Buildings Decarbonization

Steven Nadel, Executive Director

Presentation to DOE Buildings Code Conference

July 2021

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American Council for an Energy-Efficient Economy

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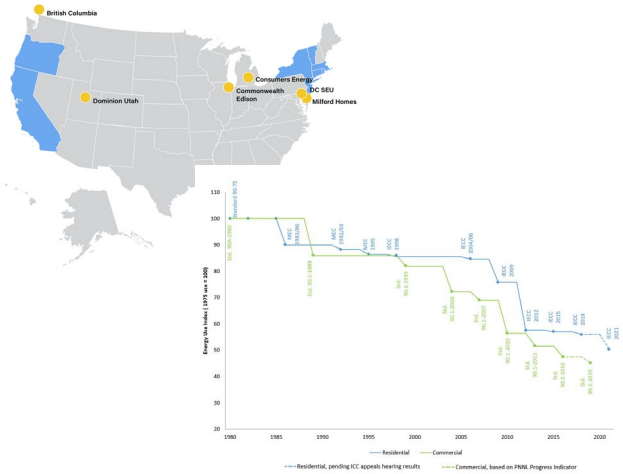
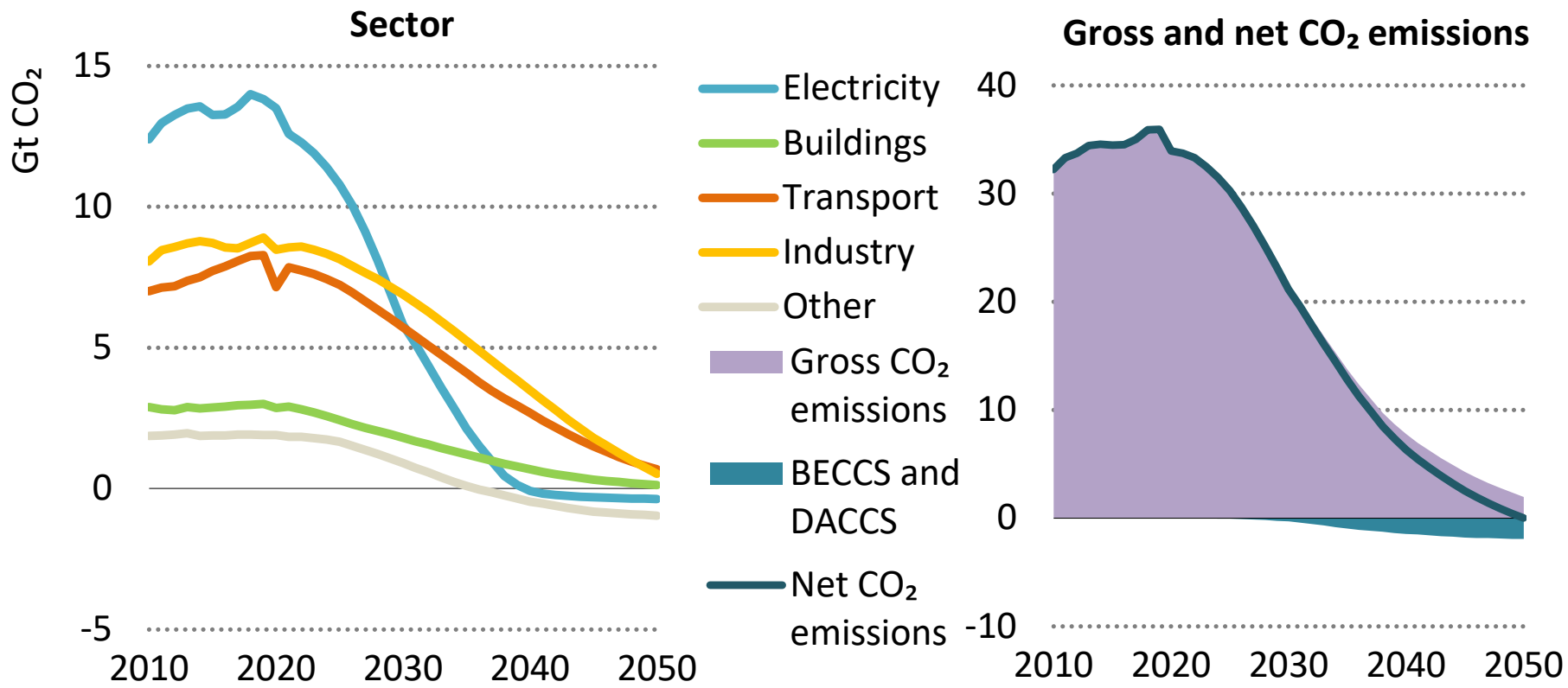


