Edward Mazria
Architecture 2030


By 2060, world population is expected to increase by about
2.67 billion people
Source: World Bank

By 2060, world ***urban population*** is expected to increase by about

2.75 billion people

absorbing the entire population growth estimate.

Source: UN Population Division

Or, ***every week*** about

1.5 million people

are being added to cities worldwide.

Source: UN Population Division


Today, global building floor area is about
223 billion m²
Source: Global Status Report, GABC
architecture 2030


By 2060, global building floor area will increase by
230 billion m²
or *double* the current worldwide building stock.
Source: Global Status Report, GABC
architecture 2030


Peak CO_2 emissions by 2020, and
reach ZERO emissions by 2050
December 12, 2015
architecture 2030

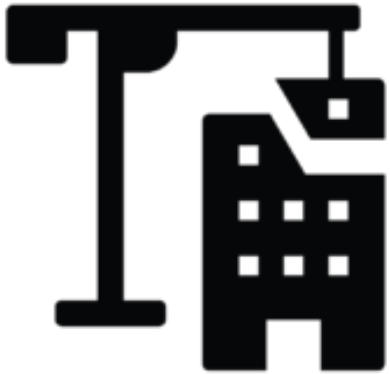

ESACTET
INOW!

Urban environments are responsible for

75% of all human-produced global greenhouse gas emissions.

CITY	% emissions from buildings
New York City	71%
Seoul	63%
Boston	73%
London	60% - 78%
Washington DC	76%
Mumbai	60%
Beijing	53%
Copenhagen	76%
Chicago	71%

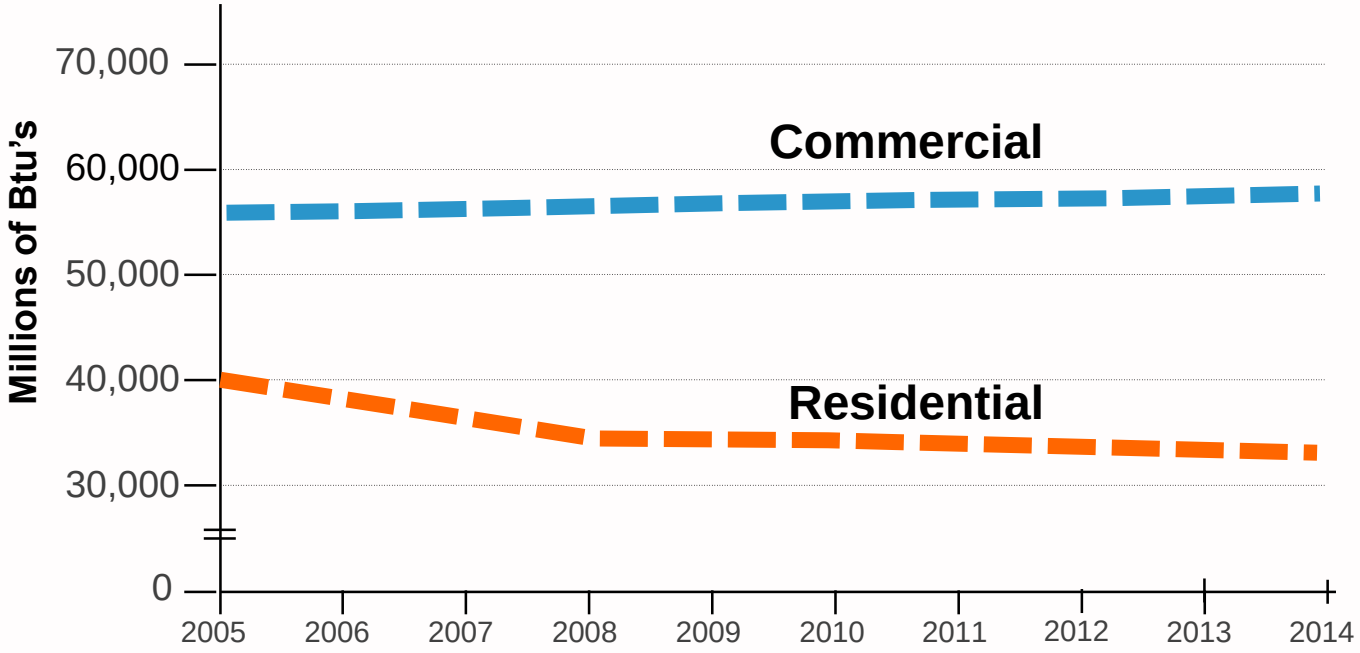
Source: UN Habitat, Paulson Inst., city data, etc.



NEW BUILDINGS

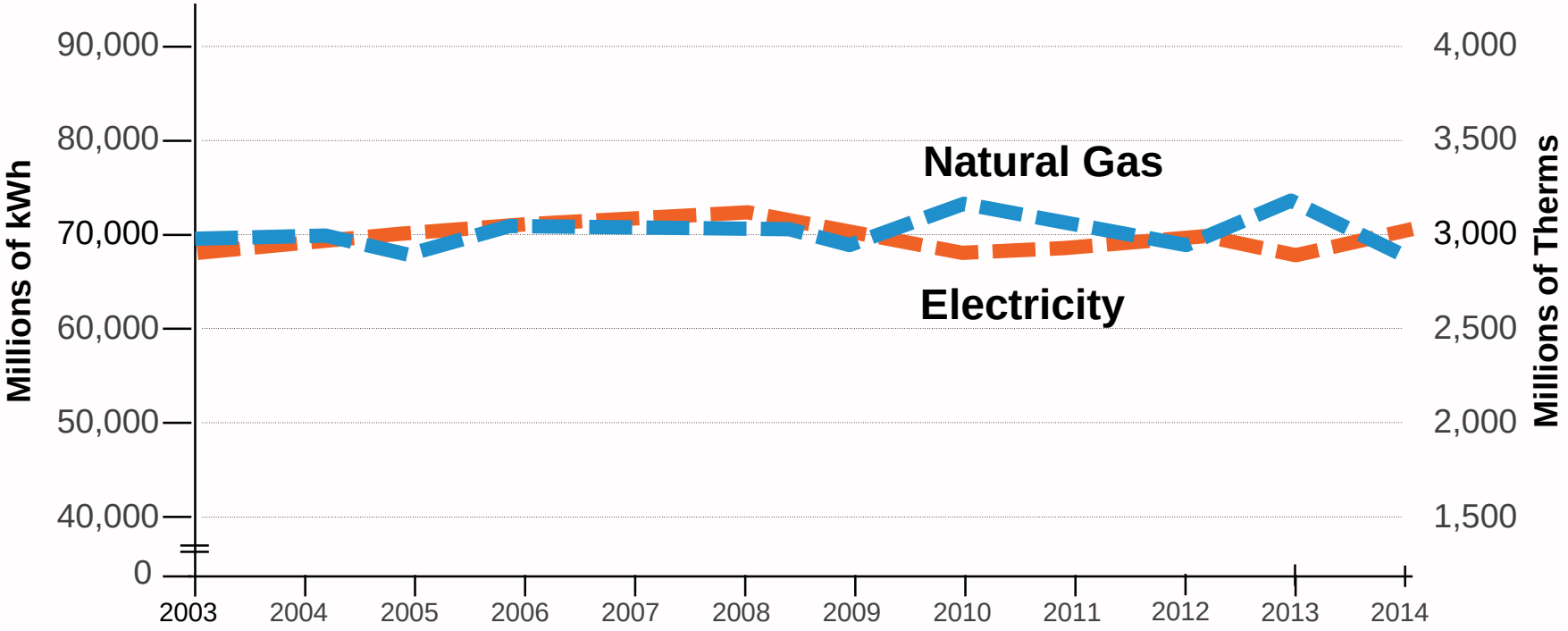
EXISTING BUILDINGS

OPERATIONS



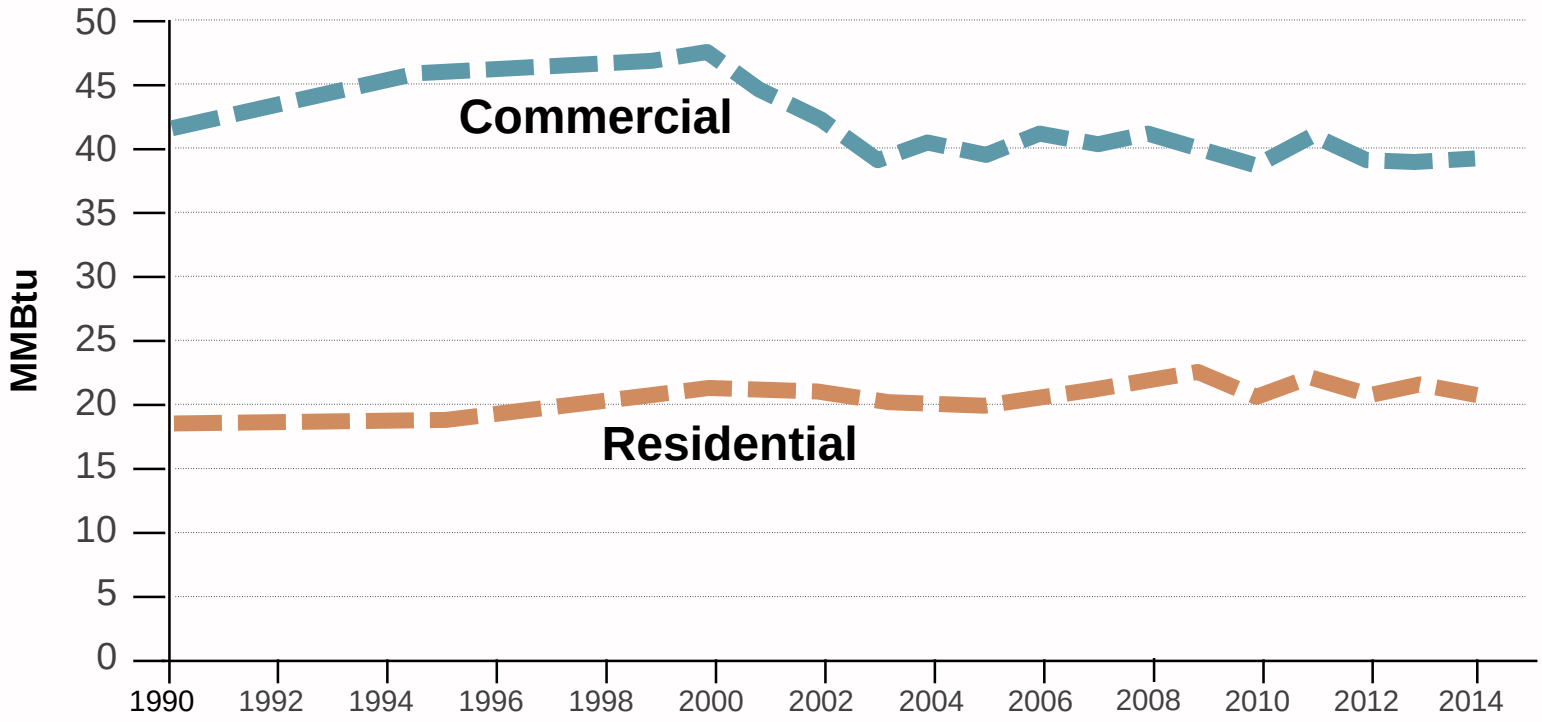
SEATTLE RESIDENTIAL AND COMMERCIAL BUILDING ENERGY CONSUMPTION

Source: Seattle office of Sustainability and Environment



LOS ANGELES COUNTY ENERGY CONSUMPTION (Buildings)

