Updated Climate Zone Adjustment Factors for Zero Energy Buildings

(09/2025)

In 2019, New Buildings Institute (NBI) published the *Zero Energy Commercial Building Targets* Paper [1], which introduced **Climate Zone Adjustment Factors** to translate measured or modeled energy use intensities (EUI) between specific climate zones and/or the national average.

These factors were derived from analyses conducted by Pacific Northwest National Laboratory (PNNL) as part of the ASHRAE 90.1-2016 determination. Building energy use can vary significantly between the most and least demanding climates in the U.S. These factors have since been used to normalize building performance results and enable normalized comparison across climate zones.

Why Climate Zone Adjustment Factors Matter

- **Normalize comparisons** – Climate zone adjustment factors are applied to "translate" the magnitude of energy use between climate zones.
- **Account for uneven representation** – Zero energy projects are not evenly distributed across all U.S. climate zones (e.g., More than half of the Net zero projects tracked in NBIs getting to zero database are in Zones 3B, 3C, 4A, and 5A).
- **Enable accurate aggregation** – Measured or modeled data can be scaled up to national averages or translated back to zone-specific equivalents.

What's New in 2025

NBI has **updated the Climate Zone Adjustment Factors** Table 1, using the most recent modeling results from the **ASHRAE 90.1-2022 energy savings analysis** [2]. These updated values provide a current representation of relative energy use across climate zones and reflect the latest building performance assumptions.

- **Source of update:** PNNL's ASHRAE 90.1-2022 prototype building models [3].
- **Availability:** Updated adjustment factors are now available for "All Buildings" as well as for individual building types.

- **Use:** The factors can be applied in the same way as the 2019 set—translating measured or modeled EUI from one climate zone to a national average (or vice versa).

How to Use

1. Normalize Baseline energy performance (EUI_b) to the national average (EUI_N)
2. Translate to Target Climate Zone (EUI_t)

$$EUI_N = \frac{EUI_b}{CZAdj_b}$$

$$EUI_t = EUI_N * CZAdj_t$$

Where:

EUI_b = Baseline EUI from the building the user would like to translate

$CZAdj_b$ = The Climate Zone Adjustment factor of the Baseline Building

$CZAdj_t$ = The Climate Zone Adjustment factor of the Target Building

Table 1. Climate zone adjustment factors for climate zones

	CZ 1A	CZ 2A	CZ 2B	CZ 3A	CZ 3B	CZ 3C	CZ 4A	CZ 4C	CZ 5A	CZ 5B	CZ 5C	CZ 6A	CZ 6B	CZ 7	CZ 8
High-rise Apartment	1.00	0.95	0.93	0.96	0.93	0.76	1.03	0.89	1.10	1.00	0.87	1.26	1.10	1.26	1.36
Mid-rise Apartment	1.00	0.96	0.95	0.96	0.93	0.80	1.02	0.90	1.10	0.99	0.89	1.25	1.10	1.28	1.42
Hospital	1.02	1.00	0.96	0.98	0.96	0.89	1.01	0.92	1.01	0.98	1.08	1.07	1.14	1.24	1.30
Large Hotel	1.11	1.06	0.98	1.00	0.96	0.90	0.99	0.92	0.98	0.98	0.94	1.05	1.02	1.10	1.20
Small Hotel	1.02	0.99	0.99	0.98	0.98	0.94	0.99	0.94	1.02	1.01	0.94	1.09	1.04	1.13	1.21
Large Office	1.11	1.04	1.07	1.00	1.05	0.92	0.98	0.92	0.98	1.06	0.92	1.05	1.10	1.05	1.08
Medium Office	1.08	1.00	0.99	0.96	0.92	0.78	1.01	0.85	1.08	0.98	0.85	1.26	1.08	1.08	1.23
Small Office	1.07	1.02	1.03	0.96	0.96	0.86	0.96	0.88	1.03	0.99	0.88	1.22	1.10	1.35	1.66
Outpatient Healthcare	1.06	1.08	0.98	0.98	0.95	0.89	0.99	0.89	1.00	0.94	0.87	1.08	1.00	1.15	1.27
Quick Service Restaurant	0.94	0.93	0.89	0.97	0.91	0.84	1.01	0.93	1.10	1.03	0.96	1.22	1.12	1.34	1.55
Full-Service Restaurant	0.96	0.94	0.89	0.96	0.91	0.81	1.01	0.91	1.10	1.03	0.95	1.25	1.13	1.37	1.60
Stand-Alone Retail	1.03	0.89	0.85	0.89	0.83	0.66	1.03	0.85	1.17	0.99	0.88	1.38	1.15	1.22	1.49
Strip Mall	1.02	0.94	0.90	0.91	0.83	0.73	1.06	0.92	1.22	1.05	0.96	1.41	1.21	1.54	1.80
Primary School	1.11	1.04	0.96	1.00	0.91	0.81	0.97	0.87	1.01	0.98	0.88	1.17	1.01	1.20	1.45
Secondary School	1.20	1.12	0.99	1.04	0.91	0.82	0.93	0.85	0.96	0.95	0.82	1.10	0.93	1.11	1.31
Non-Refrigerated Warehouse	0.57	0.54	0.57	0.73	0.56	0.45	1.24	0.79	1.79	1.13	0.75	2.54	1.73	2.38	2.44
Average	1.02	0.97	0.93	0.96	0.91	0.80	1.01	0.89	1.10	1.01	0.90	1.28	1.12	1.30	1.46

References

[1] K. Carbonnier, "Zero Energy Commercial Building Targets," New Buildings Institute, Portland, 2019. Available: https://newbuildings.org/resource/zero-energy-commercial-building-targets/

[2] D. Maddox, J. Zhang, M. Rosenberg, Y. Xle, M. Tyler, J. Lerond, M. Tillou, M. Myer, L. Troup, T. Pilet and H. Nagda, "ANSI/ASHRAE/IES Standard 90.1-2022: Energy Savings Analysis," 2024. [Online]. Available: https://www.energycodes.gov/sites/default/files/2024-02/Standard_90.1-2022_Final_Determination_TSD.pdf

[3] Pacific Northwest National Laboratory (PNNL), "Commercial, Prototype Building Models," U.S. Department of Energy's Building Technologies Office., [Online]. Available: https://www.energycodes.gov/prototype-building-models [Accessed June 2025].

New Buildings Institute (NBI) is a nonprofit organization advancing energy efficiency and decarbonization in the built environment. For over 25 years, NBI has been a trusted and independent resource helping to create buildings that are better for people, communities, and the planet. Our efforts are imperative to cutting emissions fueling climate change, keeping energy costs affordable, and delivering improved health, safety, and resiliency pathways for everyone. We work collaboratively with industry market players—governments, utilities, advocates, design professionals, consumers, and more—to drive leading-edge design, curate innovative technologies, and create public policies and programs that scale with communities. To learn more about NBI and our work, visit newbuildings.org.