Research

Program and policy
TA and advocacy

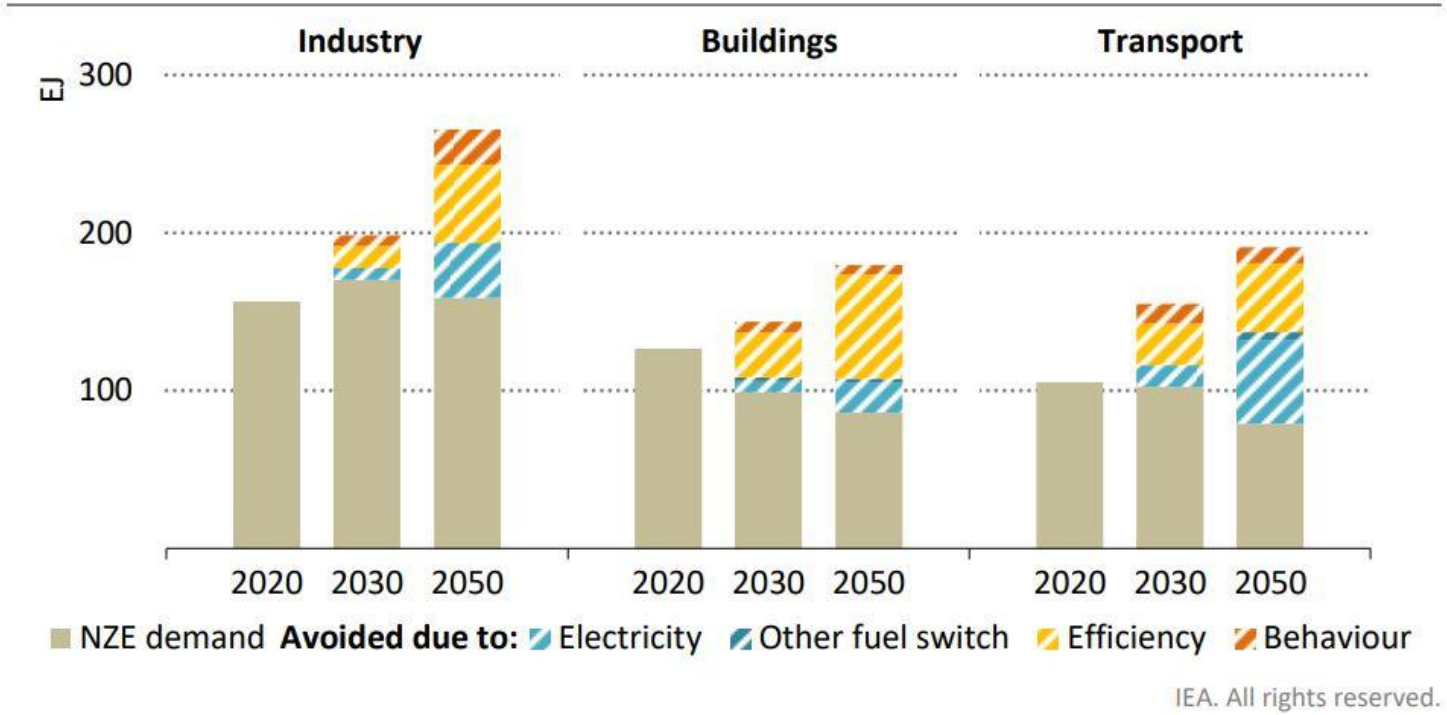
Education

IEA Net Zero Emissions Scenario



IEA Net Zero Emissions Scenario

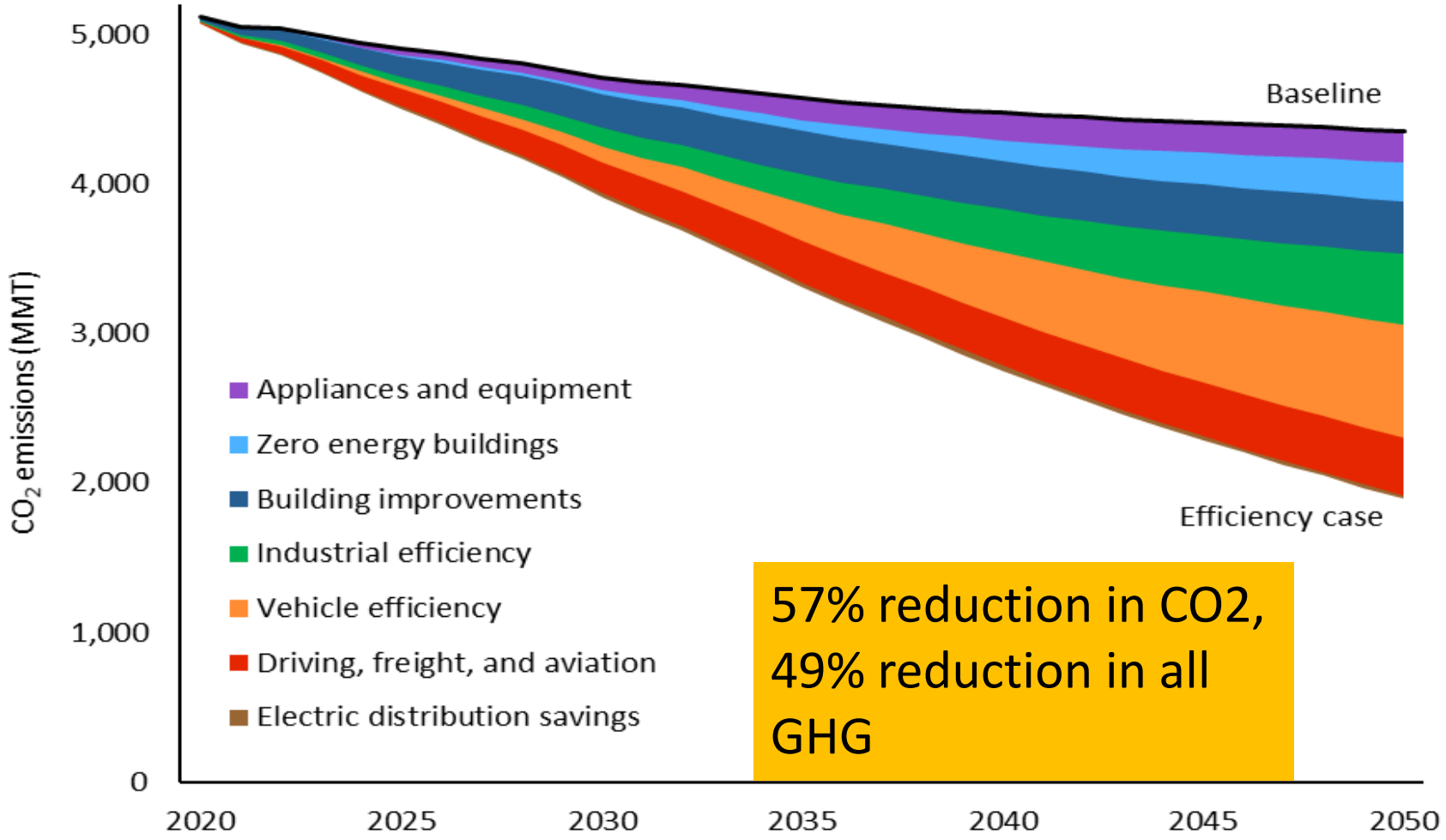
Figure 2.13 ▻ Total final consumption and demand avoided by mitigation measure in the NZE



Energy efficiency plays a key role in reducing energy consumption across end-use sectors

Notes: CCUS = carbon capture utilisation and storage. Other fuel switch includes switching to hydrogen-related fuels, bioenergy, solar thermal, geothermal, or district heat.

