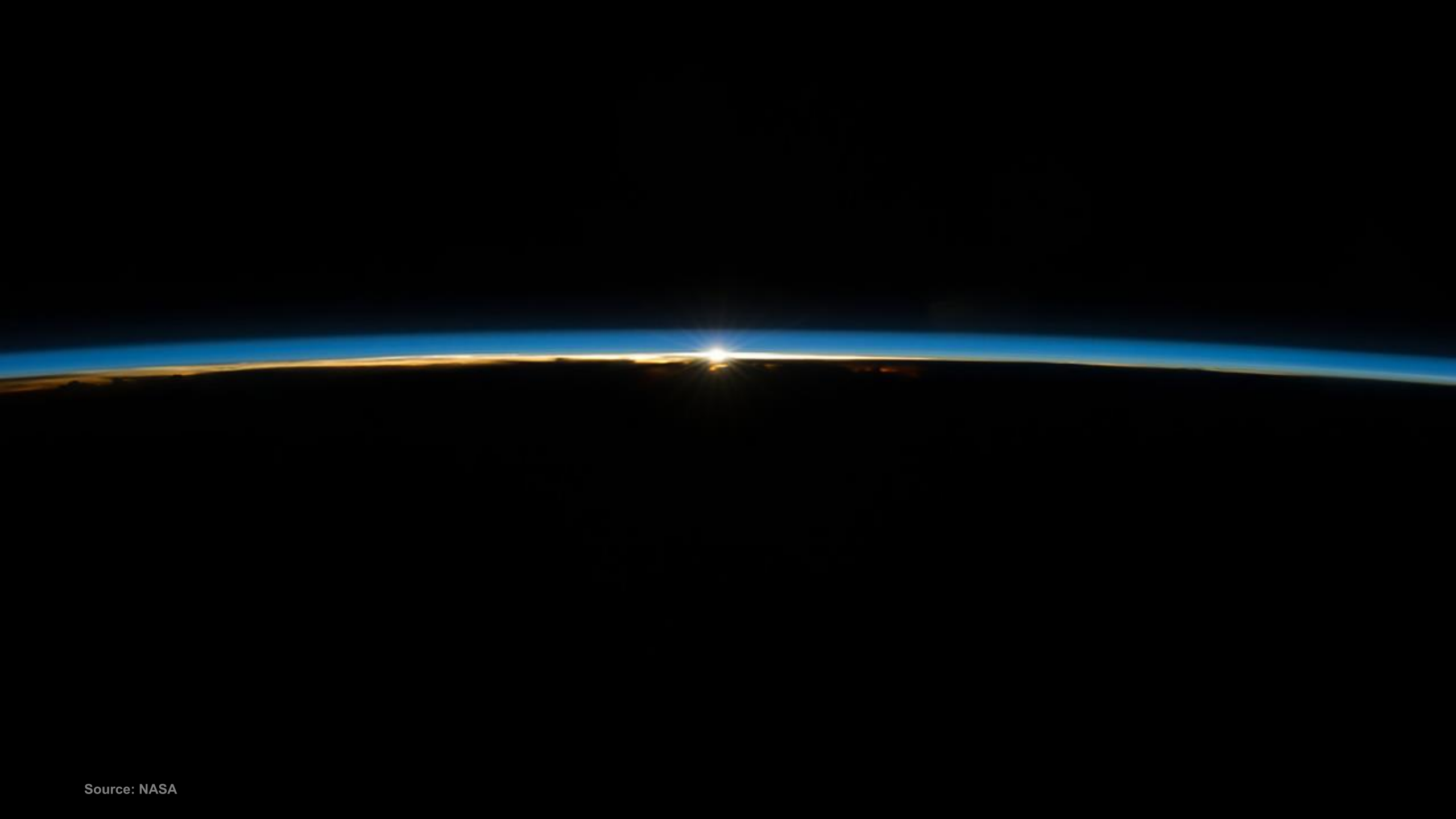
Climate Change

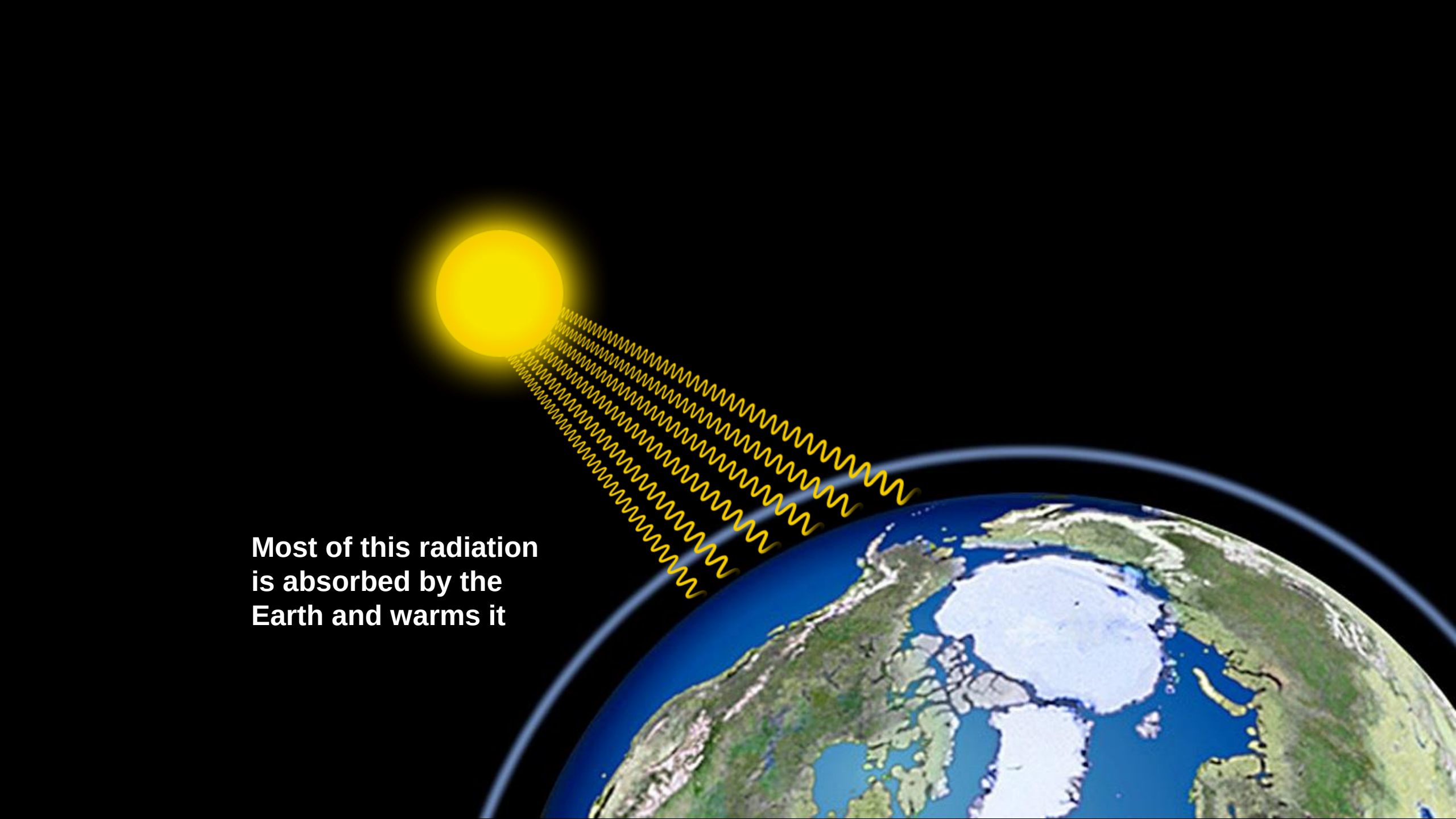
August 14, 2019

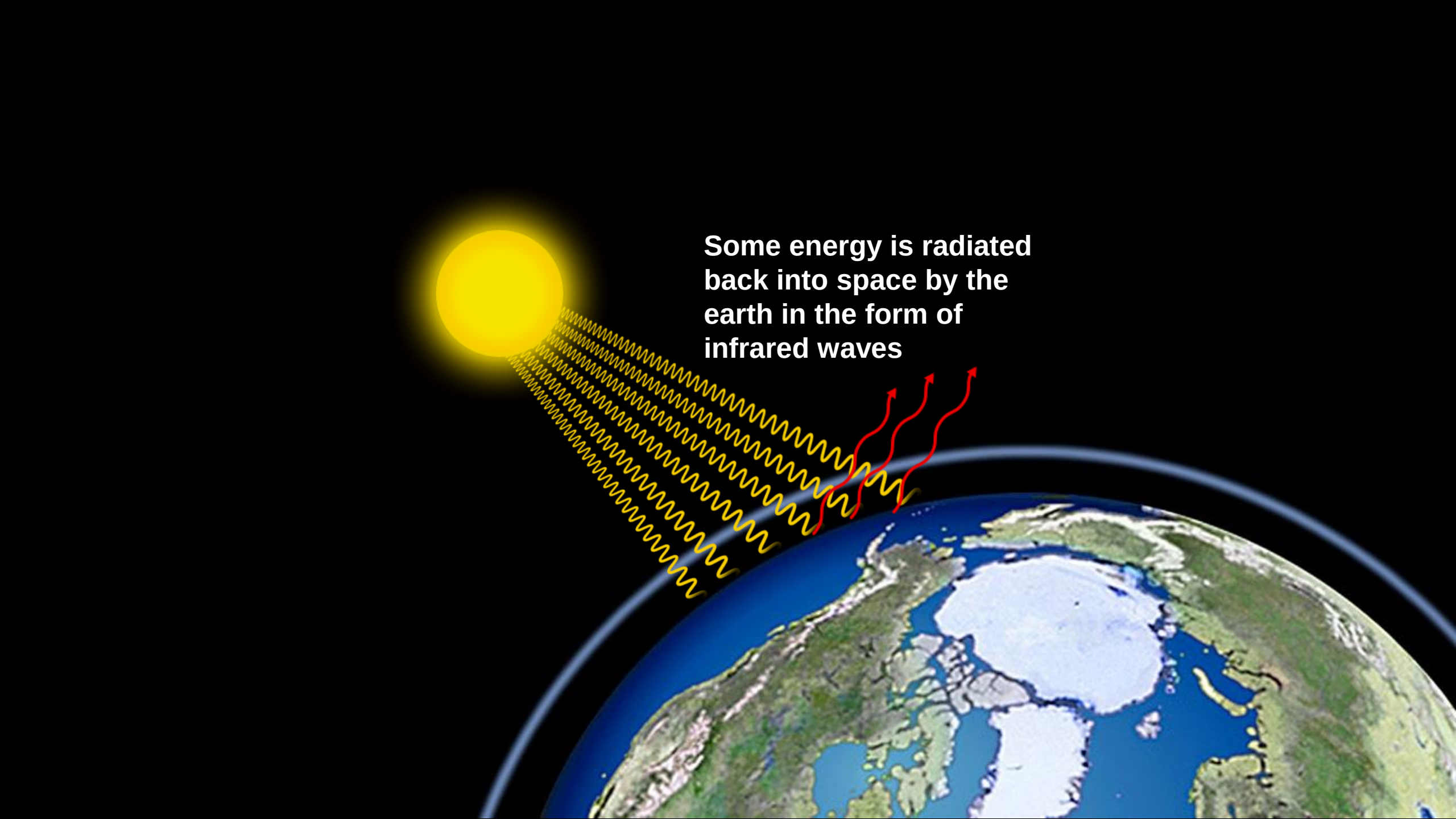
Source: NASA

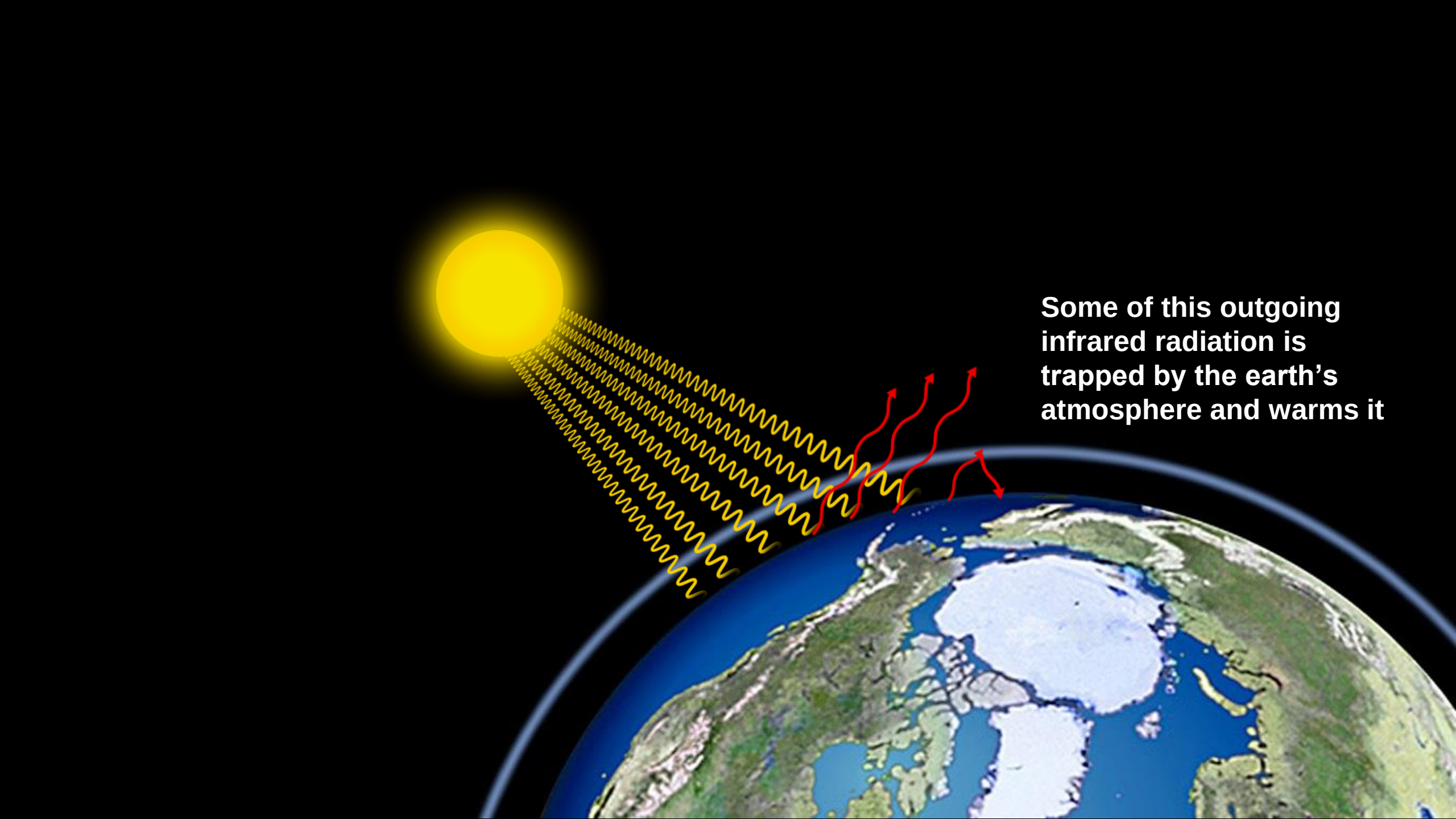


Source: NASA

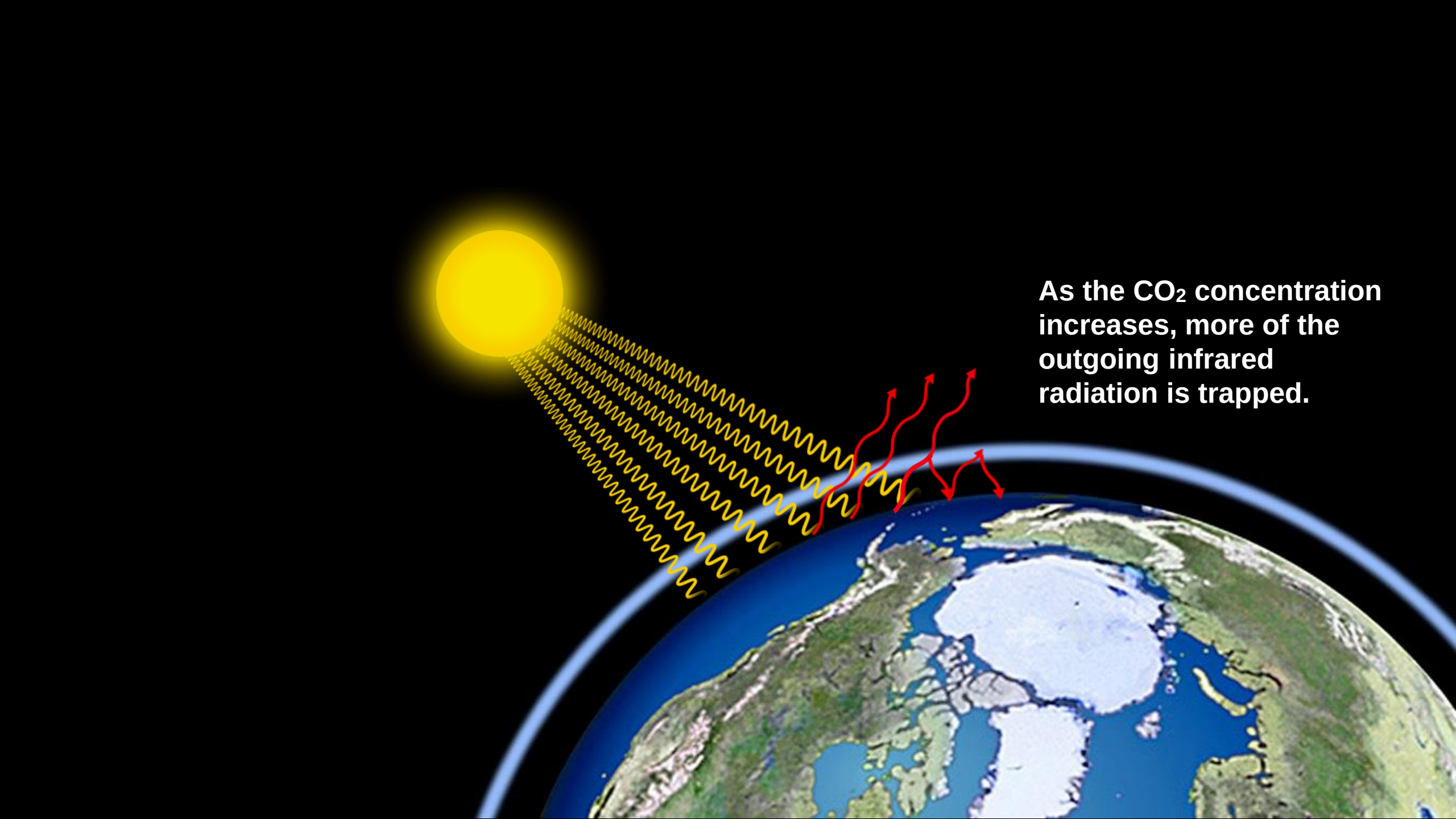
Solar radiation
in the form of lightwaves
passes through the
atmosphere


