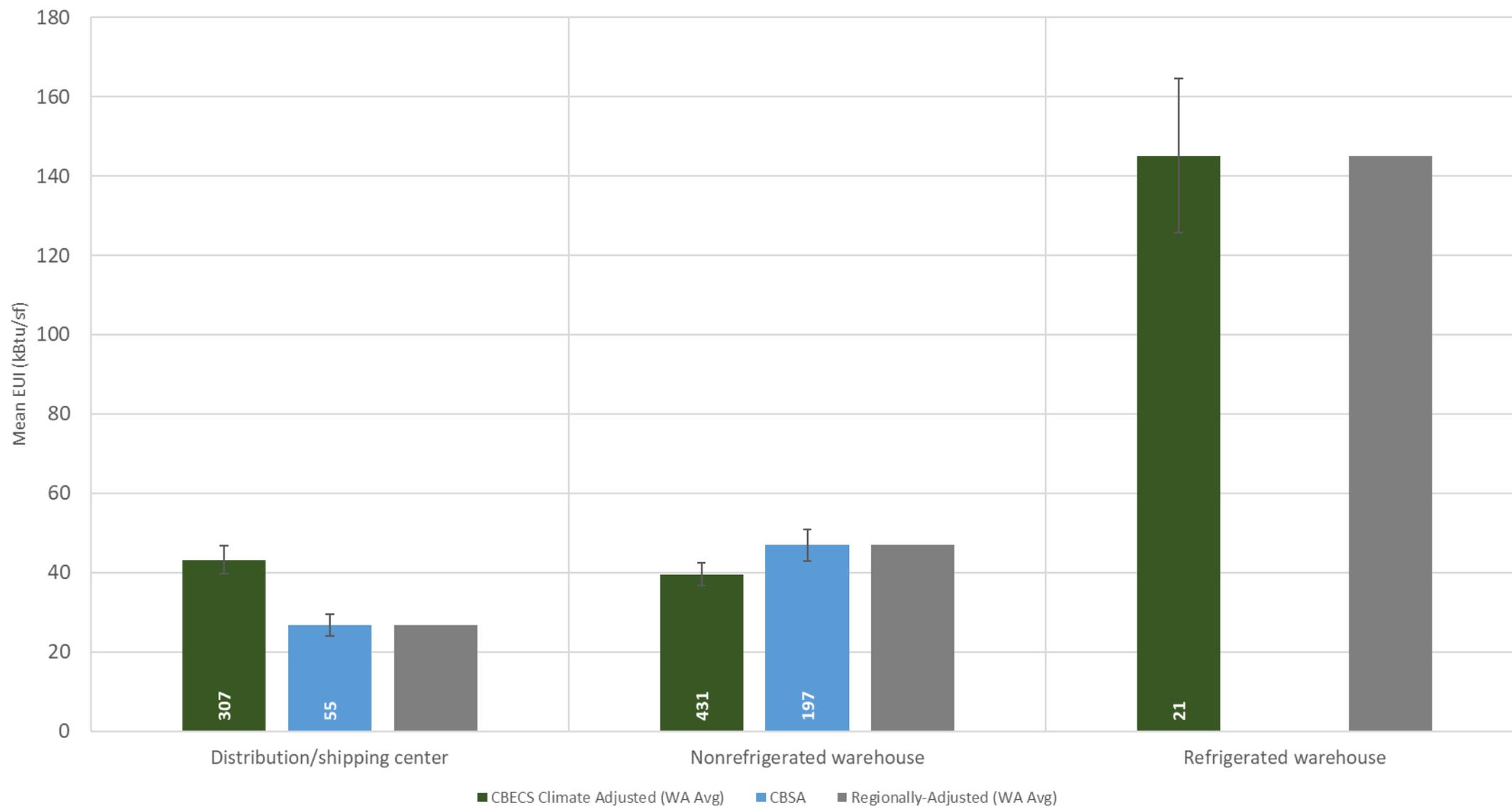


Public Order and Safety, Religious Worship





Warehouse and Storage



Multifamily Mean EUIs

- RBSA 2011 and City of Seattle Benchmarking data
 - Must be have at least 50,000 sq feet of floor area
 - Must have at least 6 floors
- Population of buildings all in Climate zone 4C
- 32 kBTU/sqft average EUI (4C)
- 32 kBTU/sqft average EUI (5B, climate ratio increases by 2%)
- Distinct from ASHRAE 100 definition (5+ units)



NORMALIZATION FACTOR ANALYSIS

Normalizations Considered

- Public input informed search for available data
- Robust publicly available studies required
 - Ensure data quality
 - Ensure fairness
- Occupancy and Operating shift had sufficient supporting data to derive normalizations
 - Supported by CBECS 2012 public microdata
 - Supported by Portfolio Manager Predicted Energy Estimator

Operating Hours

- Calculate CBECS 2012 Mean operating hours for each building Category in ASHRAE 100
 - 50 or less, 51-167, 168
 - Calculate ratio relative to mean of the whole category.
 - If there was not sufficient CBECS 2012 data to support a change, recommend sticking with to Ratio in ASHRAE100

Occupancy

- Use Portfolio Manager regressions for occupancy
- Metrics vary (FTE, # of Computers, # of Beds, etc.)
- Applies to:
 - Office
 - Hospital
 - Hospital (MRI)
 - Hotel
 - Residence Hall
 - Senior Care
 - K-12

Example 1

- Consider an administrative office open 8 hours per day, 5 days per week
- 50 thousand square feet
- 178 Full time employees per shift
 - 0.00356 workers/sqft
- 290 computers
 - 0.00580 computer/sqft
- High occupancy, low operating hours
- Target EUI 87 kbtu/sqft
 - $0.8 * 1.5 * 78 = 87$

ASHRAE 100 Building Type	5B Mean
Admin/professional office	78

Proposed Shift Ratios			
Building Type	50 or less	51 to 167	168
Admin/professional office	0.8	1.0	1.5

Occupancy Ratio			
Building Type	Low	Mean	High
Office	0.9	1.0	1.4

All metrics are less than these values	Anything not in the high or low occupancy category is in the mean category	All metrics are higher than these values
Low	Mean	High
0.001561 workers per sqft 0.002278 computers per sqft	0.002056 workers per sqft 0.003028 computers per sqft	0.00354 workers per sqft 0.005786 computers per sqft

Example 2

- Consider an administrative office open 24 hours per day, 7 days per week
- 50 thousand square feet
- 178 Full time employees per shift
 - 0.00356 workers/sqft
- 290 computers
 - 0.00580 computer/sqft
- High occupancy, high operating hours
- Target EUI 164 kbtu/sqft
 - $1.4 * 1.5 * 78 = 164$

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Proposed Shift Ratios			
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Determinants of Energy Use (DEU)	How Key Determinants of Energy Use Were Addressed:					
	Normalization Factors	Weighted Average EUI _t	Exempt from HB1257	Built in to Mean EUI	New(er) Construction EUI _t	How Addressed
Buildings w/ multiple activities (Mixed Use)		X				Policy
Small % of floor area driving bldg energy use (servers, labs, restaurants, laundry)		X	*			Policy
Vacancy		X	*	X		Policy
Occupancy Density				X		Possible Factor
Operating Shift	X			X		Normalization Factor
Building Type				X		Mean EUI
Building Size				X		Mean EUI/Policy
Standard Loads			*	X		Mean EUI
Unique Loads			*			Policy
Climate/Weather				X		Mean EUI
Campus (master metered, central plant)		X		X		Policy
Industrial/Manufacturing			X			Policy
Vintage					X	Newer Construction
Heating Fuel Type/Conditioned area				X		Mean EUI
Onsite Renewables				X		Mean EUI ²⁷