Energy efficiency can get us halfway to decarbonization…



Source: ACEEE, 2019, *Halfway There*

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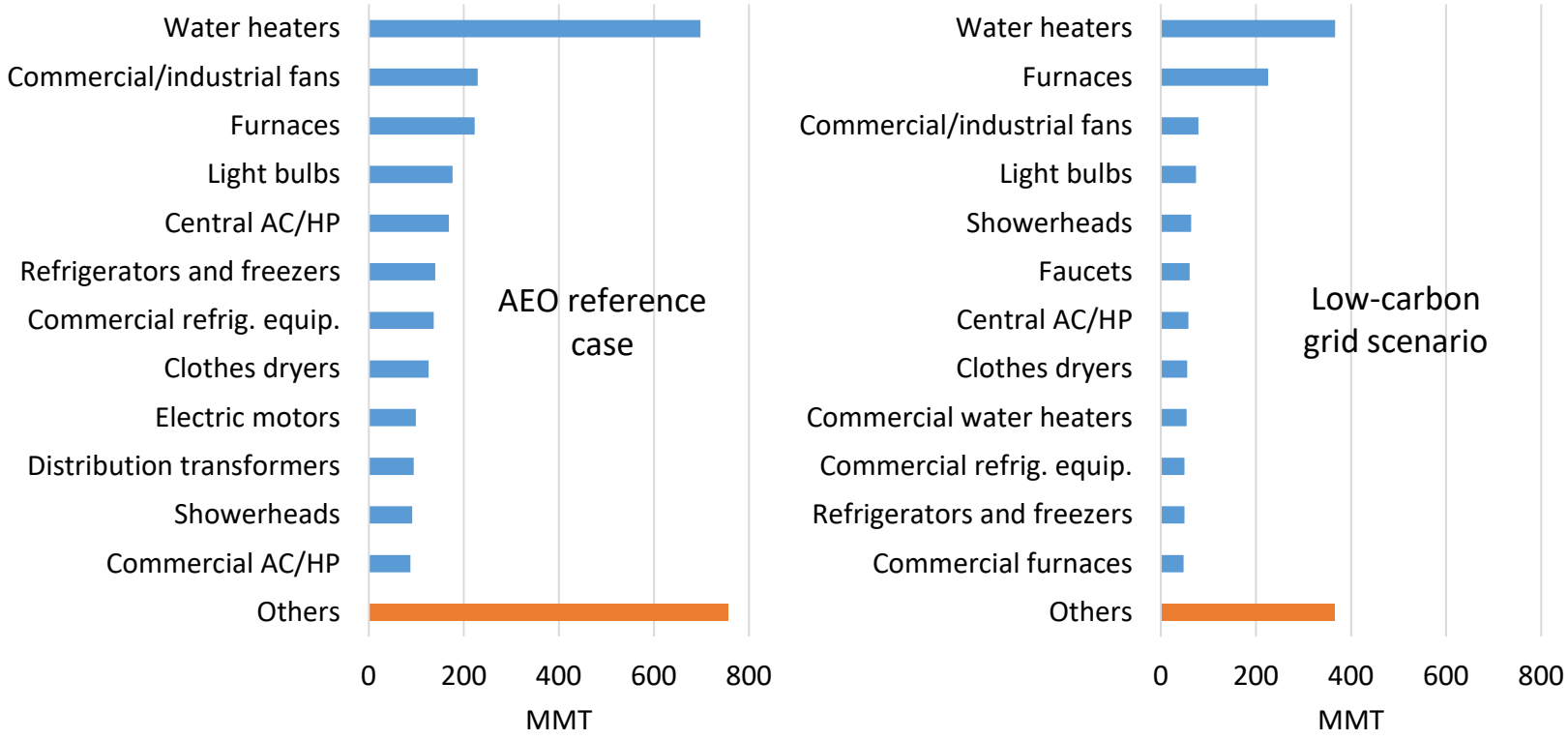
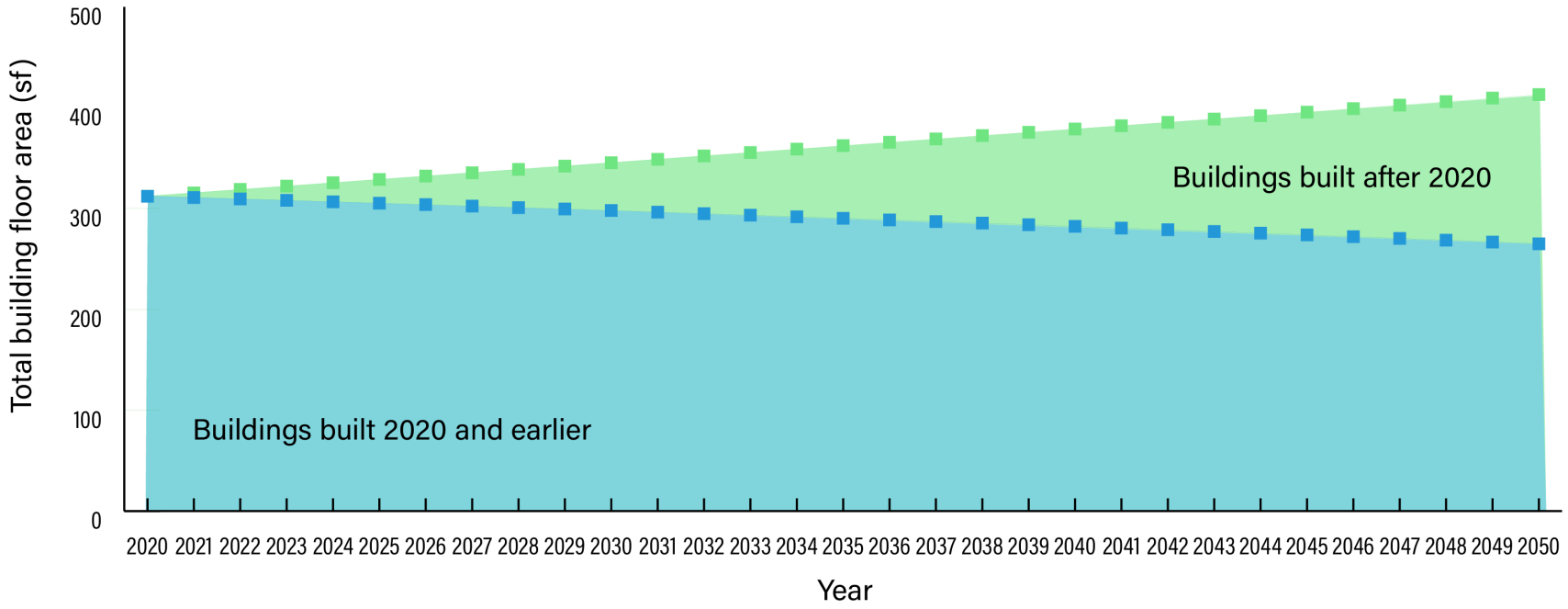
Appliances and Equipment: Potential Savings from Updated Standards



