Pacific Northwest
NATIONAL LABORATORY

# Building Energy Codes: Aligning Resilience, Affordability, and Efficiency Imperatives

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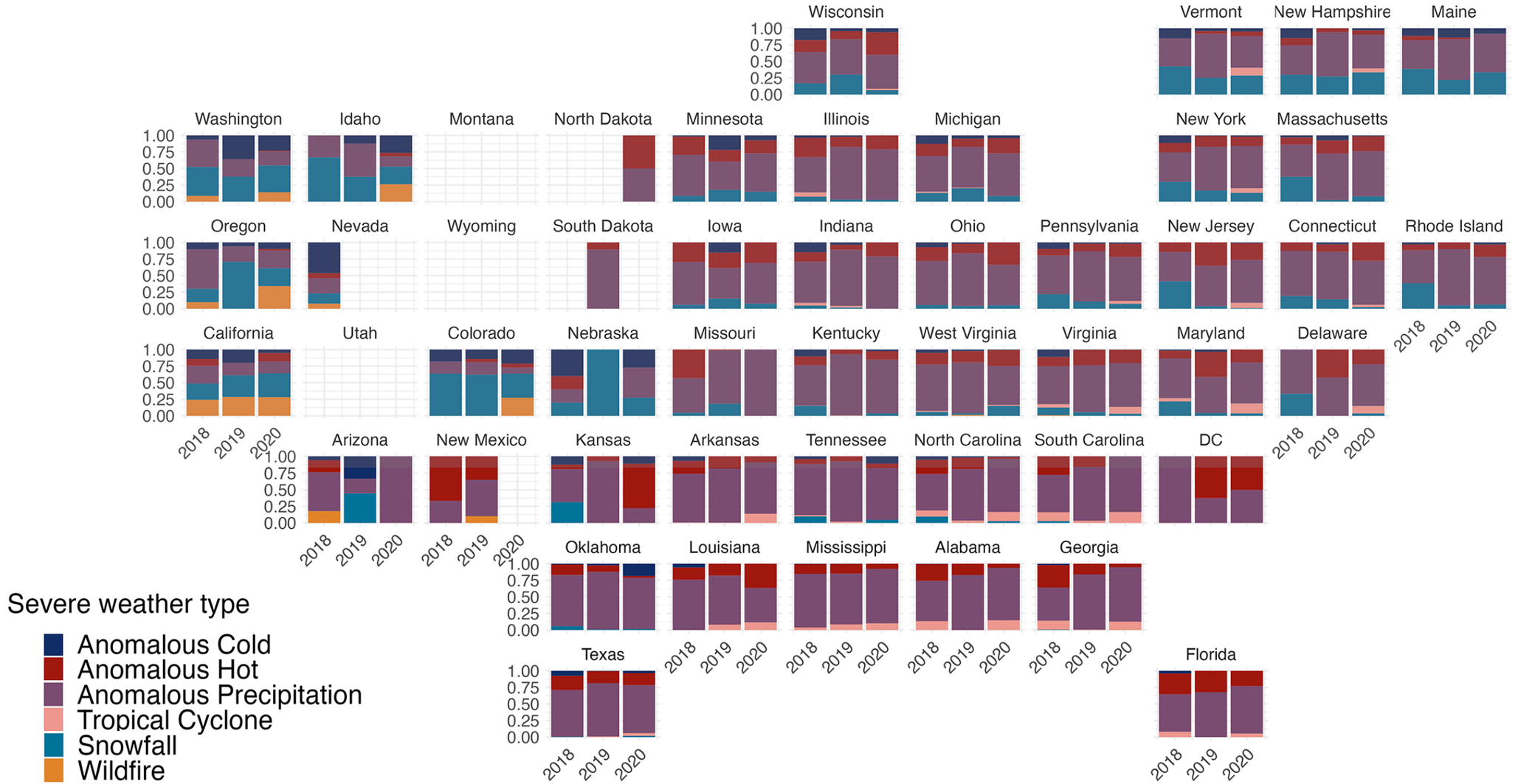
# Natural hazards by U.S. State




Source: Do V, et al. (2025) PLOS Climate 4(1): e0000523. https://doi.org/10.1371/journal.pclm.0000523

# Resilience and Energy Codes: Savings and Affordability

- Since 1980, the U.S. has sustained **403 weather and climate disasters** where overall damages/costs reached or exceeded $1 billion, with a total cost of these events exceeding $2.915 trillion.

