



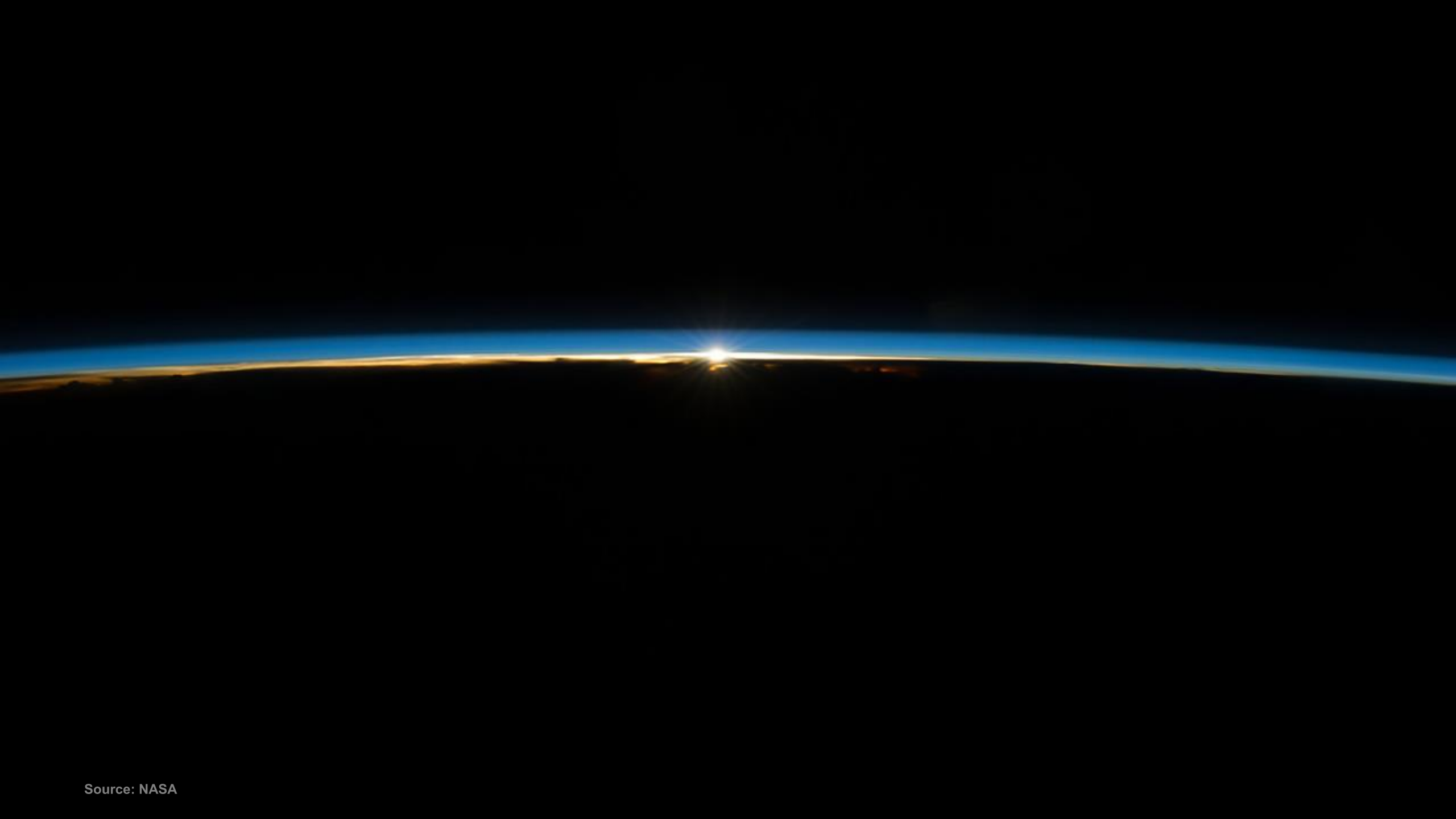
---

# Climate Change

August 14, 2019

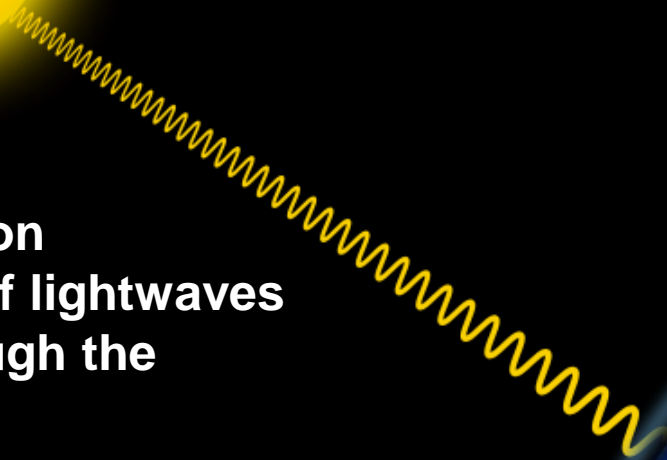


Source: NASA



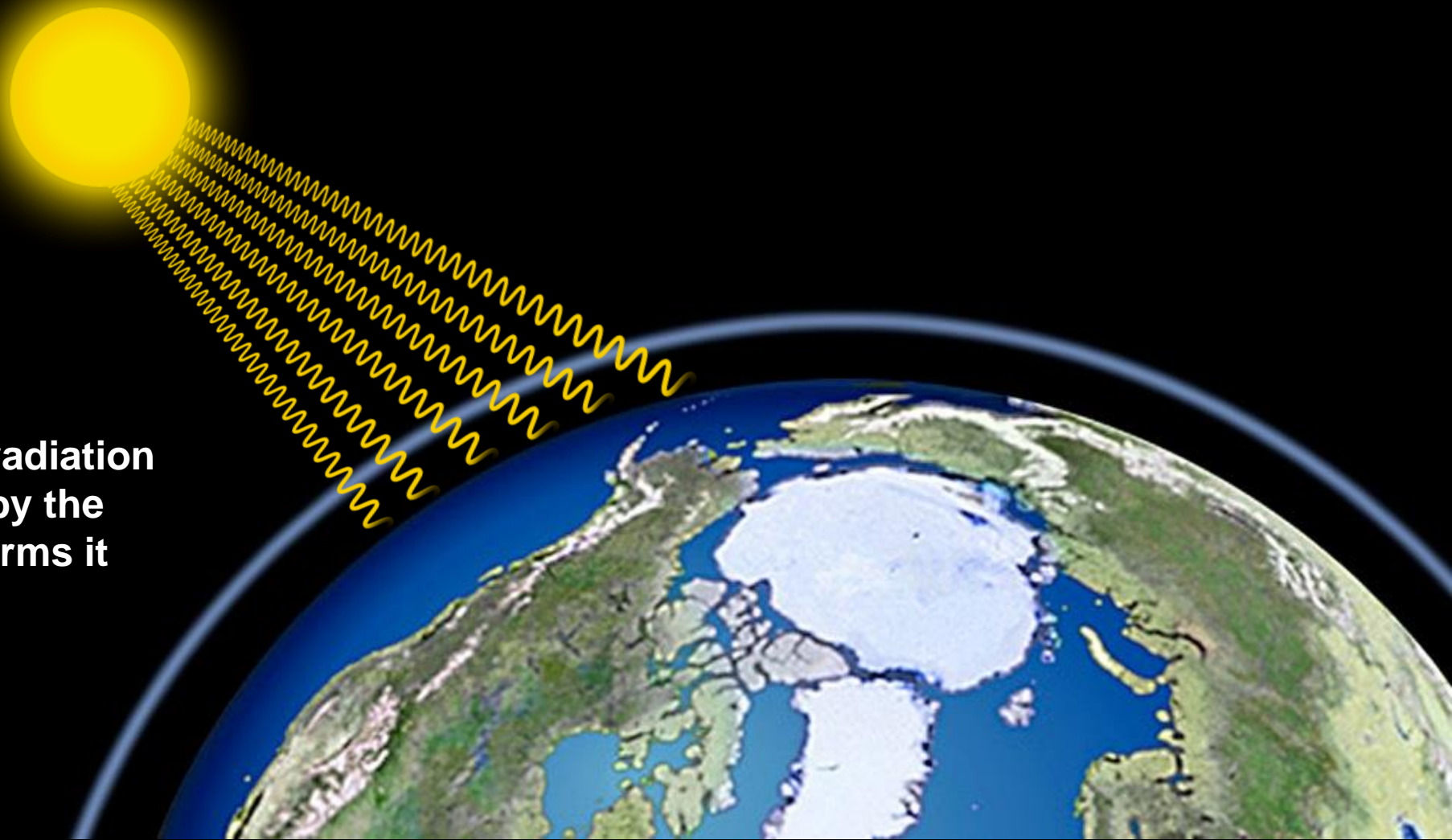
Source: NASA

**Solar radiation  
in the form of lightwaves  
passes through the  
atmosphere**

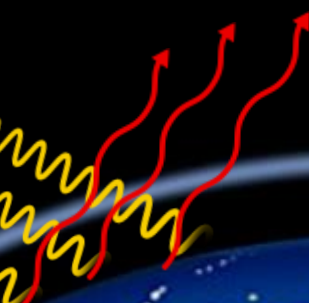
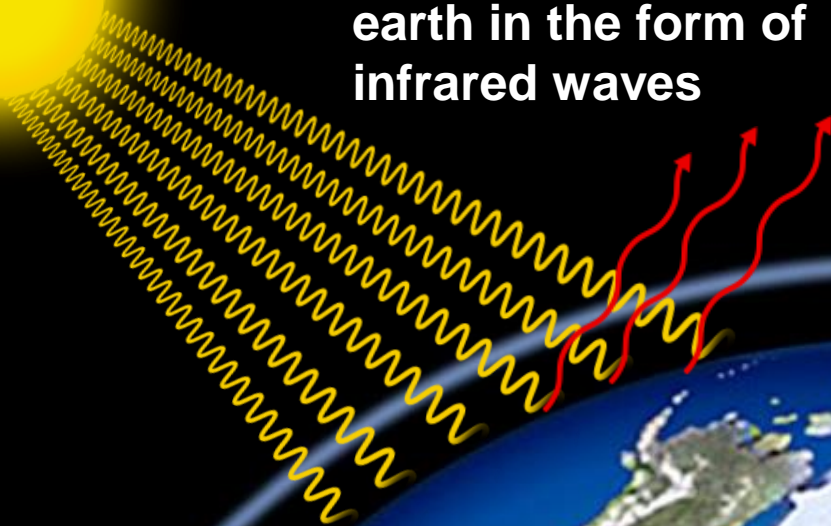
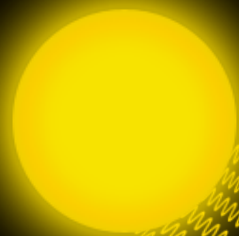