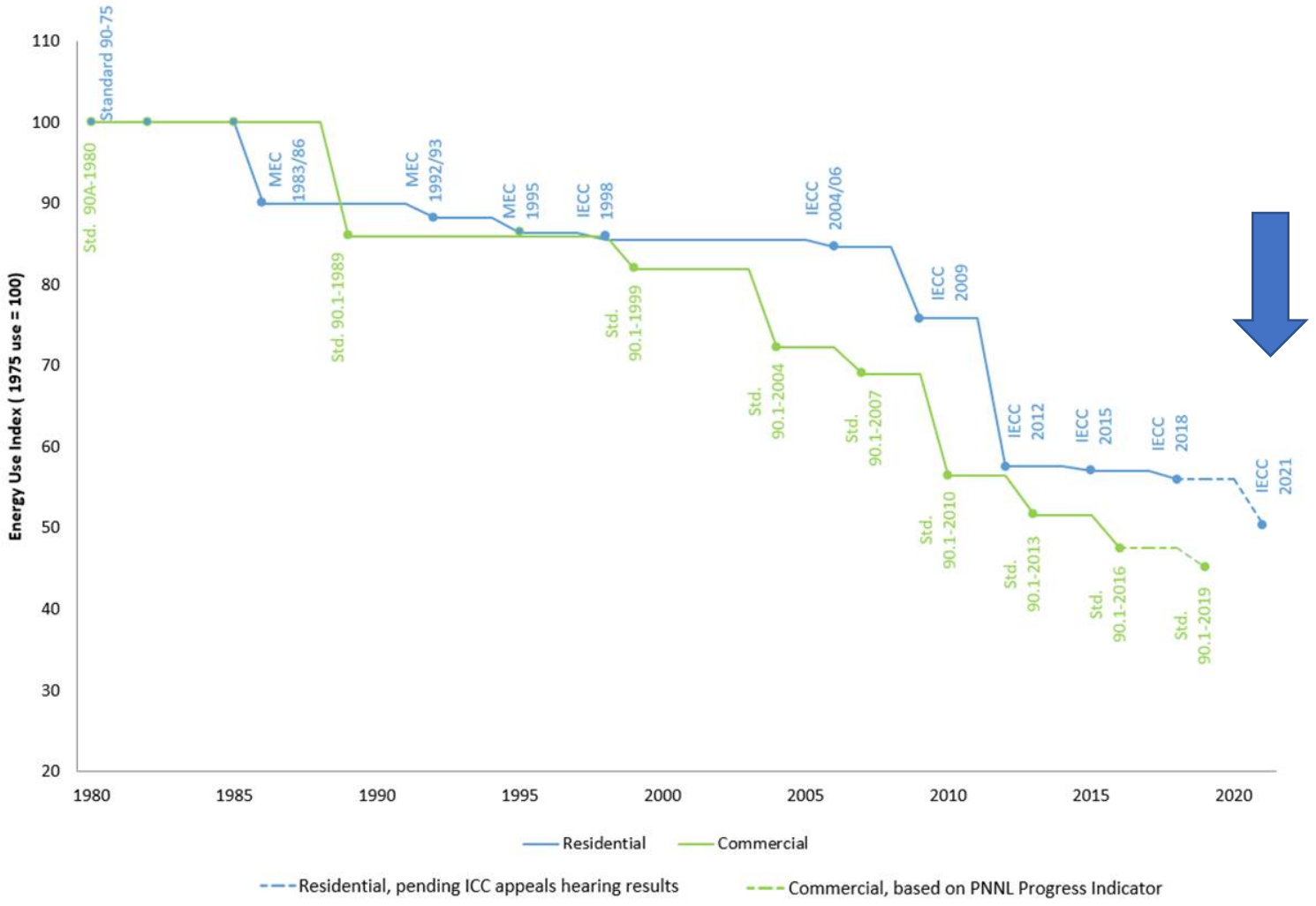
Source: A Powerful Priority, ASAP & ACEEE, 2020

New and Existing Buildings as Share of Building Floor Area (Residential + Commercial)



Source: ACEEE calculations based on data in EIA AEO 2020.

Building Energy Code Progress



Source: Data from Pacific Northwest National Laboratory & U.S. DOE Building Codes Program, except 2021 which are ACEEE estimates

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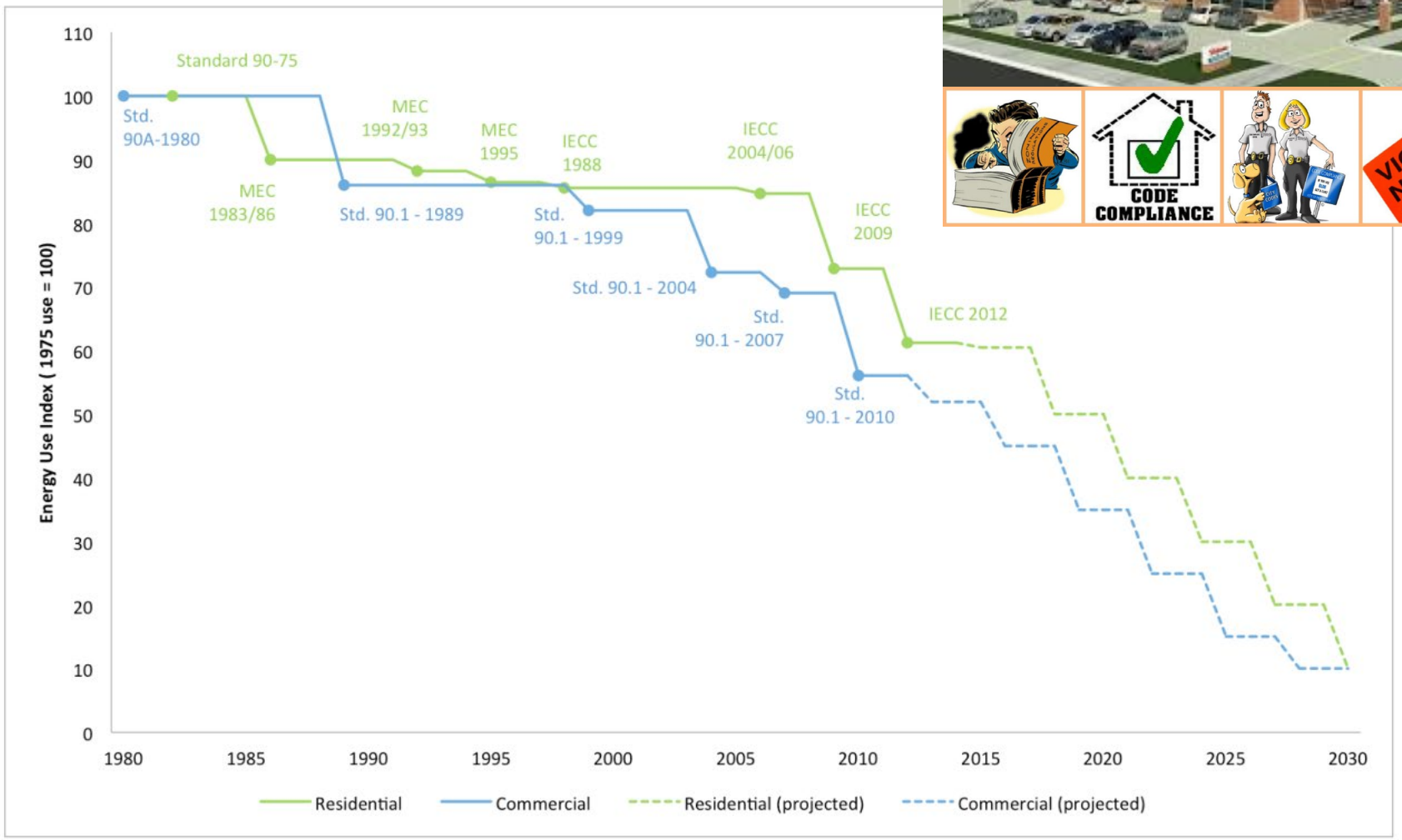
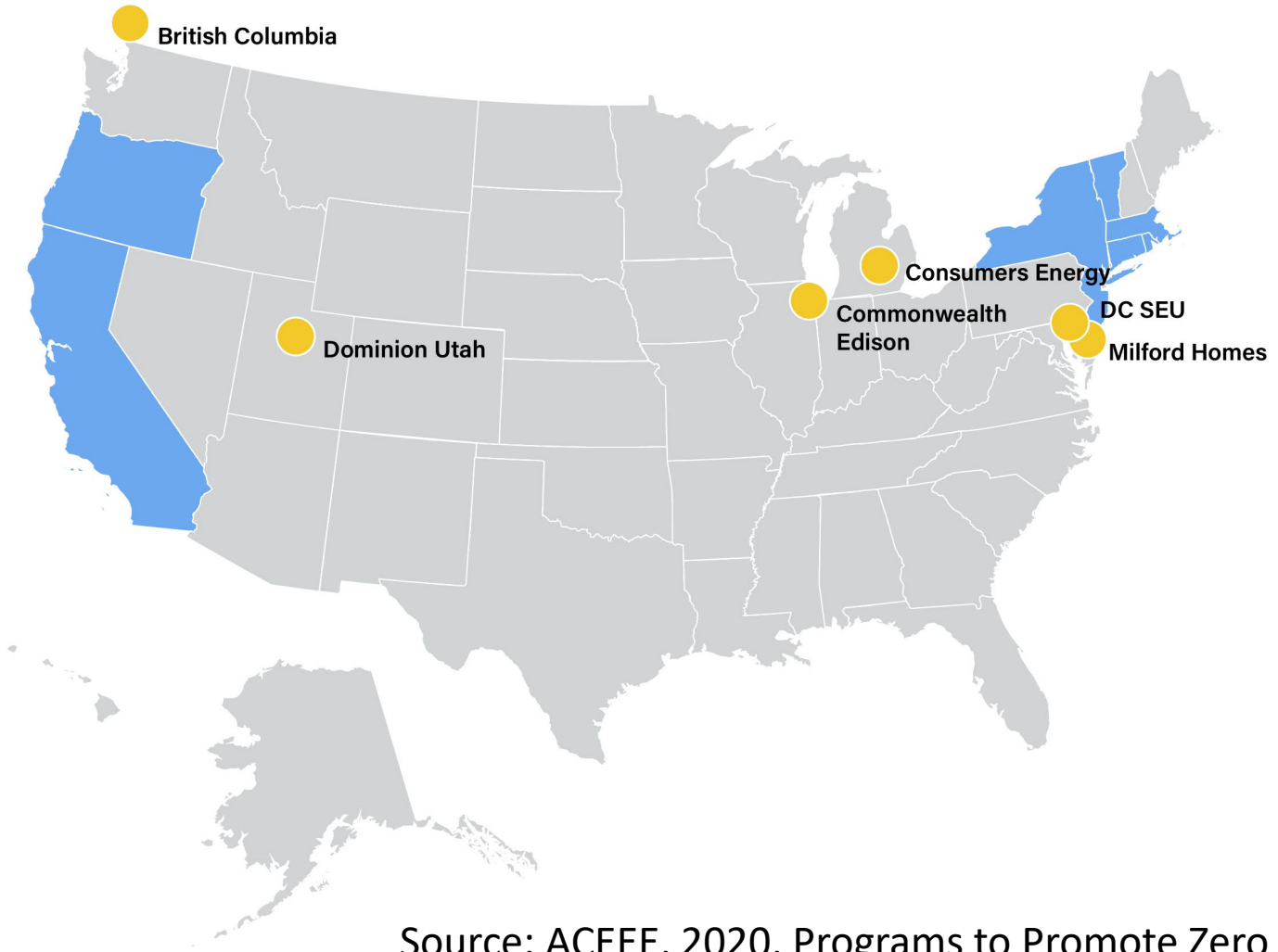
Code Goal