DRAFT EUI TARGETS CONTINUUM



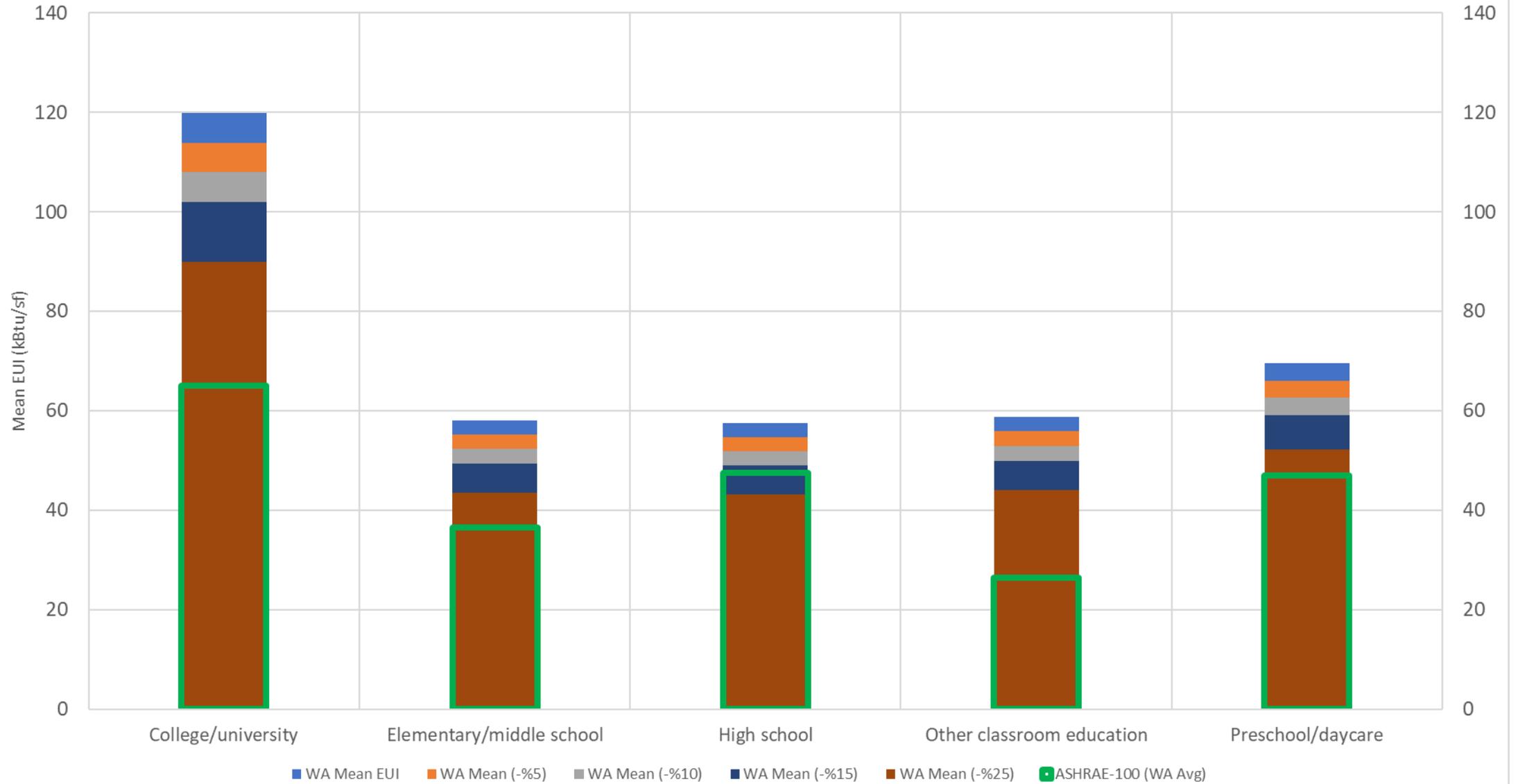
Goals and Directives from HB 1257

- Maximize GHG reductions in the building sector
- Use ASHRAE Standard 100 as an initial model
- Establish EUI targets that are no greater than the average energy use intensity for the covered commercial building type
- Consider adjustments for unique energy using features
- Update the standard by July 1, 2029, and every five years thereafter
- Consider lower EUI targets for newer construction based on the state energy code in place when the buildings were constructed

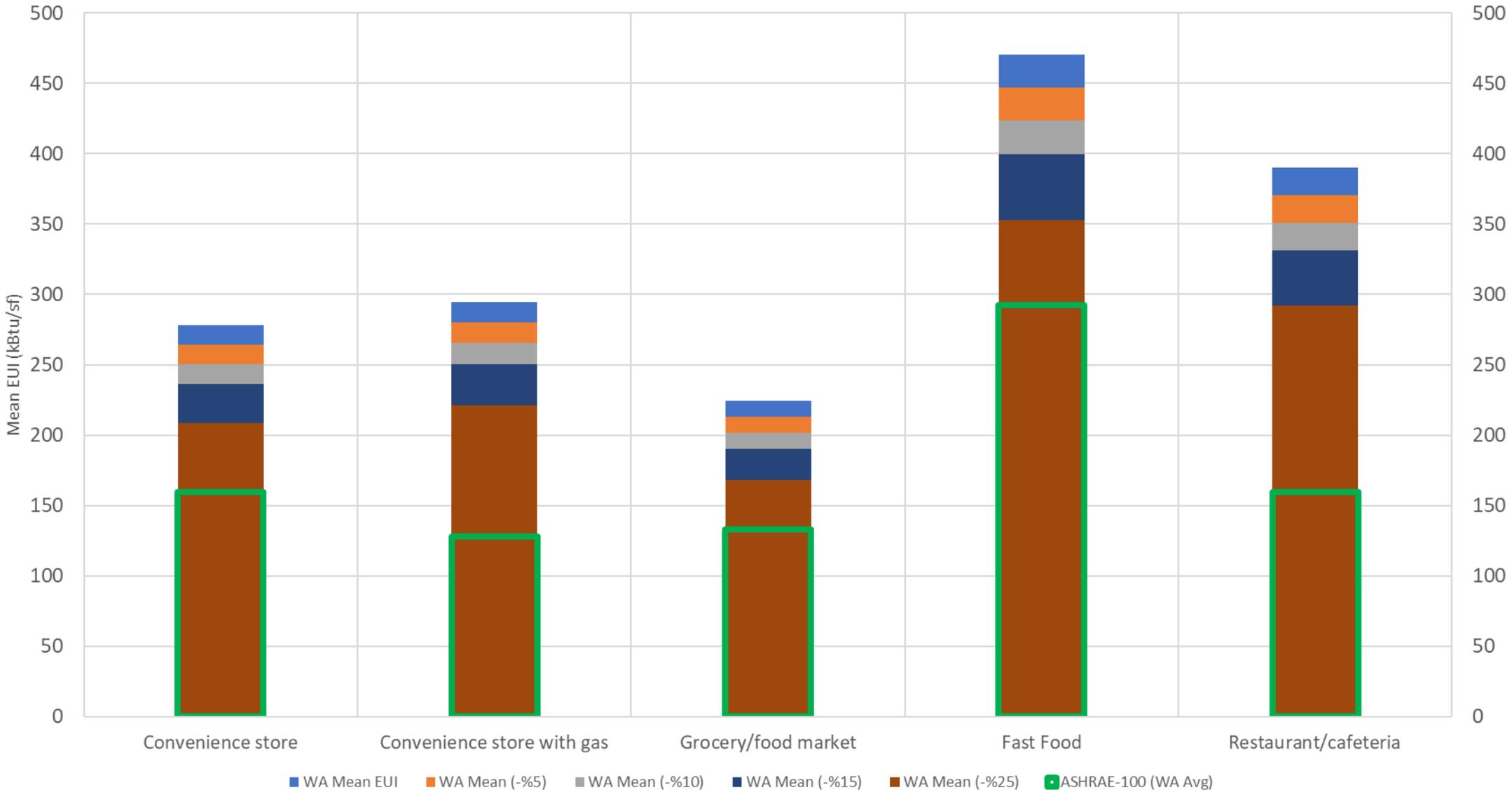
Draft EUI Targets Continuum

- WA EUI means included for reference
- Continuum of targets from mean to ASHRAE 100 targets
 - 5% less than mean
 - 10% less than mean
 - 15% less than mean
 - 25% less than mean
 - ASHRAE 100 Targets