- Reducing energy use and costs can help enhance community resilience. Building energy codes are projected to save over $182 billion through 2040.

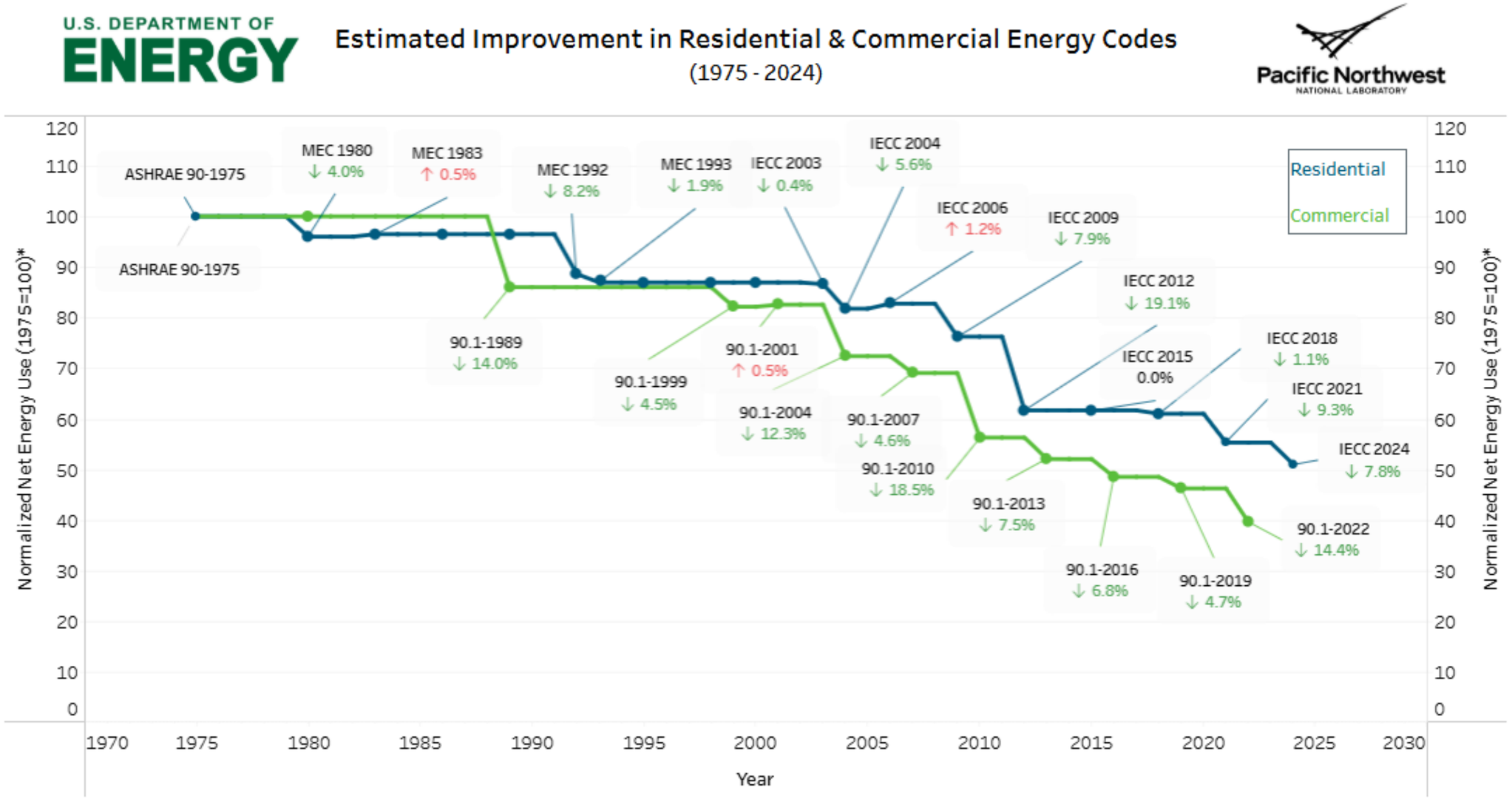
https://www.energycodes.gov/impact-analysis
https://www.ncei.noaa.gov/access/billions

# Energy Reliability and Affordability

| Passive Survivability | Grid Reliability |
| --- | --- |
| The ability to maintain safe indoor conditions in the event of extended energy outage or loss of energy supply. In practice, passive survivability enables safe indoor thermal conditions, relying on building design measures that require no energy.<br><br>As a measure of a building's thermal performance, passive survivability offers an integrated assessment of both energy efficiency and resilience. | Building energy technologies that provide efficiency and grid flexibility services. These technologies can provide grid services during peak demand periods.<br><br>Demand load reductions alleviate energy supply and grid constraints, thereby decreasing the risk of power system failures. |