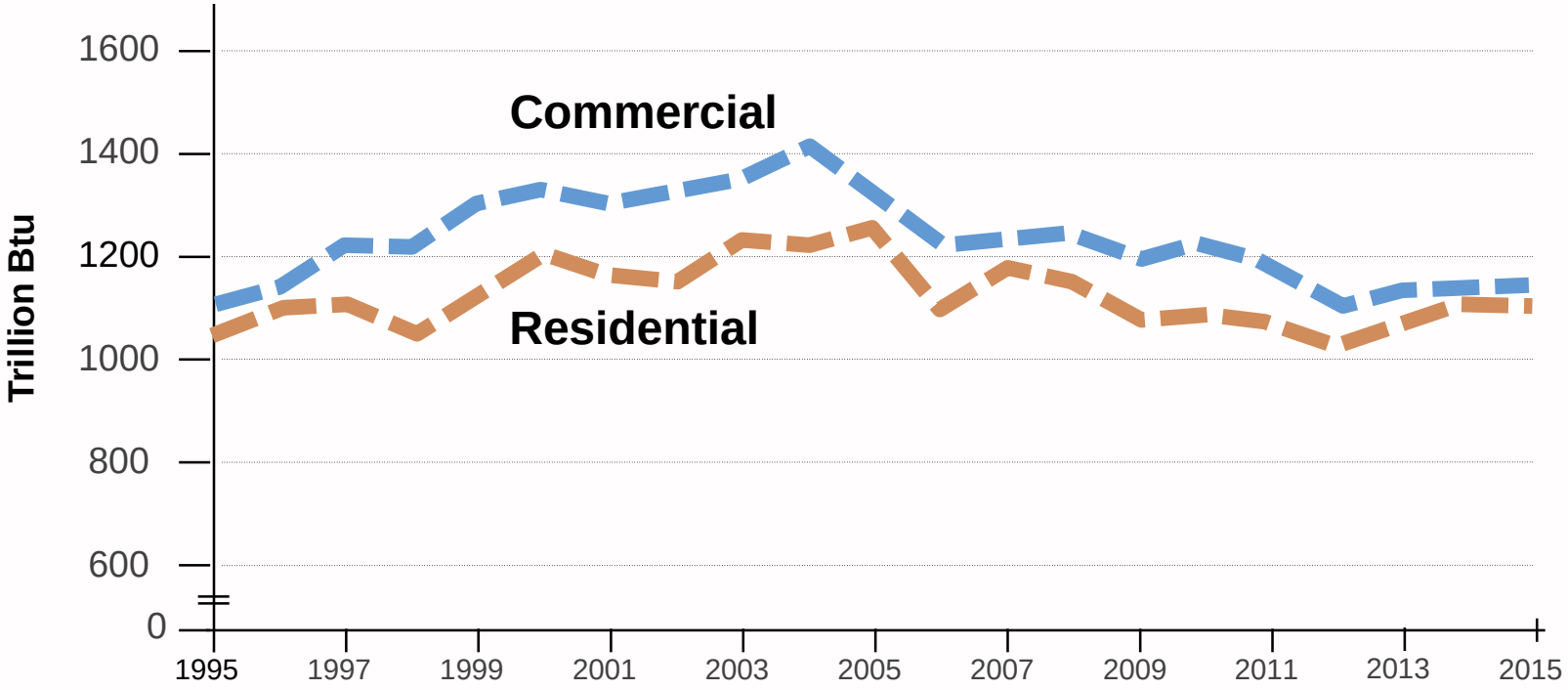
Source: California Energy Commission



PORTLAND (Multnomah County)

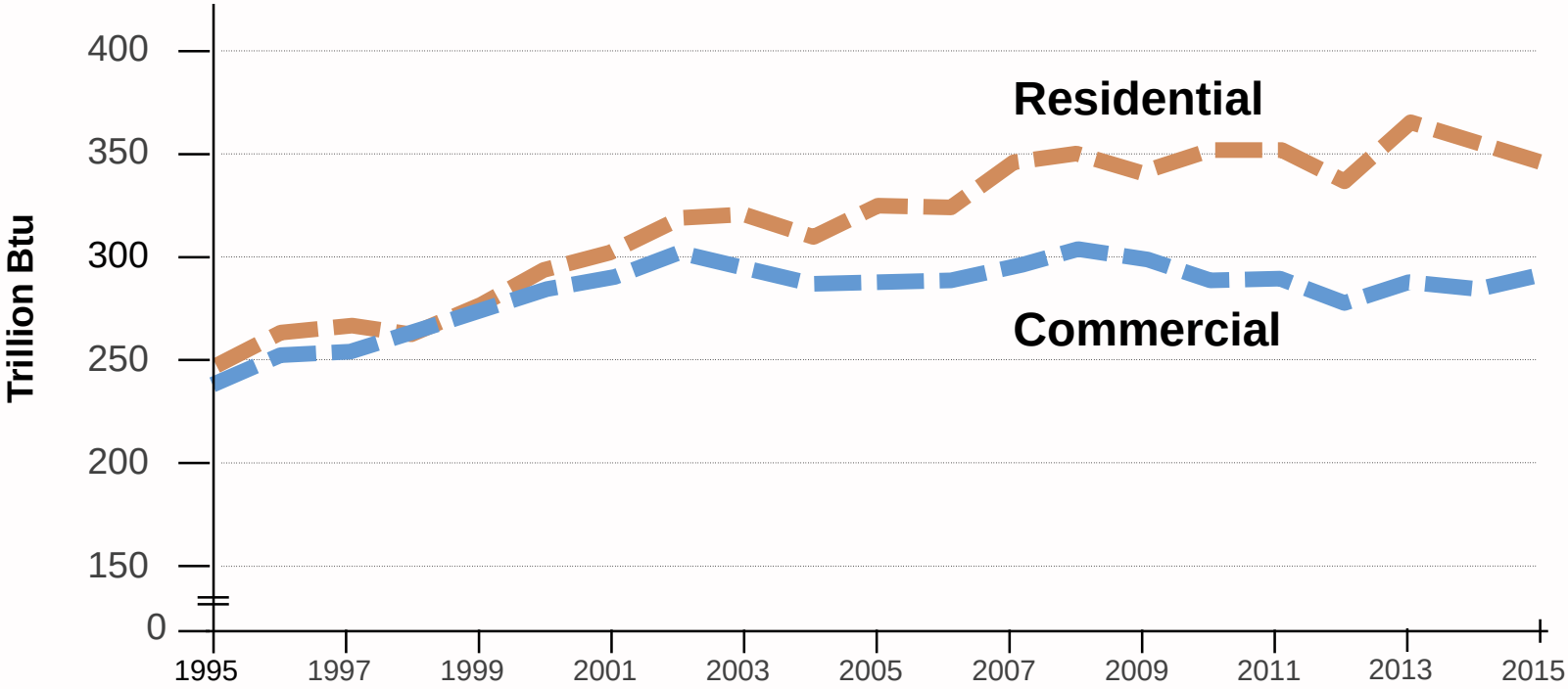
Residential/Commercial Building Energy Consumption

Source: Multnomah County Greenhouse Gas Inventory (1990-2014)



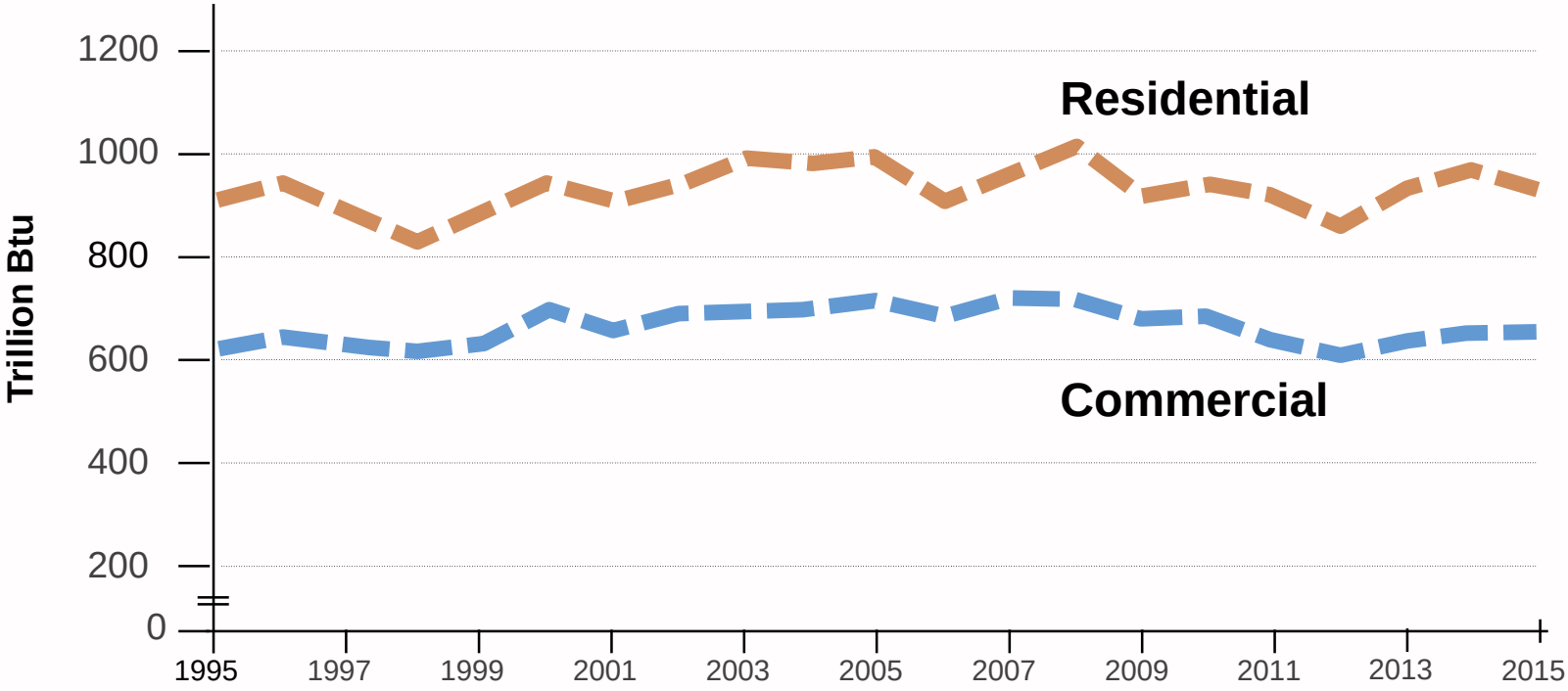
NEW YORK STATE ENERGY CONSUMPTION
(Residential and Commercial Buildings)

Source: Energy Information Administration



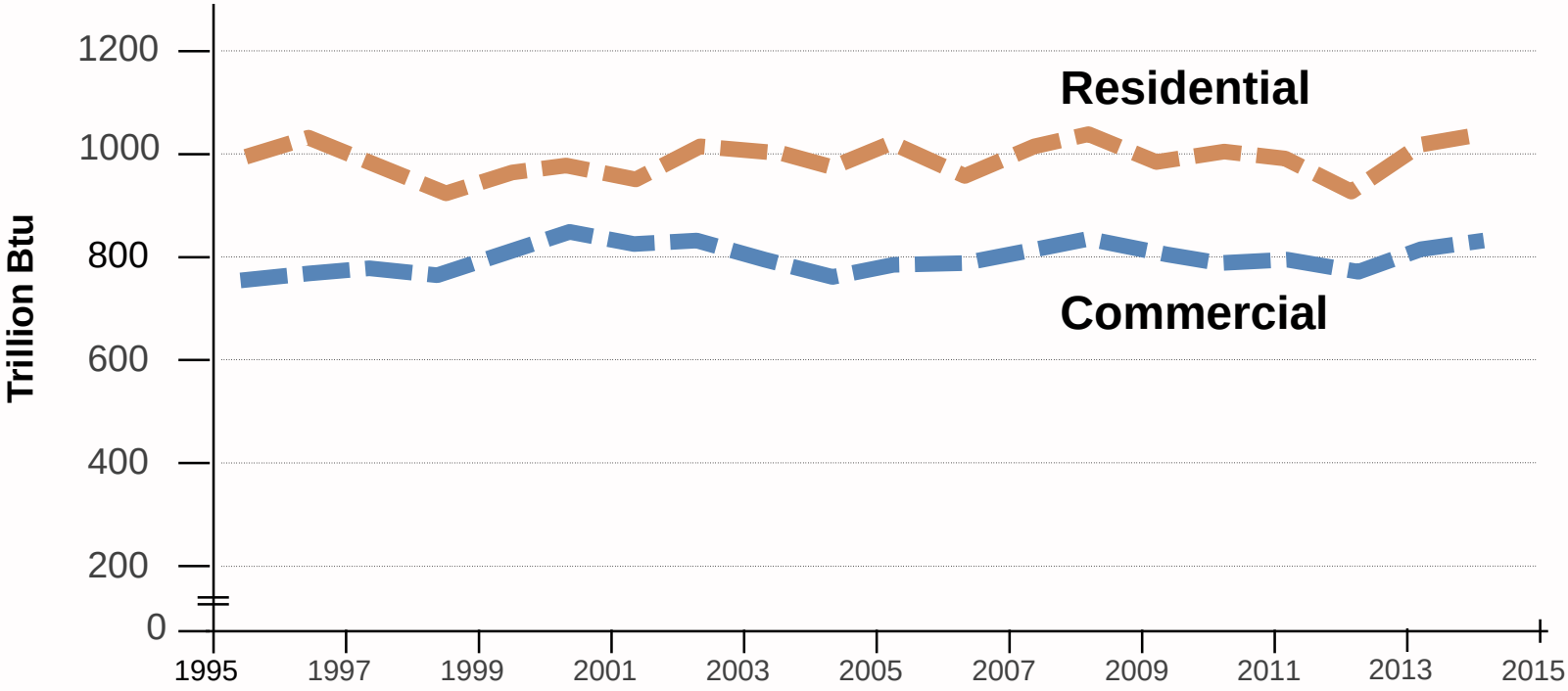
COLORADO ENERGY CONSUMPTION
(Residential and Commercial Buildings)