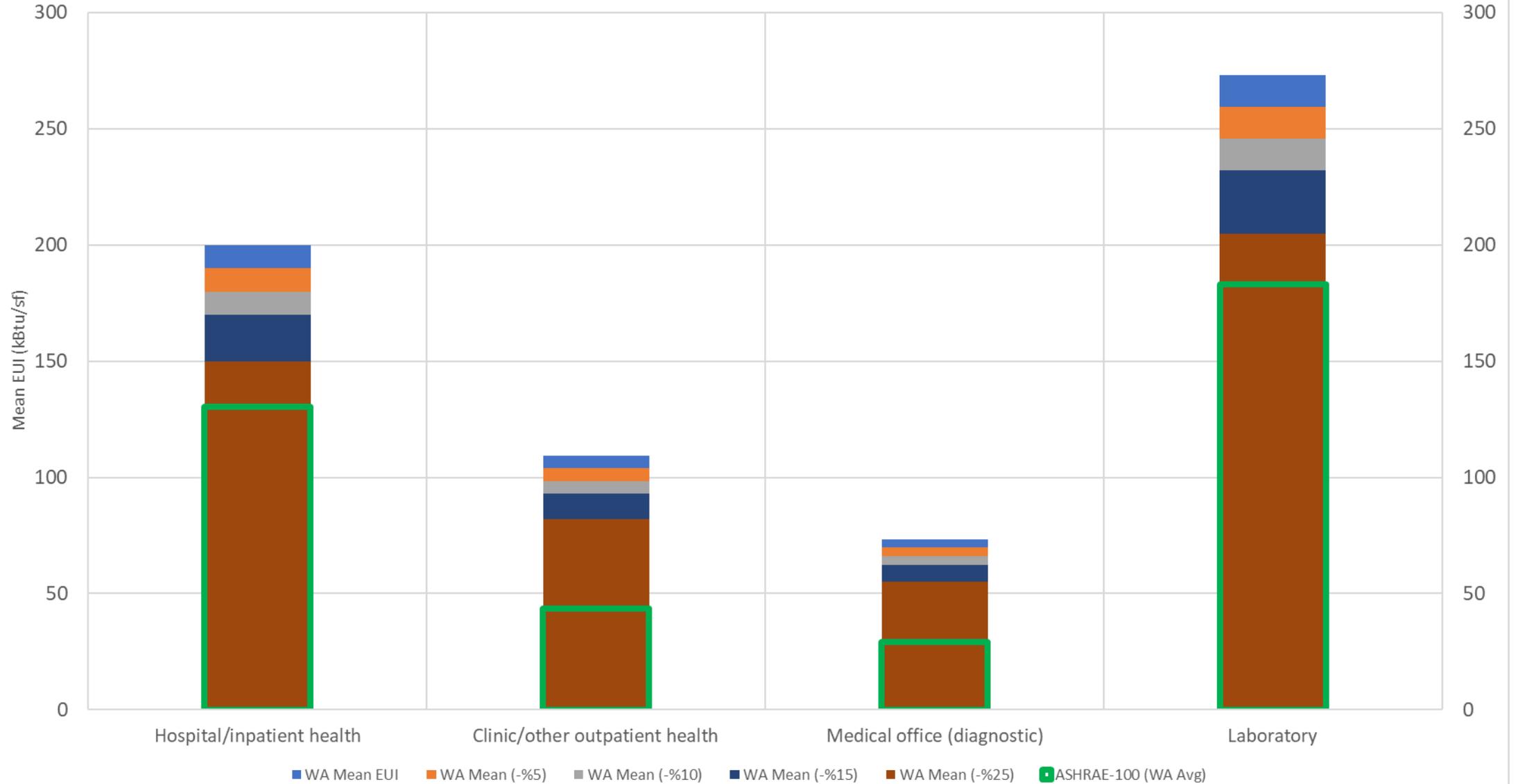
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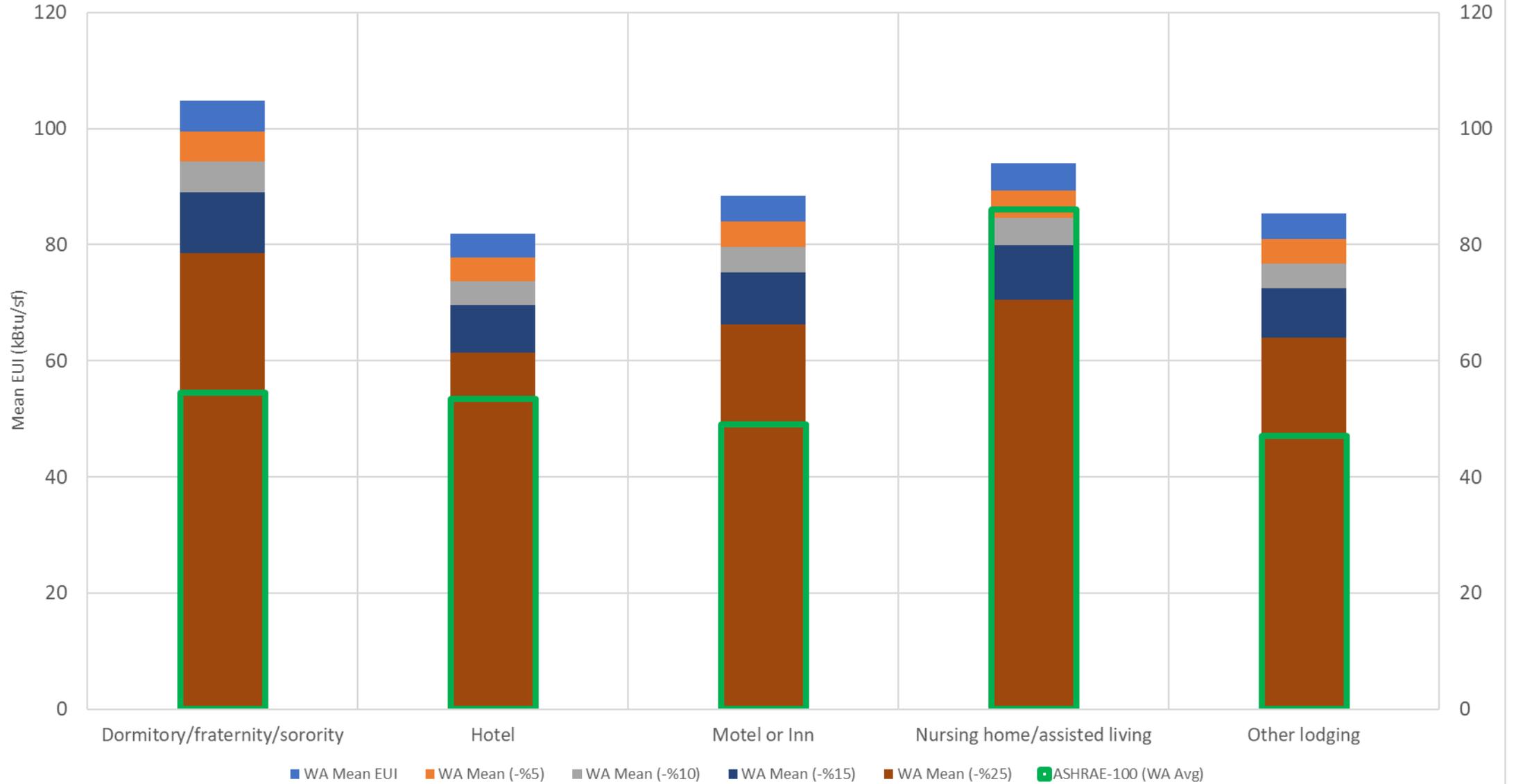
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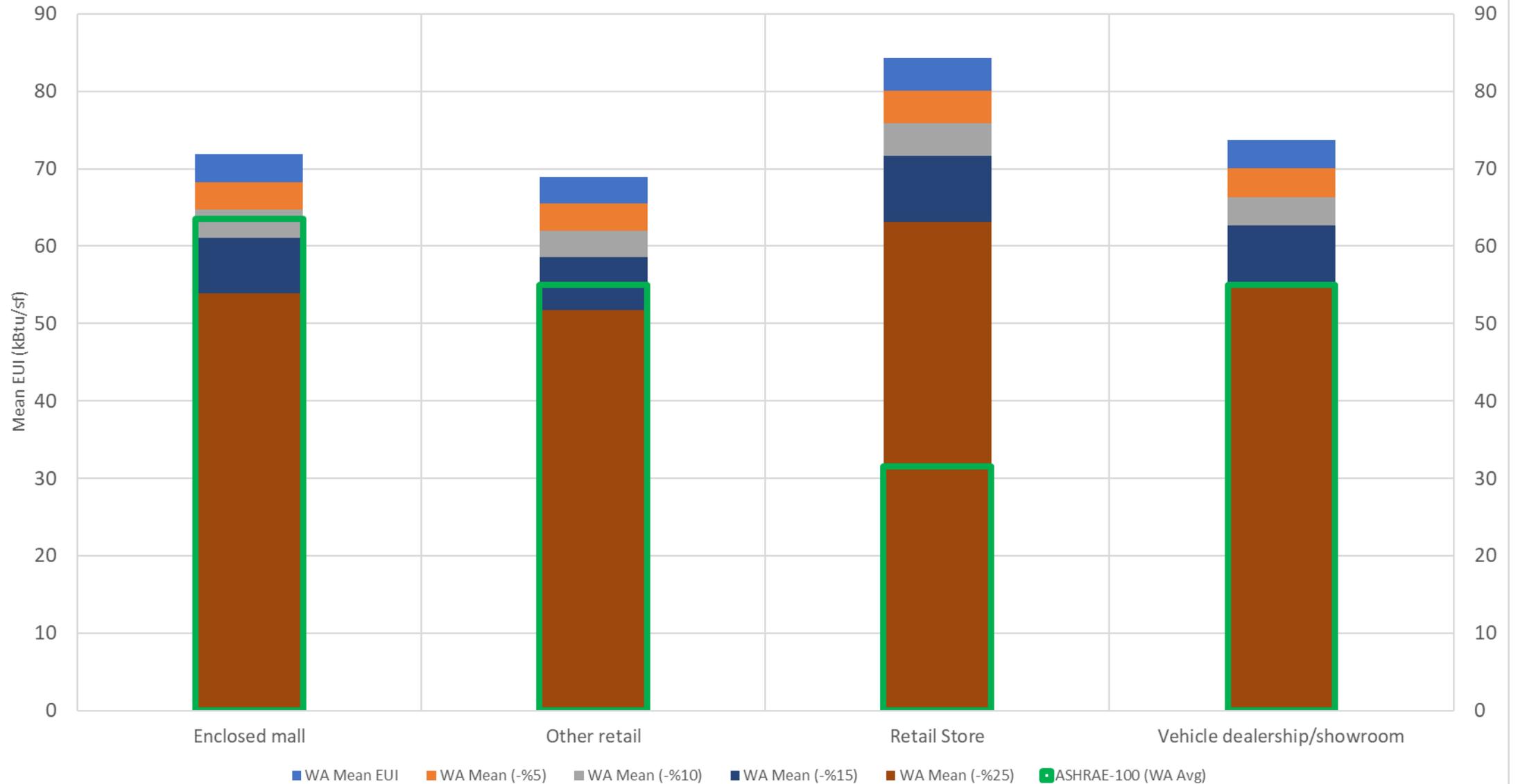
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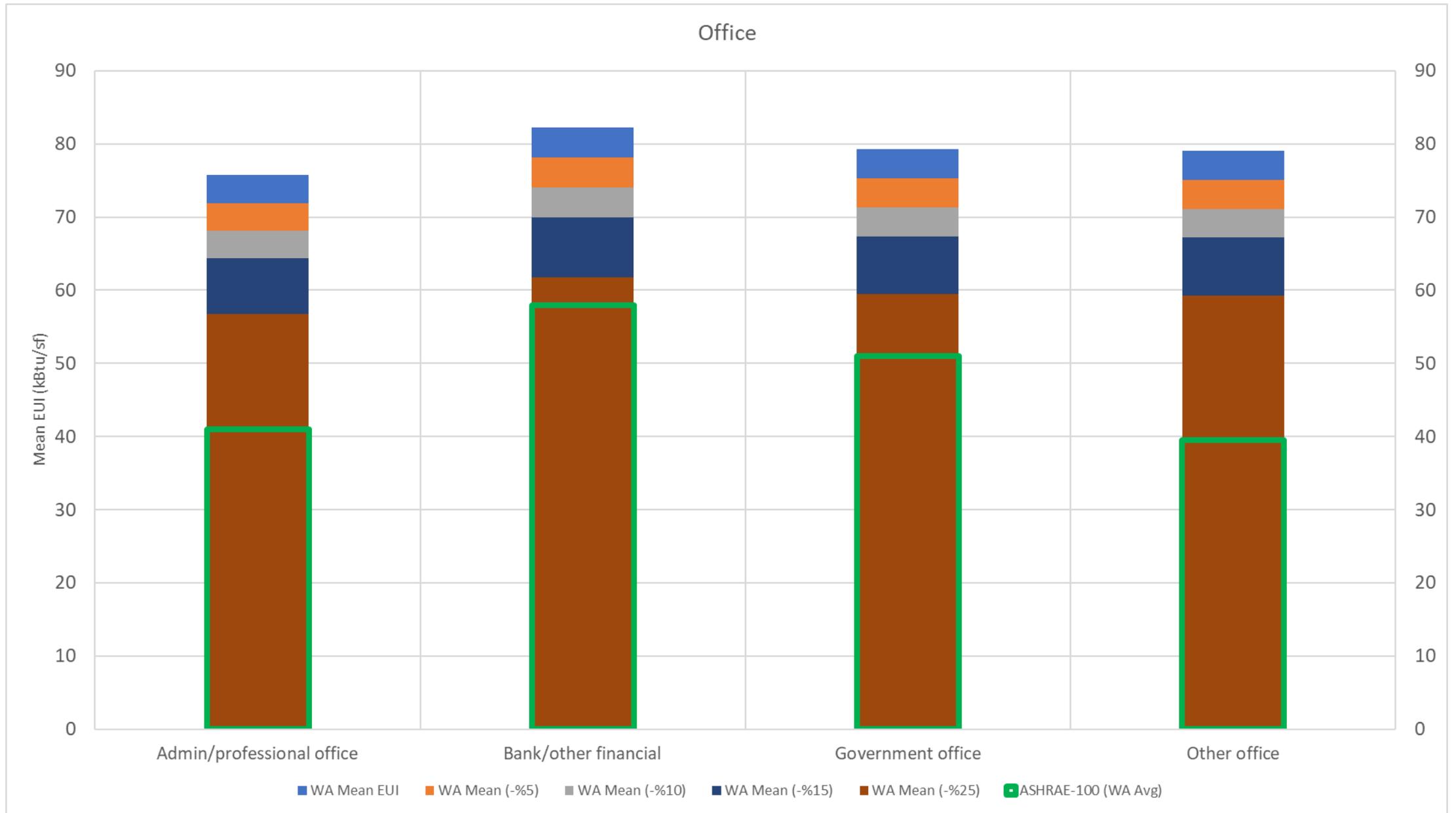