CODE
COMPLIANCE
VIOLATION
NOTICE


Energy Use Index (1975 use = 100)
110
100
90
80
70
60
50
40
30
20
10
0
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
Standard 90-75
Std.
90A-1980
MEC
1983/86
MEC
1992/93
Std. 90.1 - 1989
MEC
1995
IECC
1988
Std.
90.1 - 1999
Std. 90.1 - 2004
Std.
90.1 - 2007
Std.
90.1 - 2010
IECC
2004/06
IECC
2009
IECC 2012
Residential
Commercial
Residential (projected)
Commercial (projected)

Zero Energy Home and Building Programs



Source: ACEEE, 2020, Programs to Promote Zero Energy Homes and Buildings

Estimated Retrofit Rates

Residential

HPwES: 87k/yr

WAP (all sources): 85k/yr

Together 0.1%/yr of homes

Other efforts double this??

Commercial

CBECS: 14% received HVAC retrofits over 18 yrs

If add lighting and other retrofits and assume no overlap, 39% over 18 yrs

This is 0.8-2.2%/yr of the existing building stock

Residential Retrofits

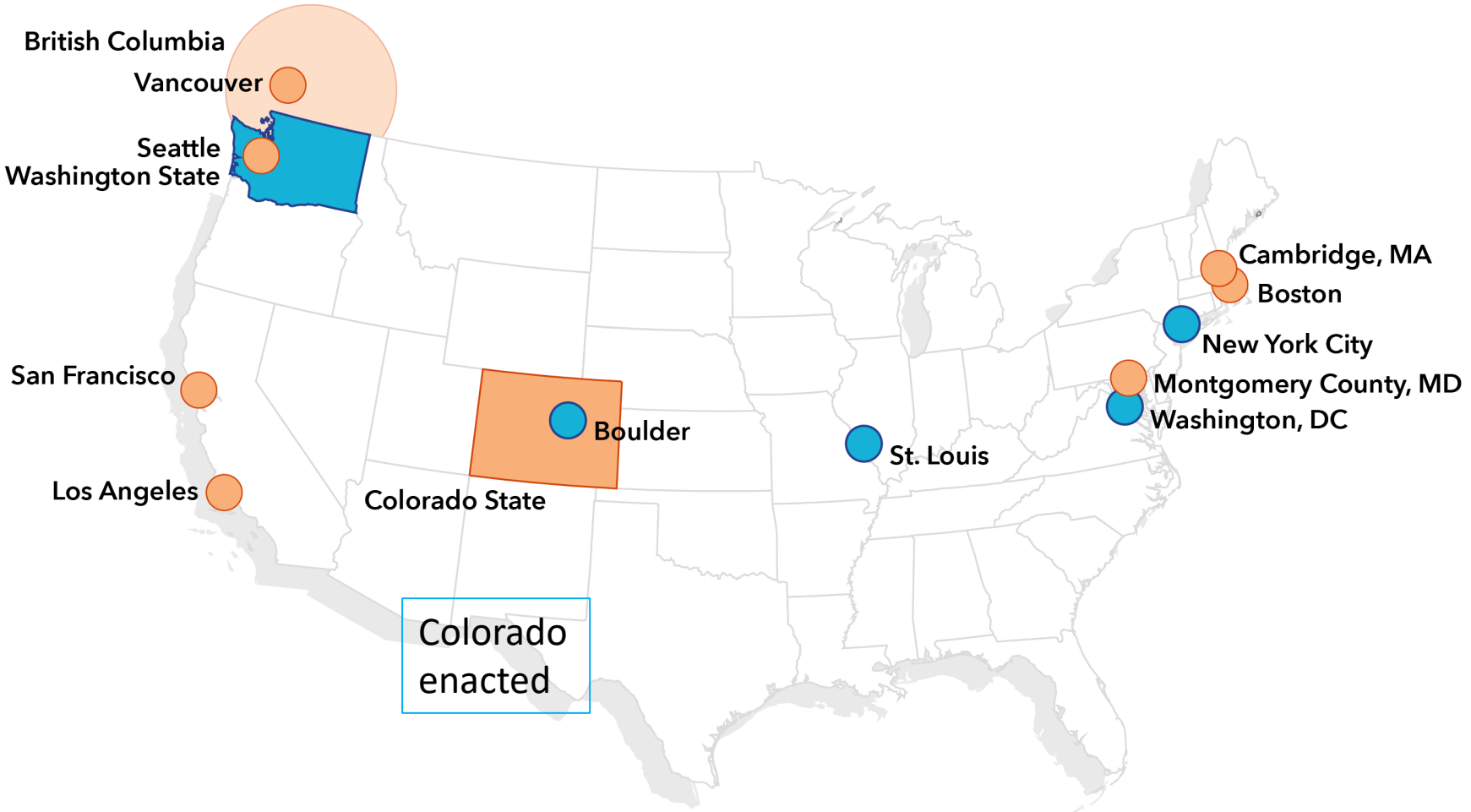
- Hope for Homes retrofit incentives now before Congress
- Need improved retrofit techniques