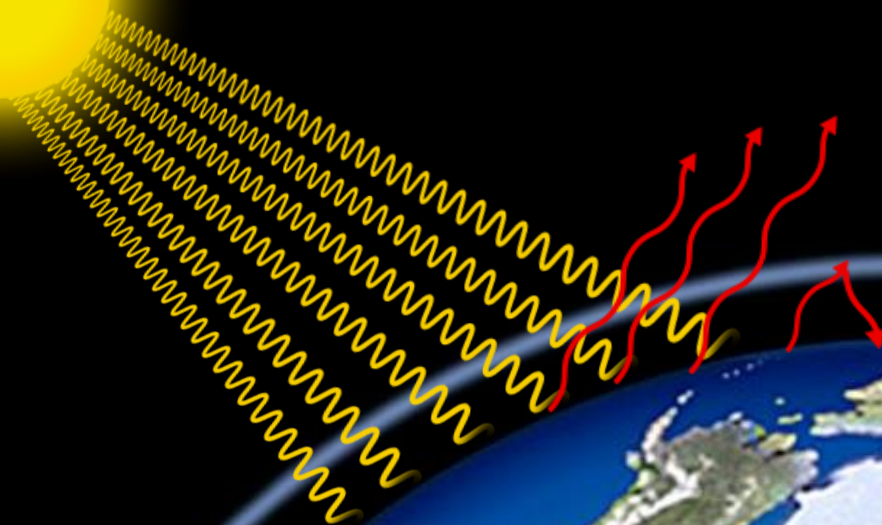
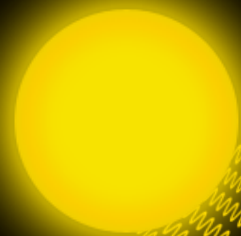


**Most of this radiation  
is absorbed by the  
Earth and warms it**

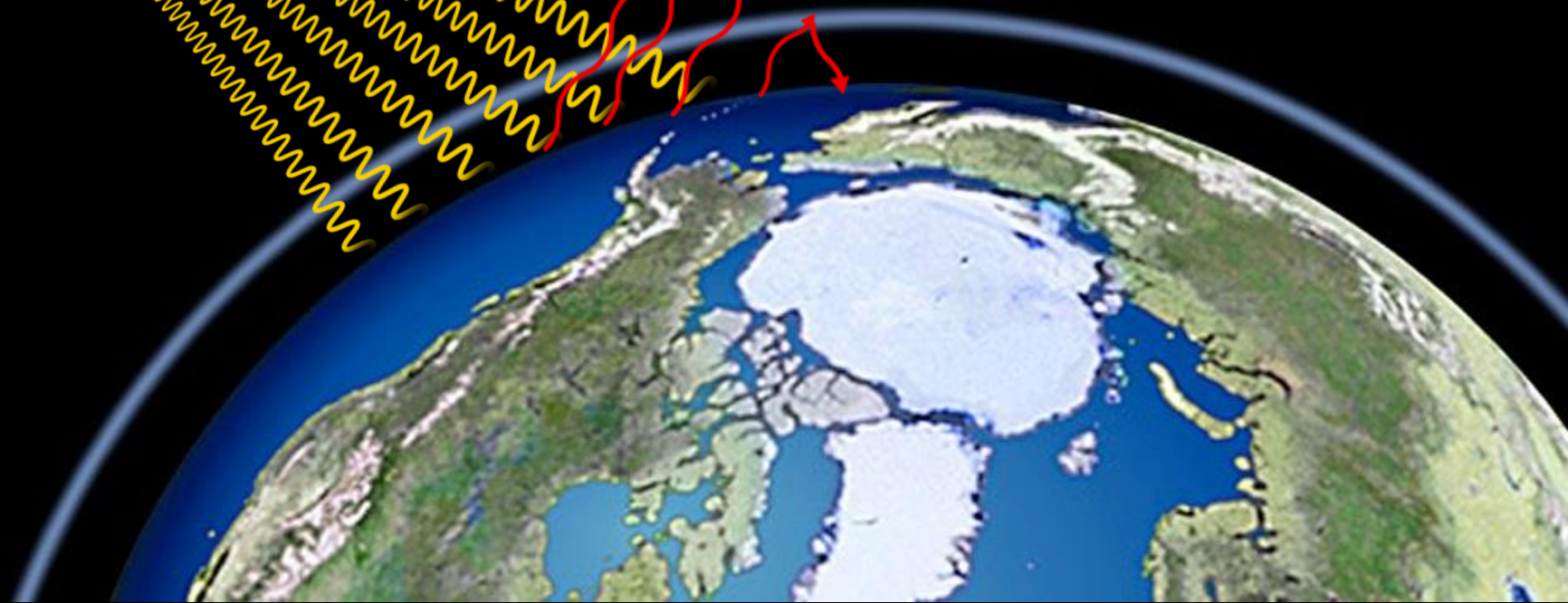


**Some energy is radiated  
back into space by the  
earth in the form of  
infrared waves**

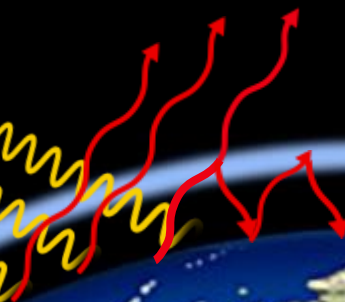
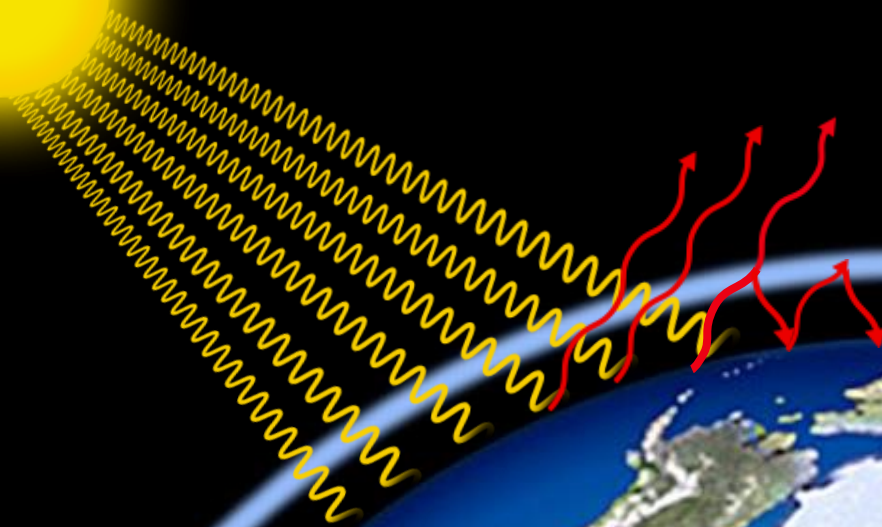
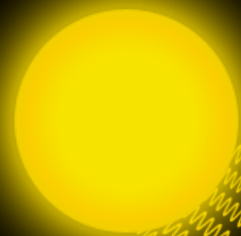




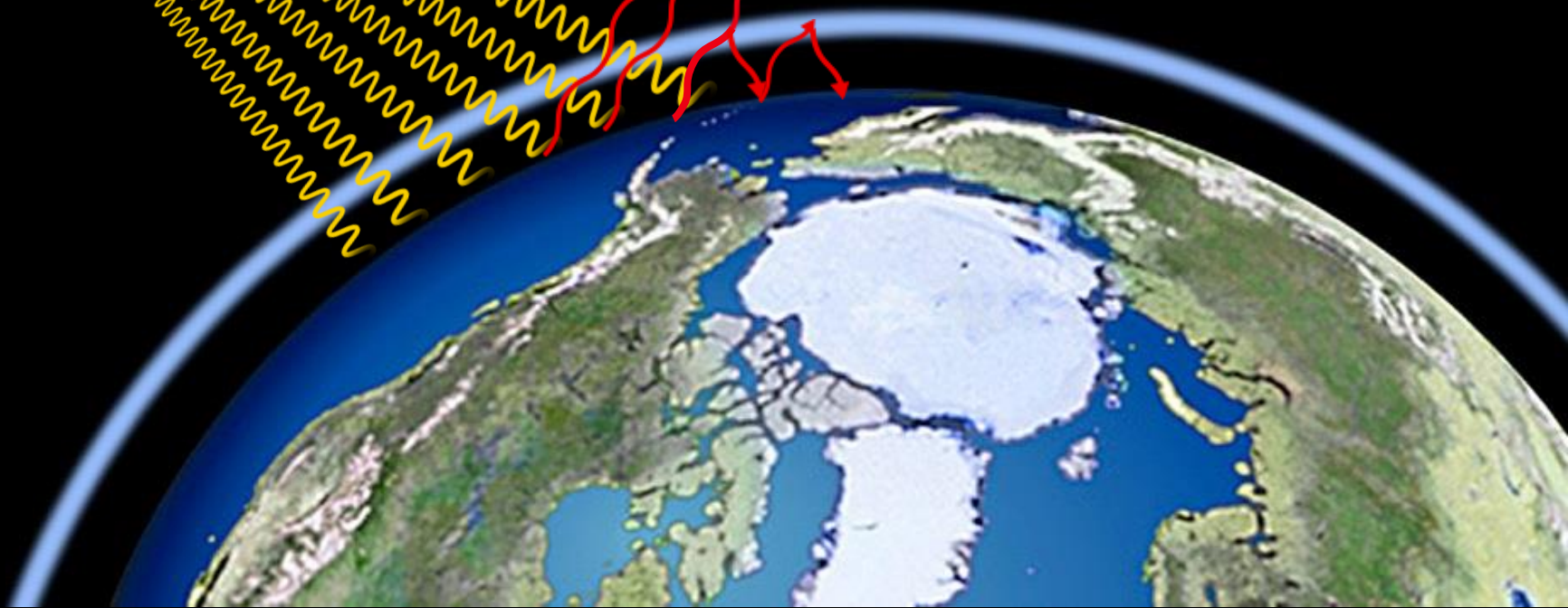
**Some of this outgoing  
infrared radiation is  
trapped by the earth's  
atmosphere and warms it**