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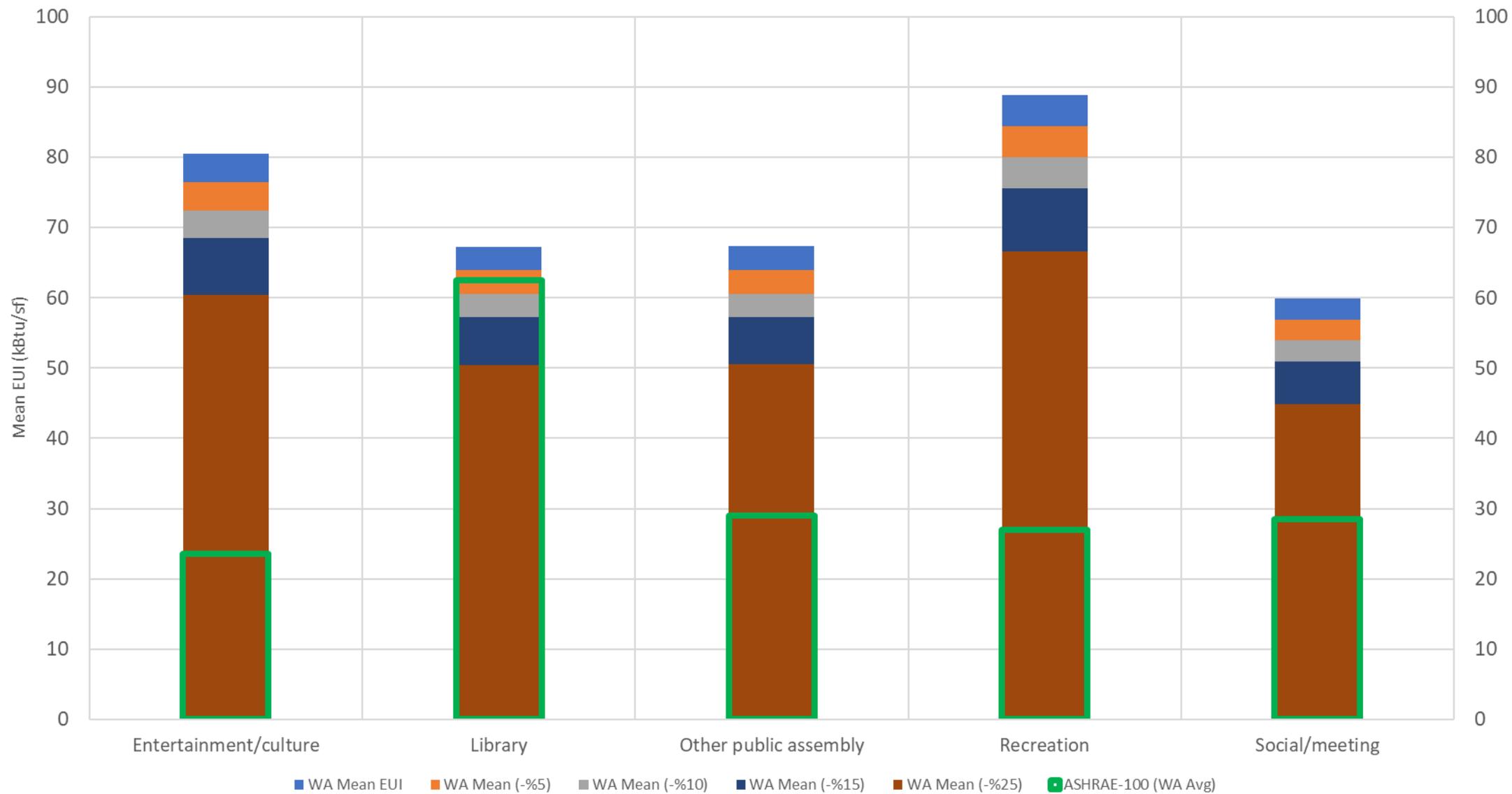