Commercial Retrofit Programs

- Moving beyond lighting
  - **Intelligent efficiency/GEB**
  - **Whole building retrofits**
  - **HVAC including ventilation**
- Deep retrofits at time of building renovation
- ACEEE will be doing a study on commercial retrofit programs in 2021

GAO Deep Retrofit Project

Building Performance Standards



Source: ACEEE, *Mandatory Building Performance Standards*, 2020

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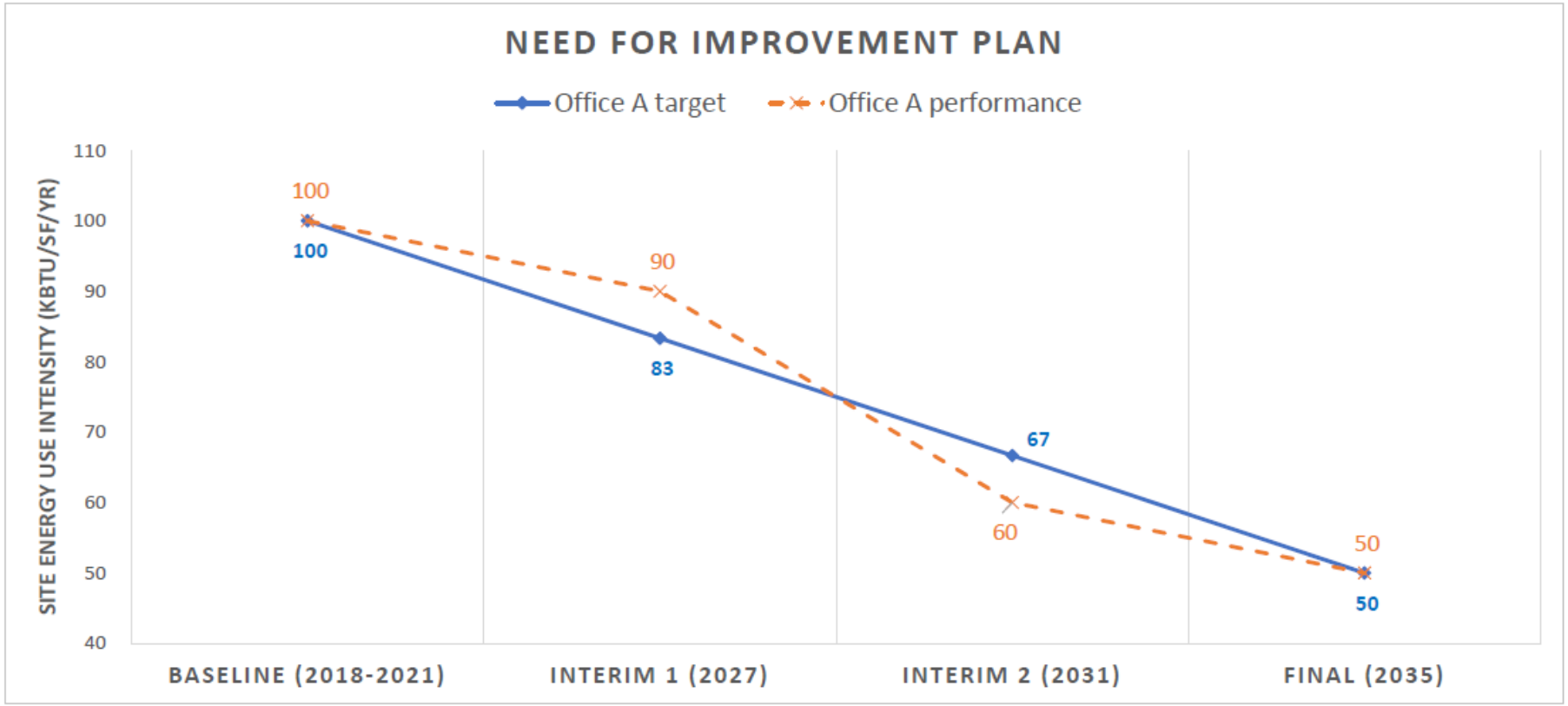
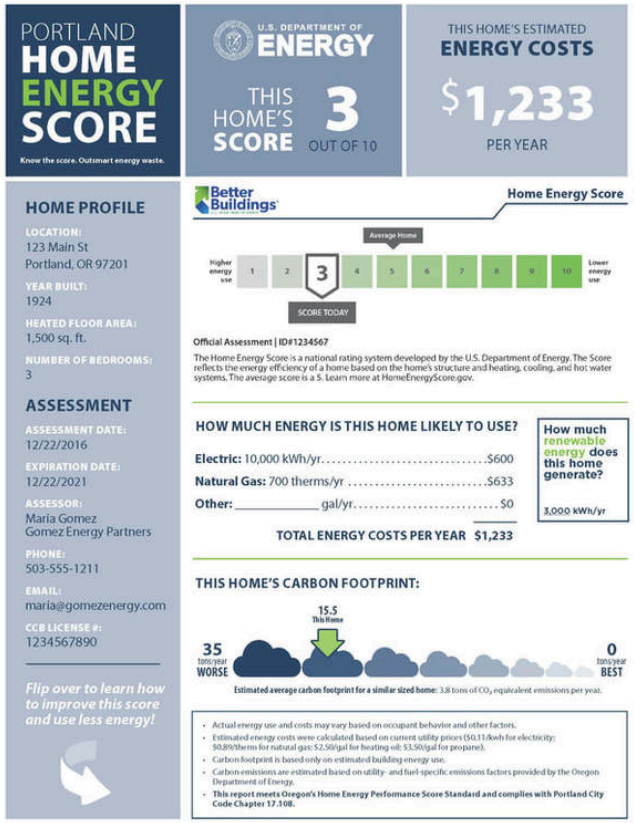
Proposed Montgomery County MD Building Performance Standard