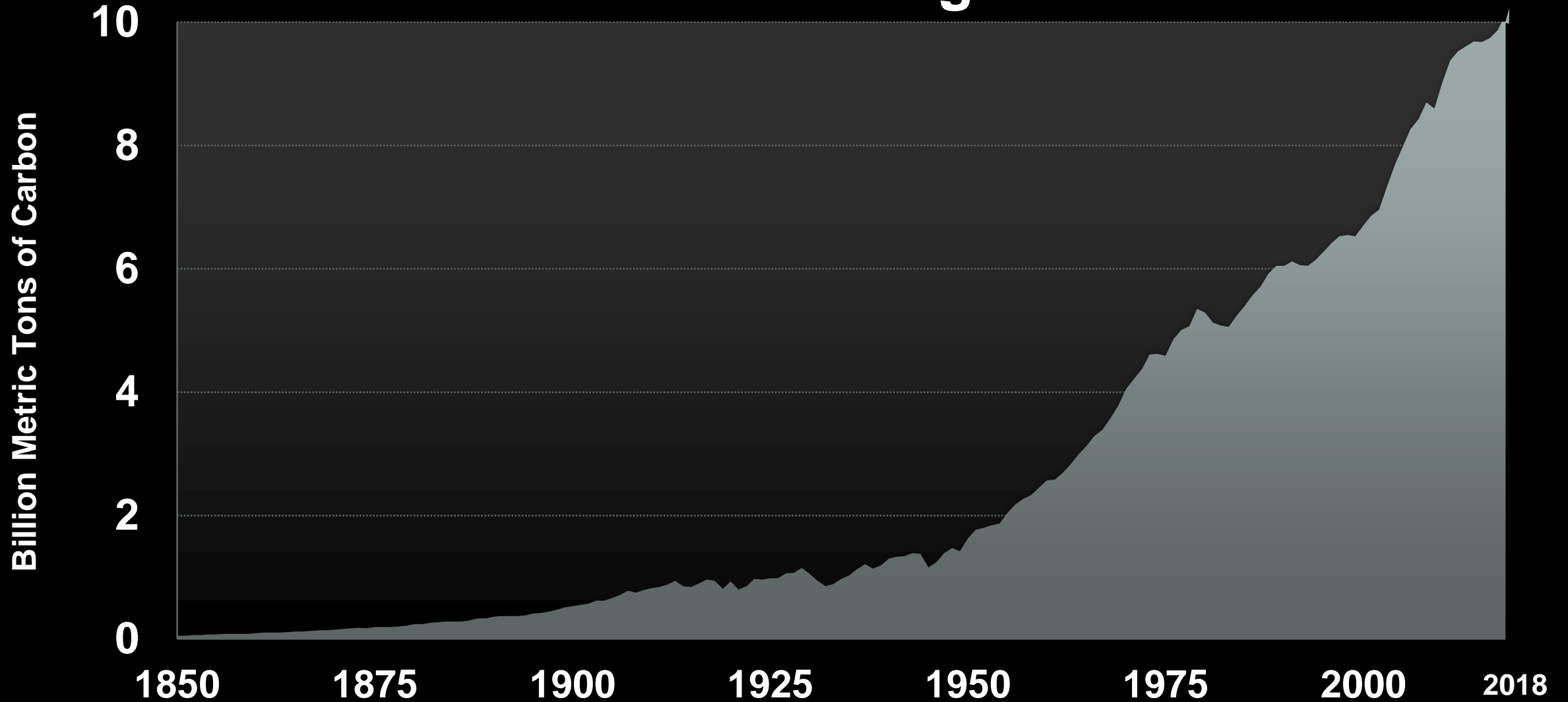


**As the CO<sub>2</sub> concentration increases, more of the outgoing infrared radiation is trapped.**





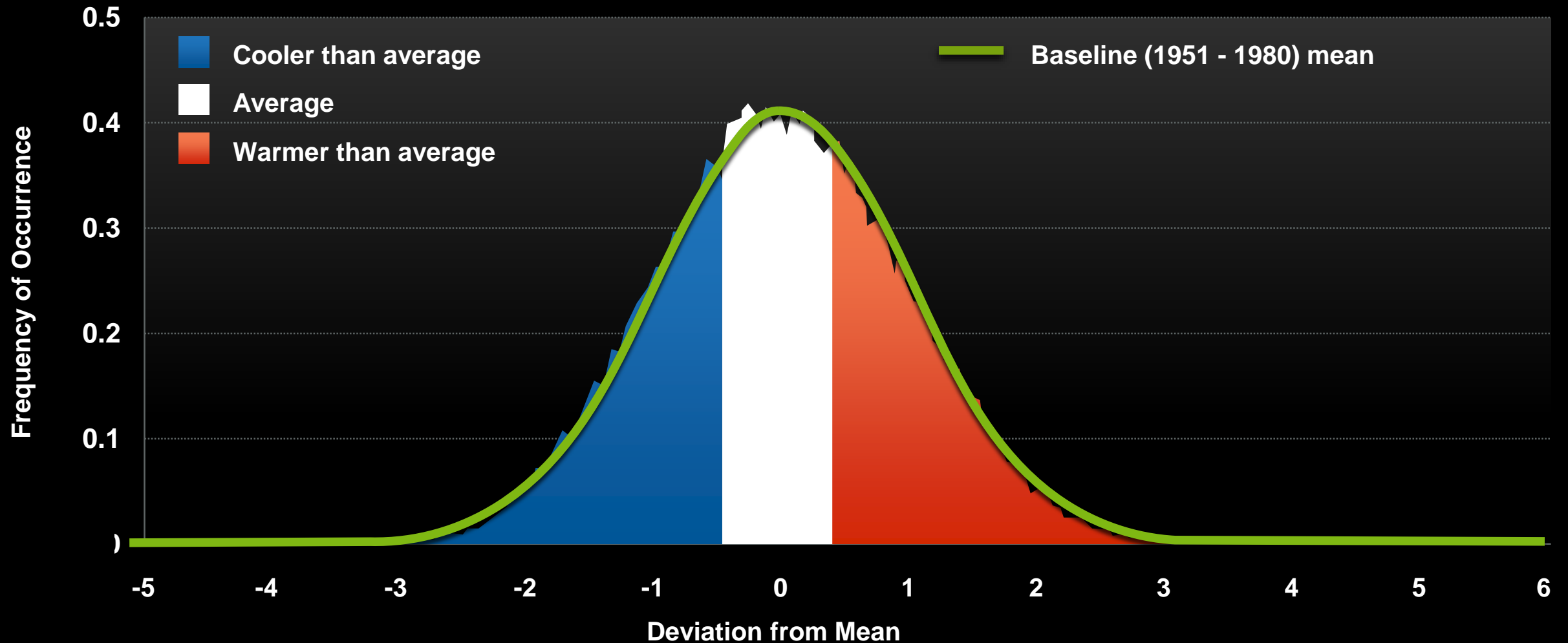
# The Largest Source of Global Warming Pollution Is the Burning of Fossil Fuels