Most of this radiation
is absorbed by the
Earth and warms it

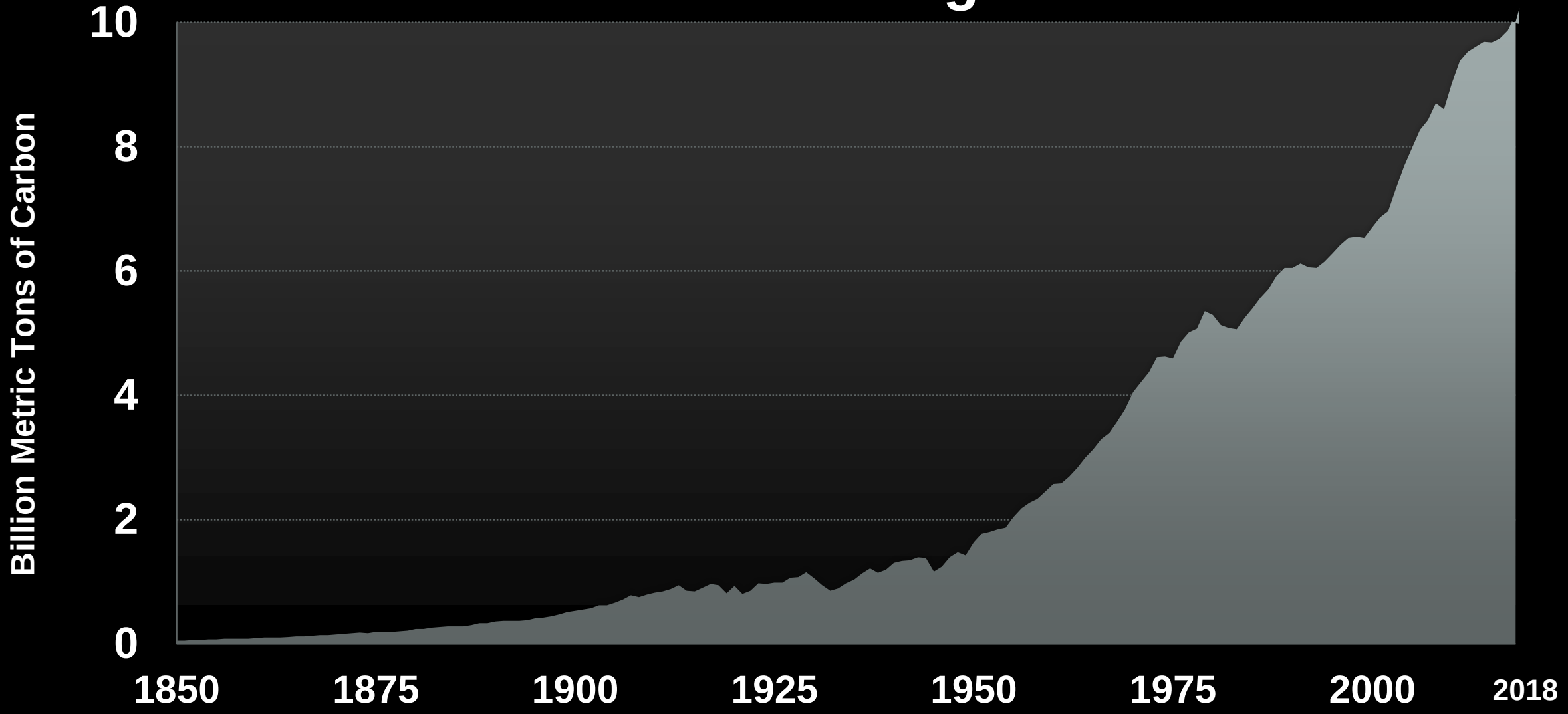

Some energy is radiated back into space by the earth in the form of infrared waves



Some of this outgoing infrared radiation is trapped by the earth's atmosphere and warms it


As the CO_2 concentration increases, more of the outgoing infrared radiation is trapped.

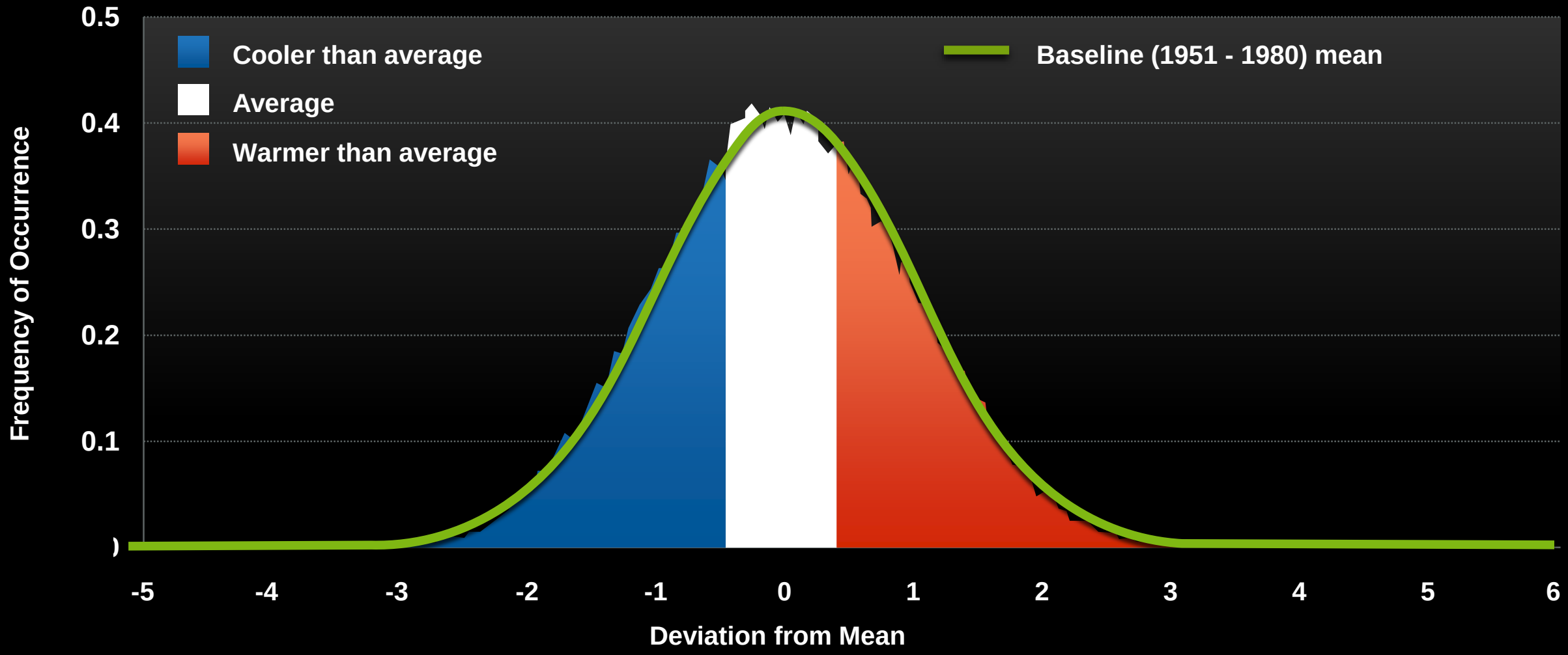
The Largest Source of Global Warming Pollution Is the Burning of Fossil Fuels



Data: U.S. Department of Energy/CDIAC

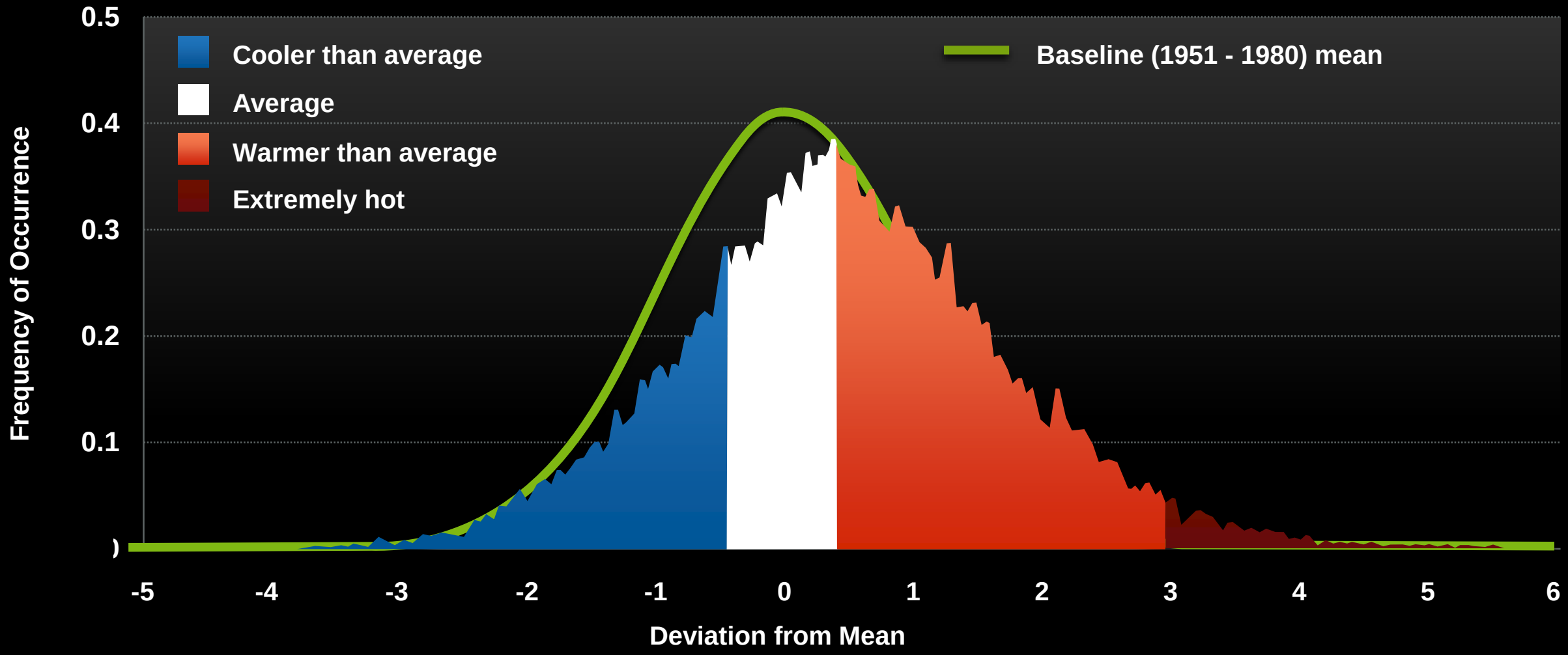
Summer Temperatures Have Shifted

1951 – 1980



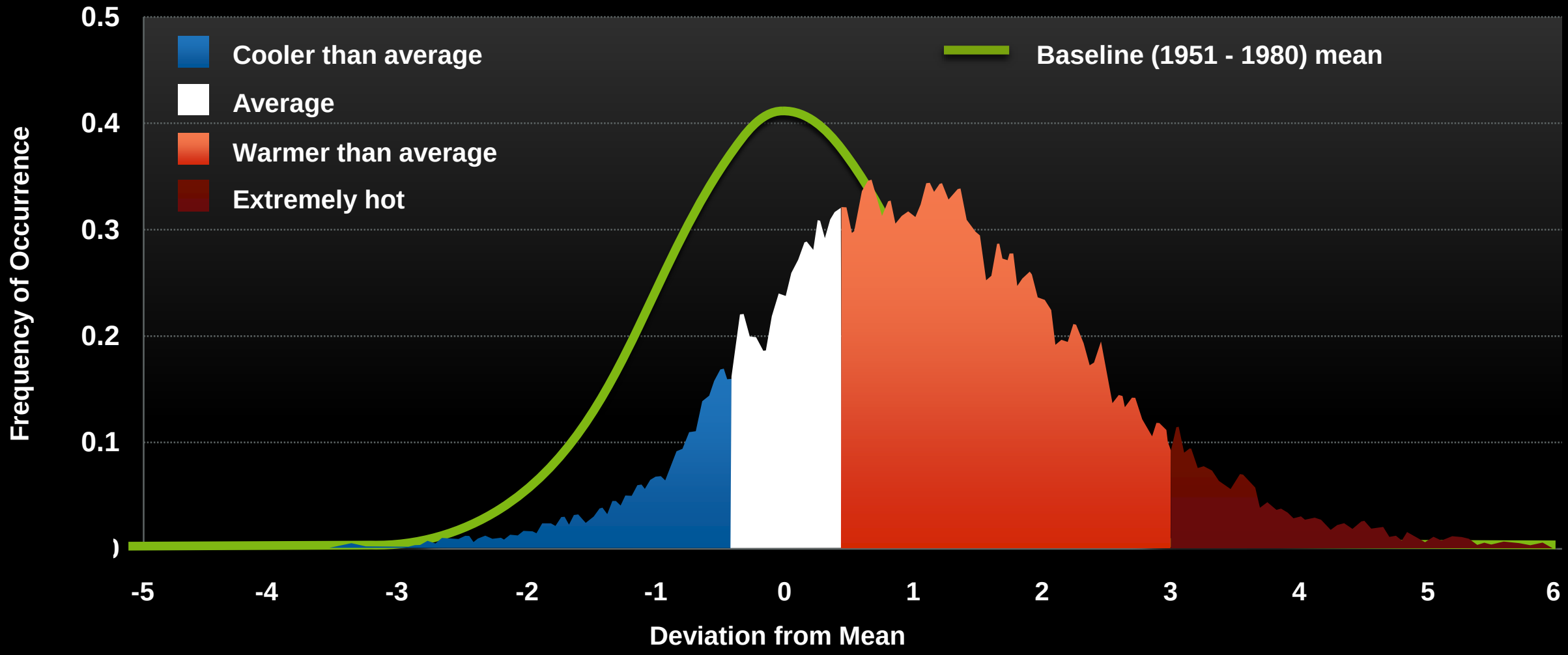
Source: NASA/GISS; Hansen, et al., "Perceptions of Climate Change," Proc. Natl. Acad. Sci. USA 10.1073, August 2012 – Updated 2016

1983 – 1993



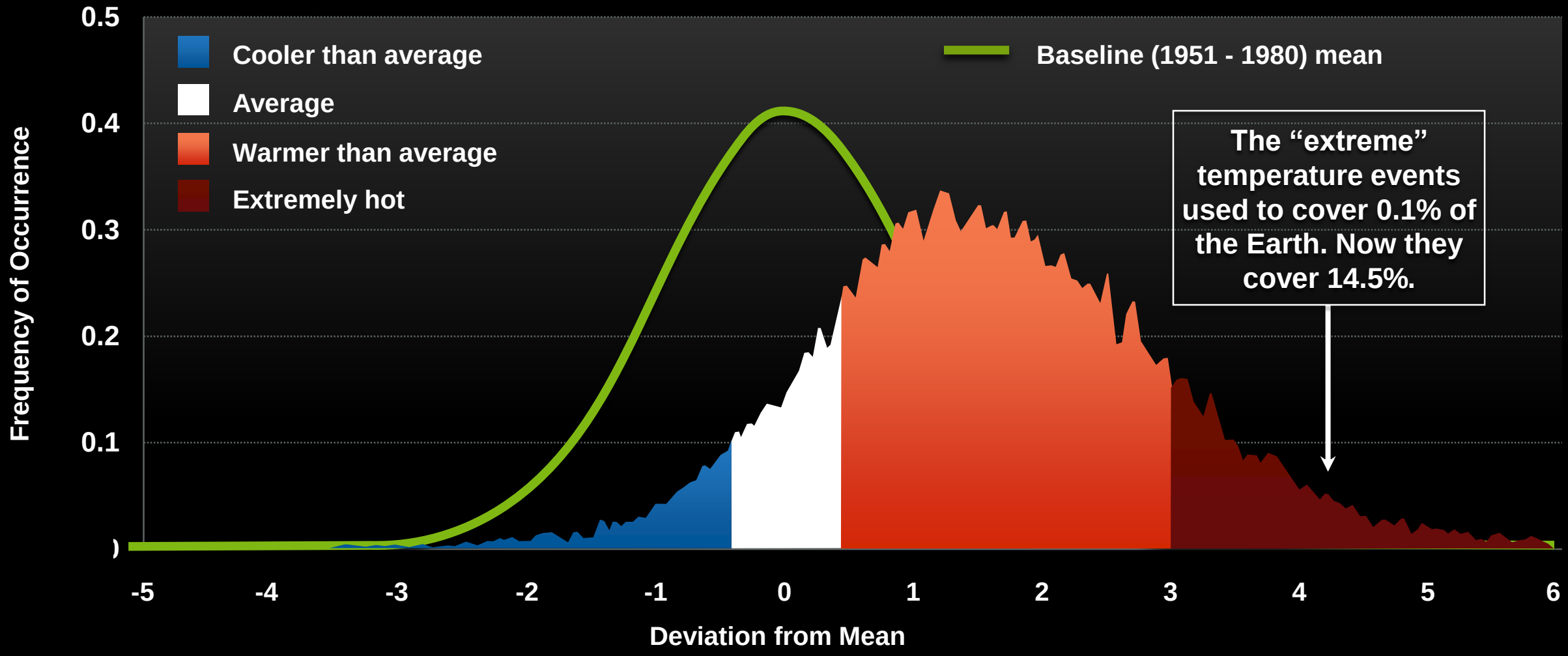
Source: NASA/GISS; Hansen, et al., "Perceptions of Climate Change," Proc. Natl. Acad. Sci. USA 10.1073, August 2012 – Updated 2016

1994 – 2004



Source: NASA/GISS; Hansen, et al., "Perceptions of Climate Change," Proc. Natl. Acad. Sci. USA 10.1073, August 2012 – Updated 2016