Source: Energy Information Administration



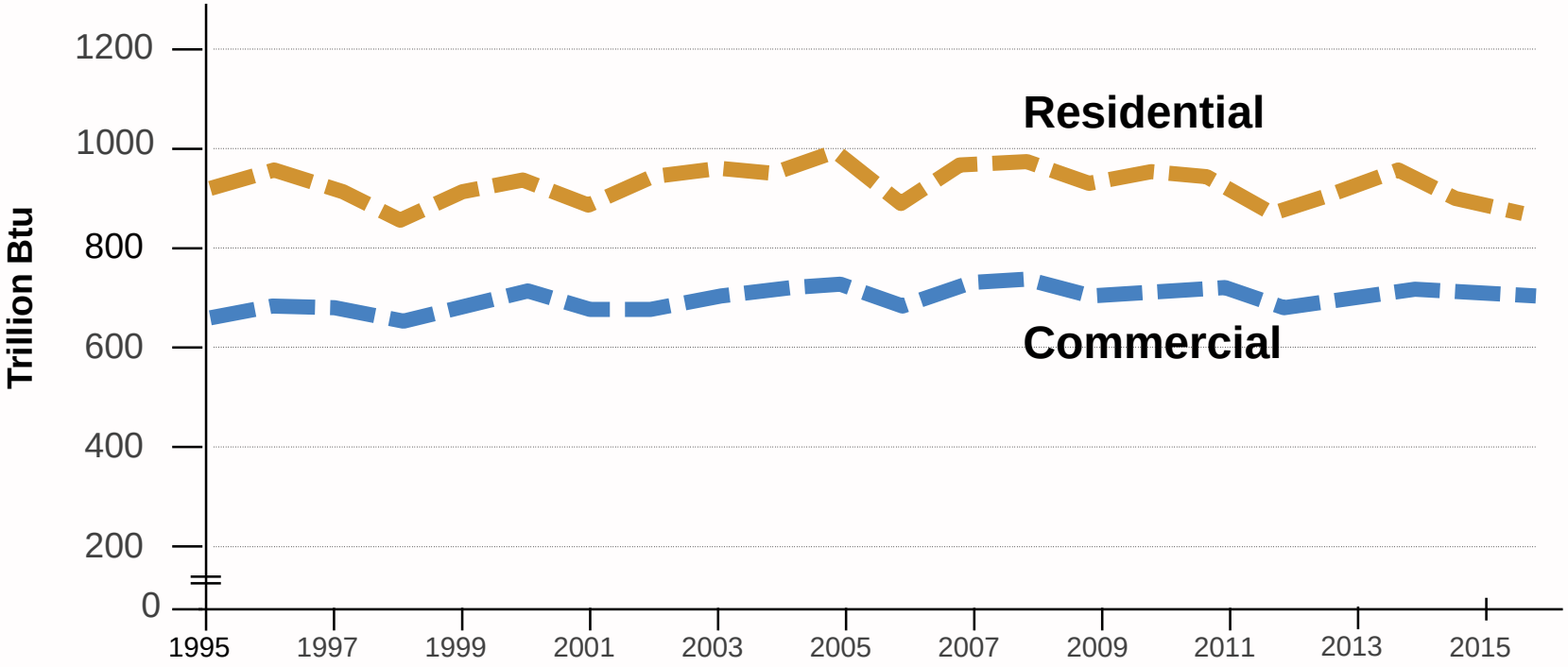
PENNSYLVANIA ENERGY CONSUMPTION
(Residential and Commercial Buildings)

Source: Energy Information Administration



ILLINOIS ENERGY CONSUMPTION
(Residential and Commercial Buildings)

Source: Energy Information Administration

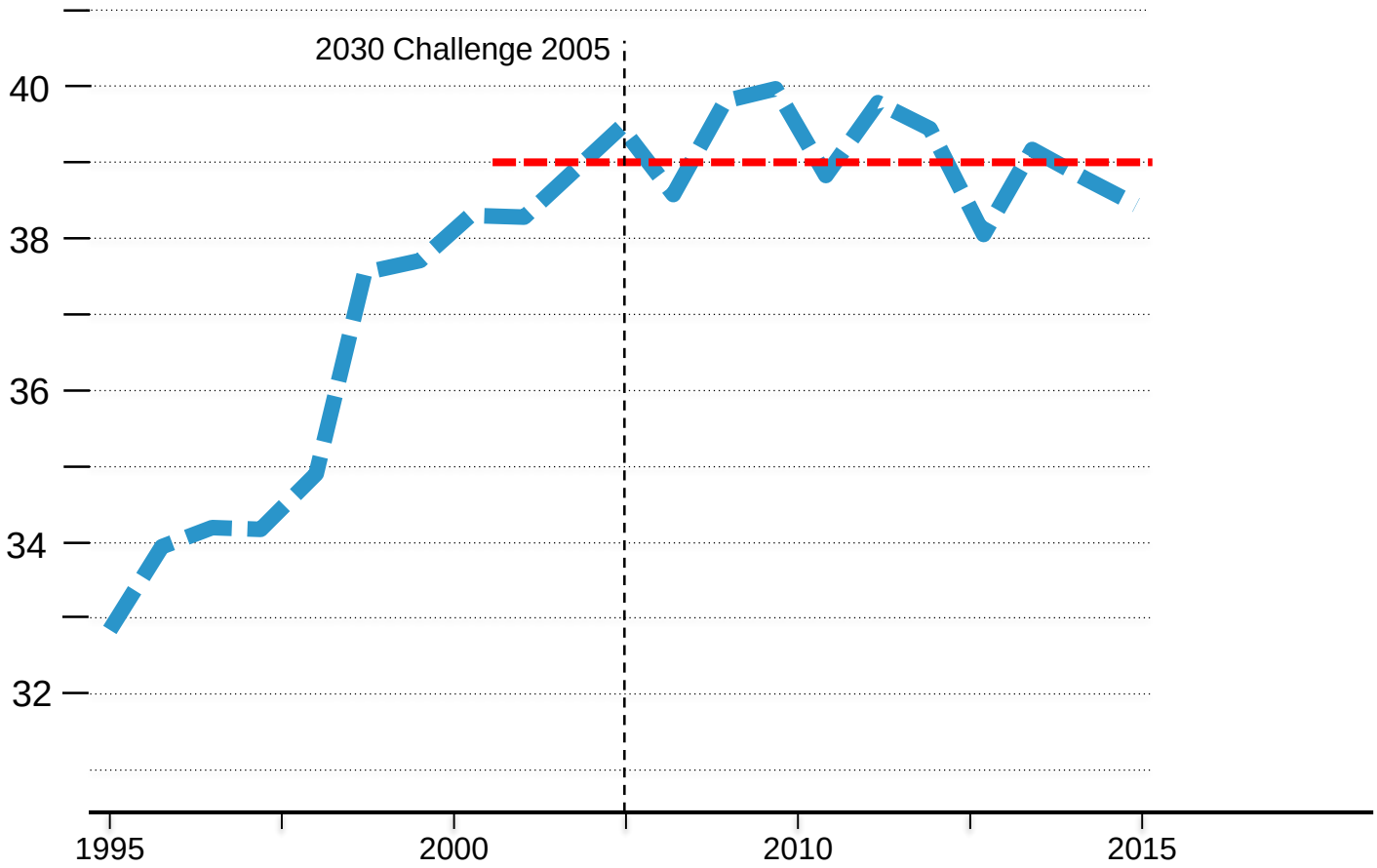


OHIO ENERGY CONSUMPTION
(Residential and Commercial Buildings)