Note: This is an illustration; values not determined yet

Other State and Local Policies to Promote Retrofits

- Building and home benchmarking and labeling (e.g. time-of-sale home energy reports in Portland, Berkeley, Minneapolis and Austin.
- Energy audit, retrocommissioning and lighting upgrade requirements.
- Job training, weatherization programs



Replacing Furnaces & Boilers with Heat Pumps

Table ES1. Representative average simple payback period for installing a heat pump at the time an existing oil or propane system needs to be replaced

	Average simple payback period (years)				
Comparison	US	West	Midwest	Northeast	Southeast
Oil furnace (83% AFUE) vs. HP (8.5 HSPF), includes AC savings	0.9	1.4	1.3 in MO; no savings in Upper MW	1.9	0.8
Propane furnace (80% AFUE) vs. HP (8.5 HSPF), includes AC savings	1.5	1.7	3.4 in MO; no savings in Upper MW	2.0	1.3
Oil boiler (86% AFUE) vs. ductless HP, without AC	4.4	7.3	18.8	6.2	5.1
Propane boiler (84% AFUE) vs. ductless HP, without AC	16.1	12.1	19.8	8.5	9.1
Std. oil water heater to HPWH (2.0 rated EF)	Immediate	Examined only at a national level			
Std. propane water heater to HPWH (2.0 rated EF)	3.9				

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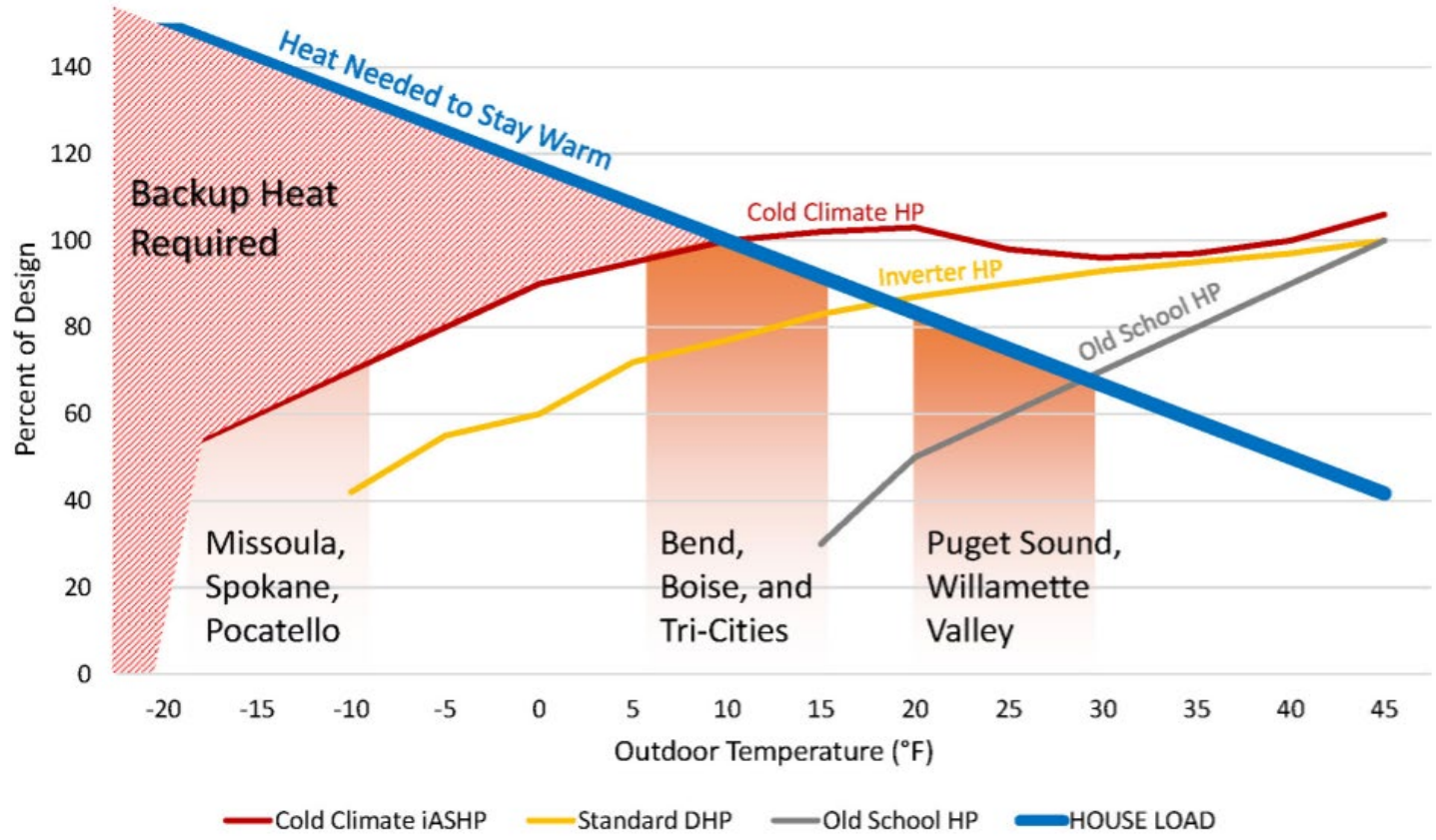
Heat Pump Heat Output as a Function of Outdoor Temperature



Source: Bruce Harley Energy Consulting

Efficiency Critical; Will be Challenging to Hit Climate Goals without Efficiency

- Efficiency lowers total cost
  - **Consumers**
  - **The grid**
- Efficiency can help reduce peak demand
- Efficiency has additional benefits beyond energy and climate
  - **Comfort**
  - **Health**
  - **Productivity**
  - **Resilience**