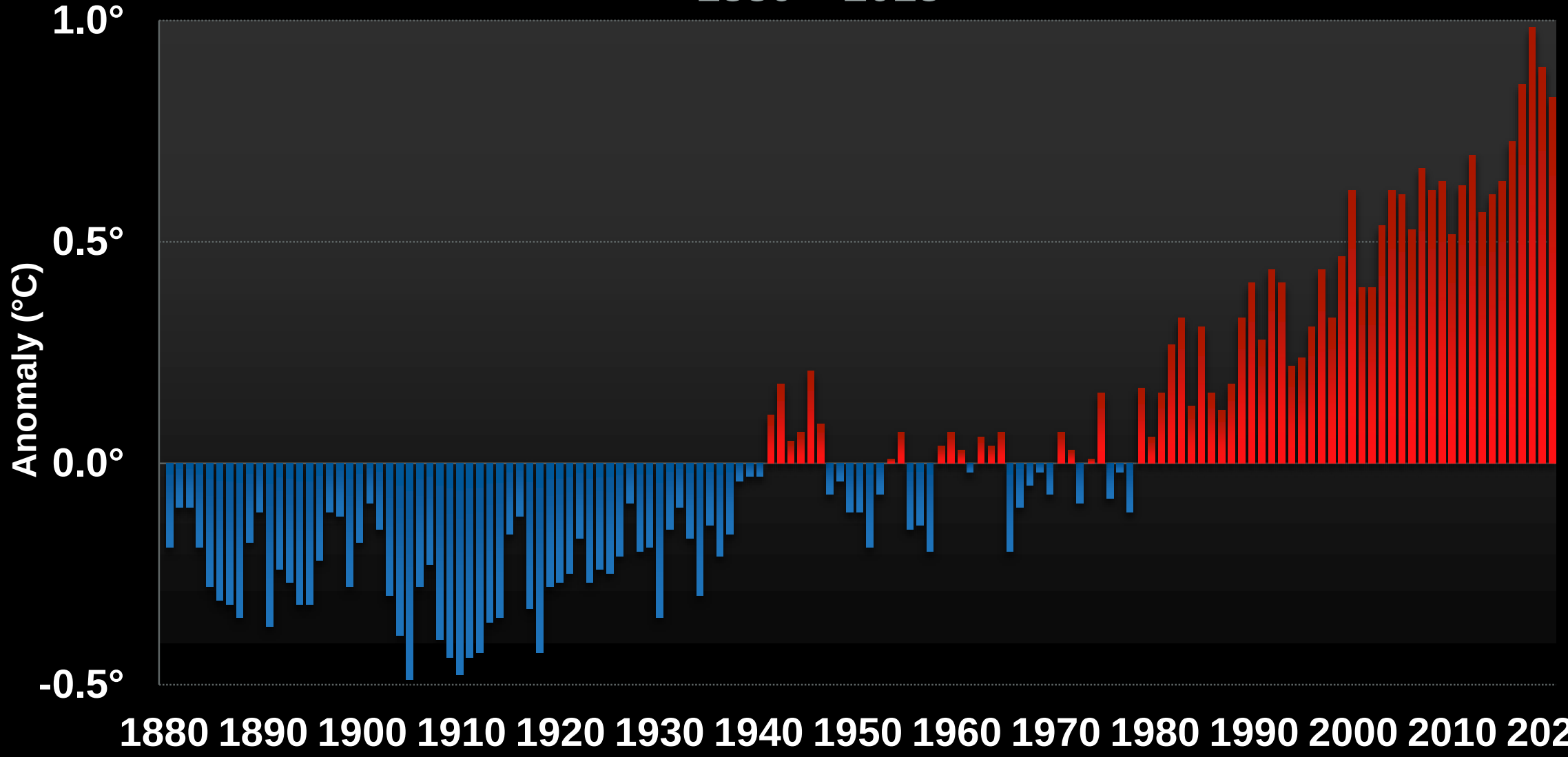
2005 – 2015



Source: NASA/GISS; Hansen, et al., “Perceptions of Climate Change,” Proc. Natl. Acad. Sci. USA 10.1073, August 2012 – Updated 2016

Global Surface Temperature – Departure from Average

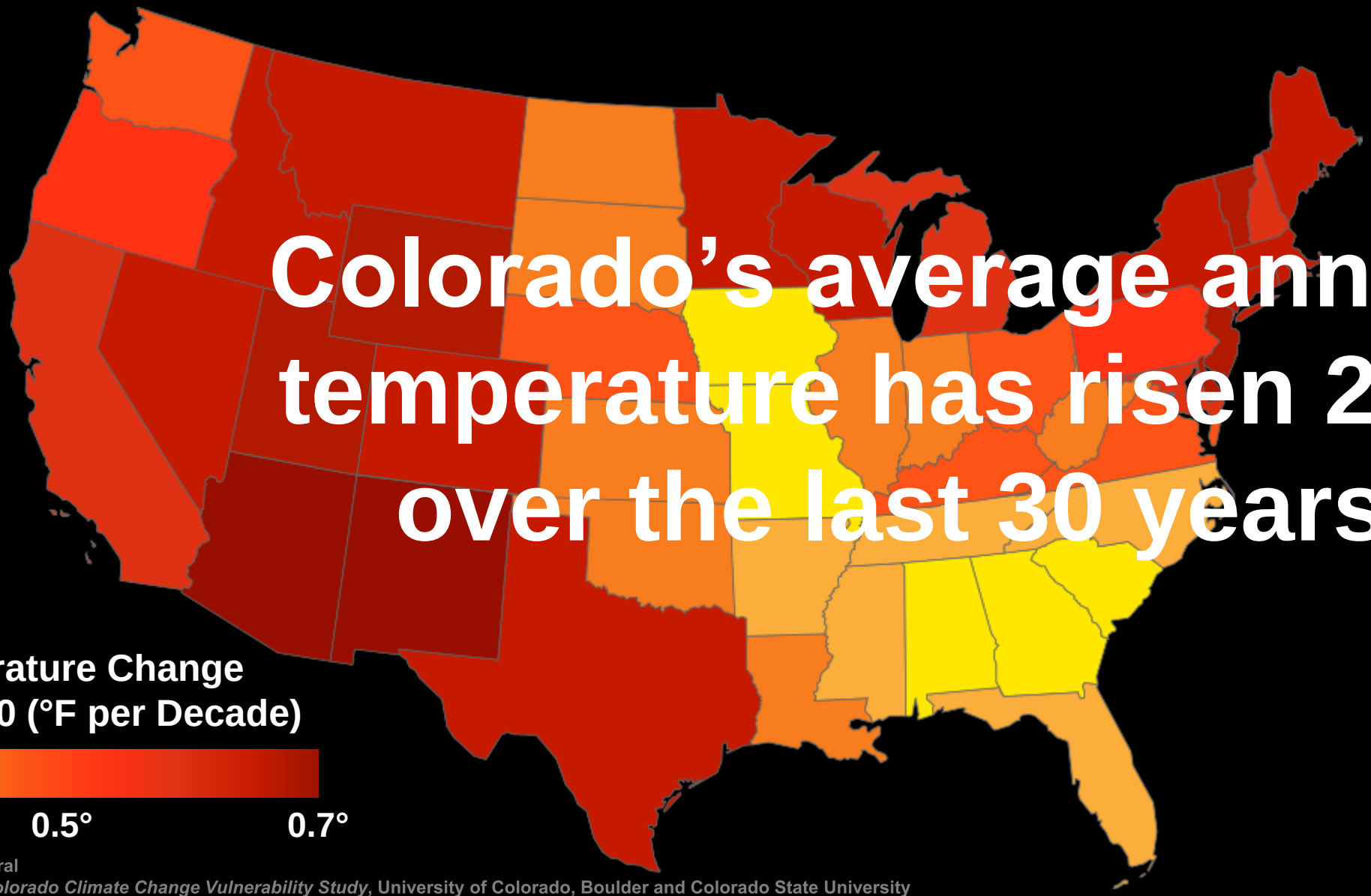
1880 – 2018



Data: National Oceanic and Atmospheric Administration

At least 224 locations around the world set all-time heat records in 2018.

Average Annual Temperature Increase by State



Colorado's average annual temperature has risen 2° F over the last 30 years

Data: Climate Central
Additional Data: *Colorado Climate Change Vulnerability Study*, University of Colorado, Boulder and Colorado State University

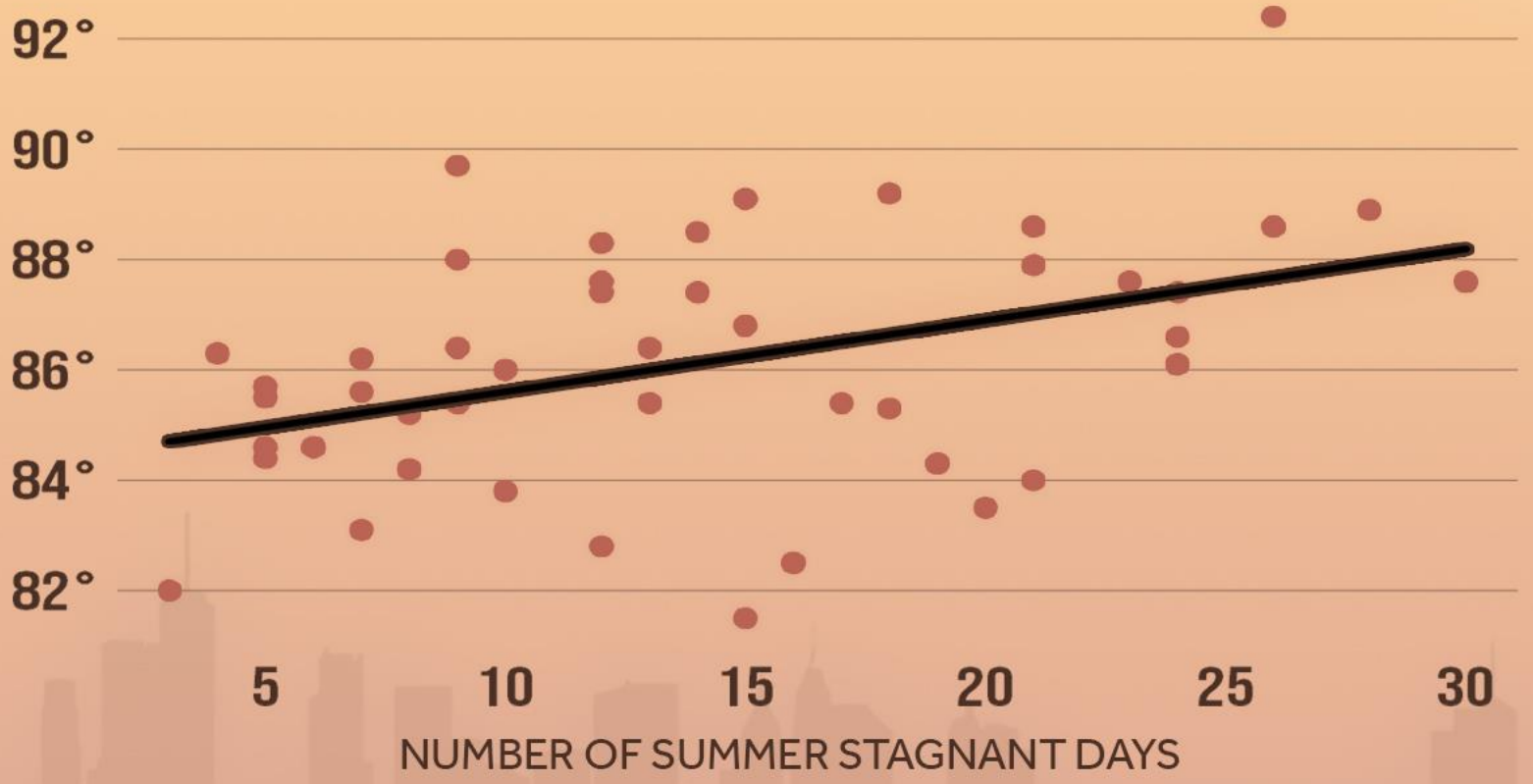
Heat wave days in Colorado are expected to jump from 10 per year now to nearly 50 per year by 2050.

Source: Climate Central “States at Risk”

DENVER

HIGHER TEMPERATURES = MORE STAGNANT AIR

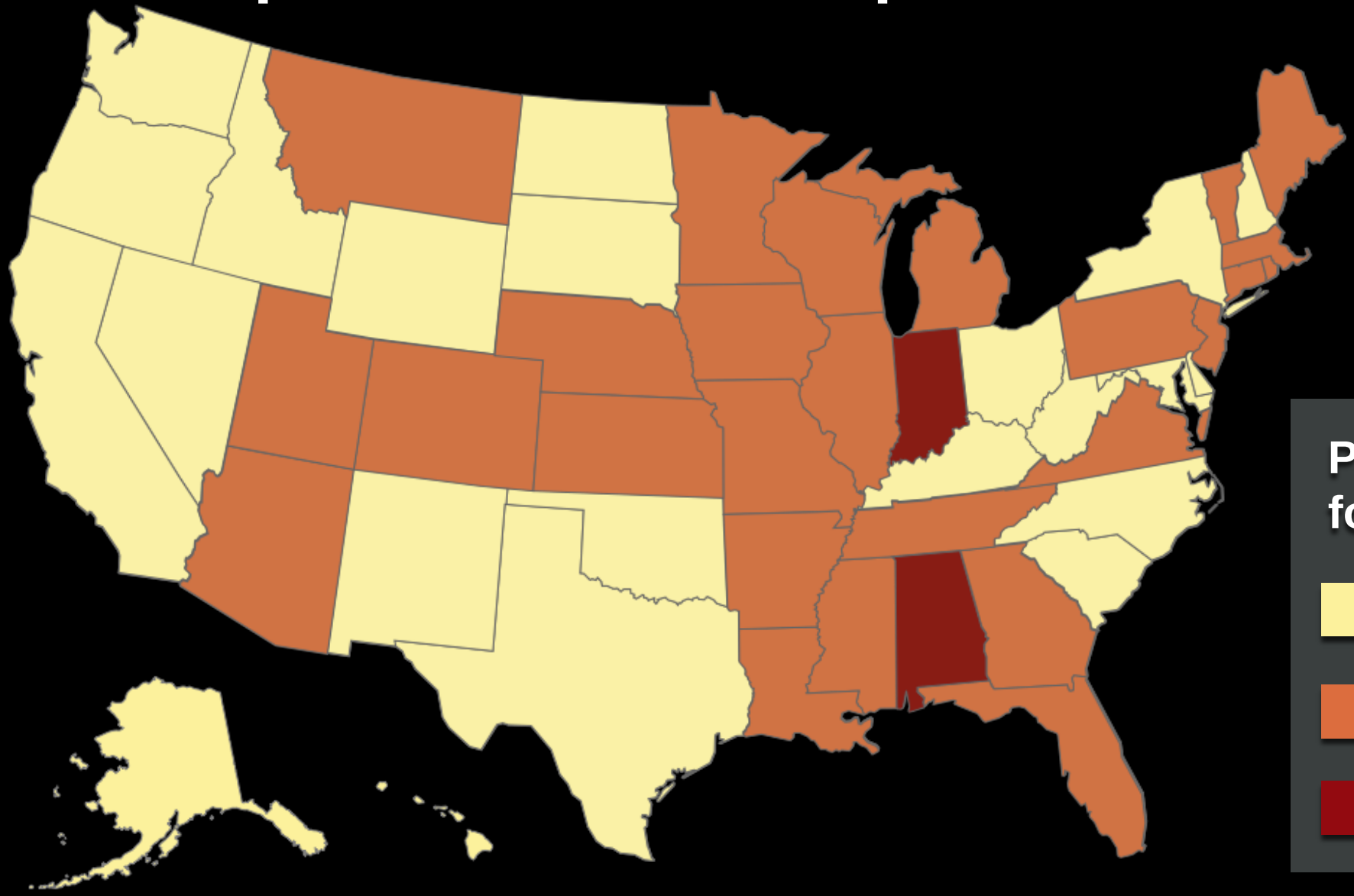
SUMMER MAXIMUM TEMPERATURES SINCE 1973



Annual average summer maximum temperature vs. summer stagnant days (1973-2018)
Source: NOAA/NCEI Air Stagnation Index, RCC-ACIS.org

CLIMATE CENTRAL

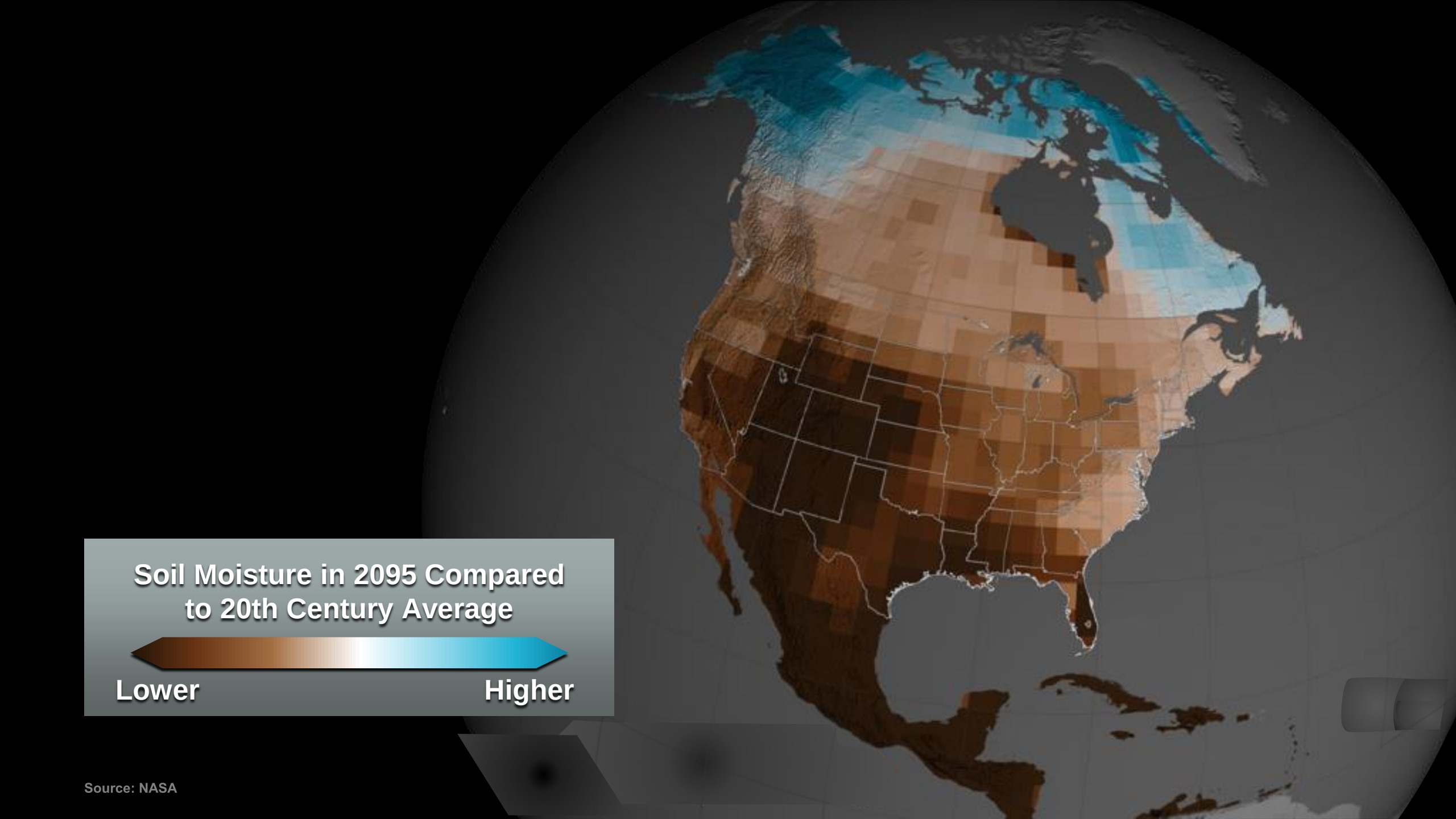
People of Color Are Exposed to More Air Pollution



Particulate Exposure for Persons of Color

- Less than or roughly equal to white persons
- Higher exposure
- More than 2x higher

Data: Mikati et al, 2018; Inside Climate News


Soil Moisture in 2095 Compared to 20th Century Average
Lower
Higher

Source: NASA

Colorado is one of the states most threatened by severe drought in the coming decades.

Source: Climate Central “States at Risk”

40 million Americans get their drinking water from the Colorado River and its tributaries

“…warming alone could cause Colorado River flow declines of 30 percent by midcentury and over 50 percent by the end of the century if greenhouse gas emissions continue unabated.”

Jonathan Overpeck

UA Regents’ Professor of Geosciences, Hydrology and Atmospheric Sciences, University of Arizona Institute of the Environment

February 2017

The total area burned in the western United States from 1984 to 2015 was nearly

TWICE

what it would have been without any human-caused warming.