Source: Energy Information Administration

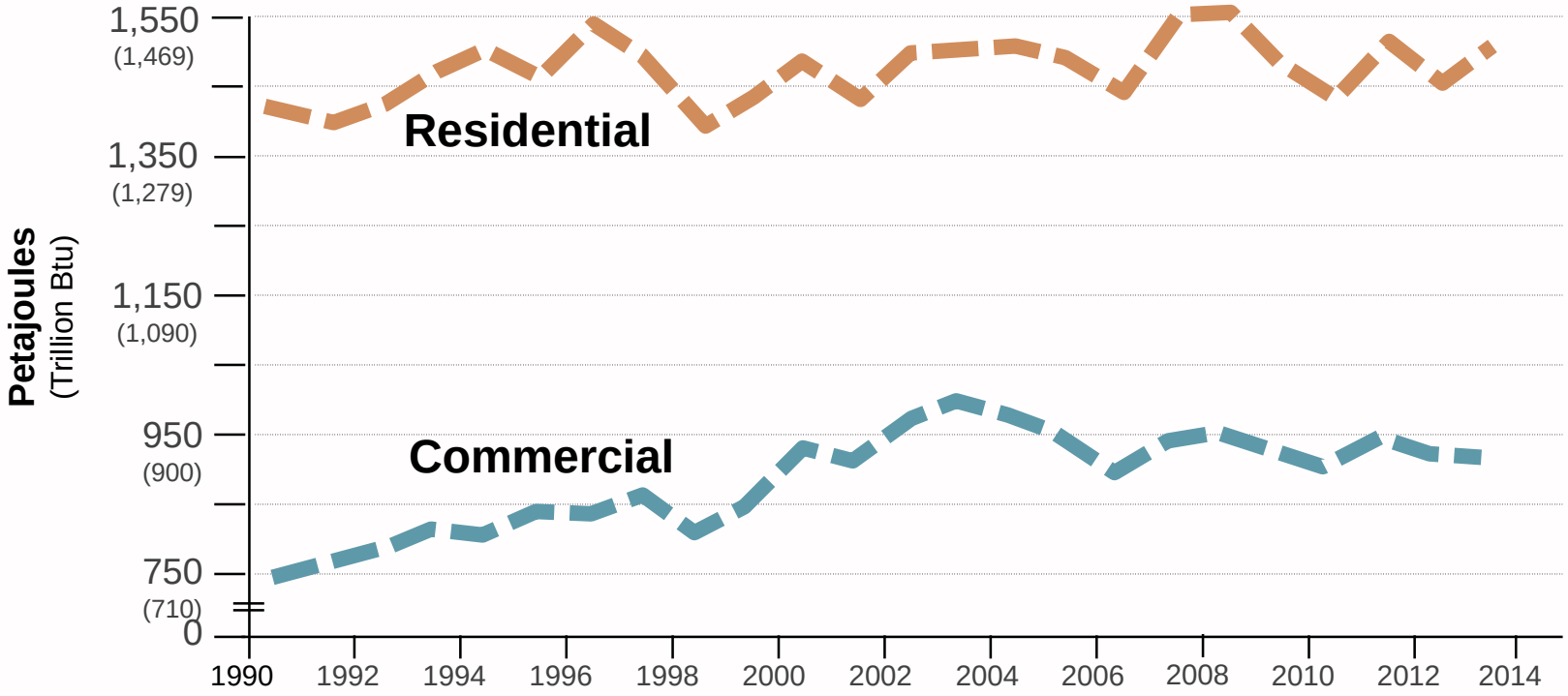
QBtu

Quadrillion Btu



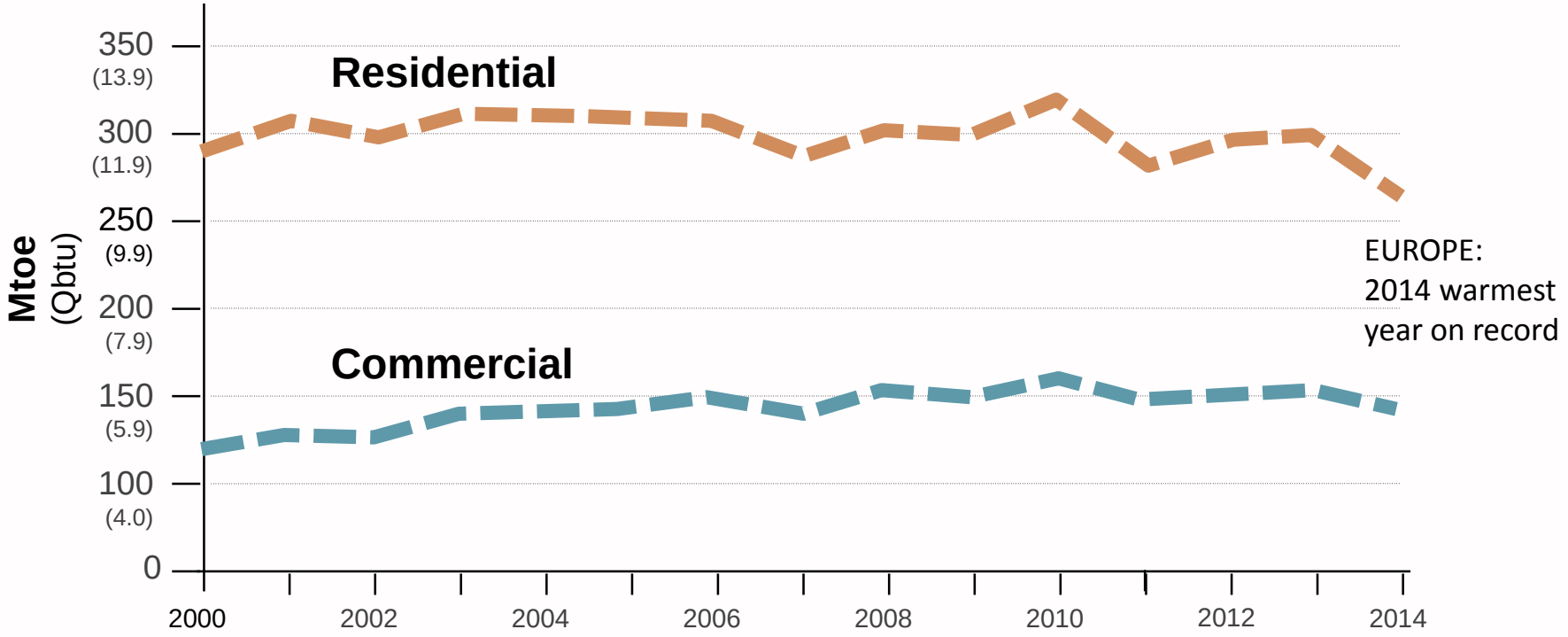
U.S. Building Operations Energy Consumption

Source: Architecture 2030, U.S. Energy Information Administration, Annual Energy Outlook



CANADA
Building Energy Consumption

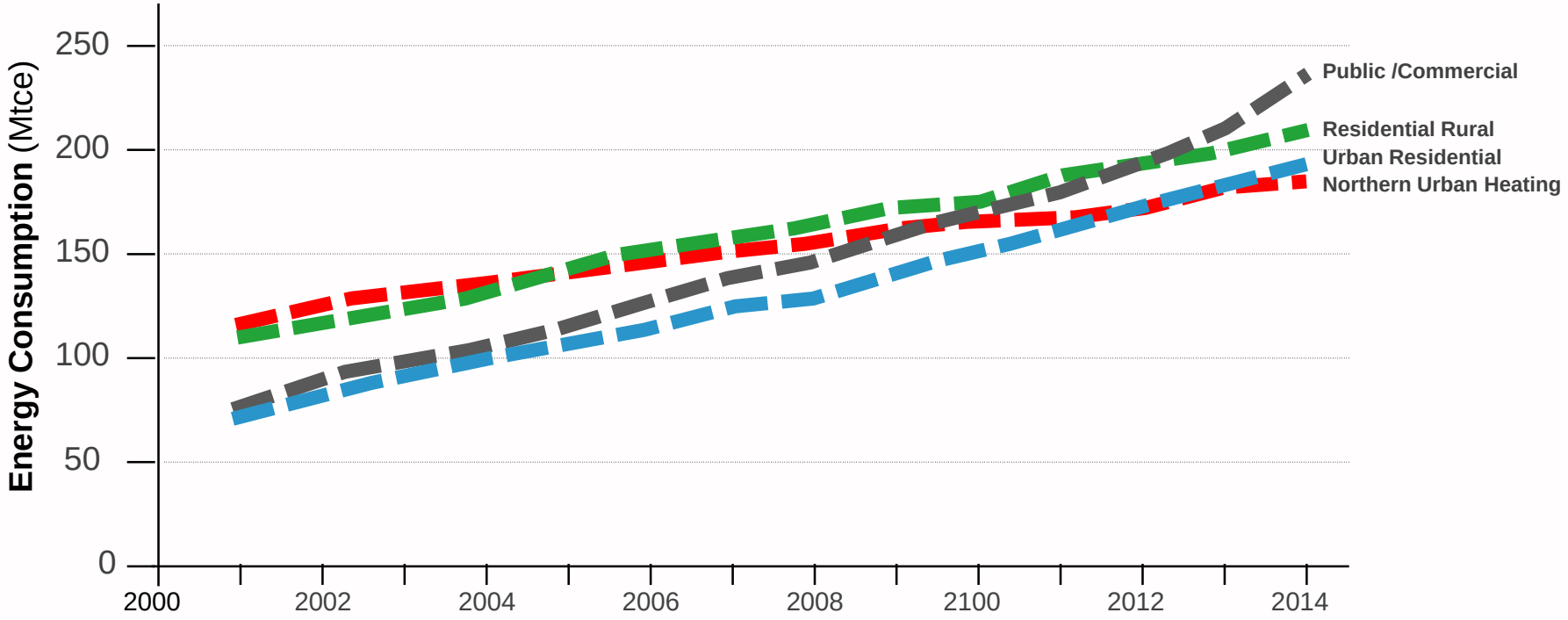
Source: Natural Resources Canada



EUROPE:
2014 warmest
year on record

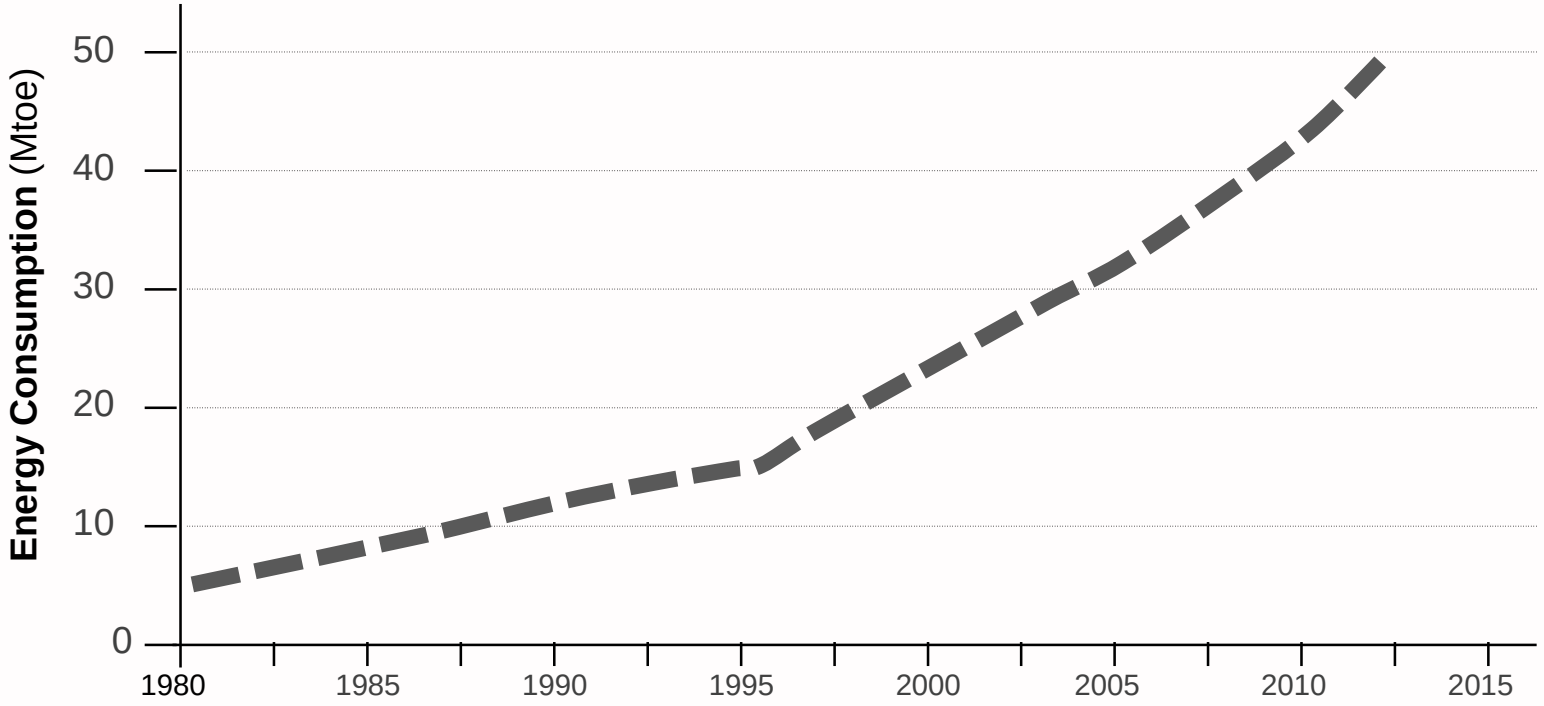
EU–28 FINAL ENERGY CONSUMPTION
(Buildings)

Source: European Commission, Energy Consumption and Efficiency Trends in the EU–28



CHINA BUILDING ENERGY CONSUMPTION (2001 - 2014)

Source: Building Energy Research Center Tsinghua University

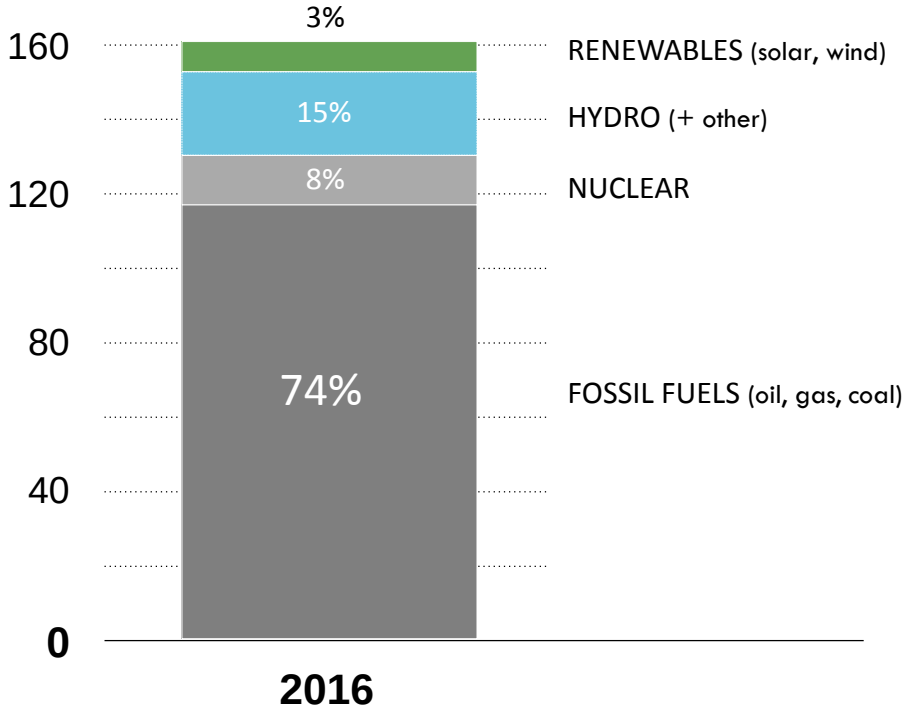


INDIA BUILDING ENERGY CONSUMPTION (1980 - 2012)