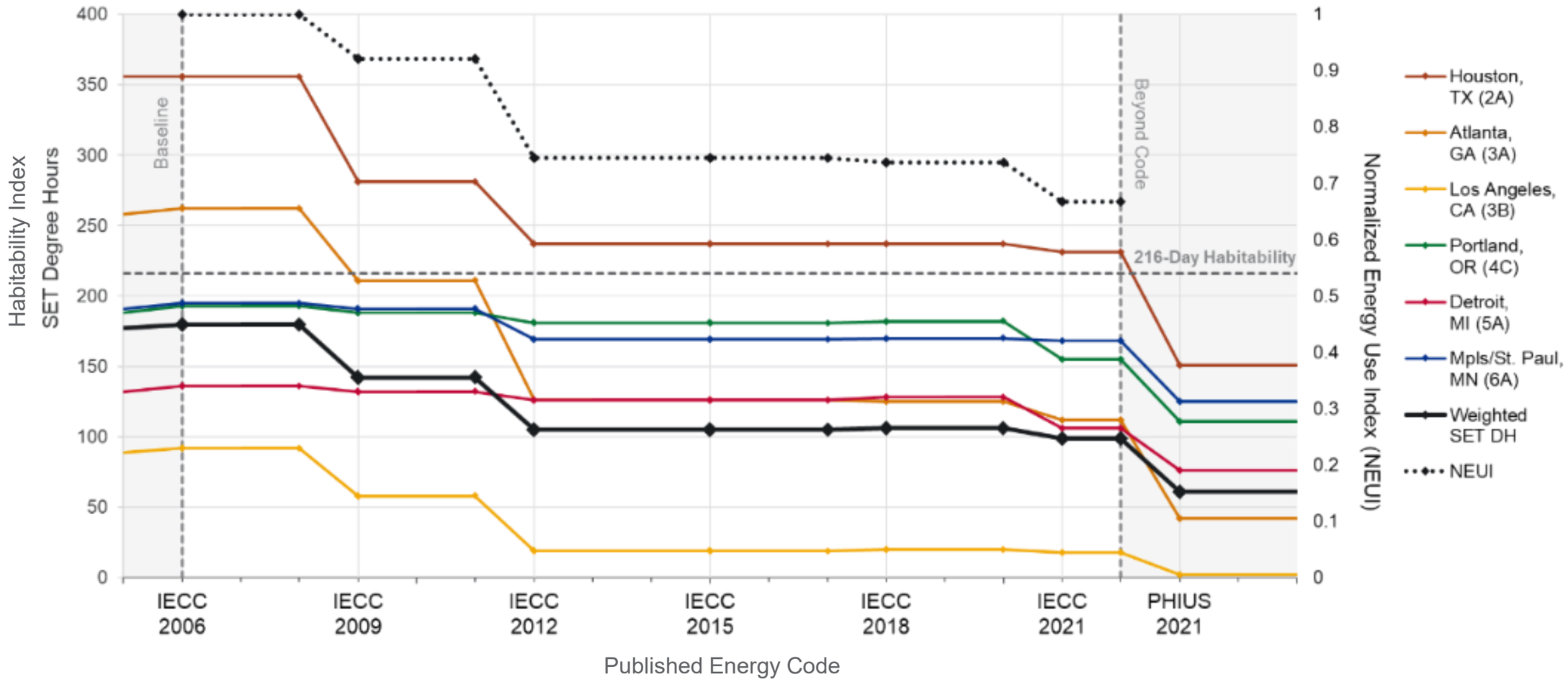
www.energycodes.gov/energy-resilience

# Role of Energy Codes



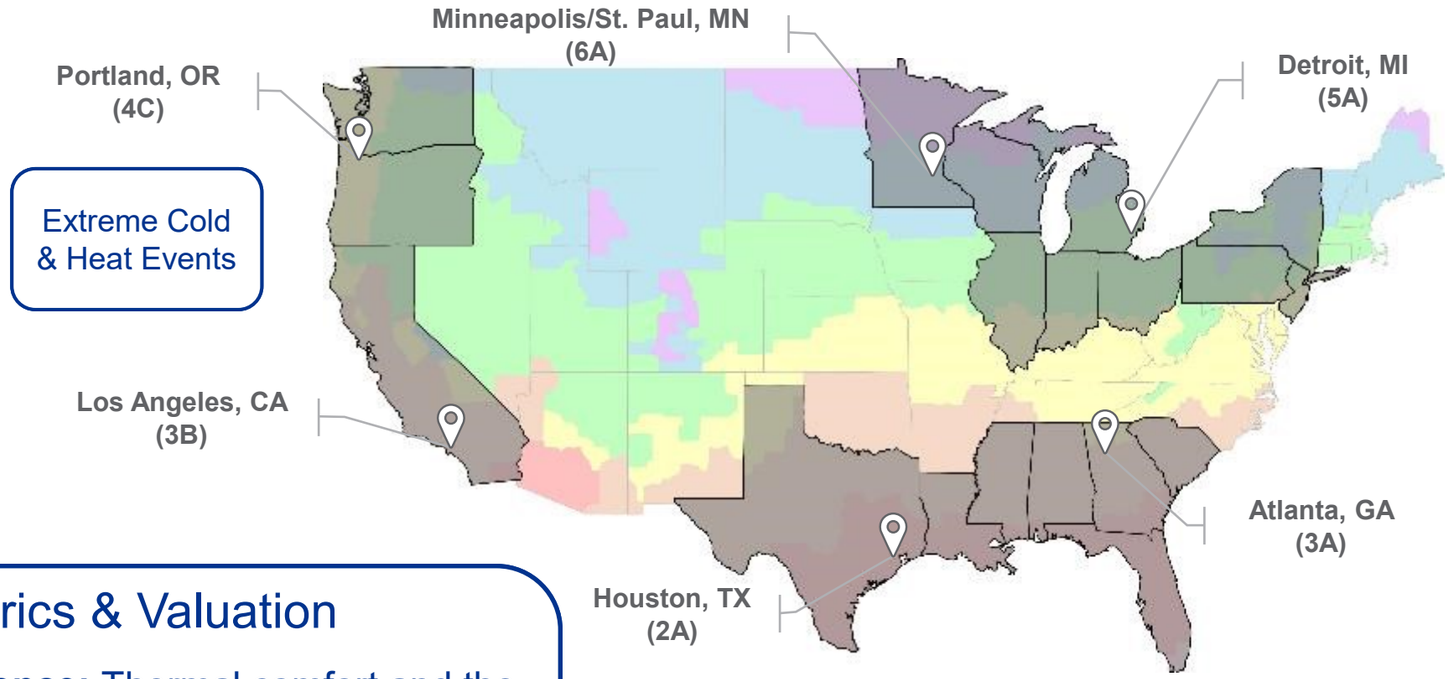

*Net energy use includes the contribution of renewable energy generation

# Role of Energy Codes



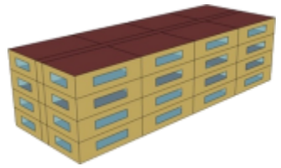
# Metrics to Measure Resilience : Tri-Lab Study

**Focus:** Investigate how adopting current energy code or stretch codes benefits resilience
**Scope:** Two residential building types, three efficiency conditions, six U.S. locations