Source: J.T. Abatzoglou and A.P. Williams, “Impact of anthropogenic climate change on wildfire across western US forests,” PNAS vol. 113 no. 42, October 2016

Lakewood, Colorado

November 28, 2016

Green Mountain Fire

Colorado's Hail Storms Were The Most Expensive In The Country Last Year. You Could Pay the Price

By Grace Hood | July 12, 2019

Colorado School Districts Grapple With Insuring Against Hail

The 2017 hailstorm that hit Denver's western suburbs, breaking records as CO's most costly storm for insurers, is still wreaking havoc.

By Chalkbeat, News Partner
Jul 30, 2019 3:24 pm ET

Cordoba, Mexico

November 5, 2018

Migrants from Central America make their way toward the United States.

The New York Times

Central American Farmers Head to the U.S., Fleeing Climate Change

Drying coffee at a cooperative in the Copán area of western Honduras.
César Rodríguez for The New York Times

By Kirk Semple

April 13, 2019

The Central American “Dry Corridor”

Source: Food and Agriculture Organization of the United Nations

Honduras was ranked #1
of all 184 countries on the
Global Climate Risk Index.
Nicaragua was ranked #4.

FAO Food Price Index

1990 – December 2016

Data: The Food and Agriculture Organization of the United Nations, 2017

We have the solutions at hand...

Wind Energy Progress

How Do Projections Compare With Reality?

2000 Projection

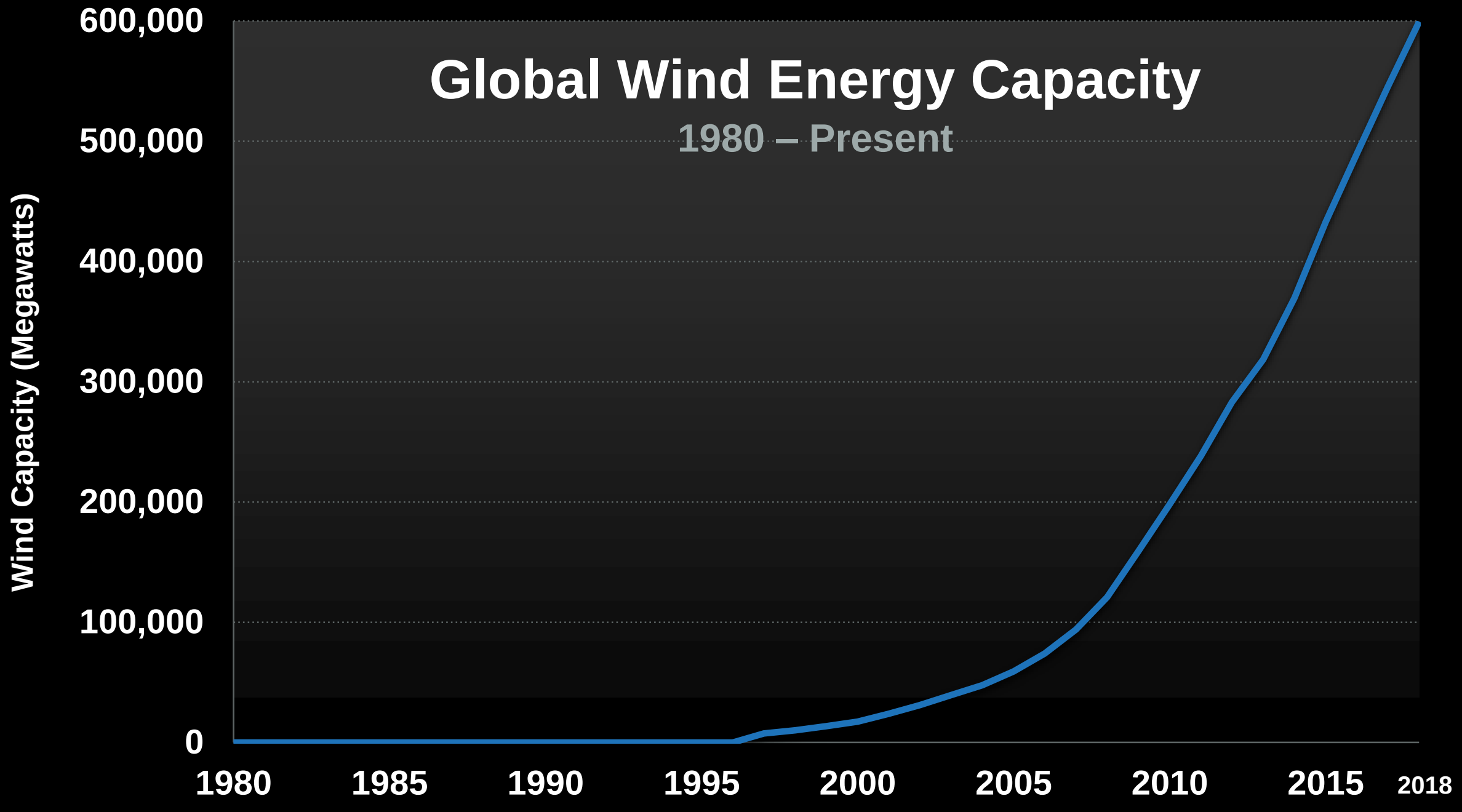
Worldwide wind capacity will reach 30 GW by 2010

Reality

By 2018 that goal was exceeded by a factor of

20 x

Data: International Energy Agency; Global Wind Energy Council; Bloomberg New Energy Finance



Data: Earth Policy Institute/Bloomberg New Energy Finance

Solar Energy Progress

How Do Projections Compare With Reality?

2002 Projection

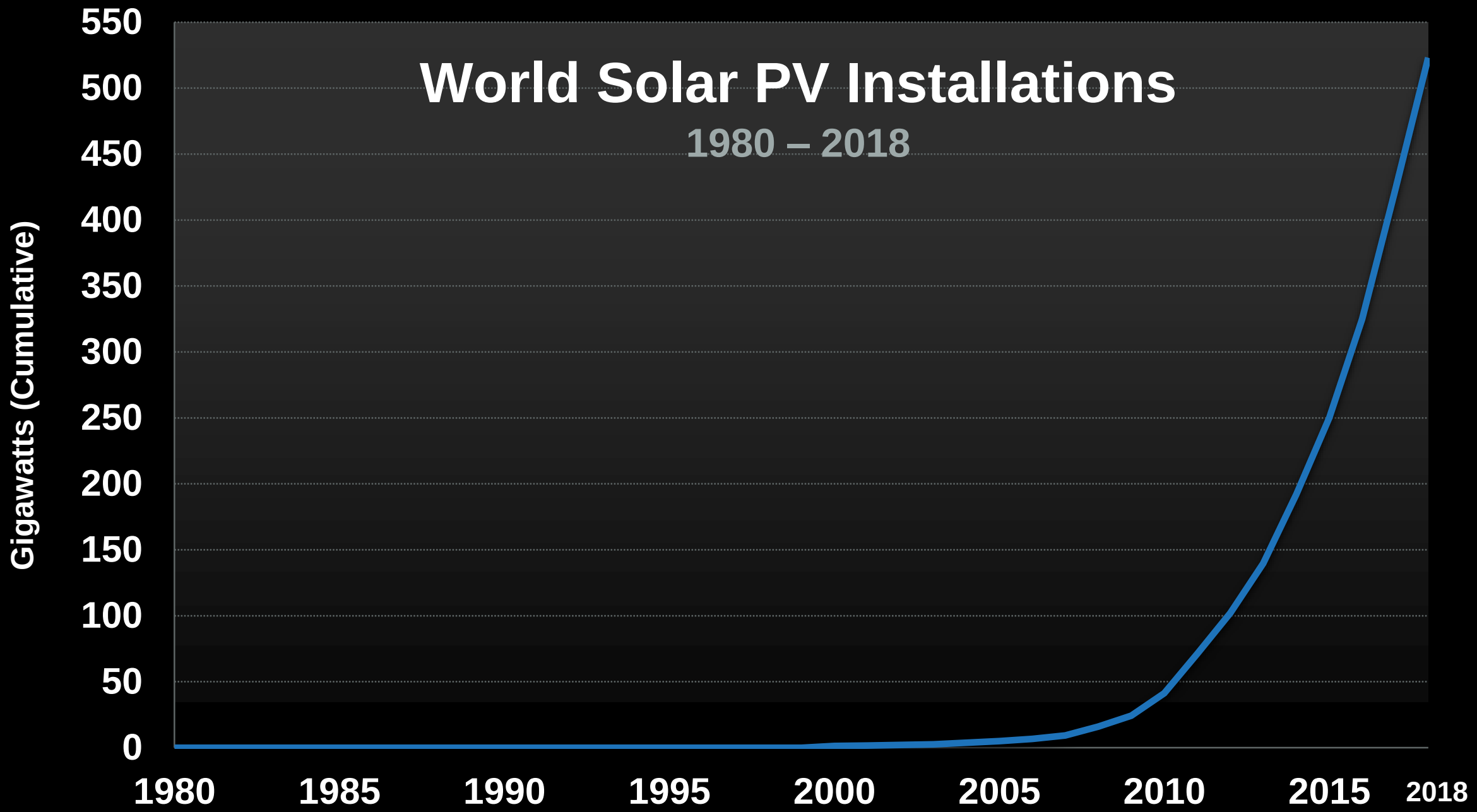
The solar energy market will grow one gigawatt per year by 2010

Reality

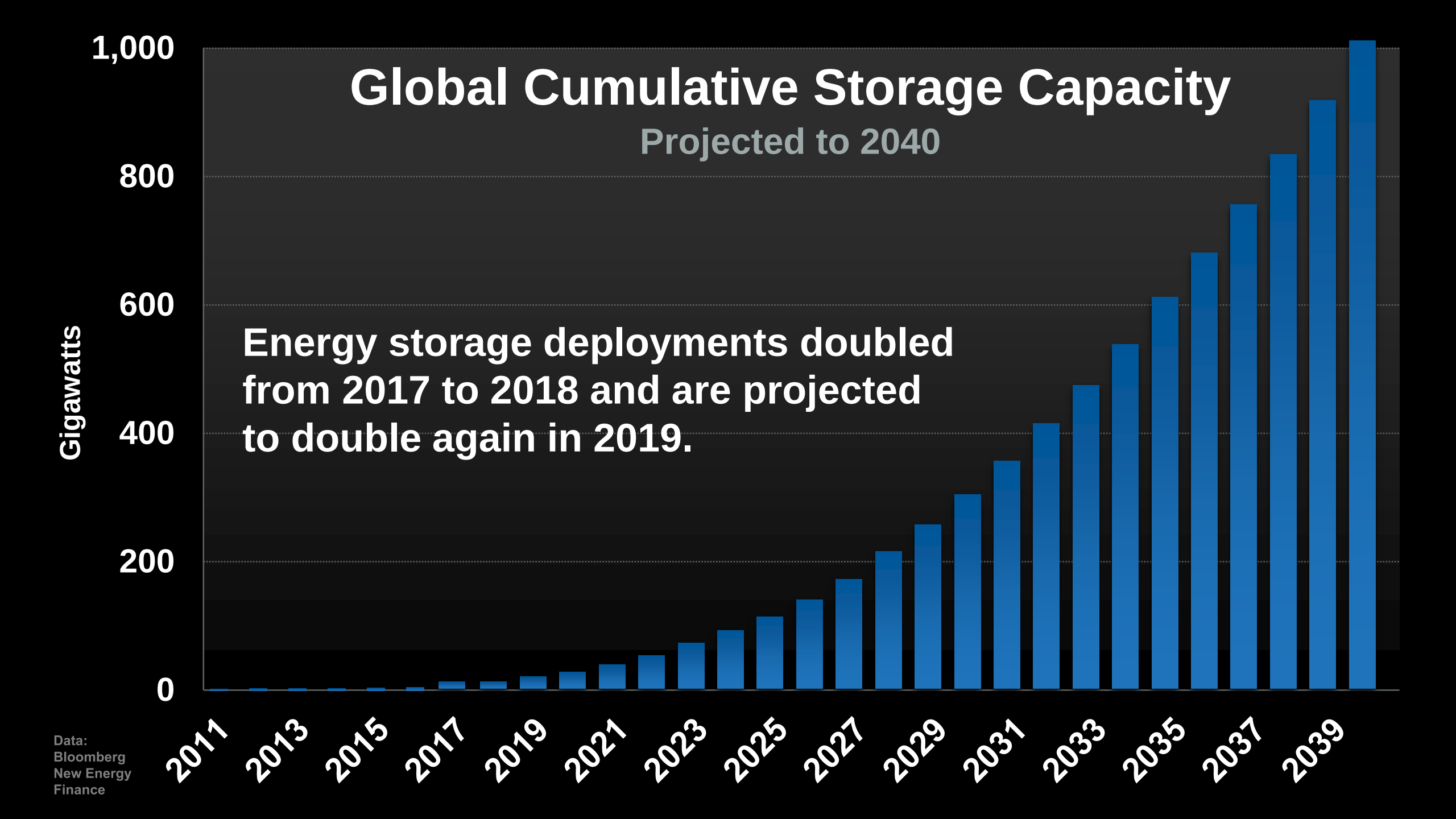
The reality is that in 2018 it was exceeded by

109x

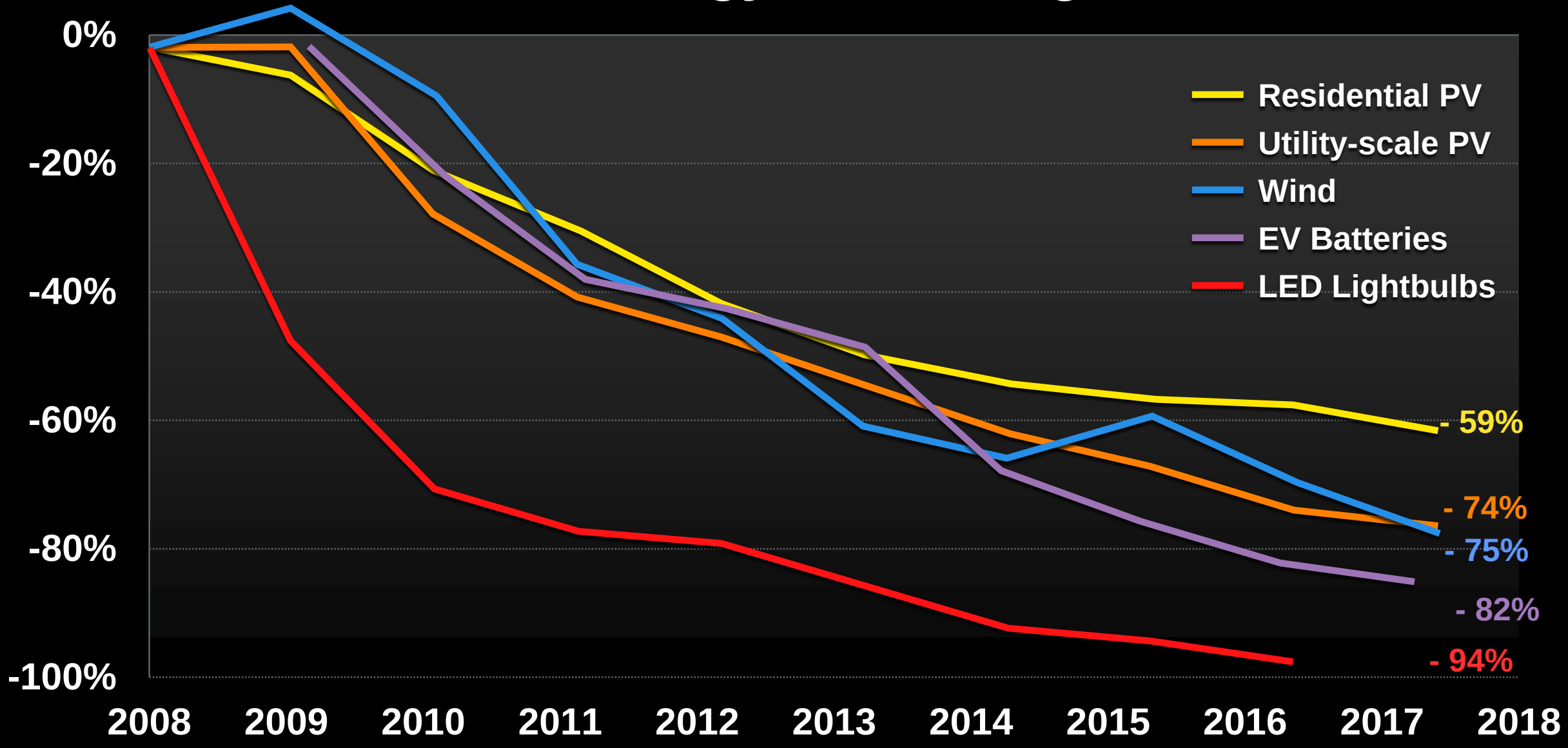
Source: Fresh-Energy; Bloomberg New Energy Finance



Data: Earth Policy Institute/BP, Statistical Review of World Energy June 2014 (London: 2014); Bloomberg New Energy Finance


Global Cumulative Storage Capacity
Projected to 2040
Energy storage deployments doubled from 2017 to 2018 and are projected to double again in 2019.
Gigawatts
1,000
800
600
400
200
0
2011
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
Data: Bloomberg New Energy Finance

Cost of Clean Energy Technologies in the U.S.