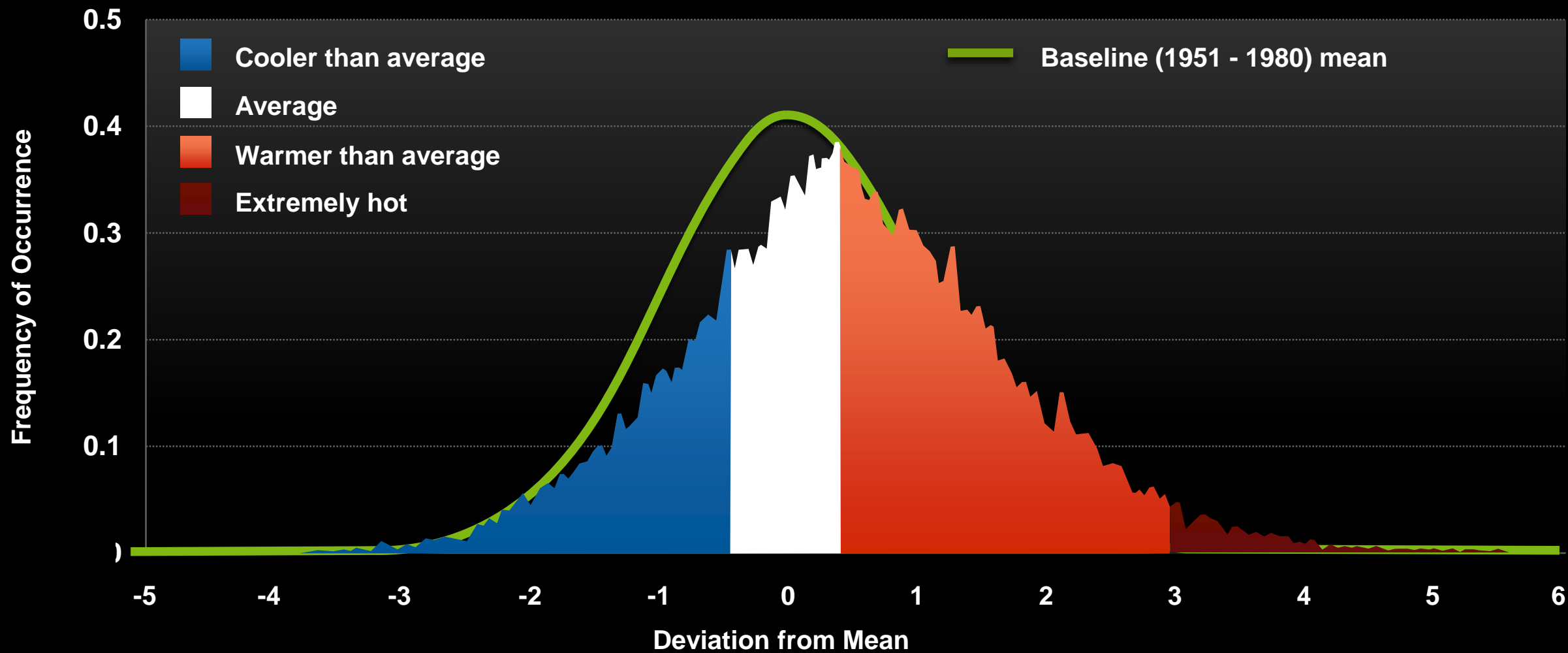
Data: U.S. Department of Energy/CDIAC

# Summer Temperatures Have Shifted

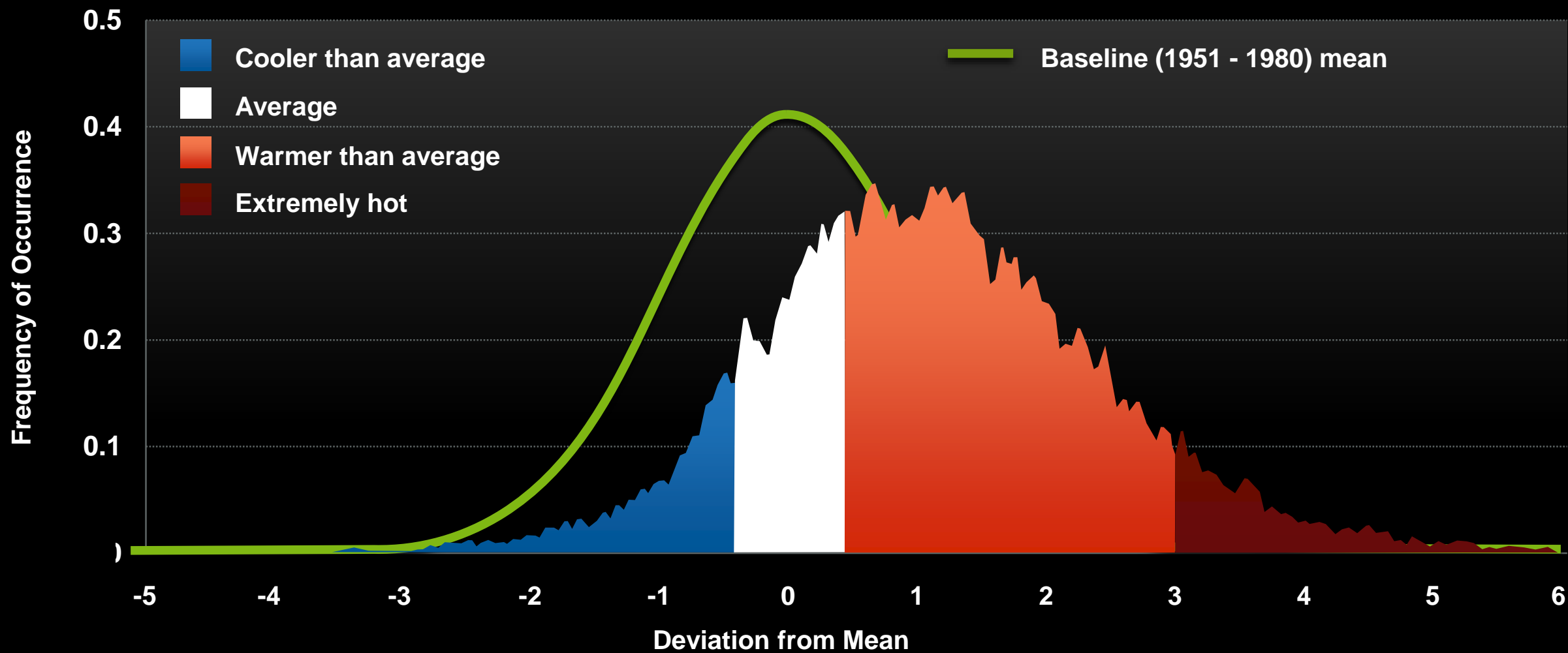
## 1951 – 1980



1983 – 1993

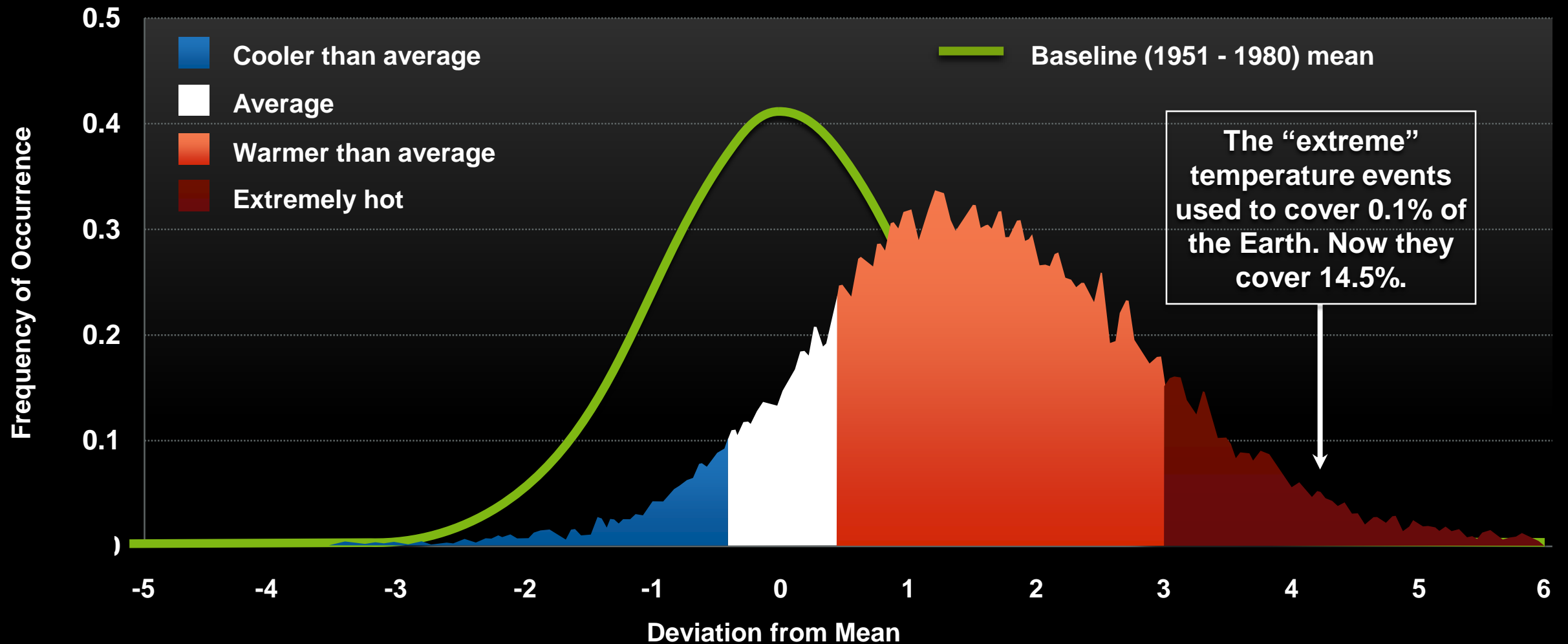


1994 – 2004



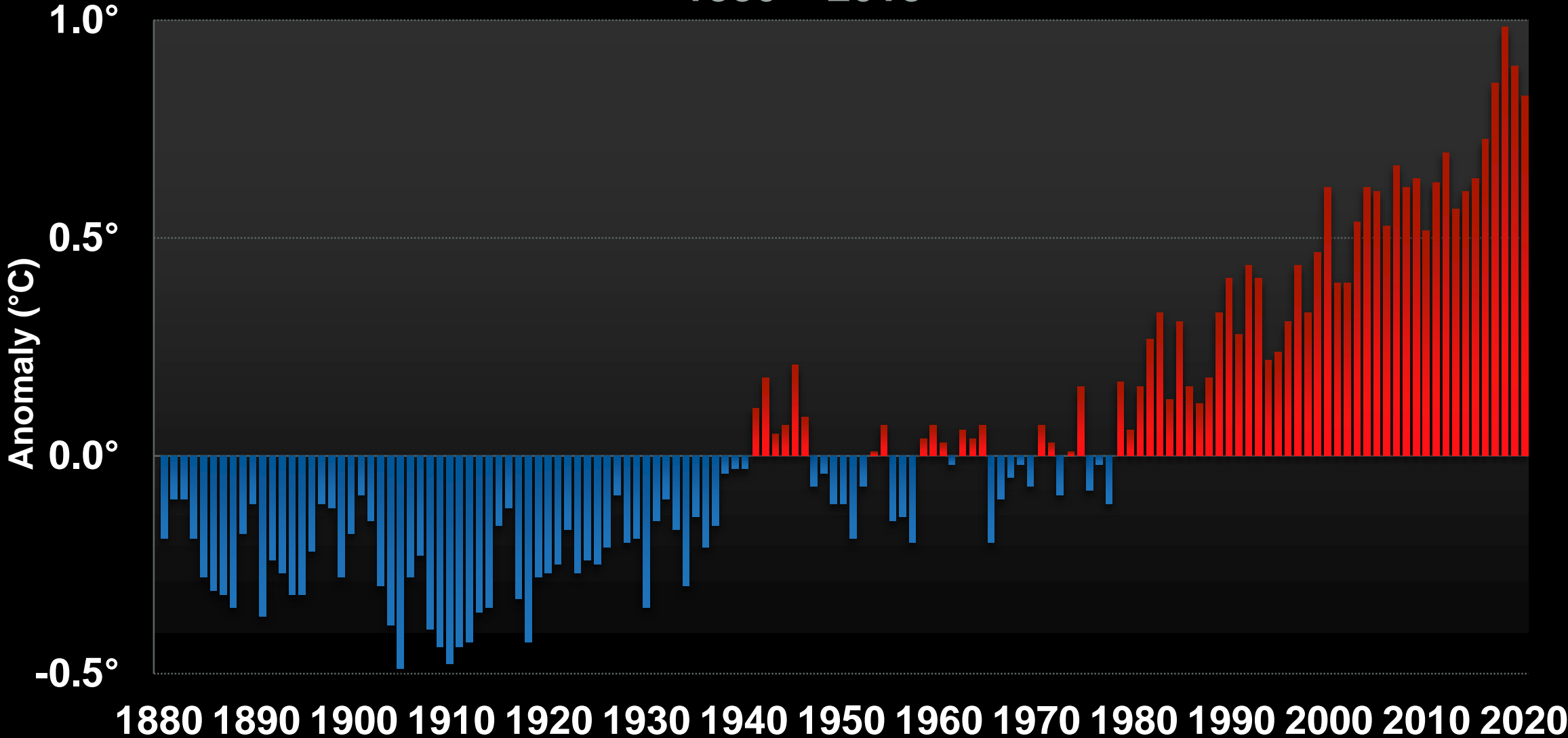


## 2005 – 2015



# Global Surface Temperature – Departure from Average

1880 – 2018



Data: National Oceanic and Atmospheric Administration

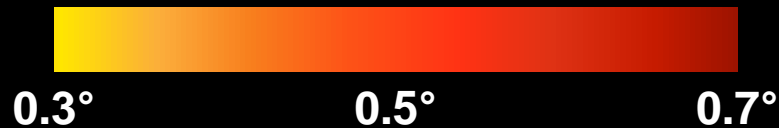
At least **224 locations** around  
the world **set all-time heat records** in 2018.



# Average Annual Temperature Increase by State

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

Temperature Change  
Since 1970 (°F per Decade)



Data: Climate Central

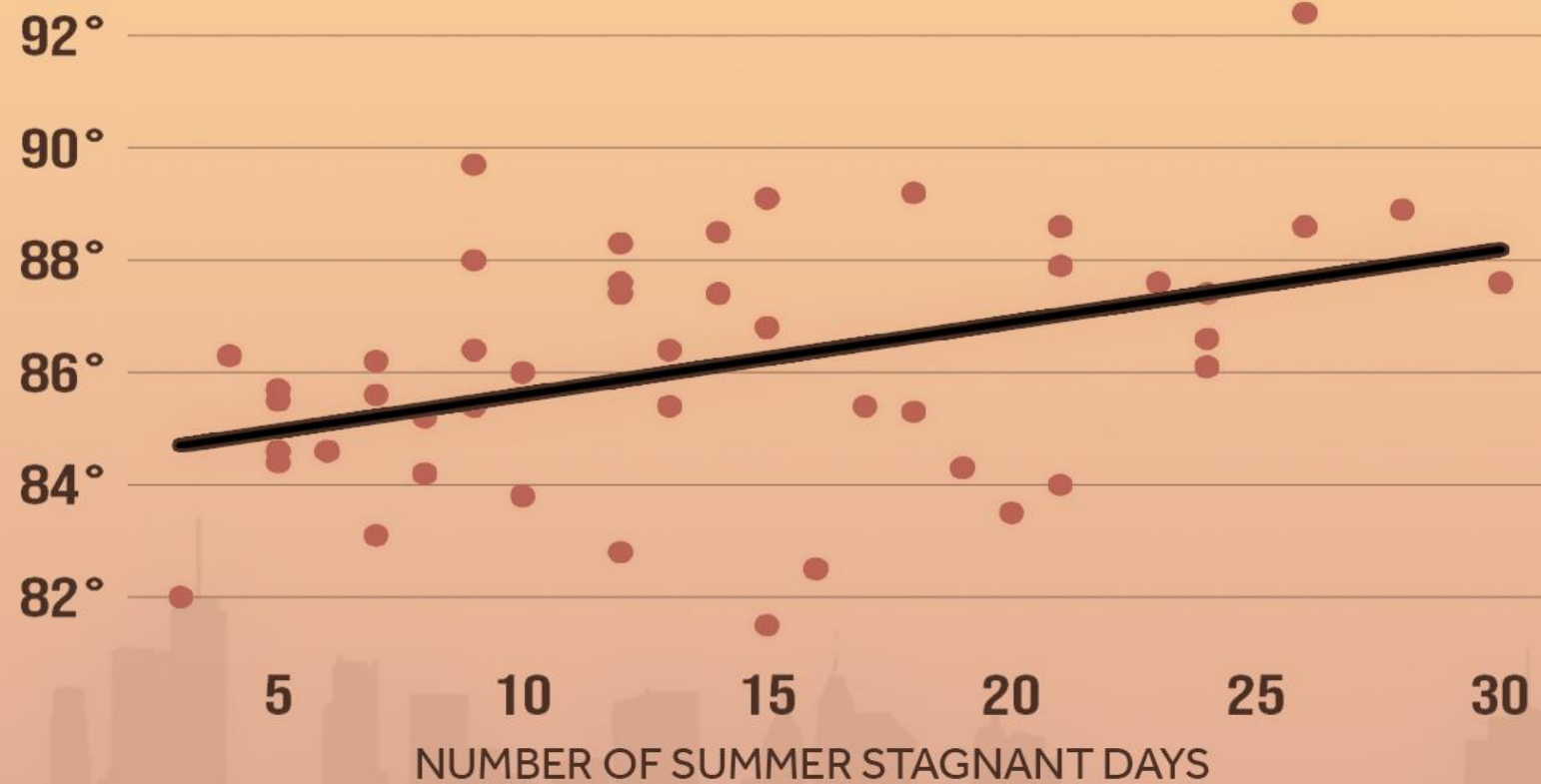
Additional Data: *Colorado Climate Change Vulnerability Study*, University of Colorado, Boulder and Colorado State University