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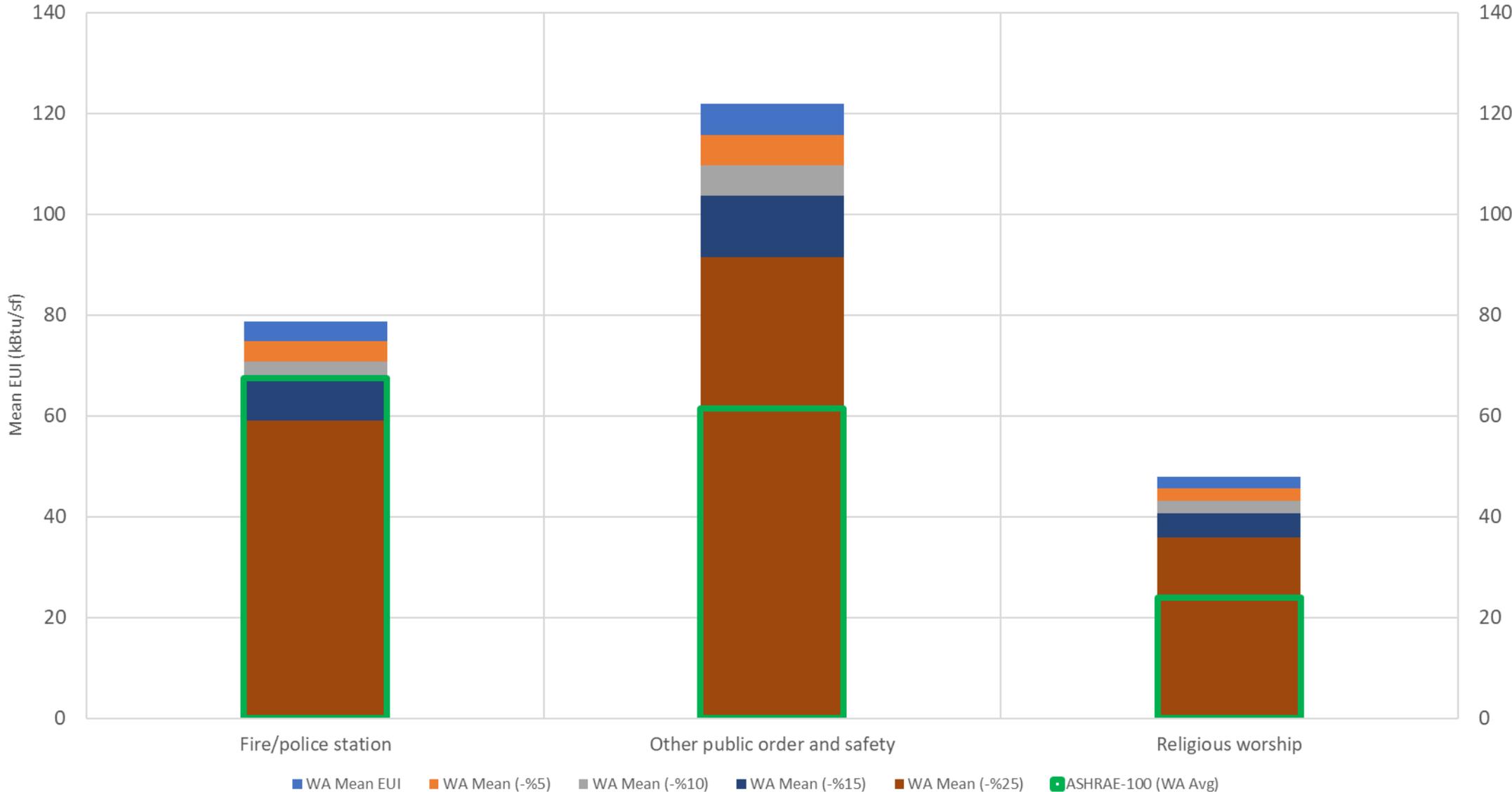