Source: TERI Energy and Environment and Overview 2014/2015

GLOBAL BUILDING SECTOR ENERGY CONSUMPTION BY FUEL TYPE

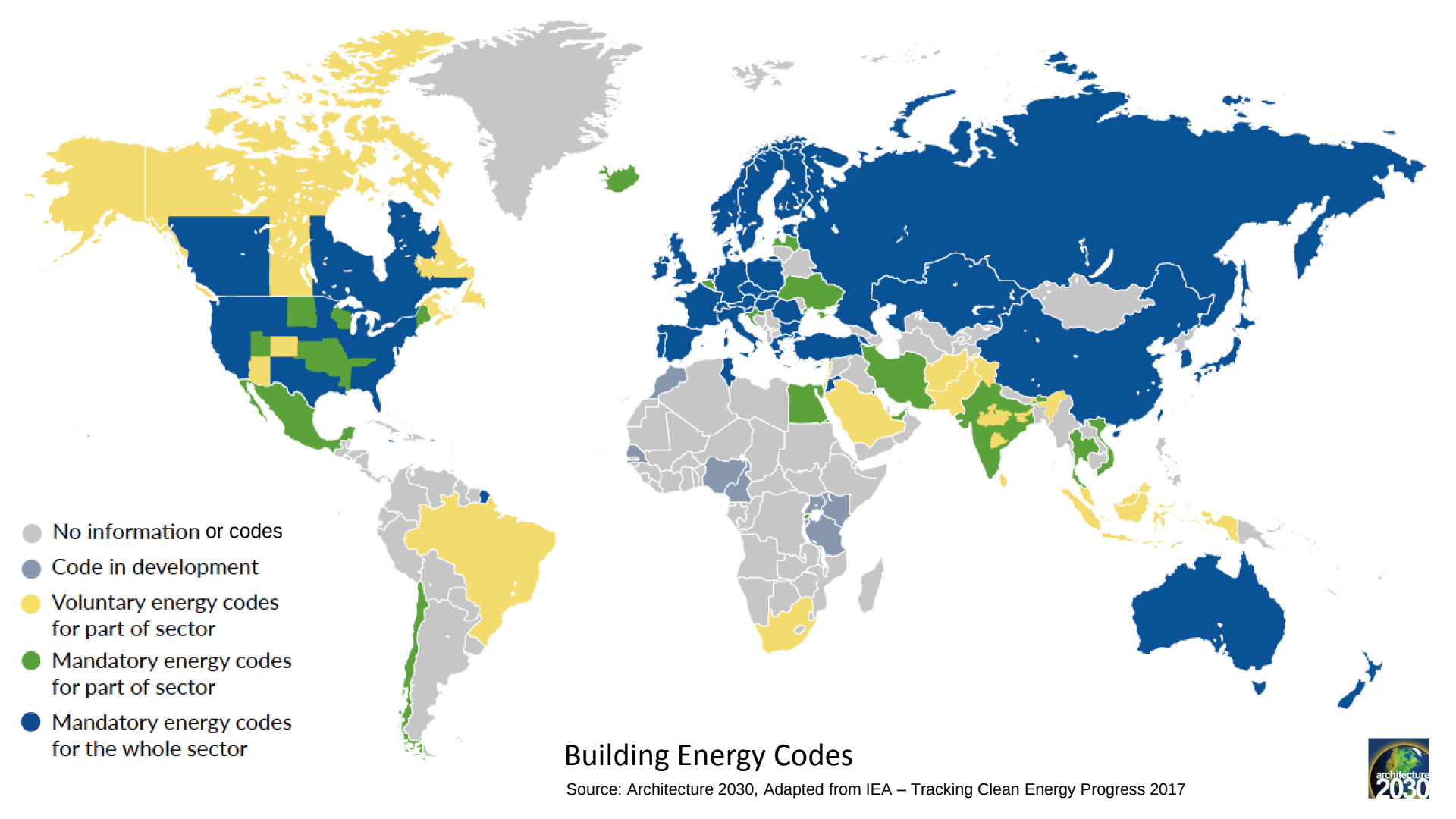
Quads (Quadrillion BTU)



45%

INCREASE IN BUILDING SECTOR EMISSIONS SINCE 1990

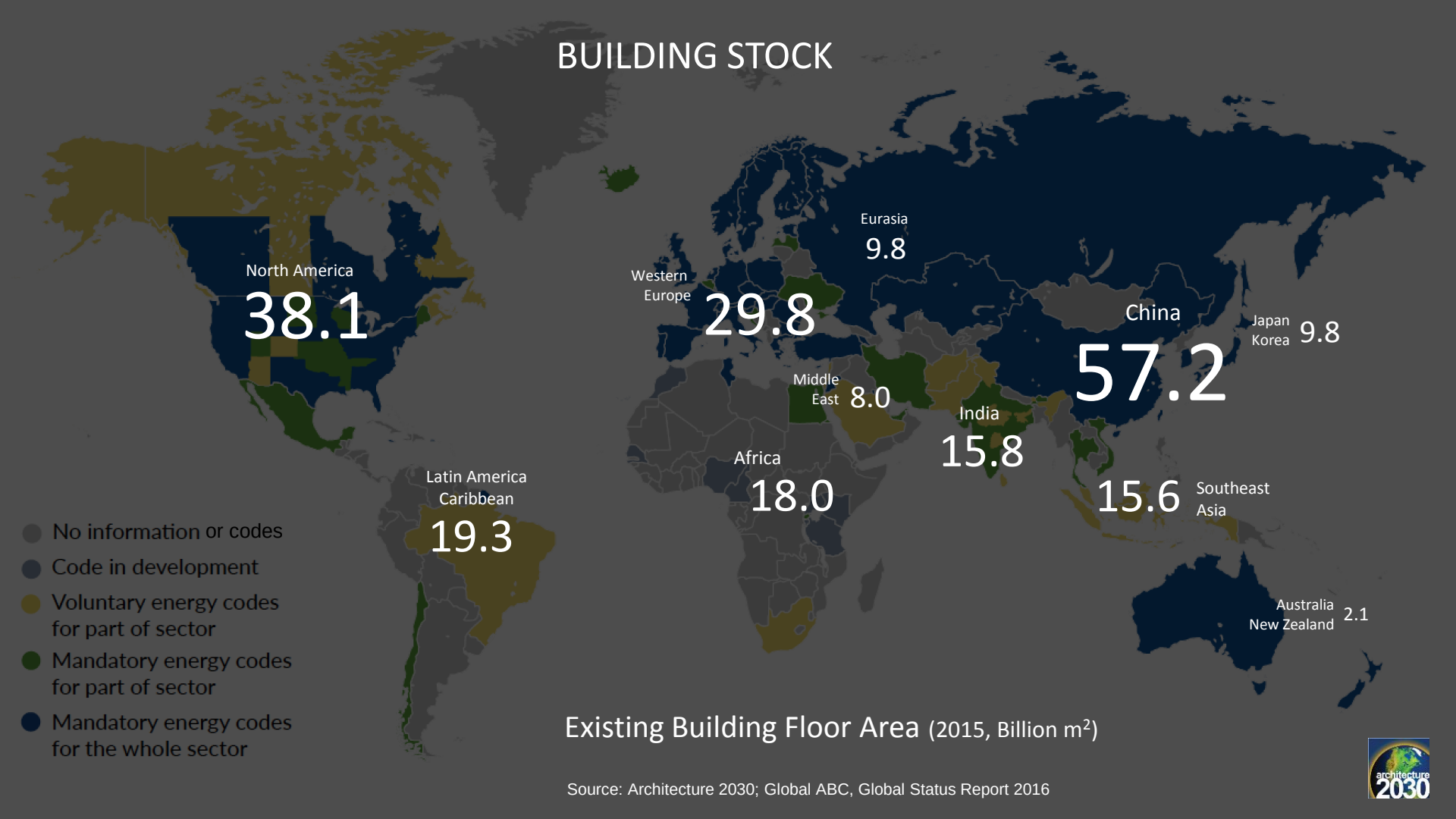
Source: Architecture 2030, Adapted from EIA – International Energy Outlook 2017 (biomass not included)



Building Energy Codes

Source: Architecture 2030, Adapted from IEA – Tracking Clean Energy Progress 2017

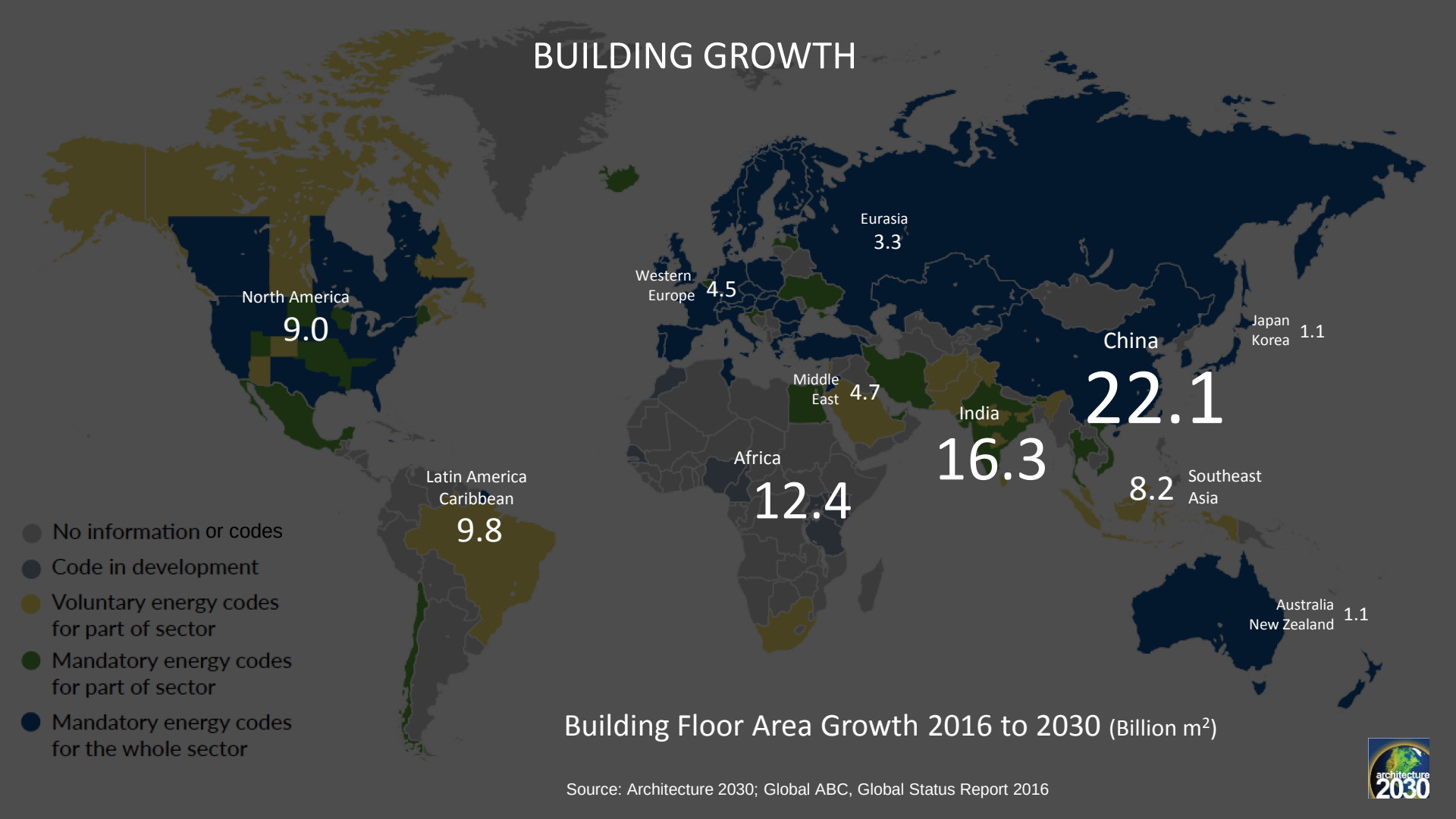
BUILDING STOCK



Existing Building Floor Area (2015, Billion m^2)