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

# DENVER HIGHER TEMPERATURES = MORE STAGNANT AIR

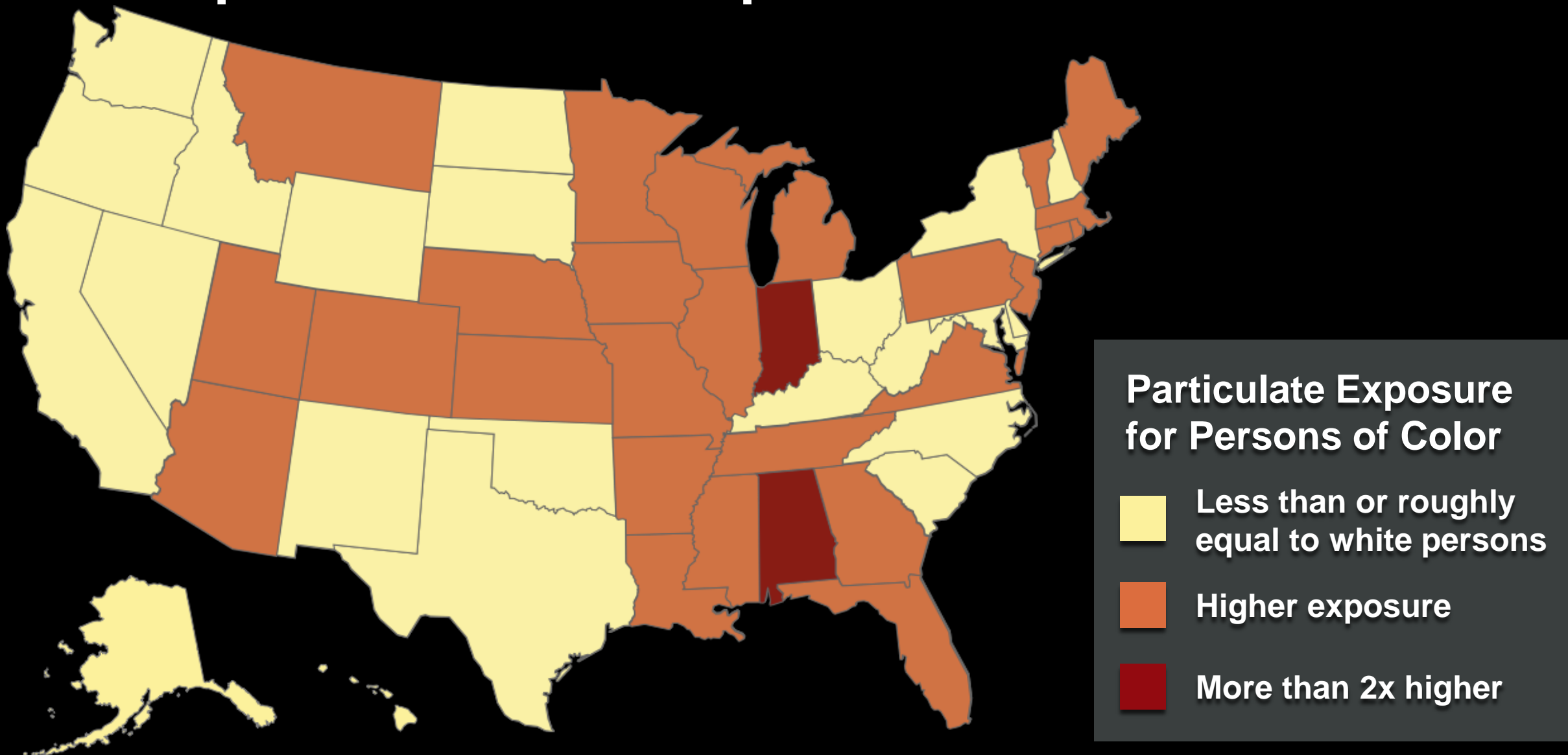
SUMMER MAXIMUM TEMPERATURES SINCE 1973



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



Data: Mikati et al, 2018; Inside Climate News

Soil Moisture in 2095 Compared  
to 20th Century Average





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



**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.**



# Lakewood, Colorado

November 28, 2016





# Boulder, Colorado

September 14, 2013





# 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

Like 1 Share

Reply





# Cordoba, Mexico

November 5, 2018

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





# *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



652

# The Central American “Dry Corridor”

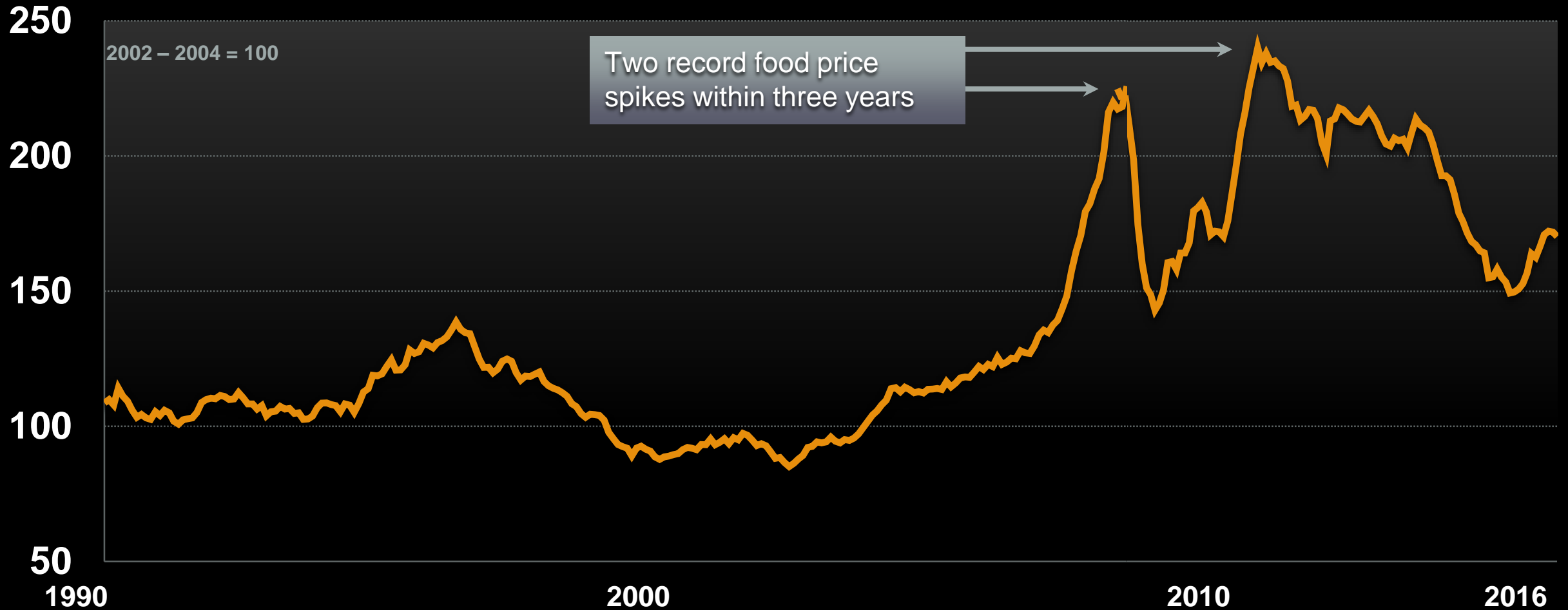


Honduras was ranked #1  
of all 184 countries on the  
Global Climate Risk Index.  
Nicaragua was ranked #4.



# FAO Food Price Index

## 1990 – December 2016



**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**

# Global Wind Energy Capacity

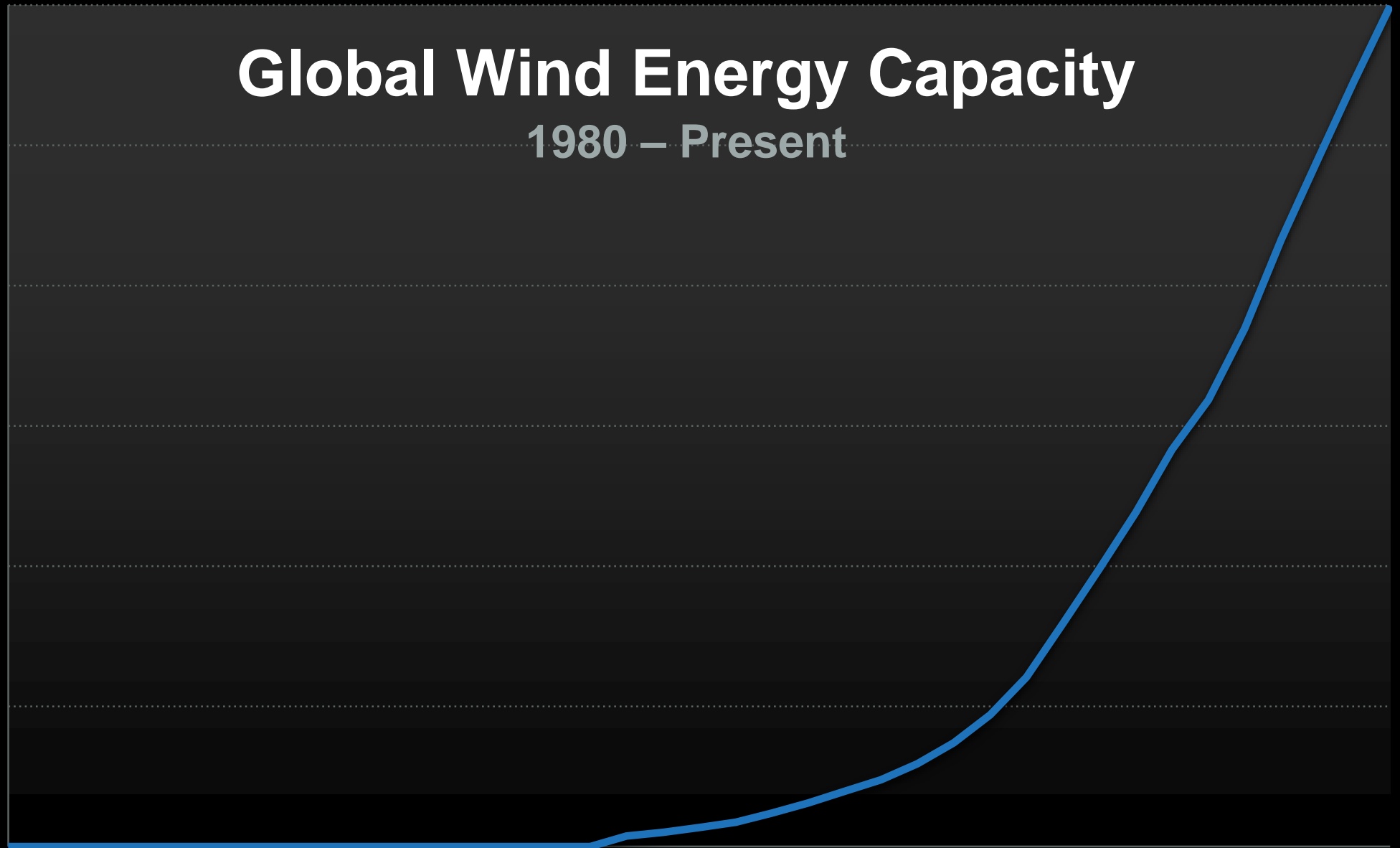
1980 – Present

Wind Capacity (Megawatts)

600,000  
500,000  
400,000  
300,000  
200,000  
100,000  
0

1980 1985 1990 1995 2000 2005 2010 2015 2018

Data: Earth Policy Institute/Bloomberg New Energy Finance



# Solar Energy Progress

How Do Projections Compare With Reality?