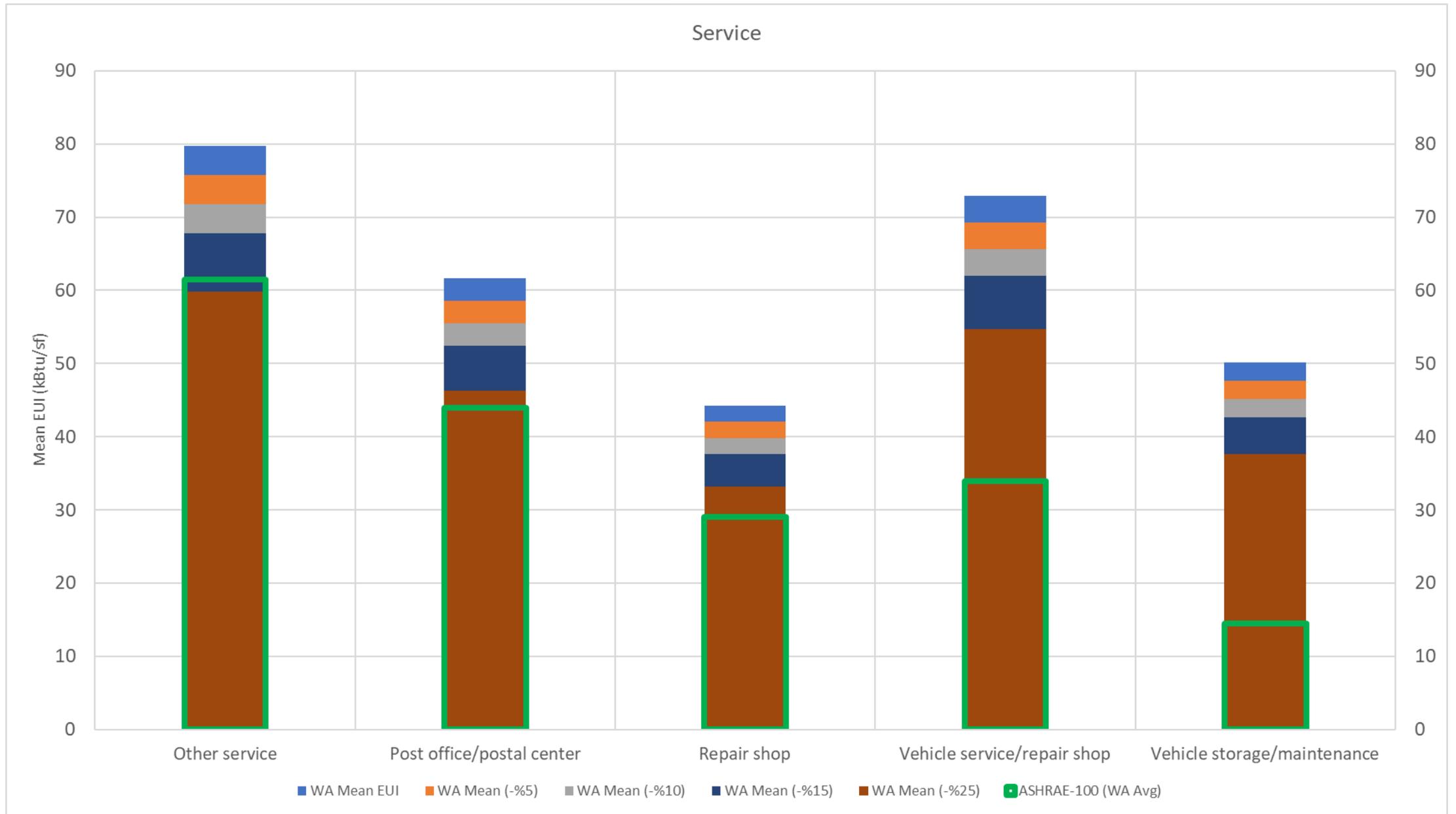


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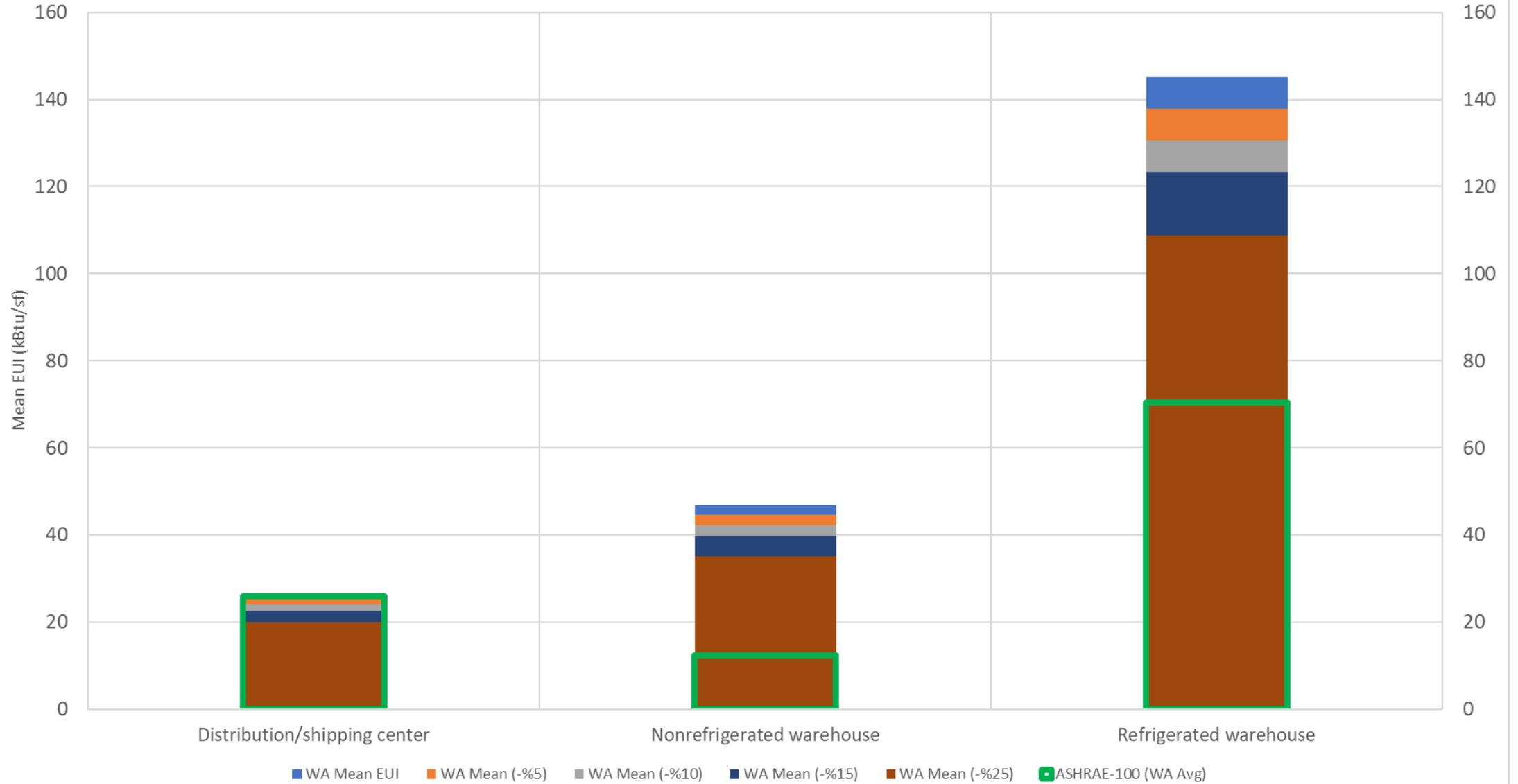