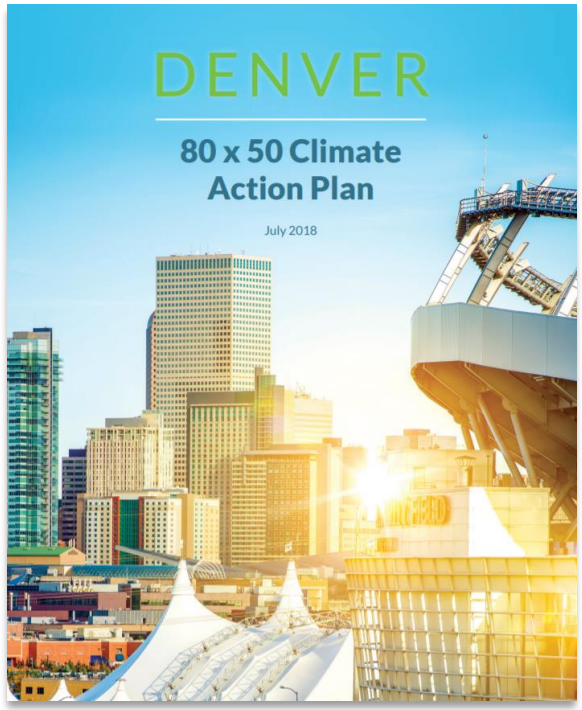


Data: Natural Resources Defense Council

Climate Goals and Greenhouse Gas Emissions Data

Denver's long-term climate goal: Reduce GHG emissions 80% by 2050 from 2005 baseline

IPCC says we must cut emissions in half by 2030 and be carbon free by 2050



ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

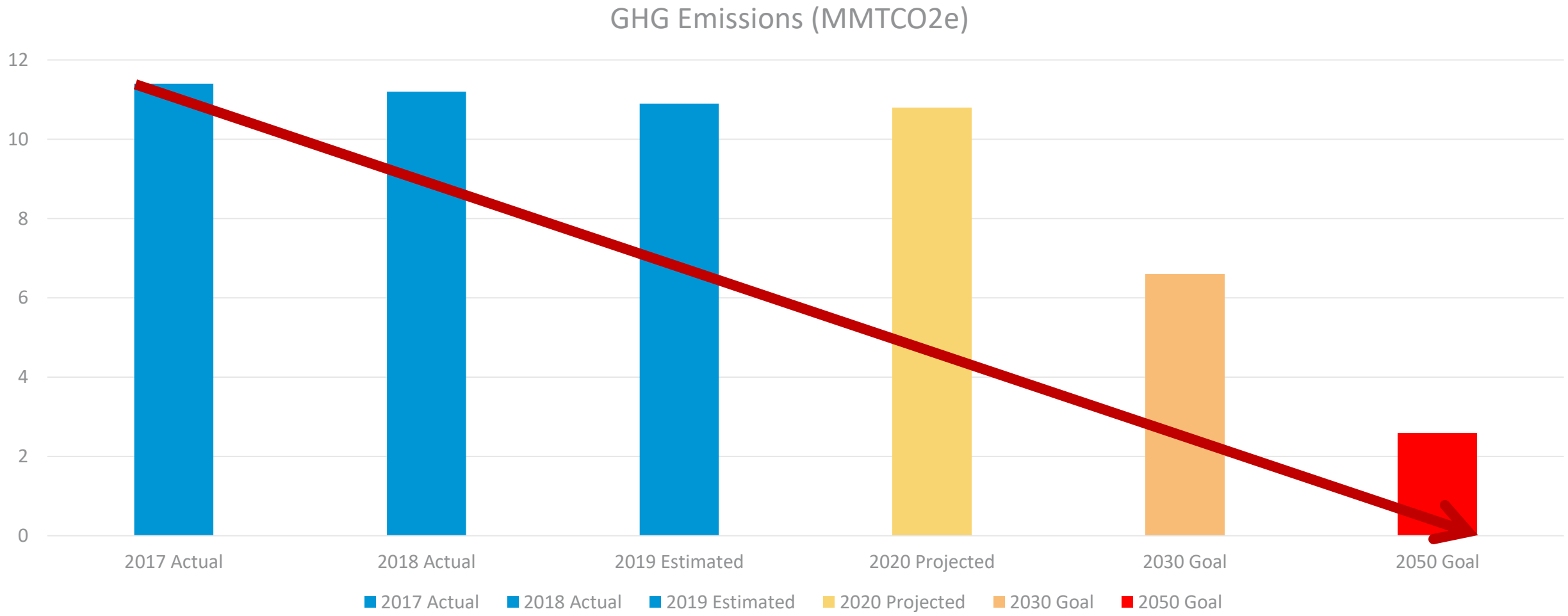
EVERY ACTION MATTERS
EVERY BIT OF WARMING MATTERS
EVERY YEAR MATTERS
EVERY CHOICE MATTERS

Moving quickly to reduce emissions also reduces harm

Stark differences between 1.5C and 2C of warming according to the latest IPCC report.

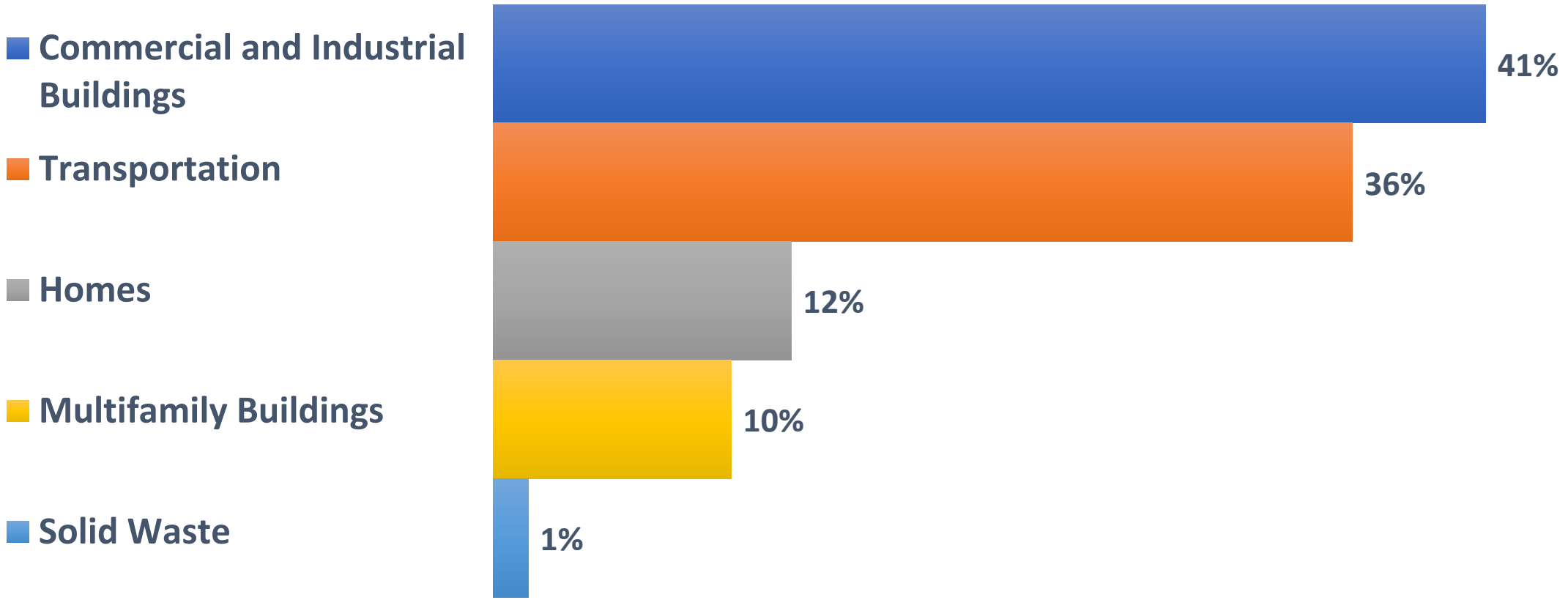
Source: Carbon Brief
https://www.carbonbrief.org/category/in-focus/infographics

DENVER
THE MILE HIGH CITY



IPCC requires ZERO emissions by 2050

Denver's Greenhouse Gas Emissions



Gaps and Opportunities

- Lots of progress on electricity emissions, more to do
- The next major challenges are:
  - Natural gas in buildings
  - Transportation
- These sectors are slow to change

Data Collection, Management, Analysis, and Reporting

Community Engagement, Outreach, and Partnerships

Policy, Regulatory, and Legislative Activities

Implementation, Programs, Incentives, and Actions

Climate Leadership

ACEEE
American Council for an Energy-Efficient Economy

Ranked #8 out of 75 large cities nationally for clean energy policy and programs

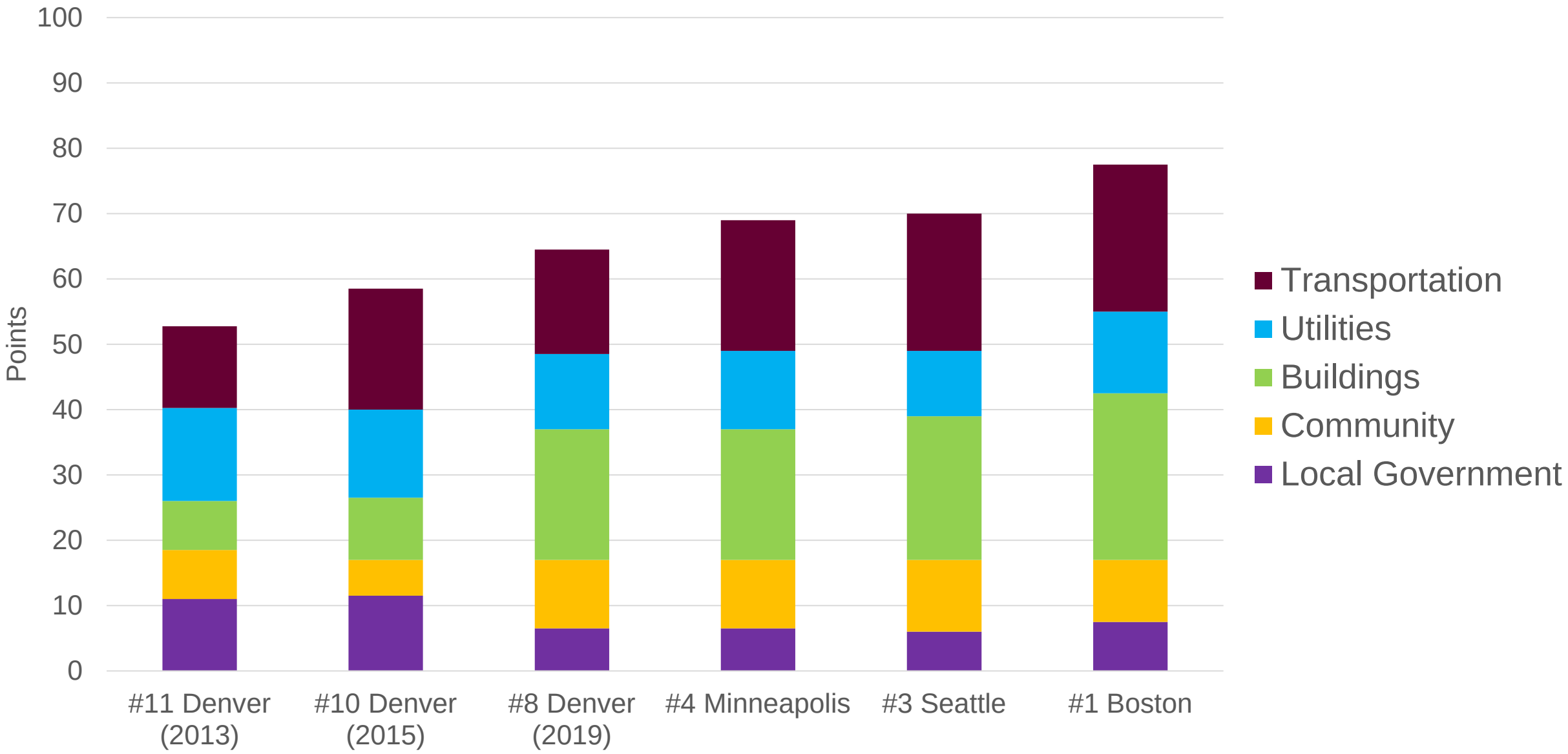
Shining Cities 2019
The Top U.S. Cities for Solar Energy

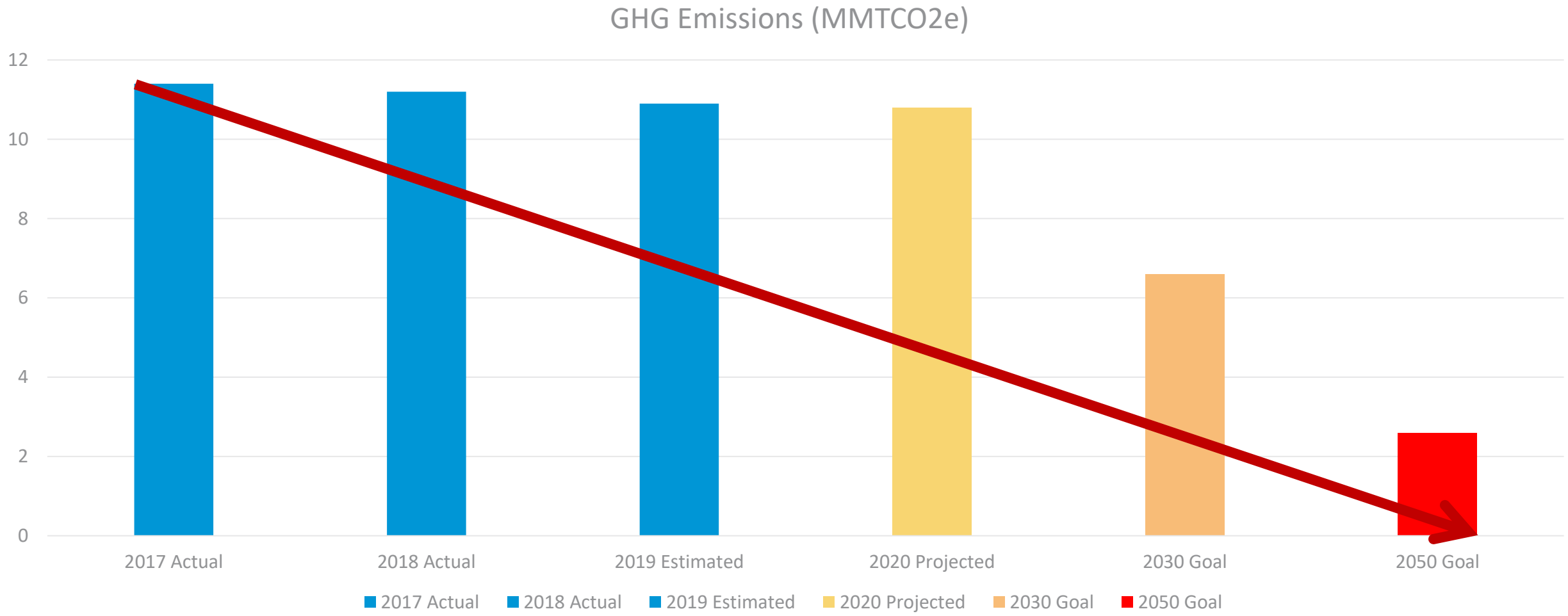
Denver recognized as a “Solar Star”, ranking # 9 in the country for amount of solar installed

CDP
DISCLOSURE INSIGHT ACTION

One of 43 global cities named to the first-ever Cities A List for climate reporting

American Council for an Energy Efficient Economy City Scorecard





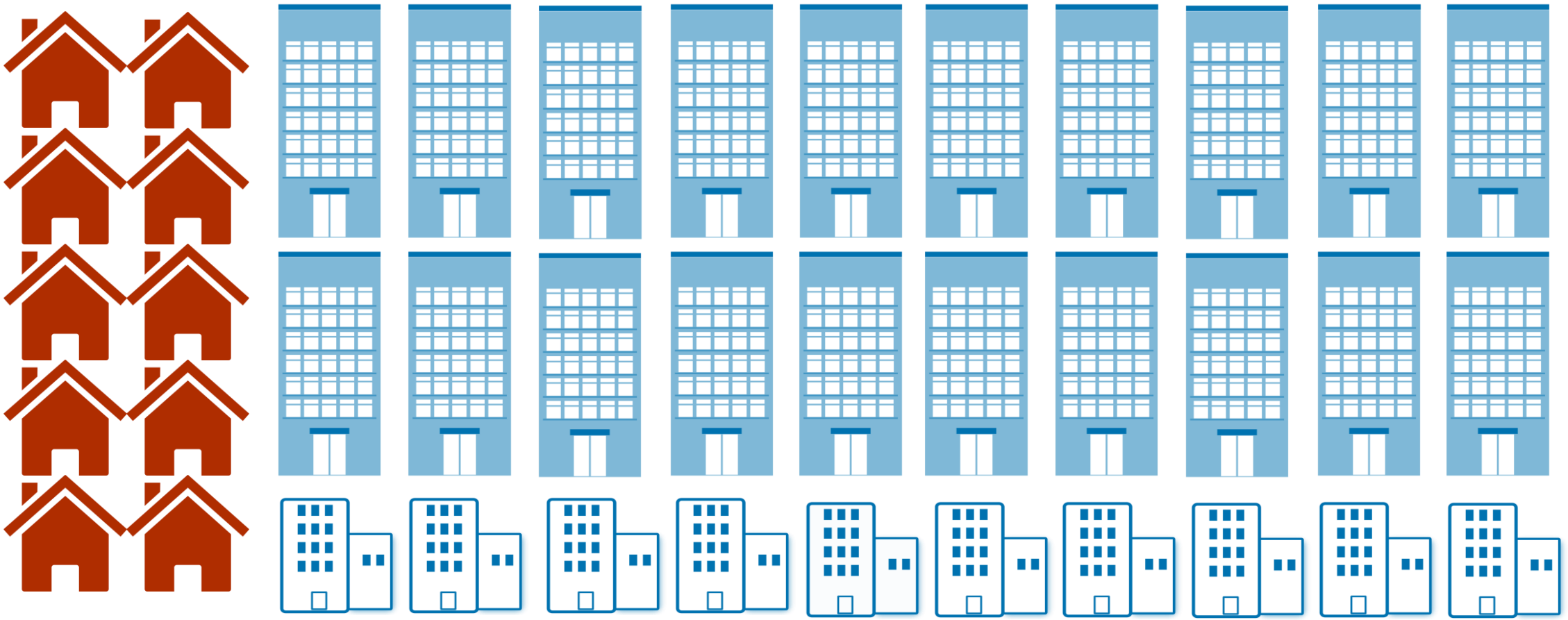
IPCC requires ZERO emissions by 2050

Buildings and Homes

August 14th, 2019

Existing Buildings and Homes

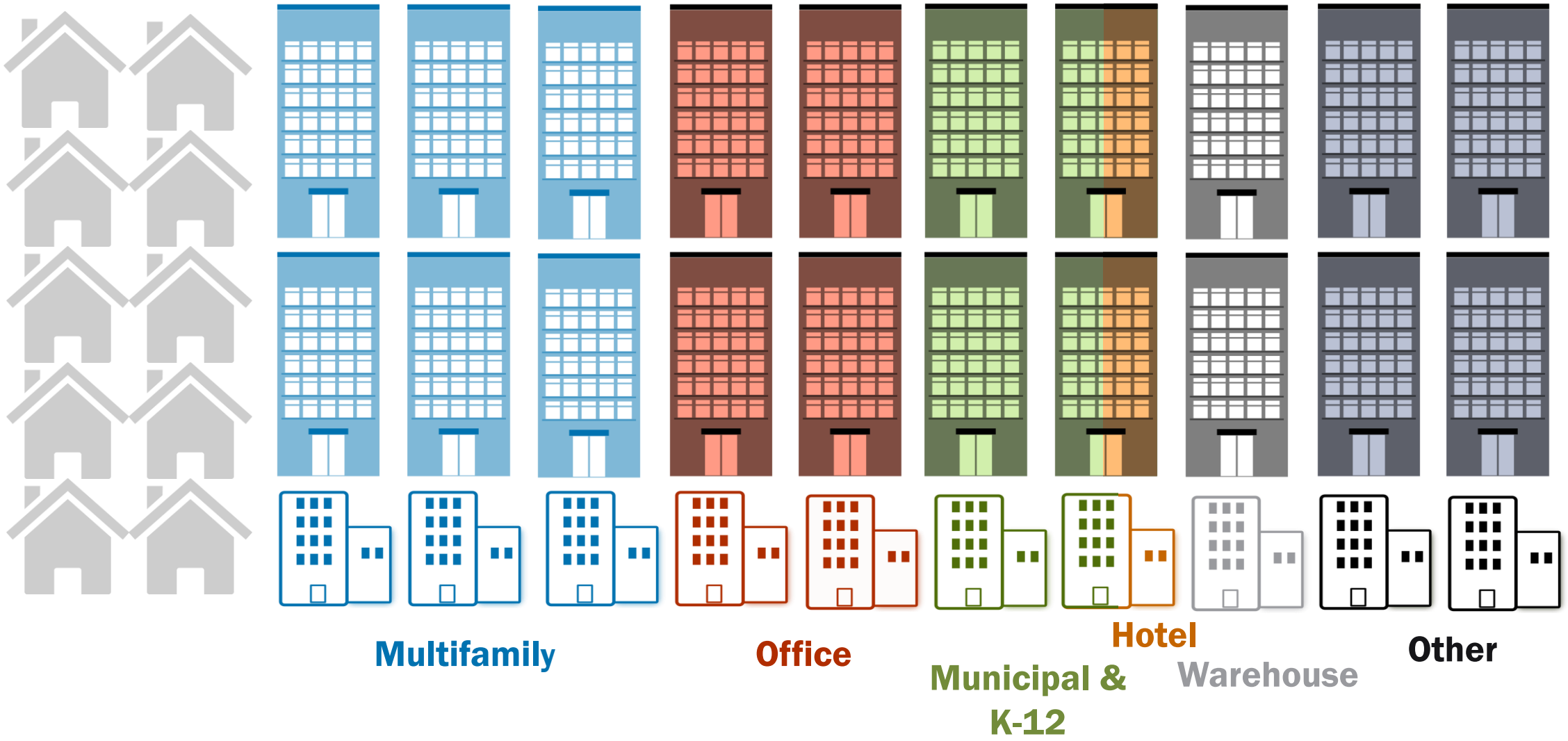
Homes and Buildings Account for 63% of Denver's GHG Emissions