## 2002 Projection

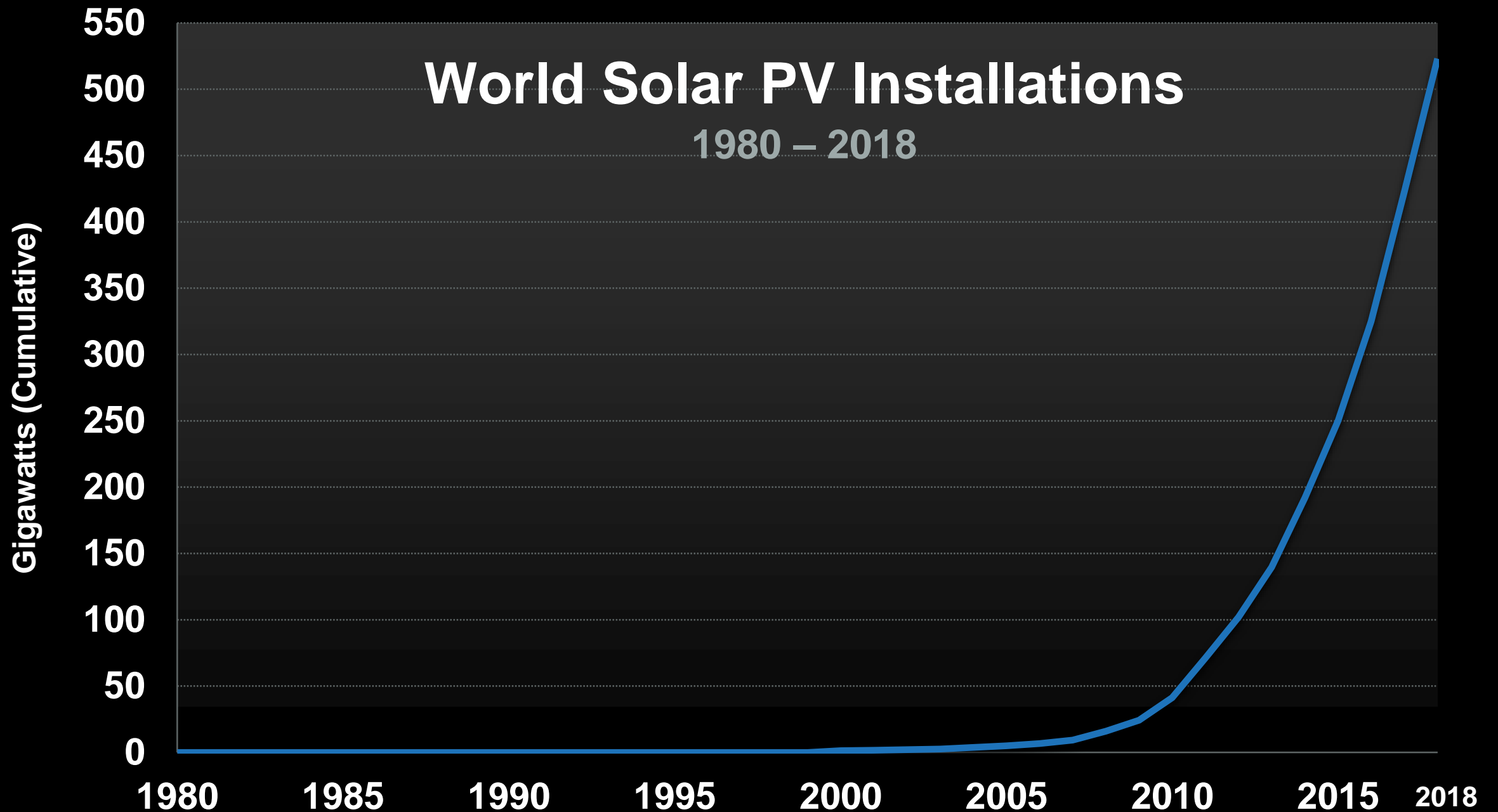
The solar  
energy market  
will grow one  
gigawatt per  
year by 2010

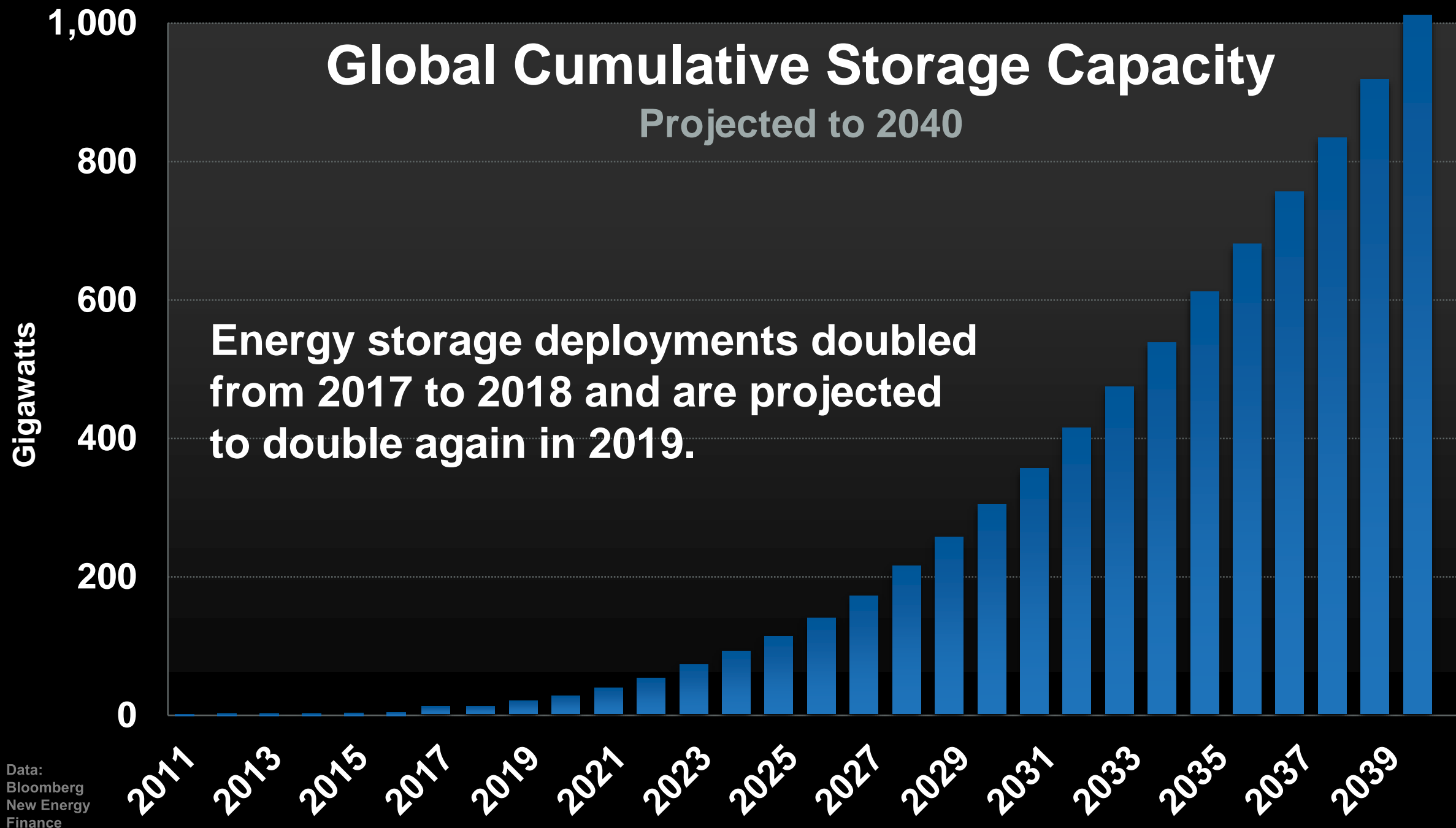
## Reality

The reality is  
that in 2018 it was  
exceeded by

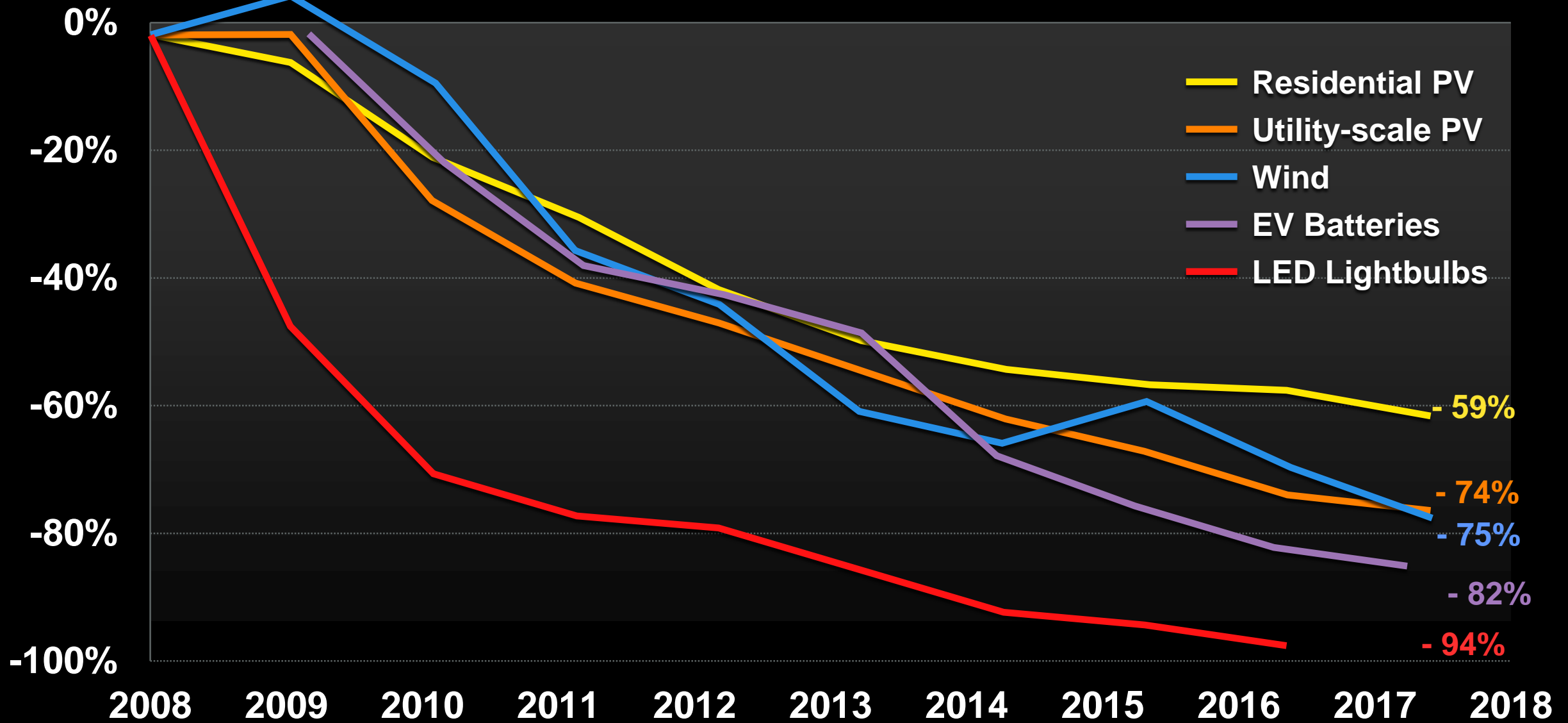
**109x**







# Cost of Clean Energy Technologies in the U.S.



**“Solar installer”**  
is forecast to be the  
**fastest-growing job**  
category in the U.S.  
through 2026, and  
**“wind turbine service  
technician” is  
second.**