Source: Architecture 2030; Global ABC, Global Status Report 2016

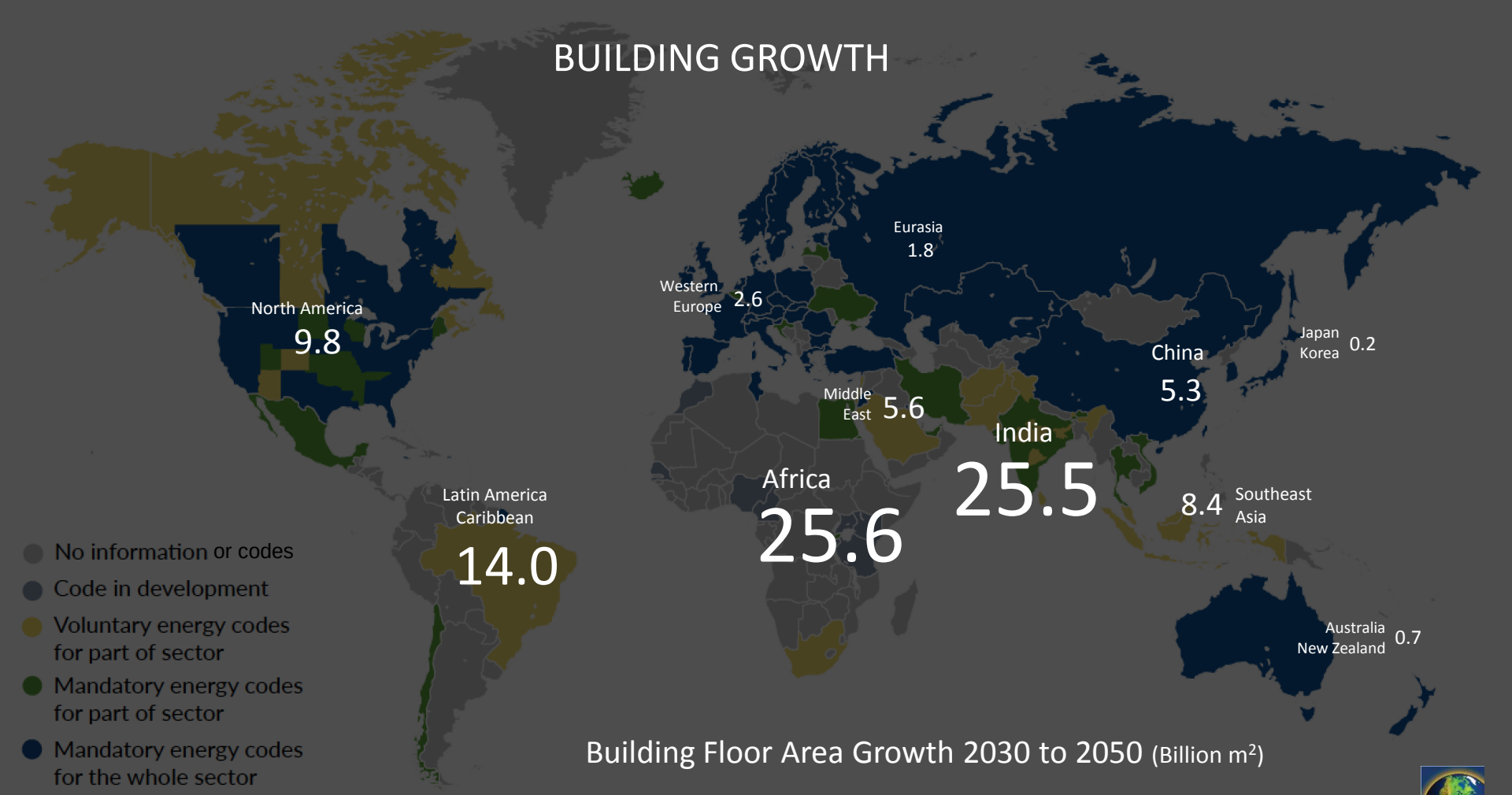
BUILDING GROWTH



Building Floor Area Growth 2016 to 2030 (Billion m^2)

Source: Architecture 2030; Global ABC, Global Status Report 2016

BUILDING GROWTH



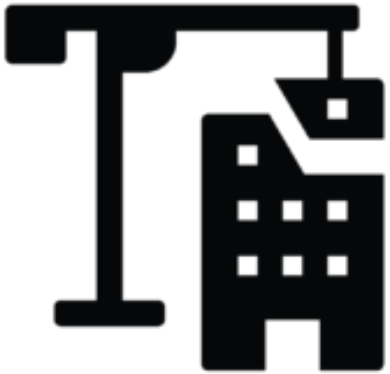
Building Floor Area Growth 2030 to 2050 (Billion m^2)

Source: Architecture 2030; Global ABC, Global Status Report 2016

cities with emissions reductions targets:

9,149

Global Covenant of Mayors

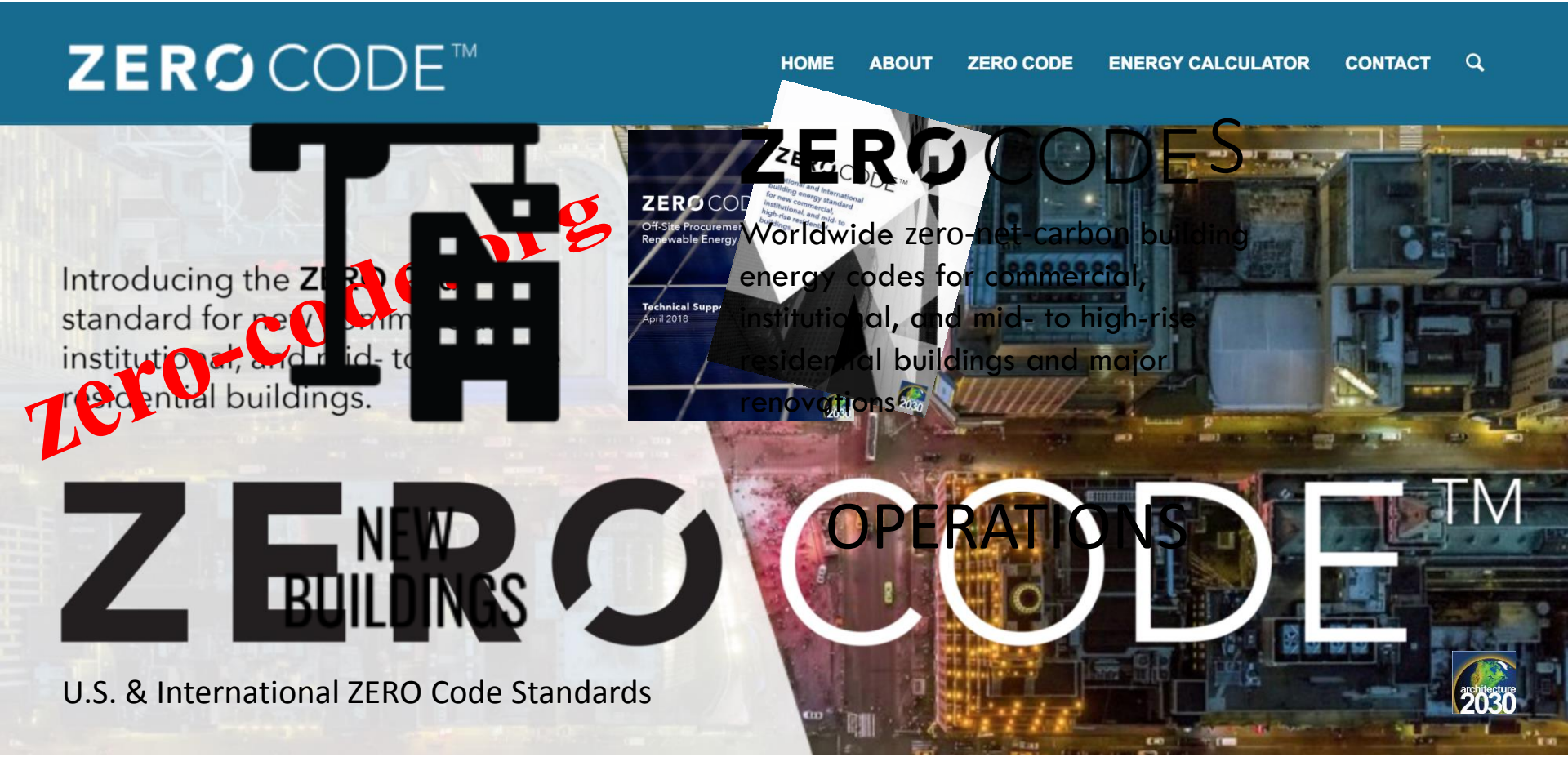


NEW BUILDINGS

ZERO CODES

Worldwide zero-net-carbon building energy codes for commercial, institutional, and mid- to high-rise residential buildings and major renovations

OPERATIONS


ZERO CODE™
HOME
ABOUT
ZERO CODE
ENERGY CALCULATOR
CONTACT
zero-code.org
ZERO CODES
Worldwide zero-net-carbon building energy codes for commercial, institutional, and mid- to high-rise residential buildings and major renovations.
ZERO NEW BUILDINGS
ZERO CODE™
OPERATIONS
U.S. & International ZERO Code Standards
architecture 2030

ZERO CODE™

Commercial • Institutional • Mid-Rise/High-Rise Residential Buildings

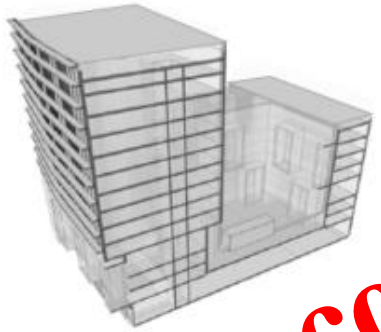
1 Design an energy efficient building

Efficiency Standard: ASHRAE 90.1-2016 minimum;

Efficient building envelope / daylighting

Passive heating / cooling / ventilation

Efficient systems / equipment / controls



zero-code.org

ZERO CODE™

MEETING THE CODE

s

COM*check*

- Prescriptive Req.
- Trade-Off Option

Base building

MODELING

- DOE - 2
- EnergyPlus

Meeting the ZERO CODE™

ASHRAE 90.1 2016
(minimum)

Prescriptive Path

Requirements for minimum building energy efficiency

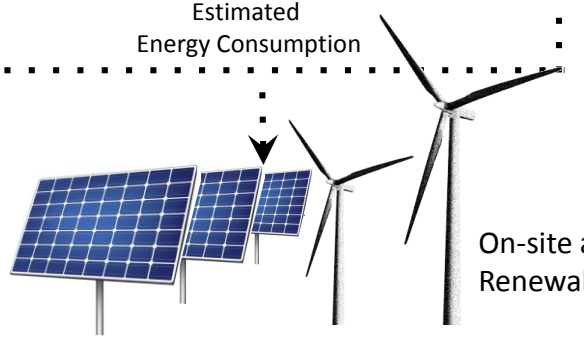
- ☑ BUILDING ENVELOPE
- ☑ HVAC
- ☑ LIGHTING
- ☑ OTHER EQUIPMENT

Performance Path

Modeled energy performance meets or exceeds the minimum building energy efficiency requirements

ZERO CODE Calculator

Estimated Energy Consumption



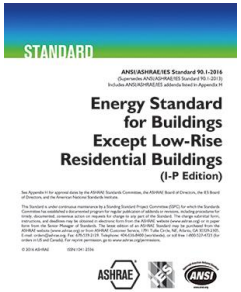
On-site and/or Off-site Renewable Energy Required

ZERO CODE

Creates a predictable and reliable market for renewable energy.

Implementing the ZERO CODE™

1. Efficient Building Energy Code Standard
   a. Existing Code: ASHRAE 90.1 2016 (min.)
   b. Upgrade/Adopt Code: ASHRAE 90.1 2016



2. Renewable Energy
   a. Establish and adopt Renewable Energy (RE) requirements.

   (Refer to the ZERO Code Renewable Energy Technical Support Document for guidelines on establishing on-site and off-site RE procurement requirements.)

architecture 2030

ZERO CODE™

HOME ABOUT ZERO CODE ENERGY CALCULATOR CONTACT

ASHRAE 90.1 2016

ABOUT YOUR BUILDING

Code Pathway: ● Prescriptive ○ Performance

Country	United States *
State	Select
City	Select *
Number of Stories	Enter Number *
Primary Building Use	Select *

ON-SITE PV SYSTEMS

Default Values estimate on-site building PV system potential. Uncheck Use Default Values to enter custom inputs. If your building has multiple PV systems, add them below.

PV SYSTEM Set Default Values Delete

Estimated Area for Collectors	Enter Number * Select *
Module Type	Select *
Losses (%)	Enter Number *
Array Type	Select *
Tilt (Degrees)	Enter Number *
Azimuth (Degrees)	Enter Number *
Inverter Efficiency (%)	Enter Number *

Add another PV System

ZERO CODE™

HOME ABOUT ZERO CODE ENERGY CALCULATOR CONTACT

ASHRAE 90.1 2016

ABOUT YOUR BUILDING

Code Pathway: (•) Prescriptive ( ) Performance

Country: United States *

State: Ohio

City: Cincinnati *

Number of Stories: 10 *

Add Another Use: *

Selected Use Type(s):

Office

OFFICE

delete

Gross Floor Area: 100000 * sq.ft *

ON-SITE PV SYSTEMS

Default Values estimate on-site building PV system potential. Uncheck Use Default Values to enter custom inputs. If your building has multiple PV systems, add them below.