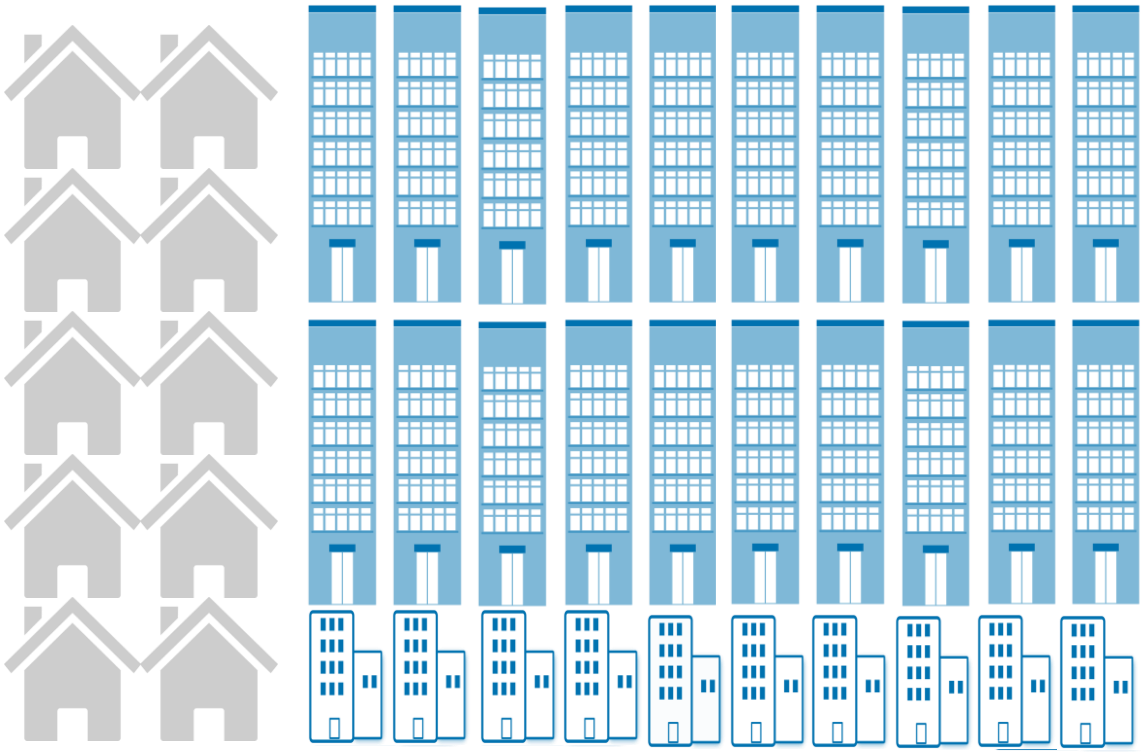
12% GHG

51% GHG

Building Square Footage by Sector



Denver's 80x50 Climate Action Plan calls for Commercial Buildings to reduce energy use 50% by 2050.



$1.3 billion opportunity in Denver

Source: "United States Building Energy Efficiency Retrofits: Market Sizing and Financing Models." Rockefeller Foundation and Deutsche Bank Group. March 2012. Numbers scaled to City and County of Denver.

ENERGY STAR® Scorecard

LEARN MORE AT energystar.gov

City and County Building

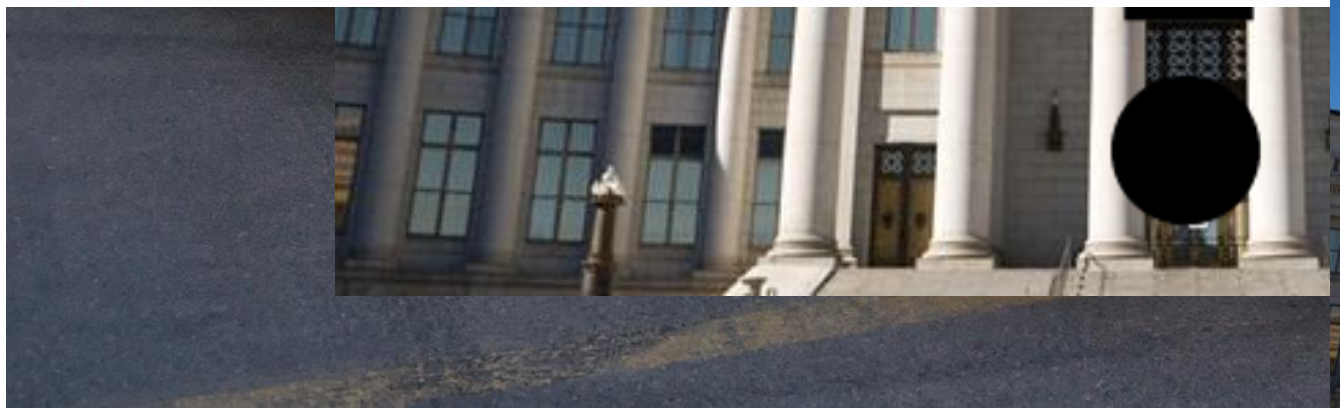
66

ENERGY STAR® Score

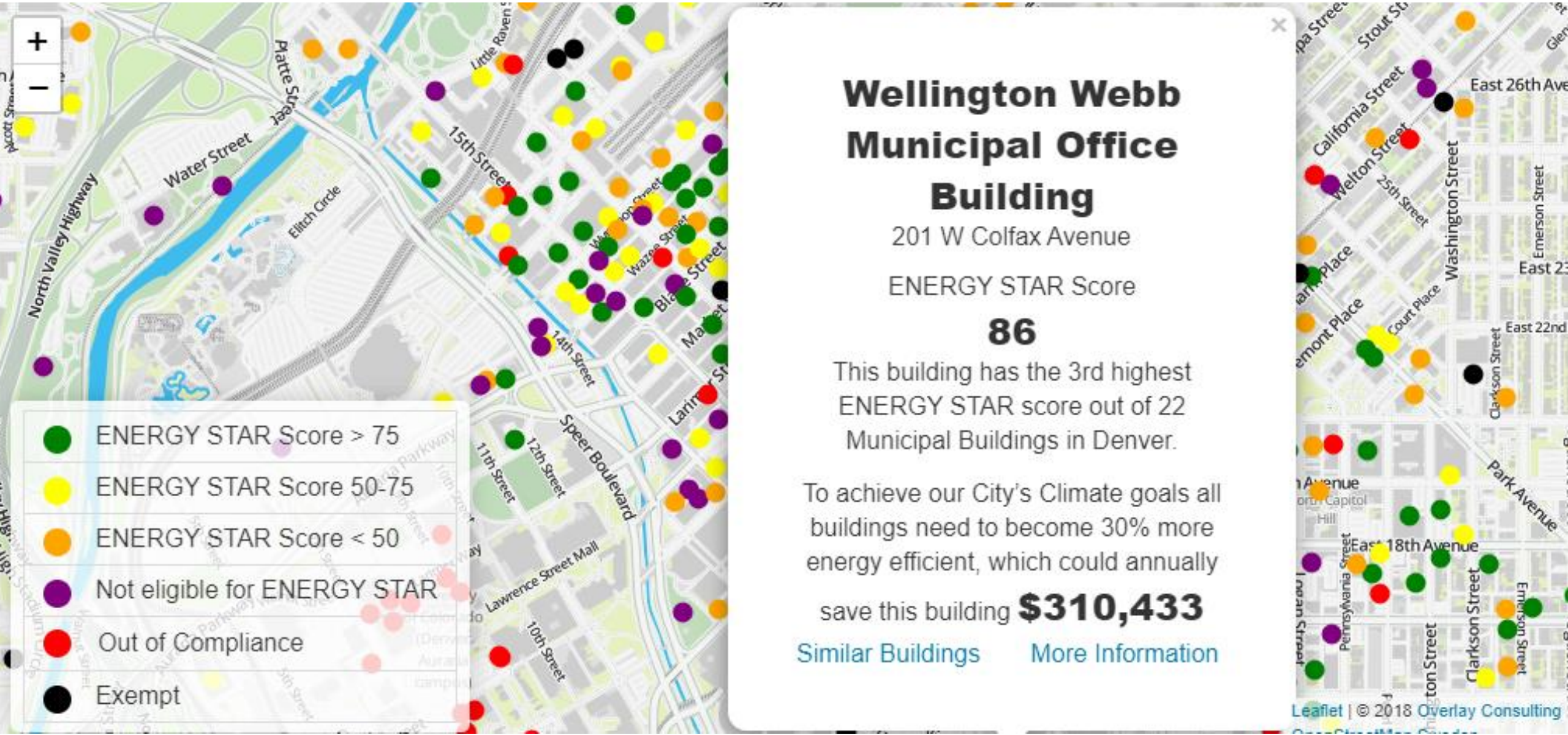
Primary Function: Courthouse
Gross Floor Area (ft²): 419,387
Built: 1980

For Year Ending: December 31, 2018
Date Generated: August 02, 2019

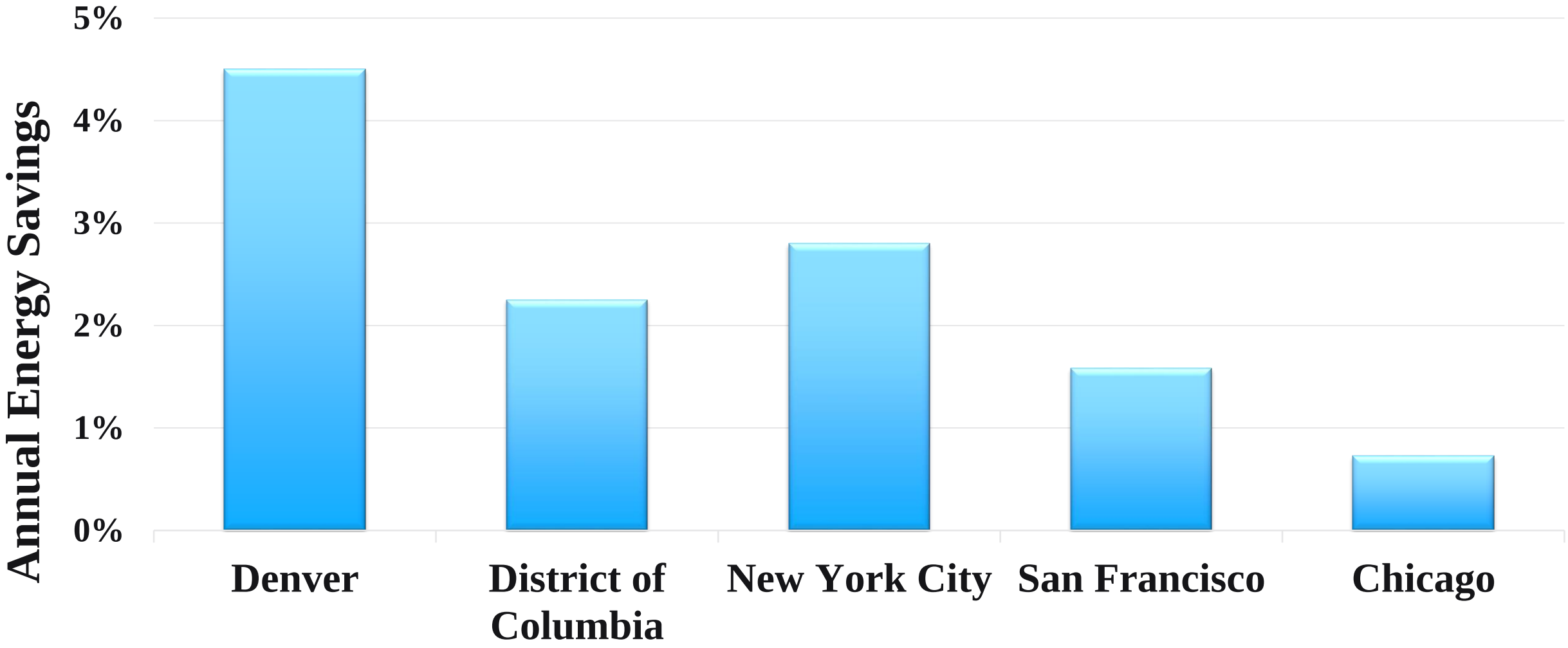
Property Address:
City and County Building
1431 Bannock St
Denver, Colorado 80202



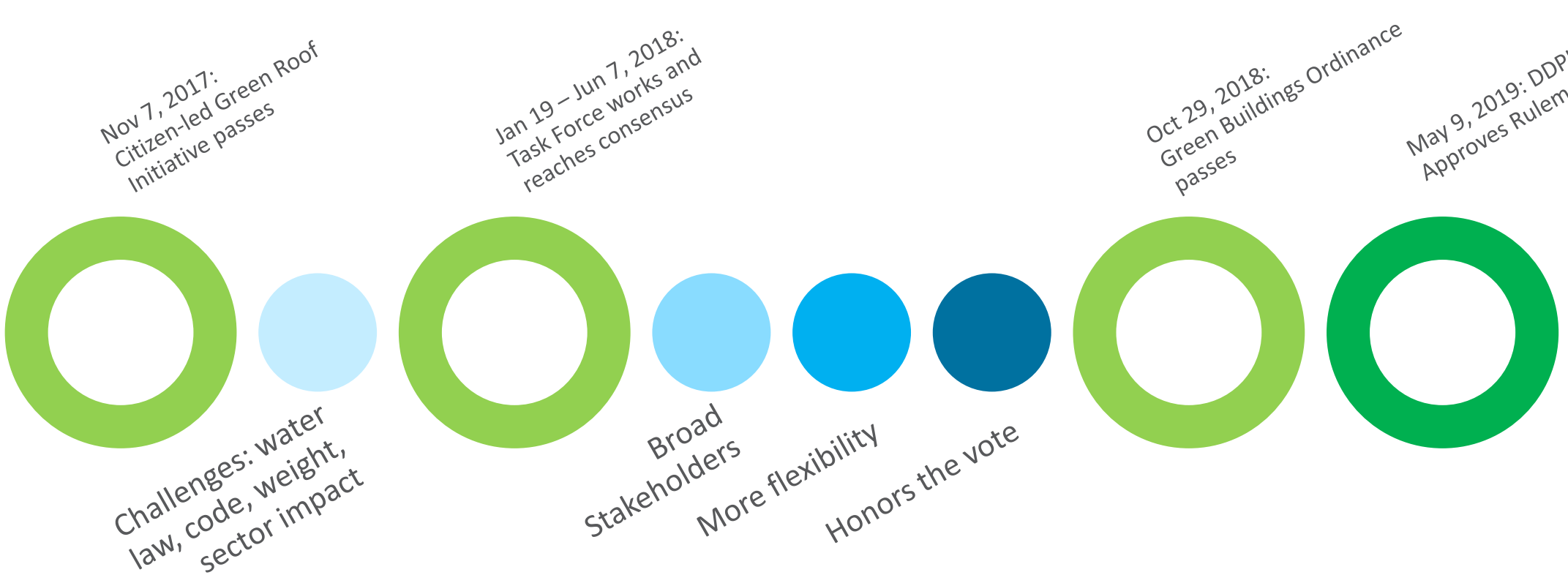
Benchmarking Data: www.energizedenver.org



Comparing Benchmarking Programs Nationwide



Green Roofs to Green Buildings

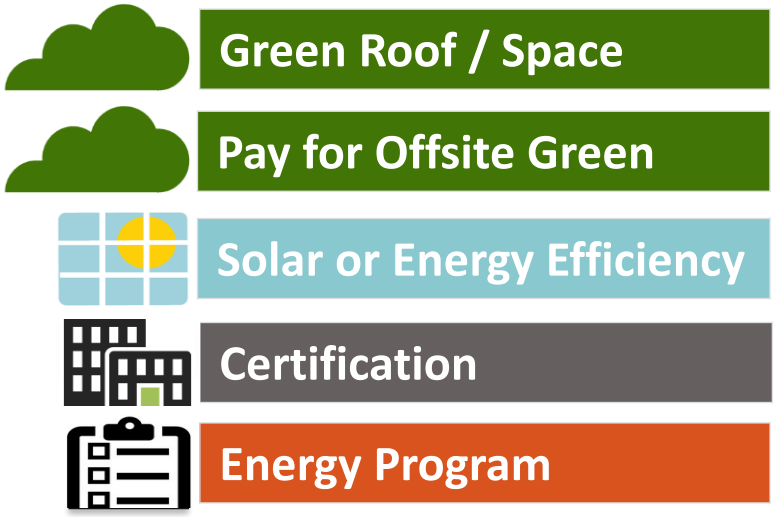


Green Buildings Ordinance: Existing Buildings

Buildings over 25,000 sqft

Cool Roof Required
+
ONE of the Following Compliance Options

Compliance Options for *Existing Buildings*



Energy Program: Compliance Options for Existing Buildings

At Roof Replacement: Cool Roof Required* plus ONE of the Following Options:

ENERGY STAR Score

EUI Improvement

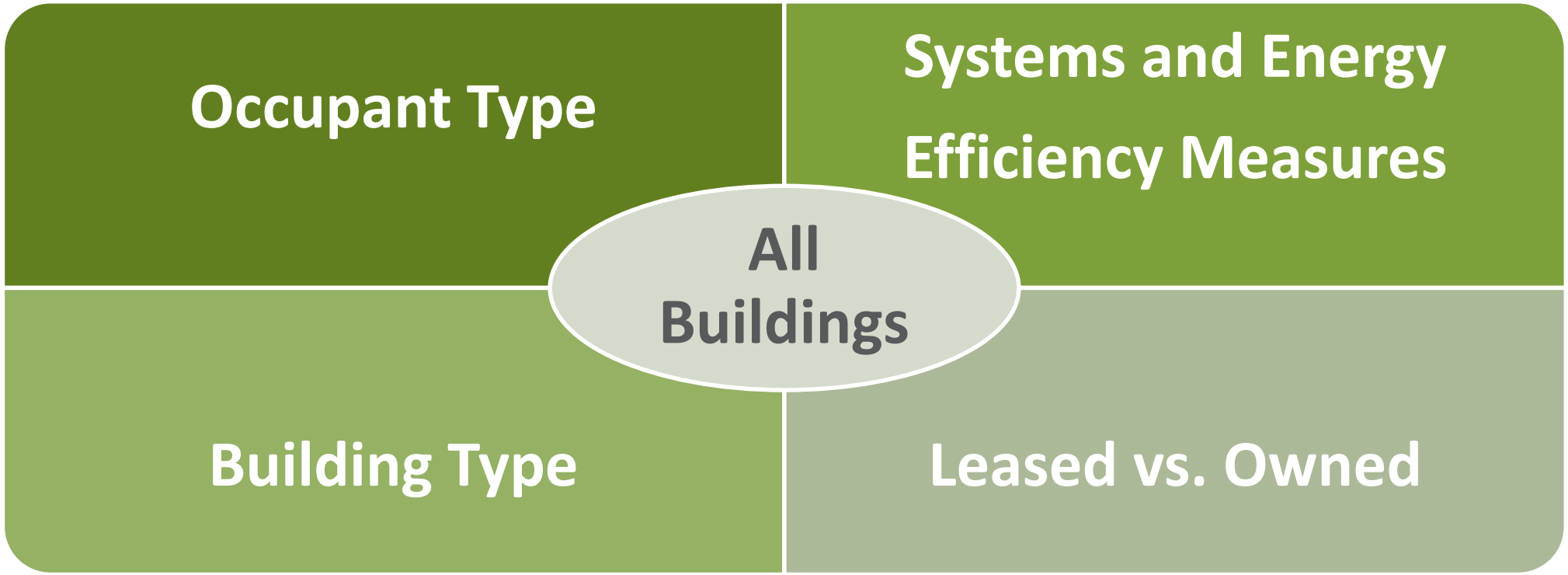
EUI + Offsite Solar

Onsite / Offsite Solar

Green Building Certification

* If the roof is a character-defining roof, CPD may allow alternative roof materials

Outreach and Education:
Targeting different segments of the market



Energize Denver Energy Efficiency Awards: 1st Place Hotel 2018

Hampton Inn and Suites
1845 Sherman St.