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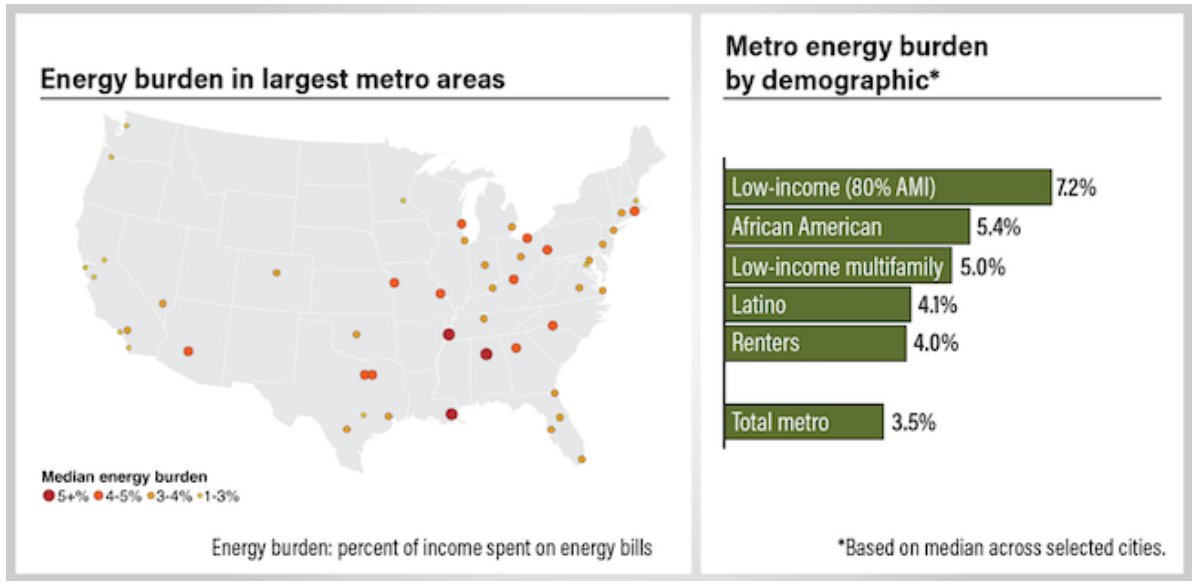
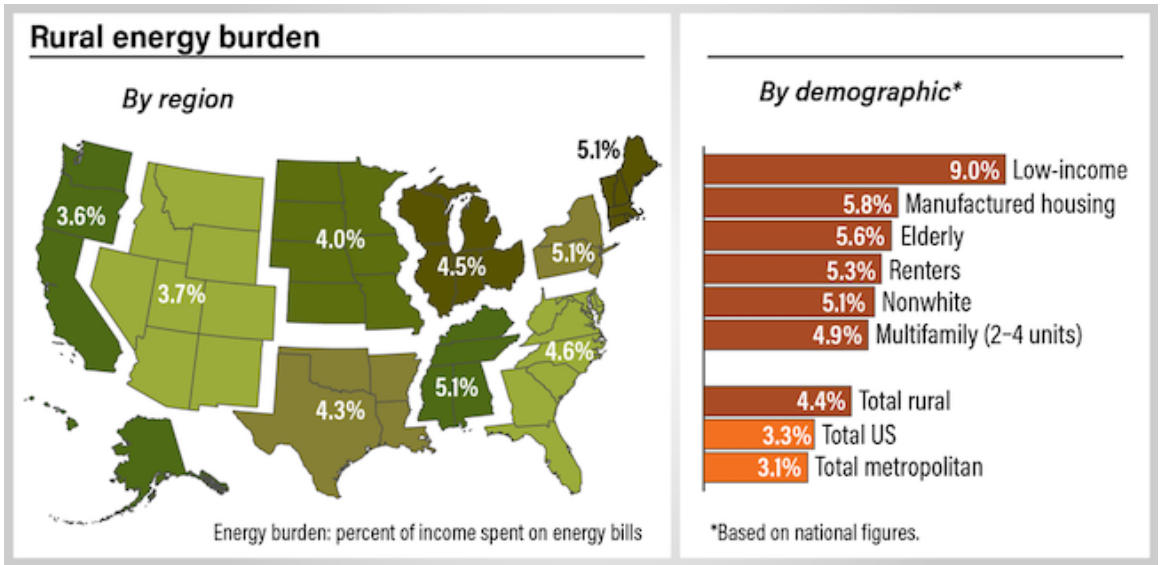
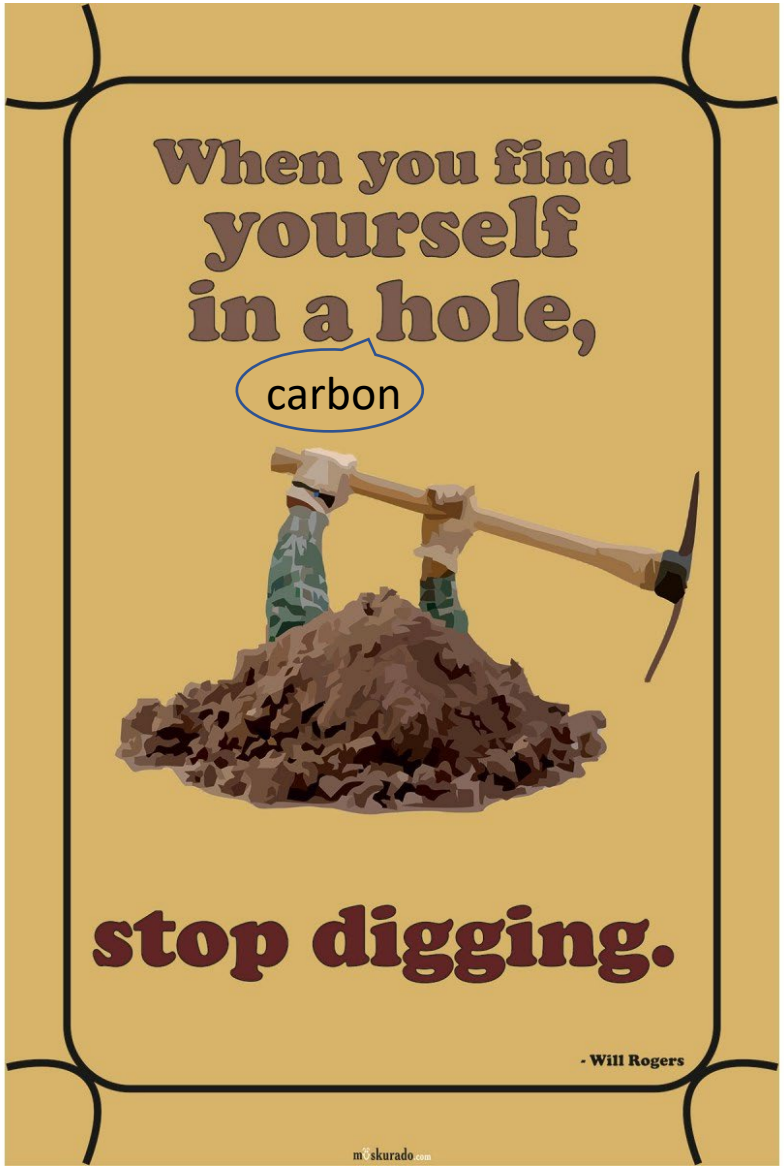
Addressing Equity Critically Important






When you find yourself in a hole,
carbon
stop digging.
- Will Rogers

Contact Information

Steven Nadel

snadel@aceee.org