PV SYSTEM

Set Default Values delete

Estimated Area for Collectors: 7547.6 * sq.ft *

Module Type: Standard *

Losses (%): 10 *

Array Type: Fixed - Open Rack *

Tilt (Degrees): 10 *

Azimuth (Degrees): 180 *

Inverter Efficiency (%): 96 *

Add another PV System

GENERATE RESULTS →

RESULTS

metric imperial

RENEWABLE ENERGY REQUIREMENTS

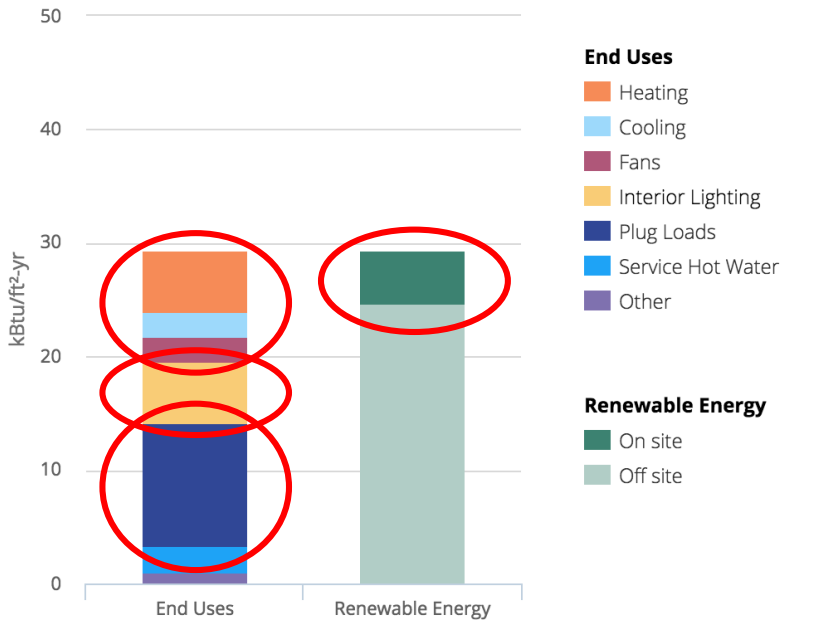
Energy Consumption & Generation

	kBtu/ft²-yr	MBtu/yr
Estimated Building Energy Consumption	**29.4**	**2,942.2**
Total Renewable Energy Required	**29.4**	**2,942.2**
On-Site PV Generation Potential	4.7	466.5
Remaining Off-Site Procured Renewable Energy	24.8	2,475.7

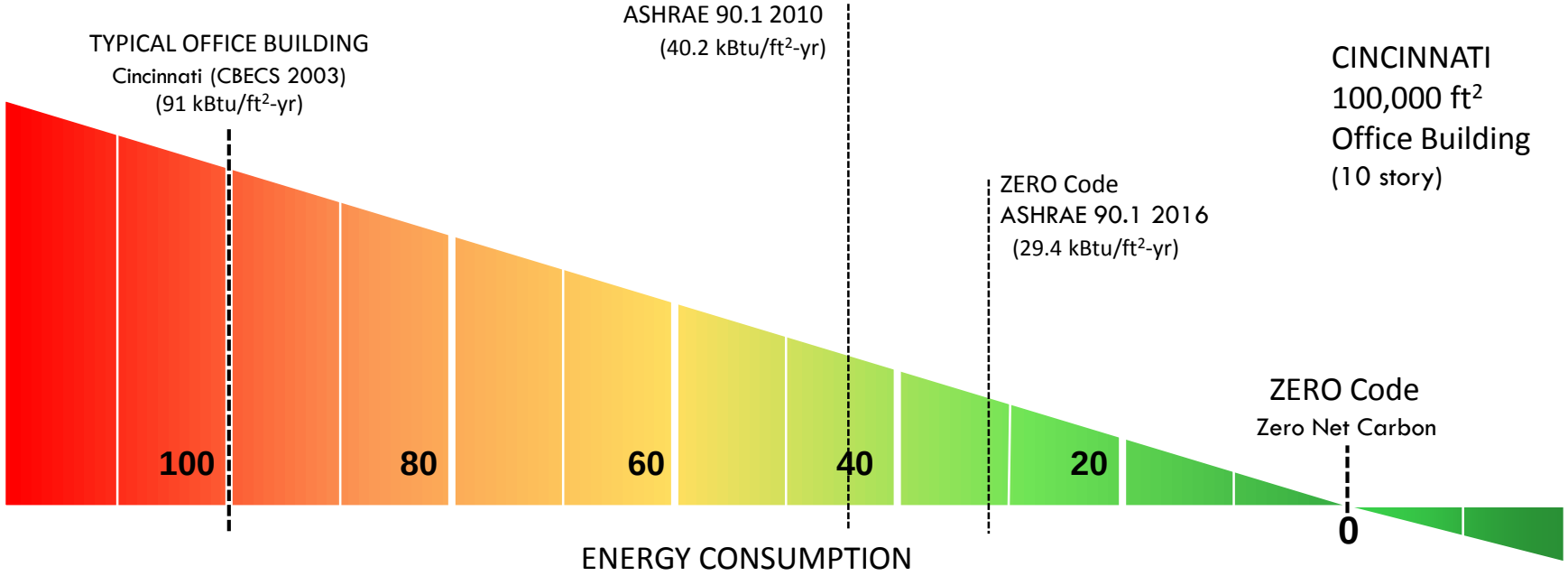
On-Site PV System

Rated Capacity (kW)	105
Estimated Area for Collectors (ft²)	7,548

ESTIMATED BUILDING ENERGY CONSUMPTION

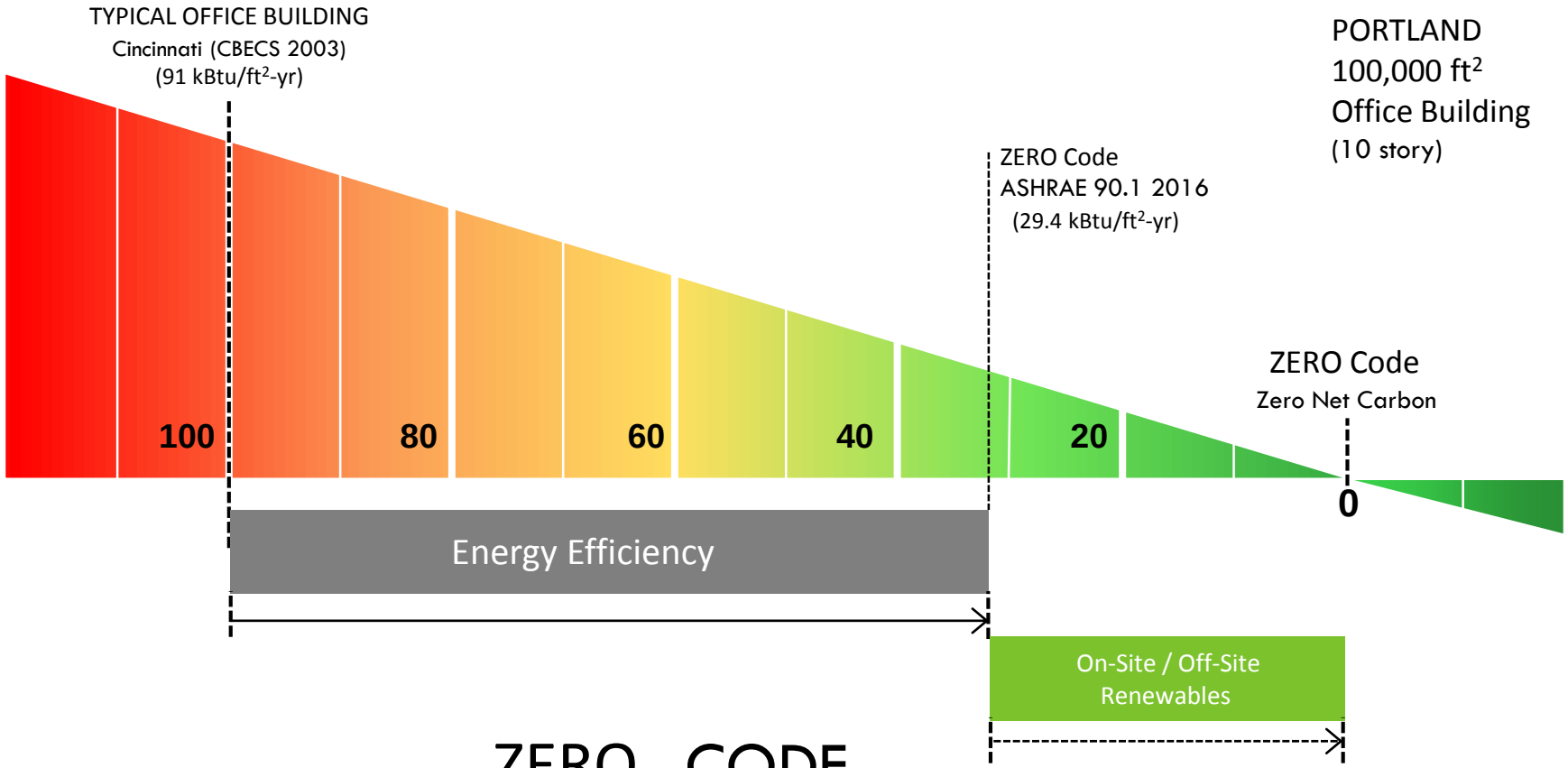


Building Energy Consumption and End Uses are based on a **code compliant prototype building** modeled by Pacific Northwest National Laboratory. Actual building energy consumption will vary from modeled results.



ZERO CODE

U.S. Commercial + Mid to High Rise Housing



ZERO CODE

U.S. Commercial + Mid to High Rise Housing

CINCINNATI

100,000 ft² High School Building (2 story)

RESULTS metric imperial

RENEWABLE ENERGY REQUIREMENTS

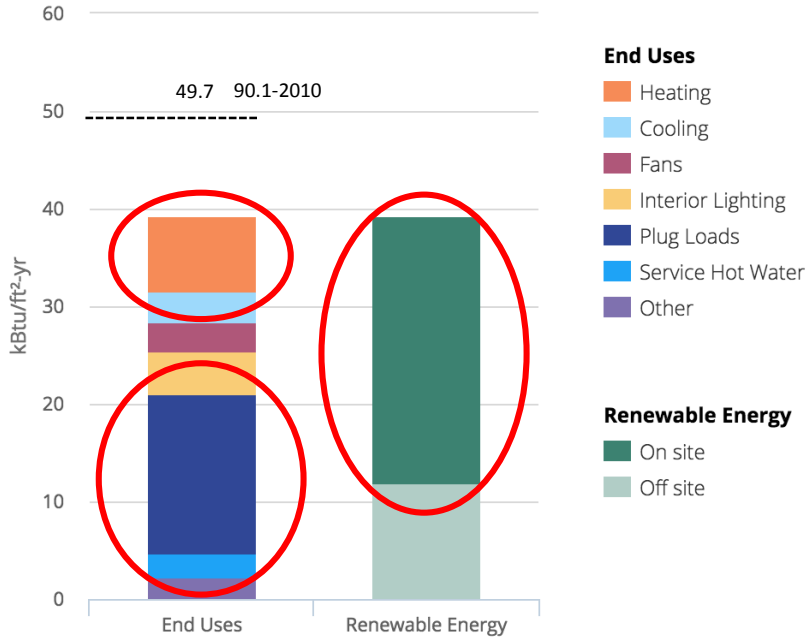
Energy Consumption & Generation

	kBtu/ft²-yr	MBtu/yr
Estimated Building Energy Consumption	**39.2**	**3,924.6**
Total Renewable Energy Required	**39.2**	**3,924.6**
On-Site PV Generation Potential	27.4	2,738.4
Remaining Off-Site Procured Renewable Energy	11.9	1,186.2

On-Site PV System

Rated Capacity (kW)	617
Estimated Area for Collectors (ft²)	44,303

ESTIMATED BUILDING ENERGY CONSUMPTION

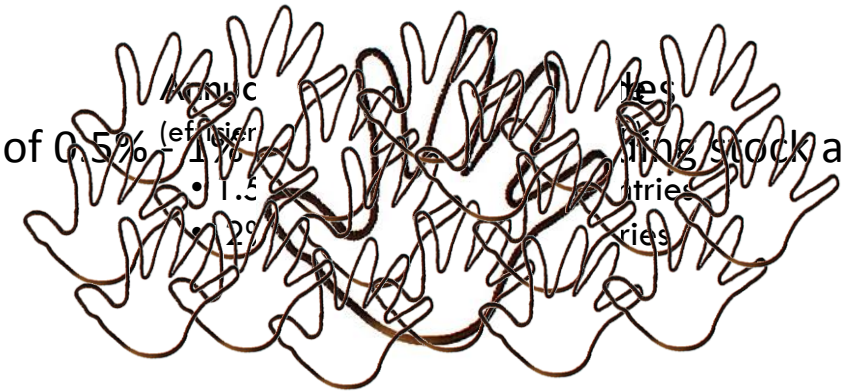


Building Energy Consumption and End Uses are based on a **code compliant prototype building** modeled by Pacific Northwest National Laboratory. Actual building energy consumption will vary from modeled results.