- ENERGY STAR score improved from 52 to 98.
- 45 percent electricity reduction in 2017.

"Month after month, we are seeing a significant decline in our energy consumption and almost 30 percent reduction with our utility bills so far."

- Lamin Jobe, the hotel's chief engineer.

SMART LEASING DENVER

The program provides **tools**, **training** and **resources** to better align the interests of tenants and landlords to achieve **healthy, high-performance, energy-efficient** buildings **through better conversations** at all stages of the leasing process.

Leasing is a process involving many stakeholders

Pre-lease & site selection → Lease Negotiation & Build out → Occupancy & Operations

SMART LEASING DENVER

Smart Leasing Pledge!

I pledge to **recognize, implement, and encourage** smart leasing practices as I am able.

SMART LEASING DENVER

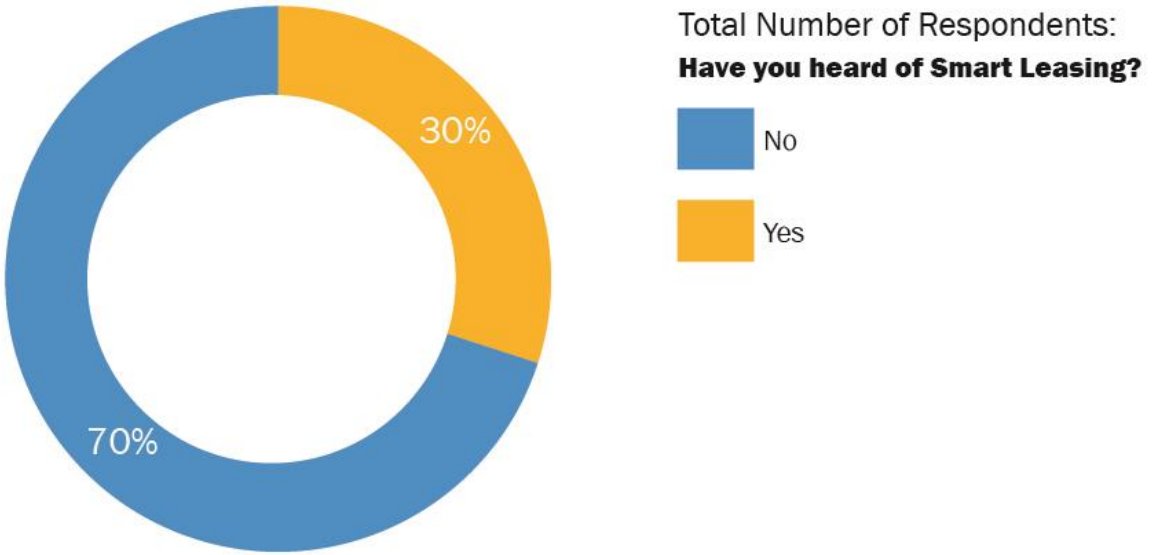
Resources:

- Access to expert advisors
- Case studies from peers
- Best practice documents
  - Sample lease clauses
  - Site selection criteria
  - Sustainable operations

Program Evaluation

- 70% of 170 initial survey respondents did not know about smart leasing.
- Survey will annually measure awareness and usage of smart leasing practices.

SMART LEASING DENVER



C-PACE Financing Pays 100% of Improvements

- Energy efficiency, renewable energy, and water conservation may be financed.
- 100% financing, no money down.
- Long term financing, up to 25 years.
- Loan is repaid via a special purpose assessment (akin to sewer assessment).
- Assessment stays with the property on sale. Tenants usually pay assessments.

www.copace.com

General Services Municipal Building Plans

Energy Performance Contracting

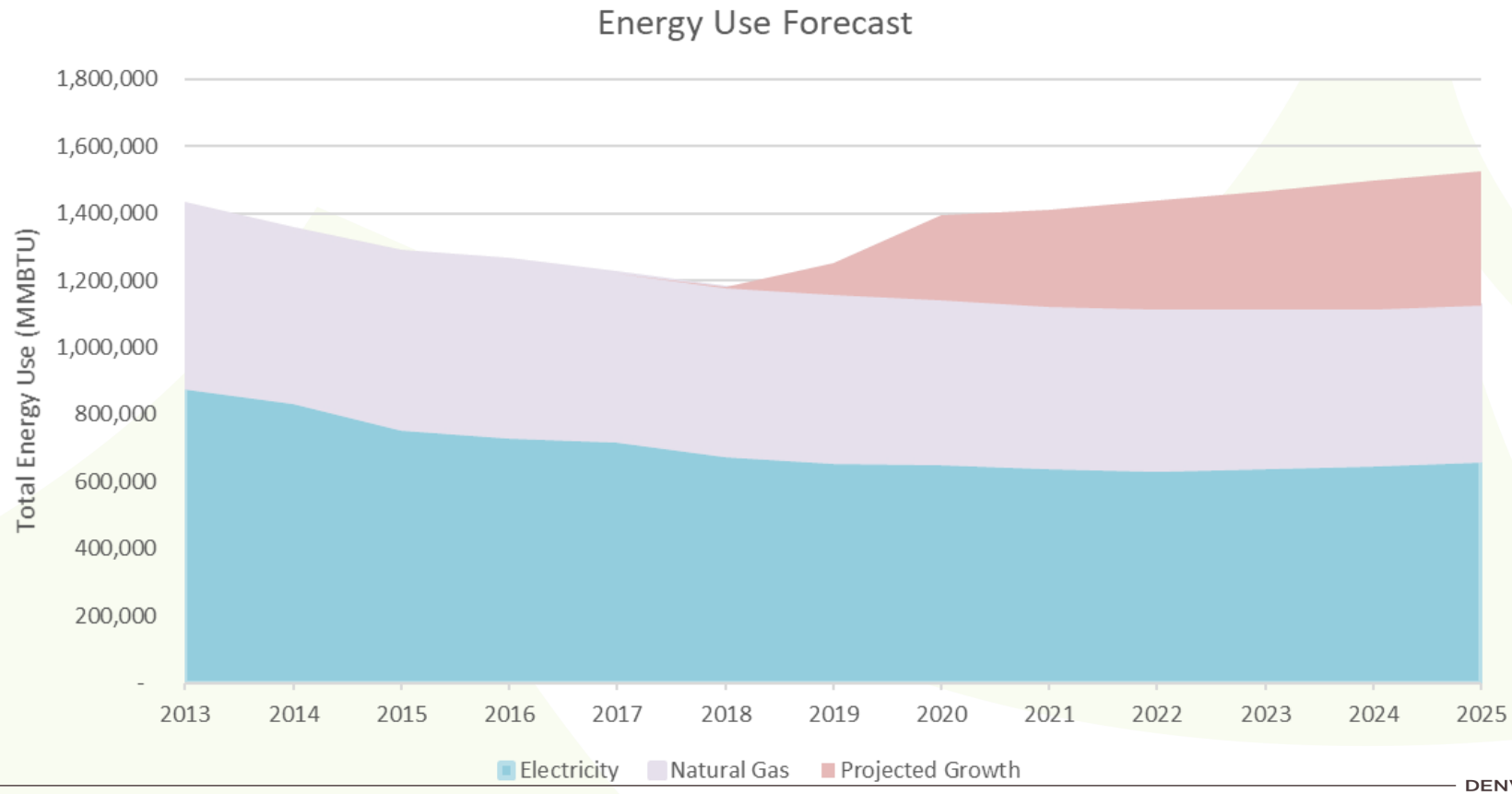
Facility Condition and Assessment Program

Steam Loop heating evaluations

100% Renewable Electricity by 2025

DEN ENERGY USE

- 2018 Energy Master Plan
  - "Ensure that Denver International Airport can meet its future energy needs with energy that is low-carbon, cost-effective, reliable, and resilient"
- 2019 Energy Budget – $22.2 million



DEN ENERGY PROGRAMS

- Energy efficiency
  - Xcel Energy Annual Achievement Awards in 2014, 2016, and 2018 for lighting, HVAC, and controls projects
- DEN hosts 7 solar photovoltaic arrays totaling over 15 megawatts
  - 4 arrays interconnected at DEN electric meters
  - 2 Community Solar Gardens
  - Xcel-owned solar canopy at Peña Station NEXT parking lot, part of a microgrid/battery storage demonstration project
- Renewable energy purchasing
  - Xcel's Renewable*Connect Program
  - Off-site Community Solar Gardens
- Green building
  - 4 Leadership in Energy and Environmental Design (LEED) certified buildings, including LEED Platinum hotel
- Over 50 electric vehicle charging stations for passengers and employees

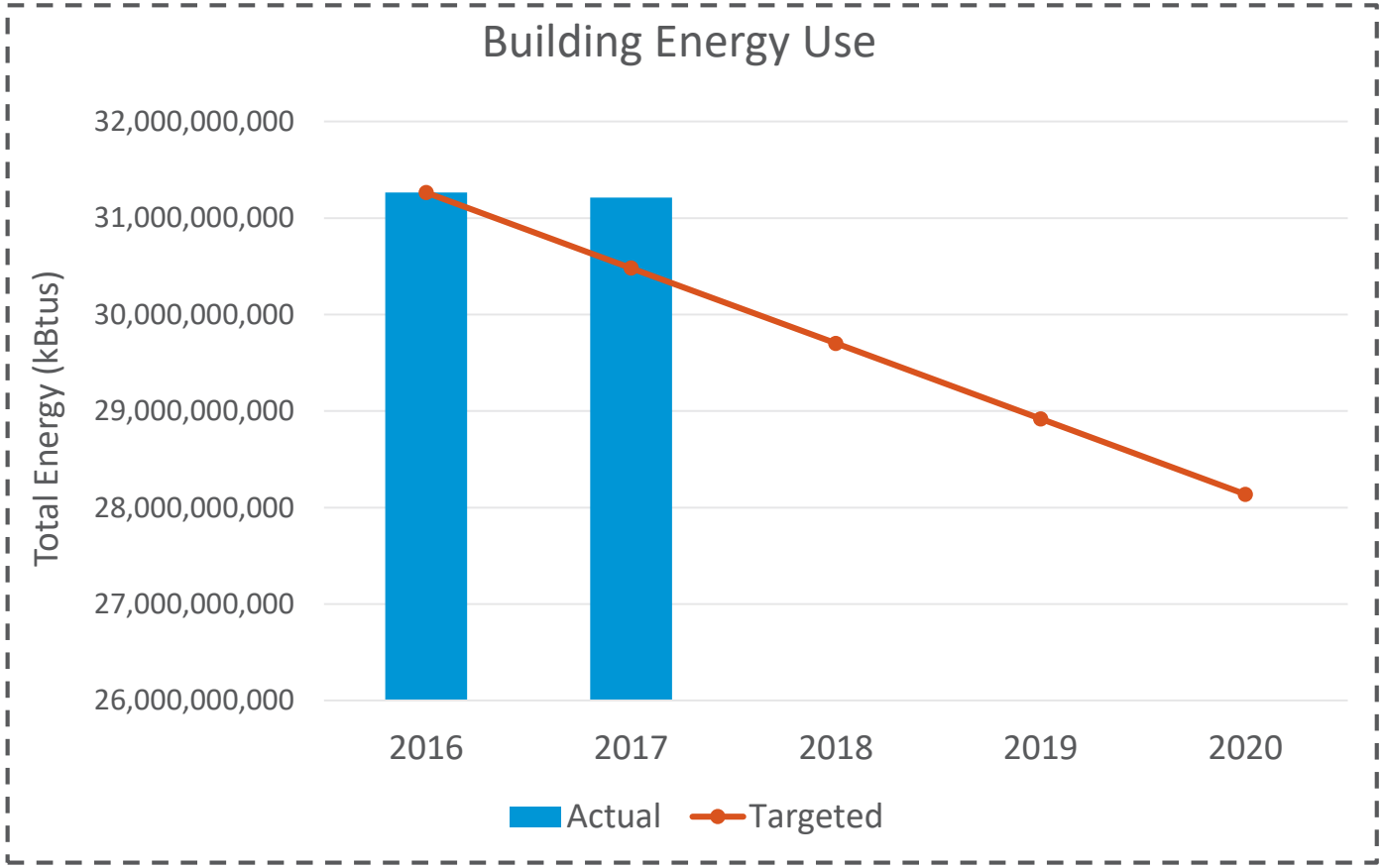
2020 DEN ENERGY PROJECTS

- Comprehensive energy audits/Energy Performance Contract
- New large-scale solar project
- Planning first net-zero energy building
- DEN Real Estate energy goals
- Xcel Community Resiliency Initiative application

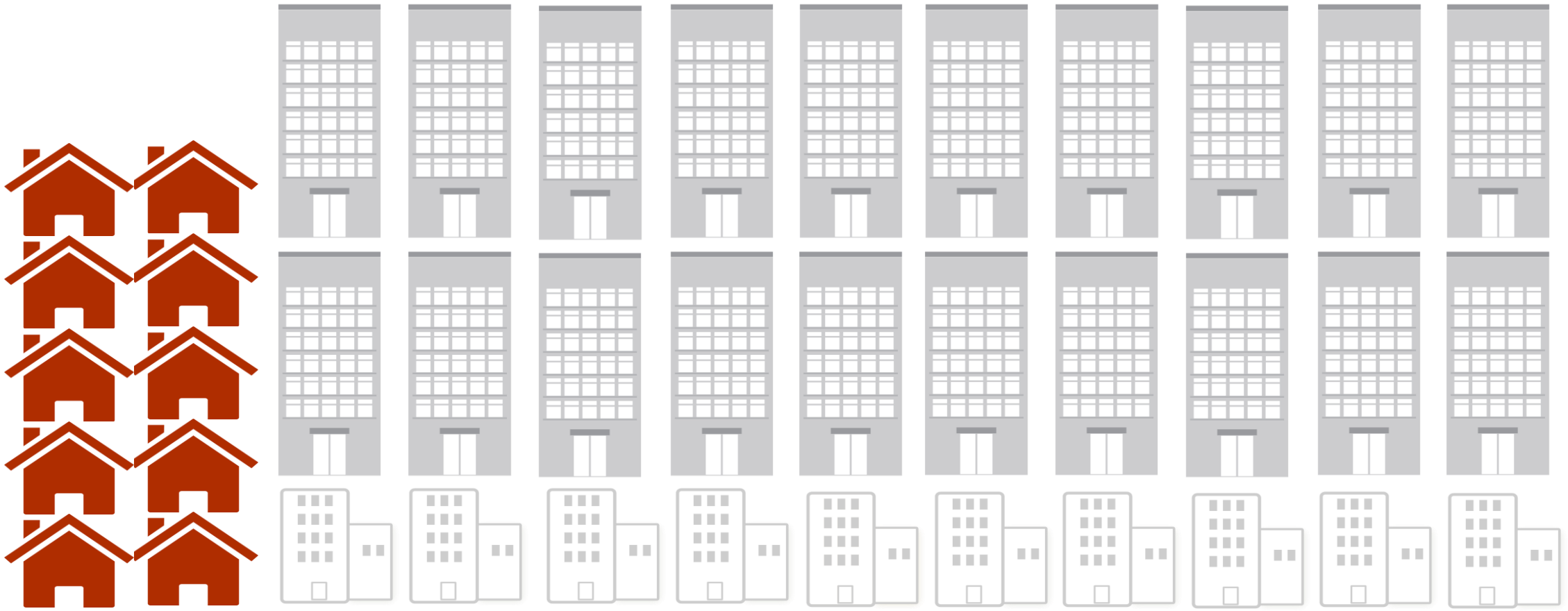
Progress towards our first 80x50 goal of reducing building energy use 10% by 2020

From 2016 to 2017:

Commercial	↑ 0.26%
Multifamily	↓ 1.15%
Total	↓ 0.17%

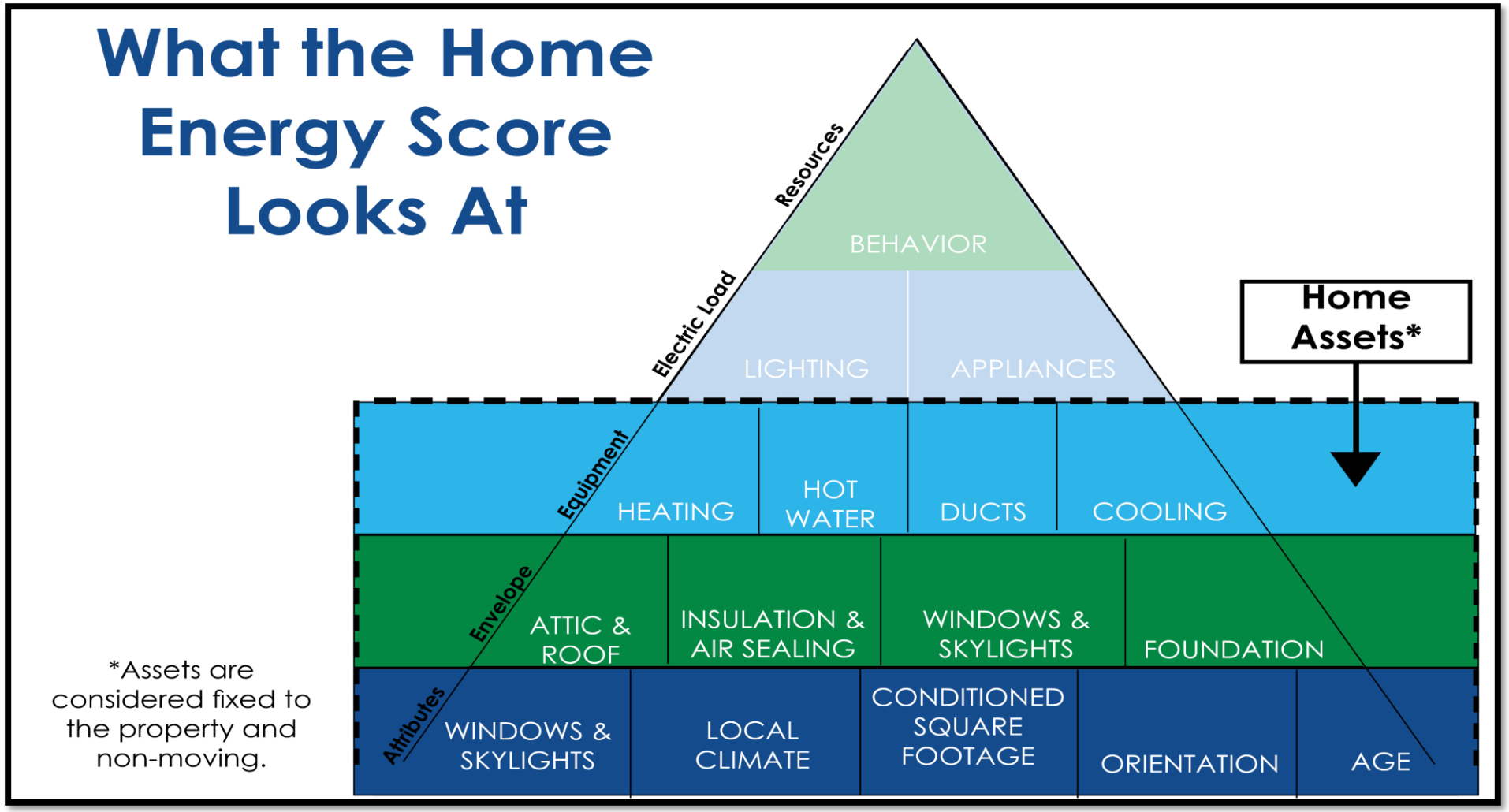


Denver's 80x50 Climate Action Plan calls for Residential Single-Family homes use 20% less energy by 2035



~160,000 Residential Single-Family homes in Denver

Free Home Energy Label Pilot Program



Benefits of a Home Energy Label

Healthier Climate

Consumer Protections

Economic Development

Community Benefits

Go solar as a group!