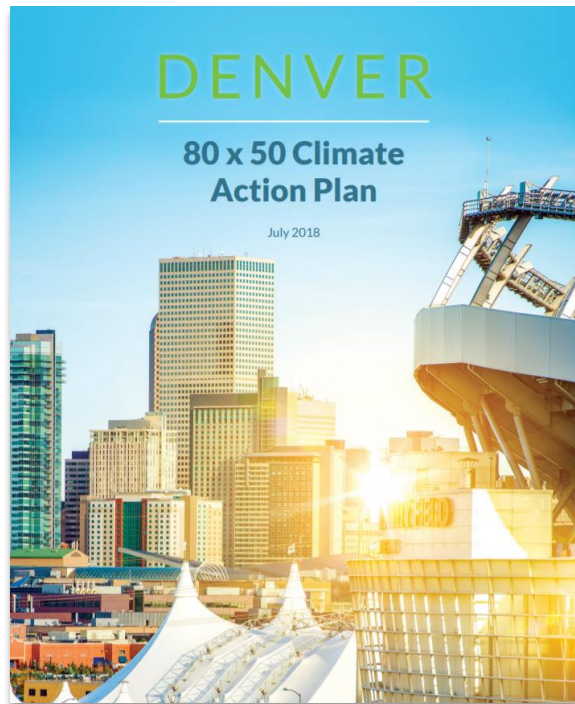


# Climate Goals and Greenhouse Gas Emissions Data



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



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

# Moving quickly to reduce emissions also reduces harm

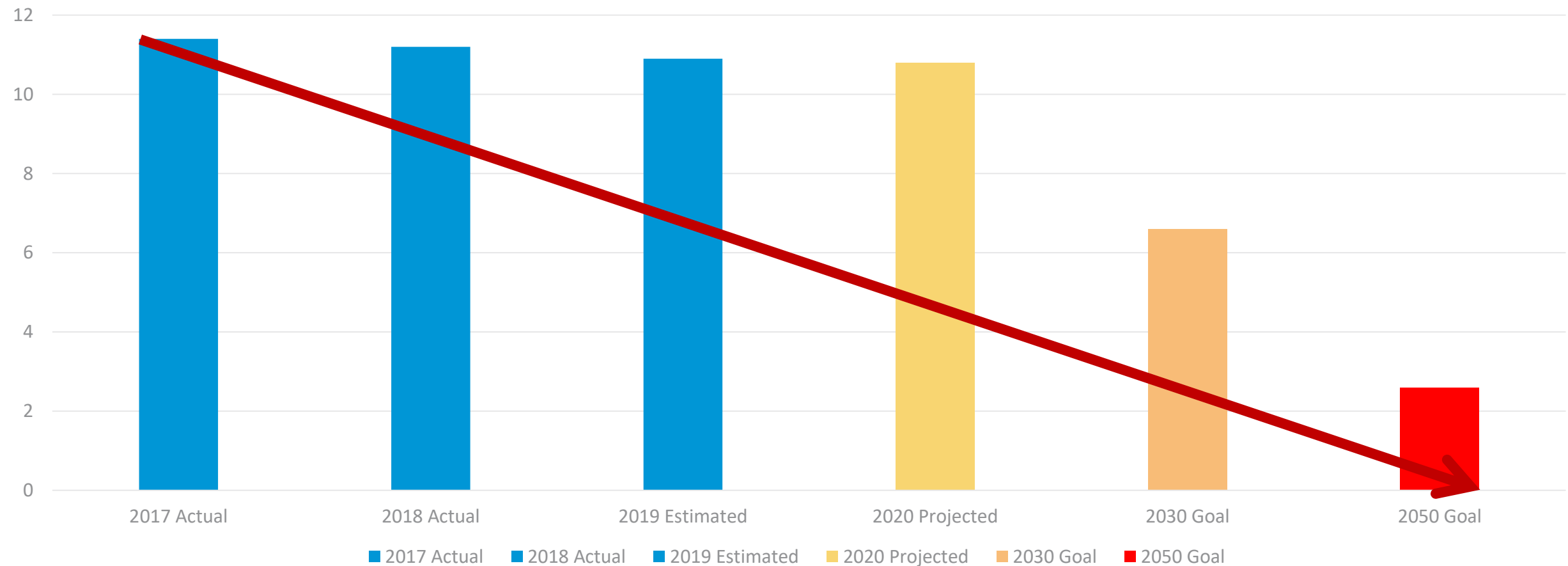
Stark differences between 1.5C and 2C of warming according to the latest IPCC report.

Source: Carbon Brief

<https://www.carbonbrief.org/category/in-focus/infographics>

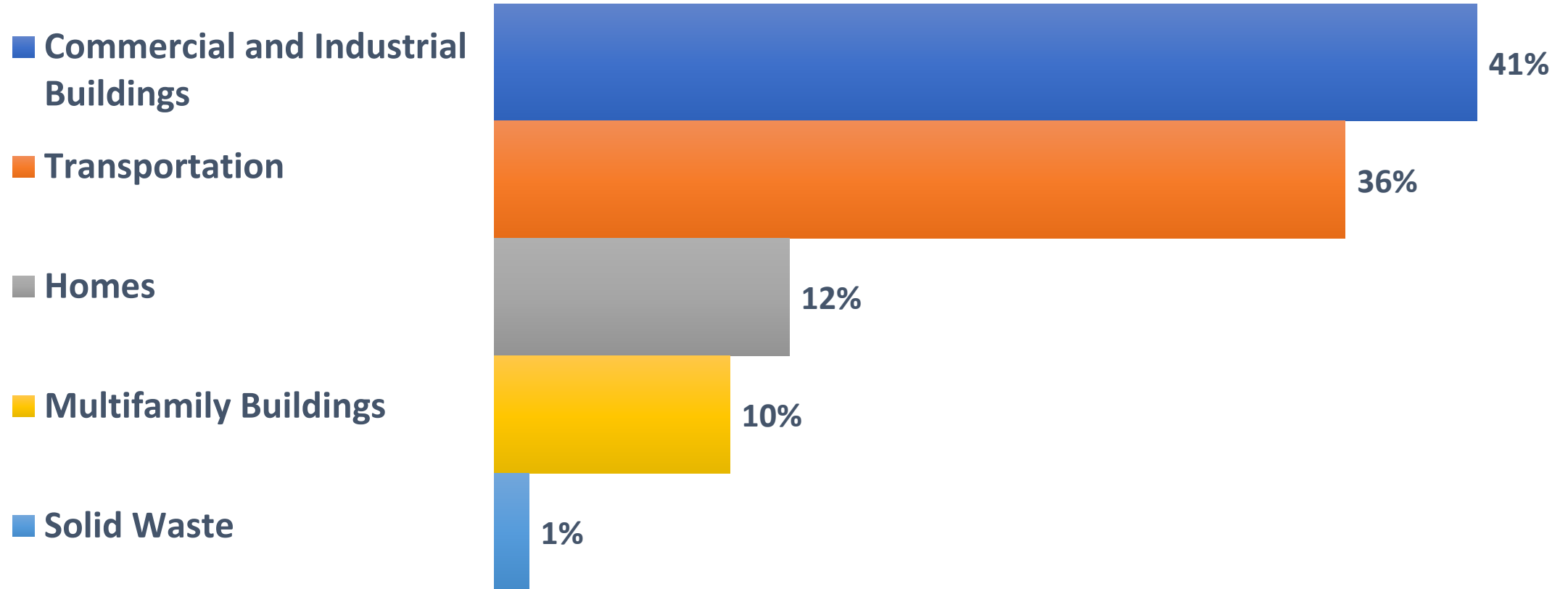


GHG Emissions (MMTCO2e)



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



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



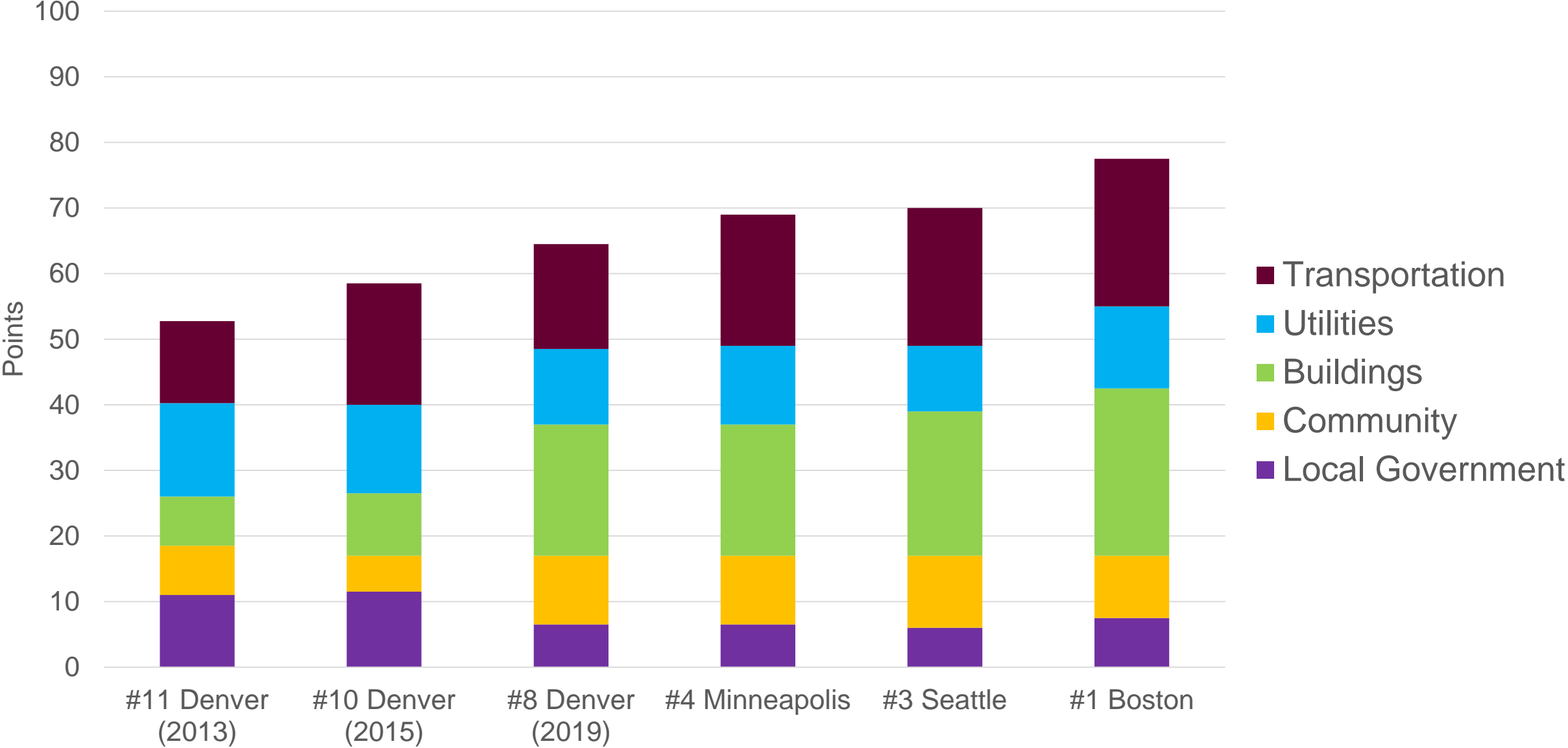
Denver recognized as a “Solar Star”, ranking # 9 in the country for amount of solar installed