EXISTING BUILDINGS

Policies

pledges, incentives, financing plans, programs



of 0.5%–1% [illegible] annually

Policies for Existing Buildings


Seattle, WA
2.8% of Seattle buildings (> 20k sf) produce 45% of building sector GHG emissions

2.7% of NYC's buildings (> 50k sf) produce **48%** of building sector GHG emissions

Less than **1%** of Long Beach buildings (> 10k sf) produce **40%** of building sector GHG emissions

Long Beach: Population 470,000, 1,463 buildings > 10k sf, 190,191 buildings < 10k sf


Los Angeles


Boston, MA


Minneapolis, MN


Phoenix, AZ


Philadelphia, PA


Cleveland, OH


Pittsburgh, PA


Cincinnati, OH


Chicago, IL

Existing Buildings Policies

Building energy efficiency improvements cost about **75% less** when undertaken during a capital improvement cycle.

Existing Buildings Policies

Big Buildings Policy

- Require energy upgrade by 2030
  (efficiency, renewables, and/or electrification)
- Require zero emissions by 2050

Small Buildings Policy

Integrate a energy upgrade at building intervention points:

- seismic or flooding resilience upgrade
- zoning or use change (within 2 years)
- point-of-sale (within 2 years)

Provide incentives

(ZNC & early adopters)

- fast track permitting
- low interest loans
- tax abatements
- rebates

2030 DISTRICTS

LINKED IN A POWERFUL NETWORK

- **436** Million Square Feet
- **Over 1,600** Buildings
- **960** Member Organizations

2030 DISTRICTS

District-wide Targets

A Successful 2030 District is a
PRIVATE-PUBLIC PARTNERSHIP comprised of:

PROPERTY OWNERS AND MANAGERS
that own, manage, and/or develop real estate within a District boundary.

SERVICES STAKEHOLDERS
providing related services within a District boundary.

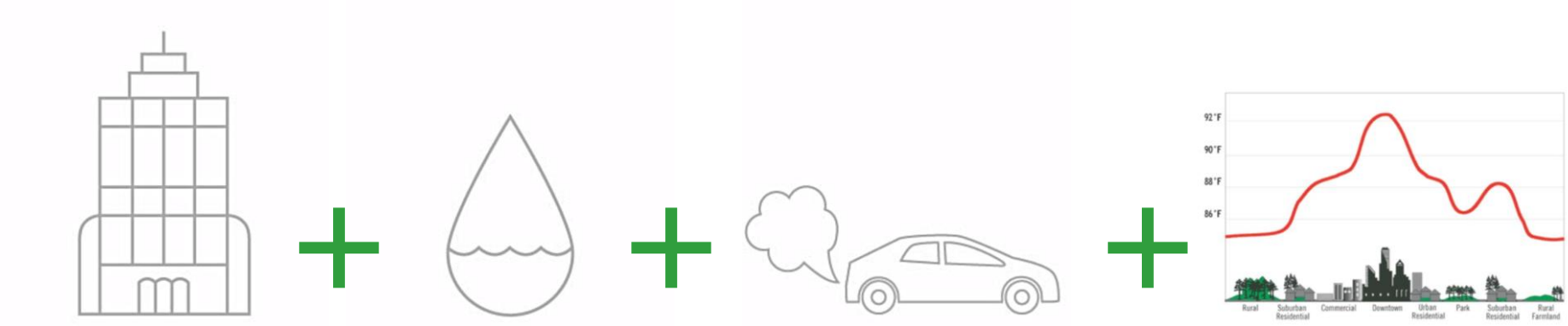
- **Over 1,600** Buildings
- **960** Member Organizations

COMMUNITY STAKEHOLDERS
representing either non-profit organizations or local government.

PORTATION
=MISSIONS

2030 DISTRICTS

District-wide Targets



BUILDING ENERGY USE

WATER CONSUMPTION

TRANSPORTATION GHG EMISSIONS

LOCAL ISSUES RESILIENCE

2030 DISTRICTS

District-wide Targets

CINCINNATI 2030 DISTRICT®

BUILI
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NEW BUILDINGS

ZERO CODES

Zero-Net-Carbon building energy codes adopted and enforced worldwide by

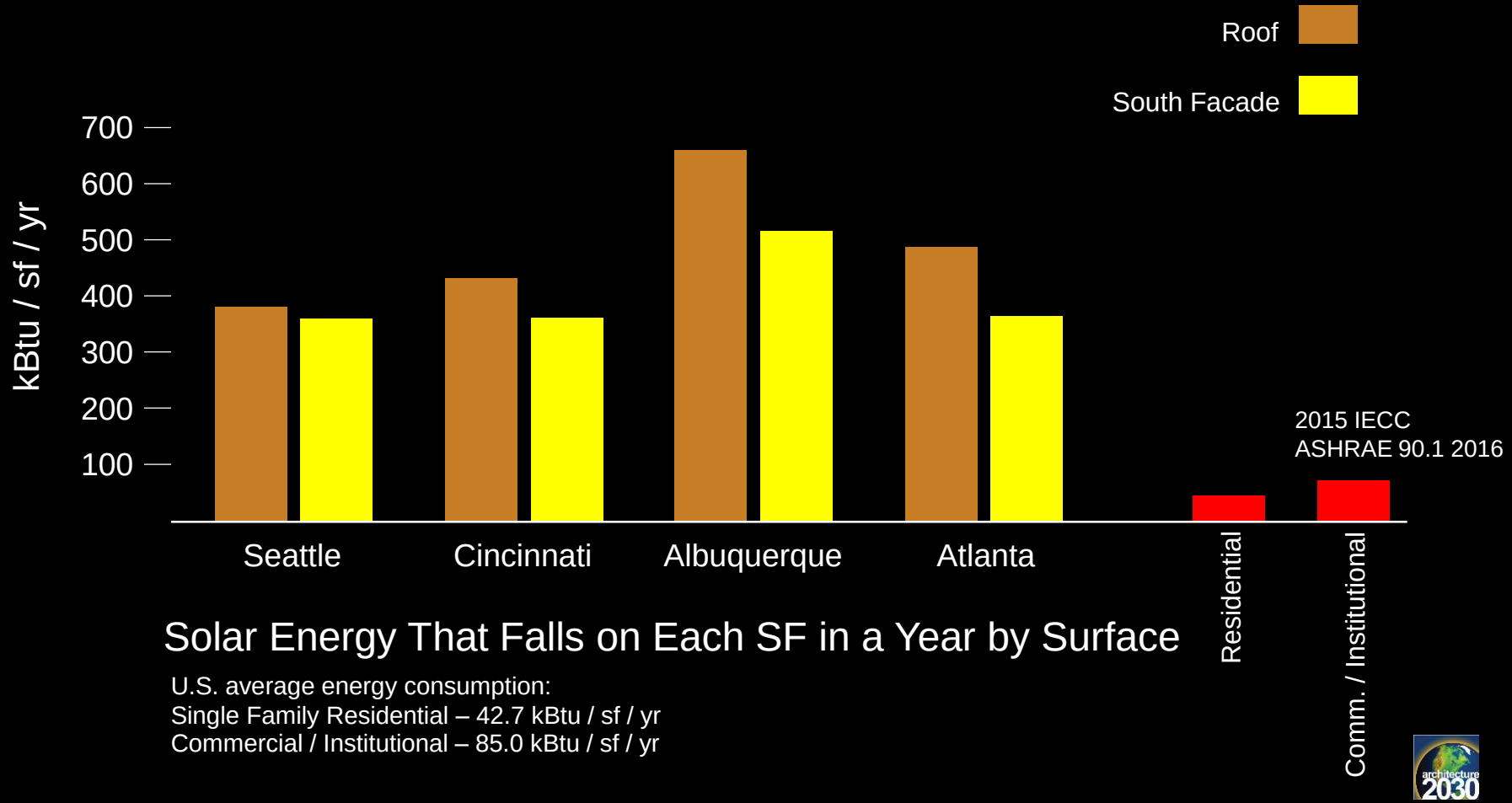
2020

EXISTING BUILDINGS

POLICIES & REGULATIONS

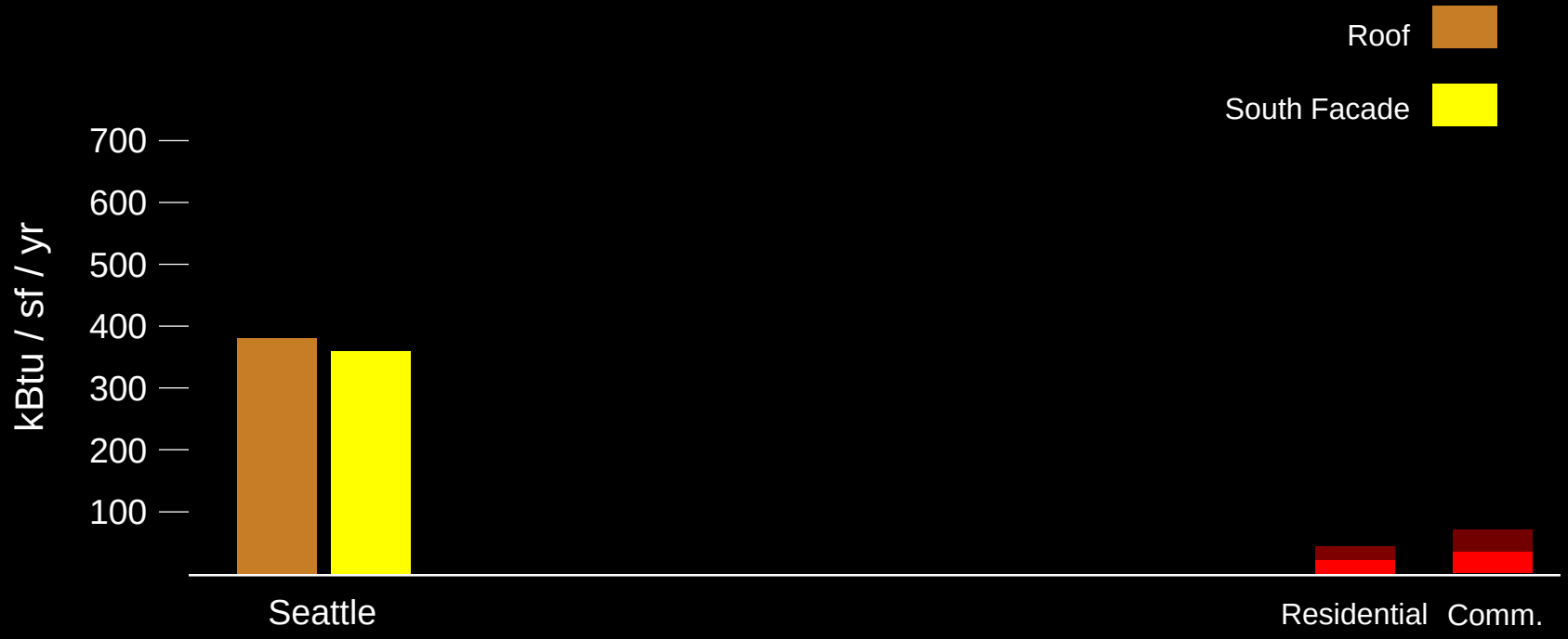
at building intervention points.

Zero-Net-Carbon by 2050



Solar Energy That Falls on Each SF in a Year by Surface

U.S. average energy consumption:
Single Family Residential – 42.7 kBtu / sf / yr
Commercial / Institutional – 85.0 kBtu / sf / yr



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U.S. average energy consumption:
Single Family Residential – 42.7 kBtu / sf / yr
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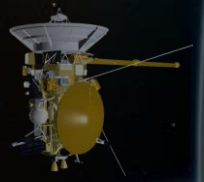
THE NEXT BUILT ENVIRONMENT TODAY



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