Public Order and Safety, Religious Worship





Warehouse/Storage





Tabular Form of EUI Target Continuum by Climate Zone

- <https://www.commerce.wa.gov/wp-content/uploads/2020/06/WA-Targets.xlsx>
- Workbook includes crosswalk to Energy Star Portfolio Manager Property Types



TARGET SETTING CONSIDERATIONS

Recap of Public Input on EUI Targets

- Establish long-term targets aligned with statutory 2030 and 2050 GHG reduction goals.
- Require steeper reductions early, then taper.
- Include more stringent scenarios as “stretch goal targets” for jurisdictions.
- Add GHG intensity requirements.
- Address on-site gas for heating in targets.
- Include lower targets for newer construction.
- Treat recently constructed and permitted buildings as existing and apply newer construction targets to buildings built to future codes.
- Align future codes with BPS newer construction targets.

Target Design Context

- **Statutory economywide GHG reduction targets (HB 2311):**
 - By 2030, 45% below 1990 levels
 - By 2050, 95% below 1990 levels
- **Long-term planning horizon:** BPS compliance date is 10-20 years later than building stock data available to develop mean EUIs for the targets.
 - Compliance years are 2026-2028
 - Means data used for target development is from 2008-2019
 - Target development mean EUIs may be higher than mean EUIs now or in 2026.
- **Other Std 100 requirements can help lower EUIs:** Building performance standard also includes energy management plan, operations and maintenance program, etc. which will help reduce EUIs.
- **Net-energy EUI targets:** EUI targets are net-energy, inclusive of onsite renewables.

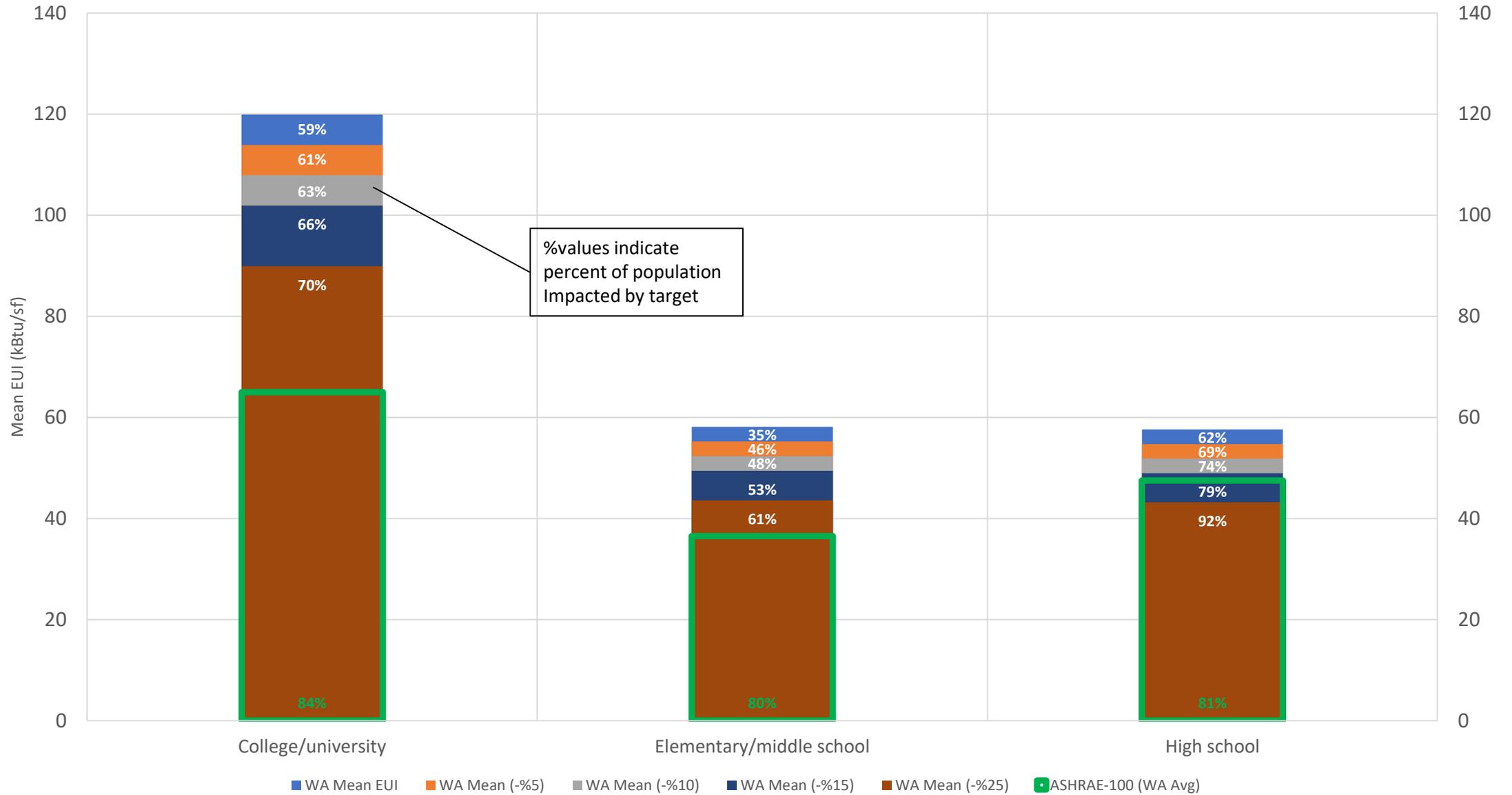
Target Design Context, Cont.

- **Normalizations and exceptions:** Applying normalization factors and exceptions may increase or decrease EUI targets for individual buildings.
- **Technologies**
 - High performance technologies and design practices can significantly reduce energy use, often at low incremental costs:
 - LEDs, heat pumps, dedicated outside air systems (DOAS)
 - Energy management systems and submetering
 - Need to leverage opportunities for equipment replacements prior to 2026
- **Benefits/Costs**
 - Efficiency measure costs are often incremental to scheduled replacements.
 - Net benefit over life of measures; cost-effectiveness "back stop" in audit process helps ensure measure ROIs.
 - Access to State and utility incentive programs