Extreme Cold & Heat Events

Multi-Family

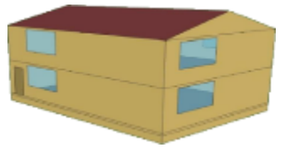


New & Existing

**Baseline Condition**
Historic Code/Existing Stock

**Current Code**
ASHRAE 90.1-2019 & IECC-R 2021

**Beyond Code**
Informed by 2021 Passive House



Single-Family

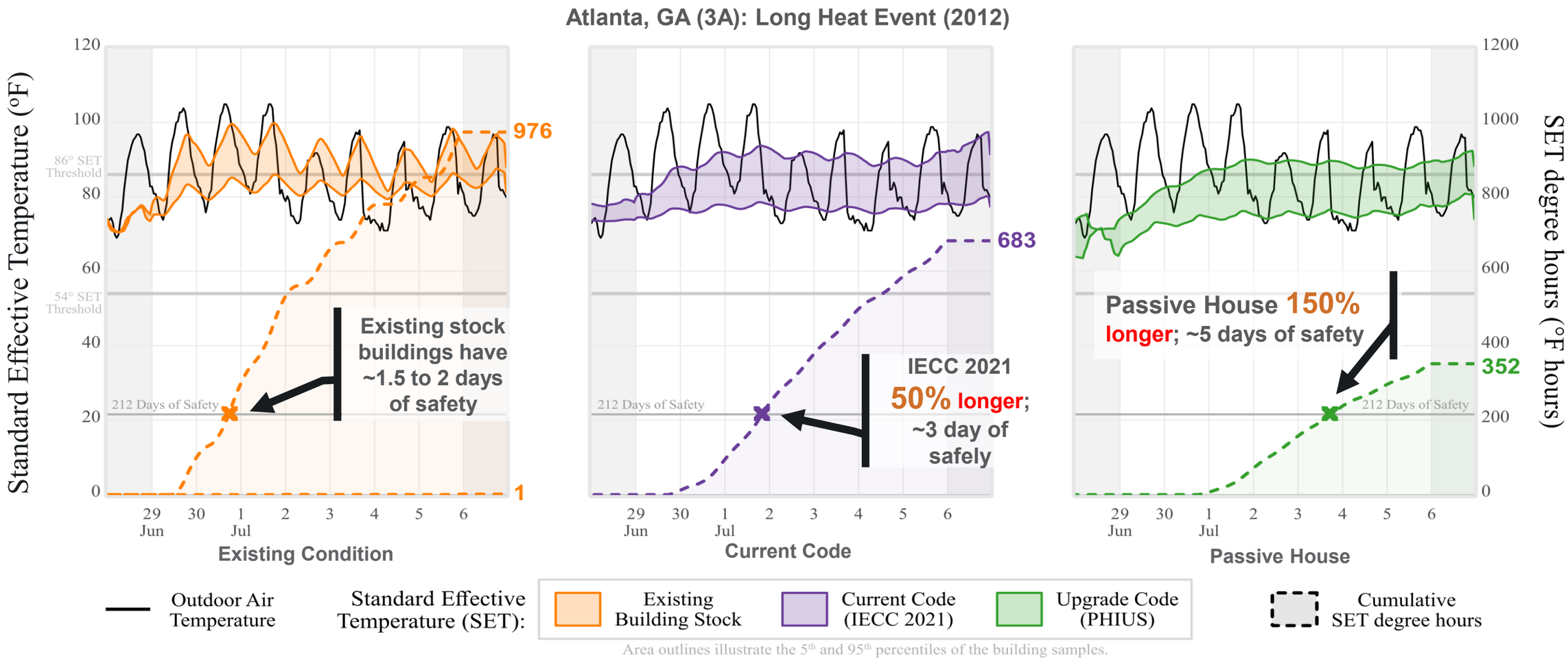
## Metrics & Valuation

**Thermal Resilience:** Thermal comfort and the ability to shelter in place
**Mortality:** Attributable to heat and cold
**Investment:** Efficiency investment costs, efficiency and resilience benefits, net present value

# Example Resilience Metrics to Assess and Compare Mitigation Impacts

| | |
|---|---|
| **Thermal resilience metrics indicating occupant exposure** | |
| **Standard Effective Temperature (SET)** | Indoor conditions measurement that considers of temperature and relative humidity |
| **SET Degree Hours** | Cumulative hourly SET degrees that fall outside of a specified threshold (54°F and 86°) |
| **Days of Safety** | The time elapsed over a seven-day period when the SET Degree Hours does not exceed a value of 216. |
| **Occupant damage metrics** | |
| **Excess deaths** | Deaths attributed to extreme heat or cold |
| **Economic metrics (for annualized net present value calculation)** | |
| **Measure investment costs** | First costs for installation of measure package |
| **Measure annual energy cost savings** | Evaluated based on a typical weather year |
| **Societal value of emissions reduction** | Associated with annual energy use savings |
| **Losses associated with excess deaths** | Based on $10 million per excess death |
| **Losses associated with property damage** | Based on FEMA national risk data base values |
| **Benefit cost ratio** | Based on annual coincident risk of extreme temperature events and above economic values |

# Tri-Lab Study: Exposure Analysis



# Support for RECI IIJA Awarded Projects

- Climate Resilient Energy Codes for Multifamily Housing, Clean Energy Group
- Resilient Southwest Regional Collaborative, NBI
- Optimizing Grid Integration Strategies for Climate Zone 1 Buildings, NBI
- Incorporating Resilience into Building Performance Standards, Resilience Authority of Annapolis and Anne Arundel County
- Establishing and Testing a Building Codes and Resilience Field Study Methodology, NASEO

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# Thank you