Denver has partnered with Solar United Neighbors of Colorado to launch the Denver Solar Co-op.

Join the Denver Solar Co-op today!

SOLAR UNITED NEIGHBORS OF COLORADO

DENVER PUBLIC HEALTH & ENVIRONMENT

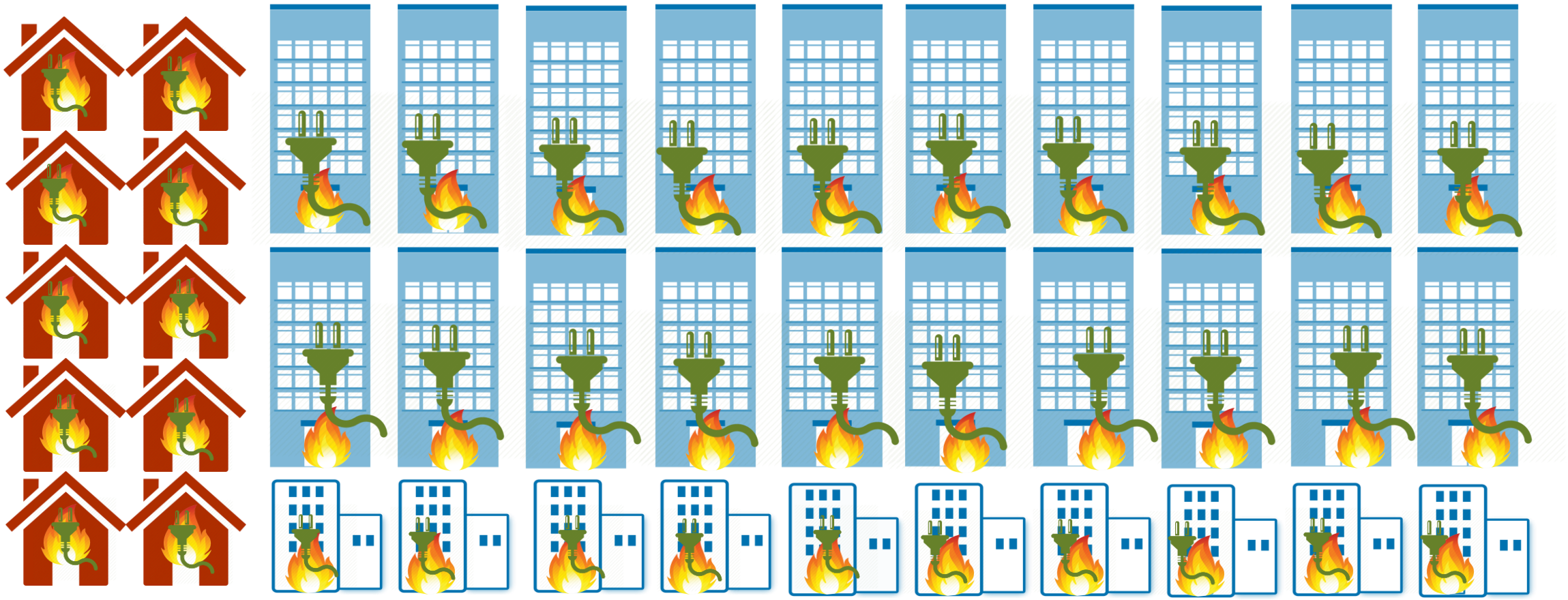
Denver Energy Challenge (2010-2017)

Over 12,500 homes served

Over $1.7M saved on energy bills

Energy saved equal to taking 5,445 cars off the road every year

80x50 Goal: Heating Emission Reductions



By 2050, 100% of Heating Emissions must be eliminated

Strategic Building Electrification Roadmap

Under Development in 2020

Energy Future Collaboration:
Strategic Building Electrification Working Group

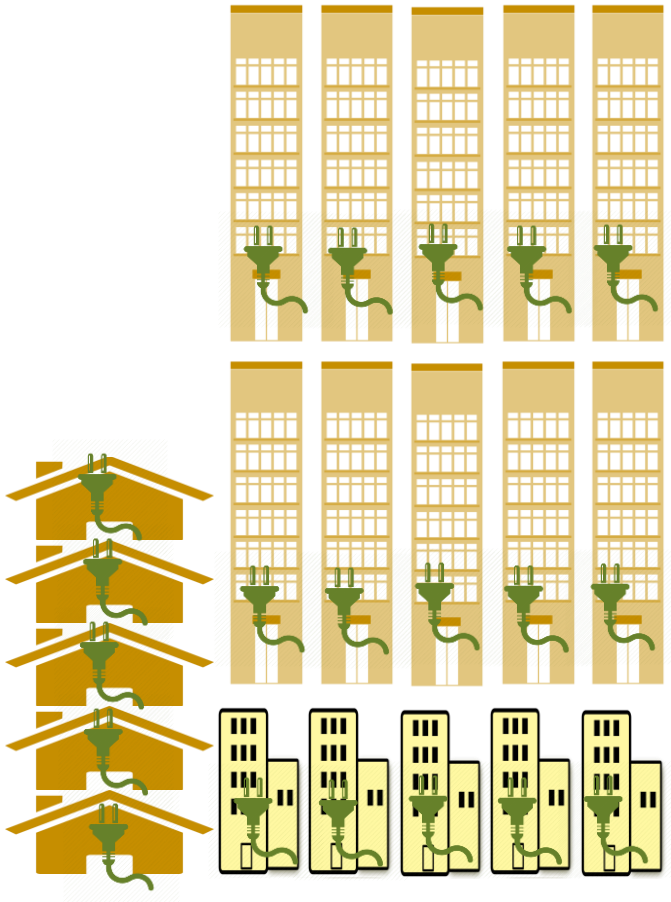
DENVER
THE MILE HIGH CITY

Partnership

Xcel Energy®

New Buildings and Homes

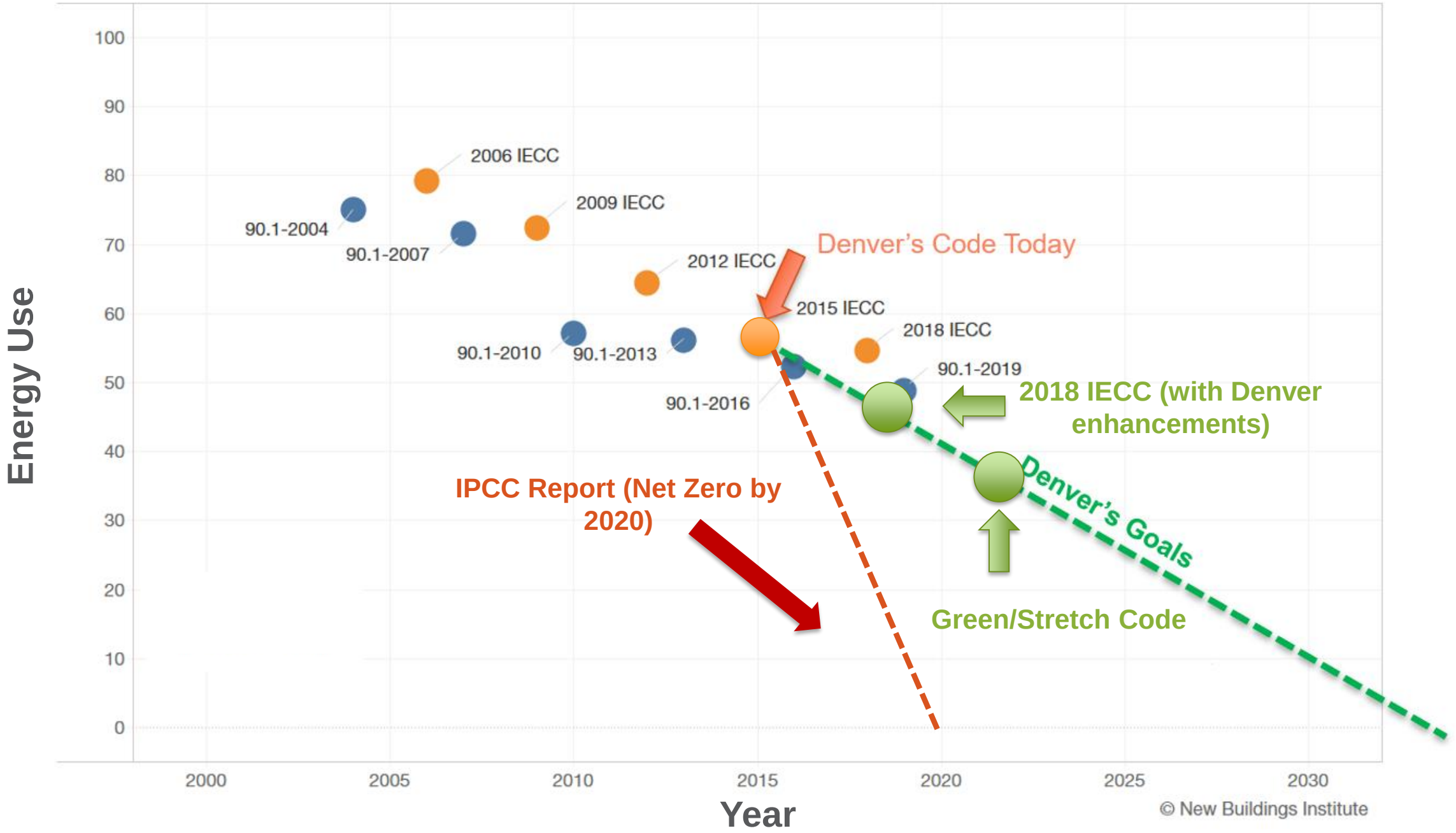
80x50 Goal: Net Zero New Construction by 2035



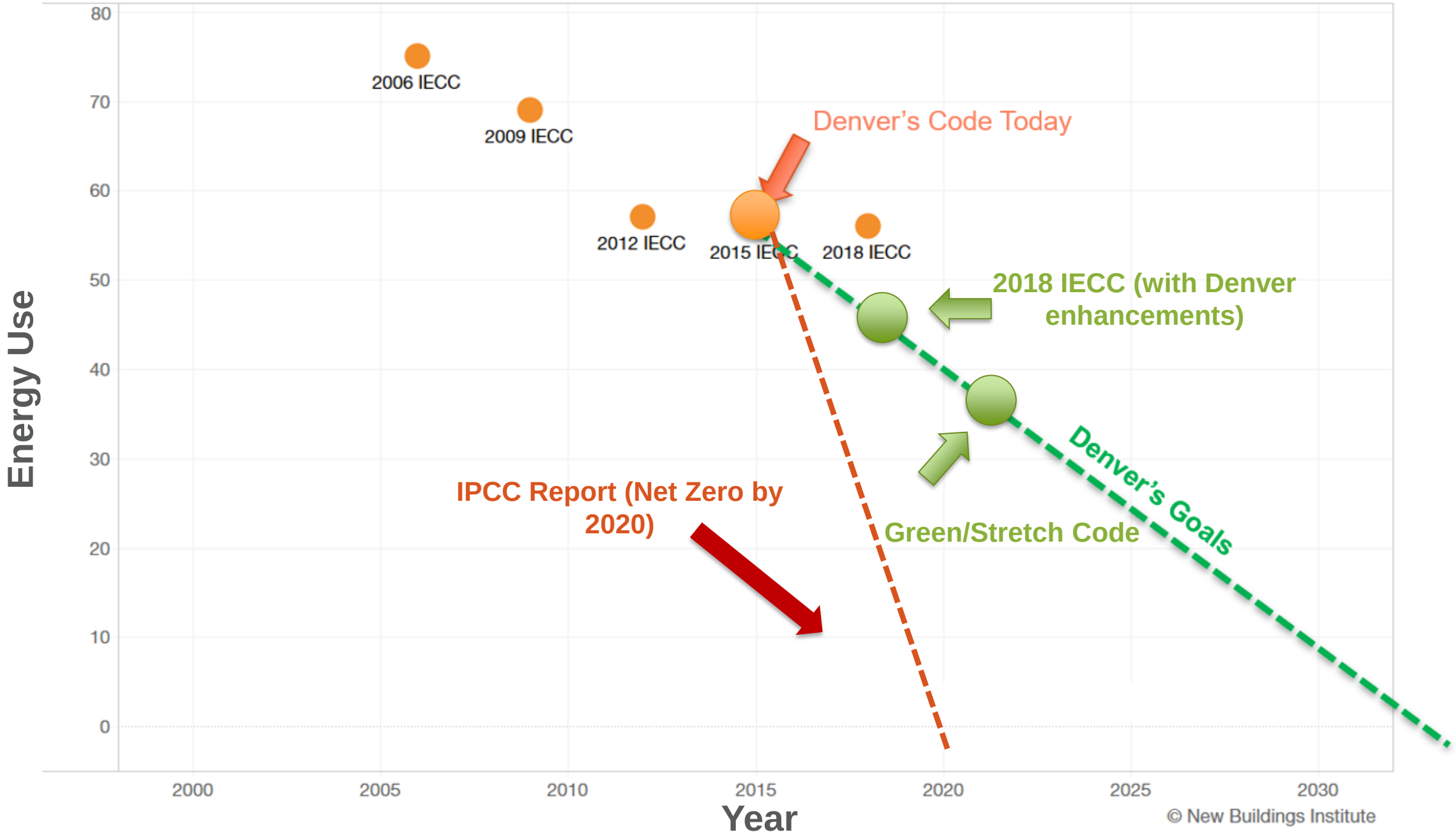
The IPCC tells us we must have net zero new construction in 2020.

By 2050, ~40% of our building stock will be “new” construction

Denver's Path To Net Zero Energy – Commercial



Denver's Path To Net Zero Energy – Residential

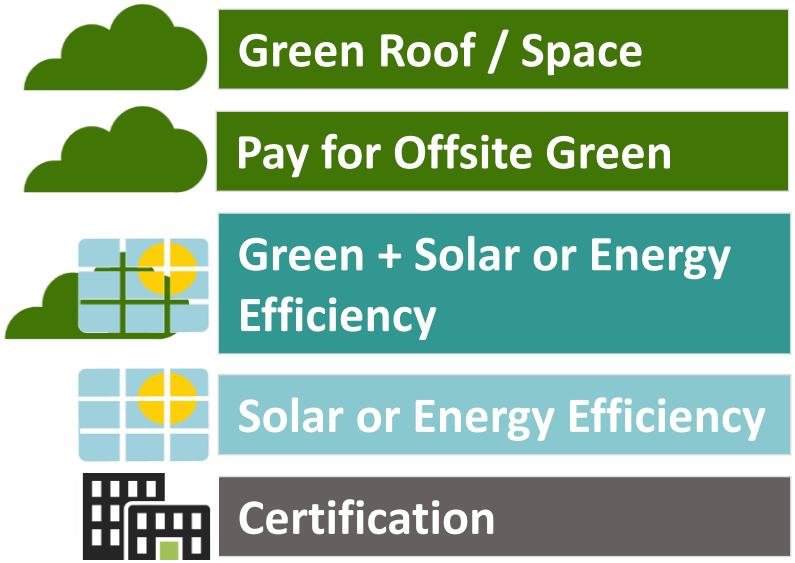


Green Buildings Ordinance: New Buildings

Buildings over 25,000 sqft

Cool Roof Required
+
ONE of the Following Compliance Options

Compliance Options for *New Buildings*



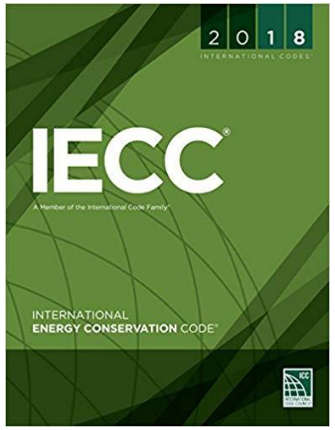
2019 Code Adoption Process

Amendment Proposal Development
- Jan-April

Code Committee Meetings
- April-August

Code Adoption – City Council Process
- Fall 2019

Base Code: IECC 2018 (with strong efficiency amendments)



Voluntary Green/Stretch Code: IgCC 2018

Energy Code Compliance

- IECC Specialist
- Bloomberg Study - Fall 2019
- Implementation - 2020

Model Energy Codes need to keep up

- IECC – America's Model Energy Code
- IECC 2018 development process - <600 votes were cast.
- IECC 2021 is under development now
- **Denver will cast 60 votes in the development of IECC 2021.**

Road Map to Net Zero

Under Development fall 2019-fall 2020

Questions?