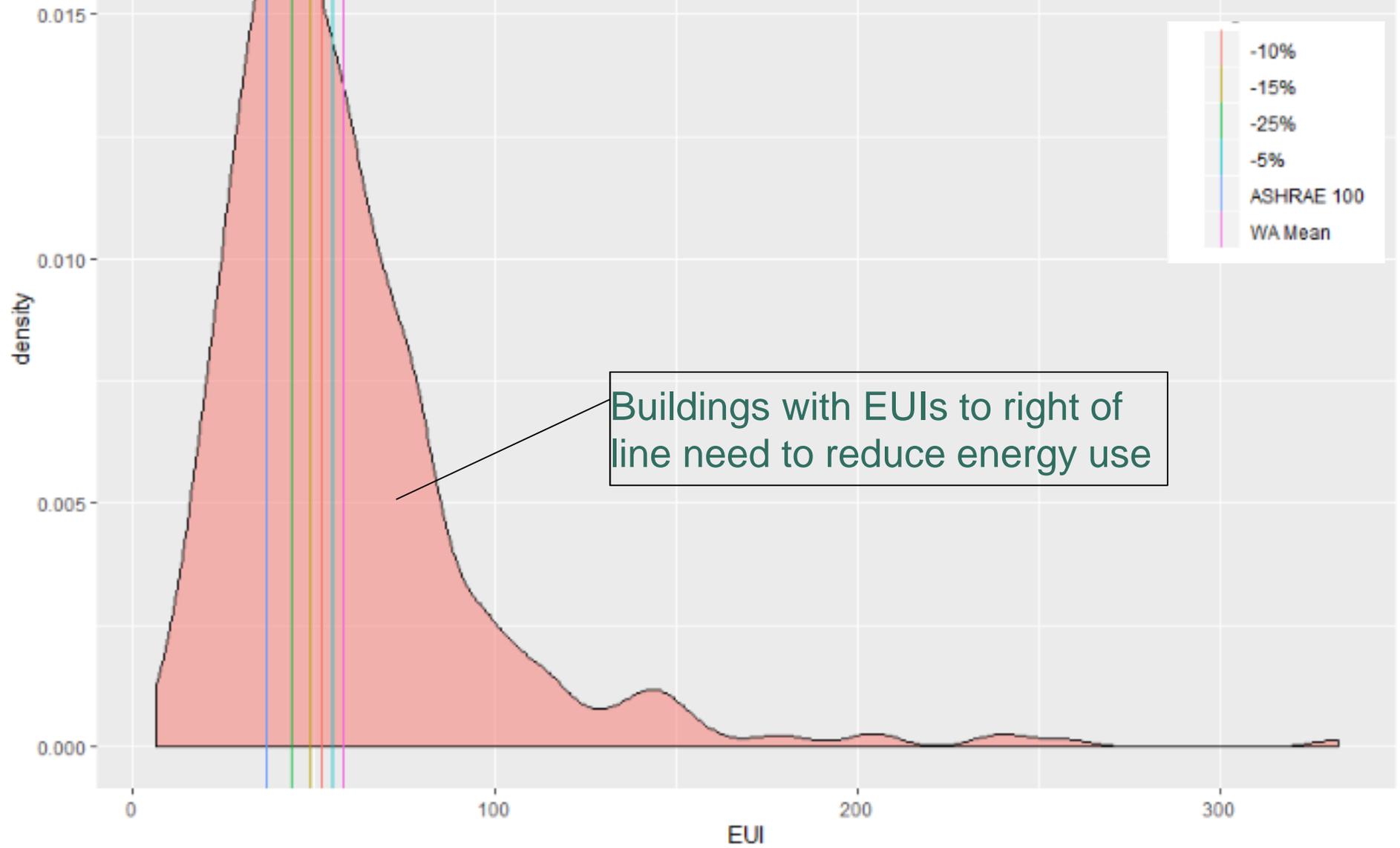
Target Design Context, Cont.

- **Impacts:** amount of buildings or floor area affected and overall energy and greenhouse gas reductions increases with each percent reduction in the EUI targets
- Catalog of buildings in WA required to comply with 1257 is not available yet
 - Example of estimated floor area impacts using CBECS data for select building types shown in following chart

Education



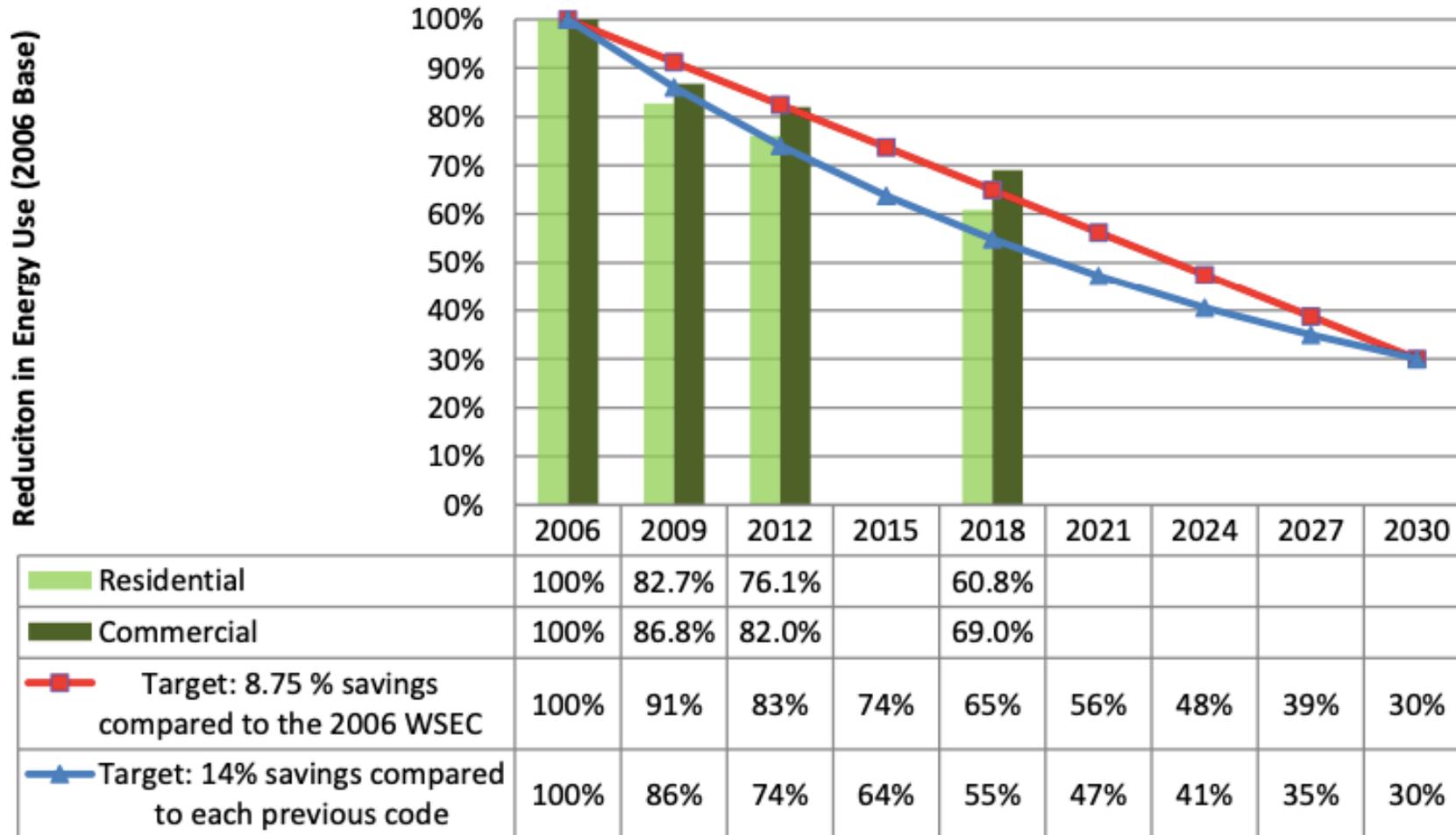
Distribution of Climate-Adjusted CBECS EUIs Elementary/middle school



Newer Construction Considerations

- WSEC mandate requires 70% below 2006 baseline by 2031
- Building characteristics and EUIs changing in new construction:
 - Energy code
 - Technology improvements
- Establish code cycle cutoff for applying lower targets:
 - 2015 WSEC or later?
 - 2021 WSEC or later?
- Establish magnitude of reduction compared to base targets
- WSEC is on a path to achieve incremental improvements to meet 70% goals by 2031

Energy Code Incremental Improvements as Context for Setting BPS Newer Construction EUI Targets



Possible Newer Construction Compliance Path

- Establish targets based on some portion of savings projected in WSEC path to 2031 70% reduction.
- Possible compliance structure:
 - If building EUI is higher than newer construction target, require retro commissioning
 - If building EUI is higher than base target, require Std 100 Sections 8 and 9

EUI Target Development Process

CR101 Pre-rulemaking

**Comments due
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