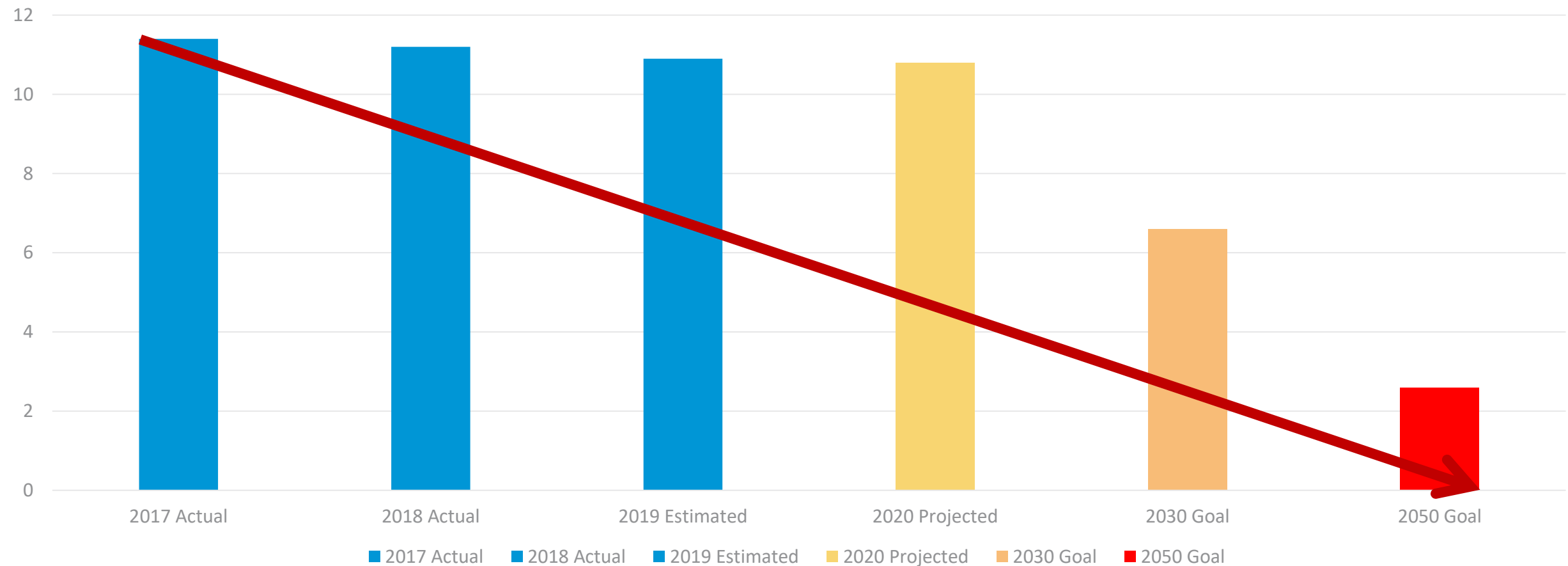
One of 43 global cities named to the first-ever Cities A List for climate reporting

# American Council for an Energy Efficient Economy

## City Scorecard



GHG Emissions (MMTCO2e)



IPCC requires ZERO emissions by 2050

# Buildings and Homes

August 14<sup>th</sup>, 2019



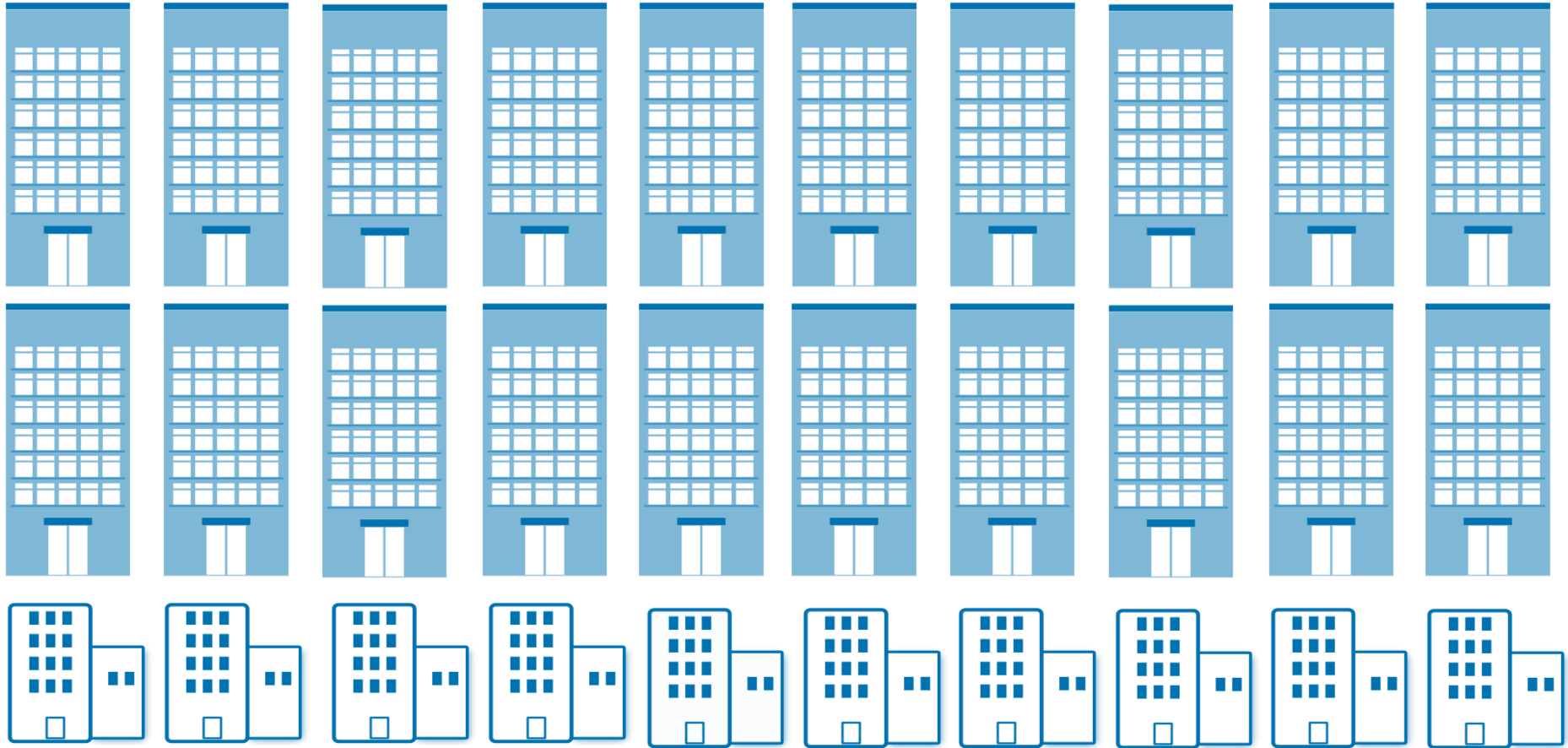


# Existing Buildings and Homes

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

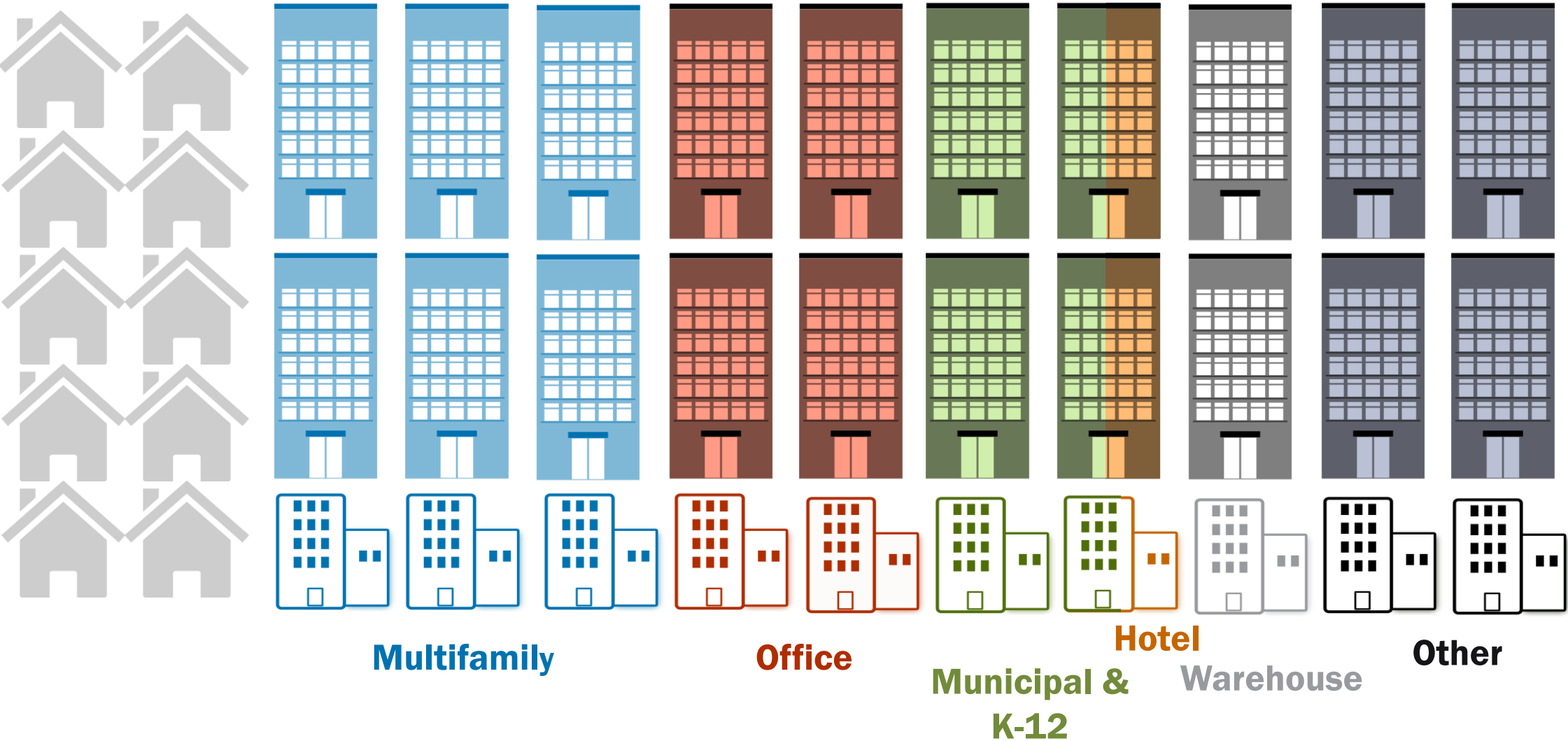


12% GHG

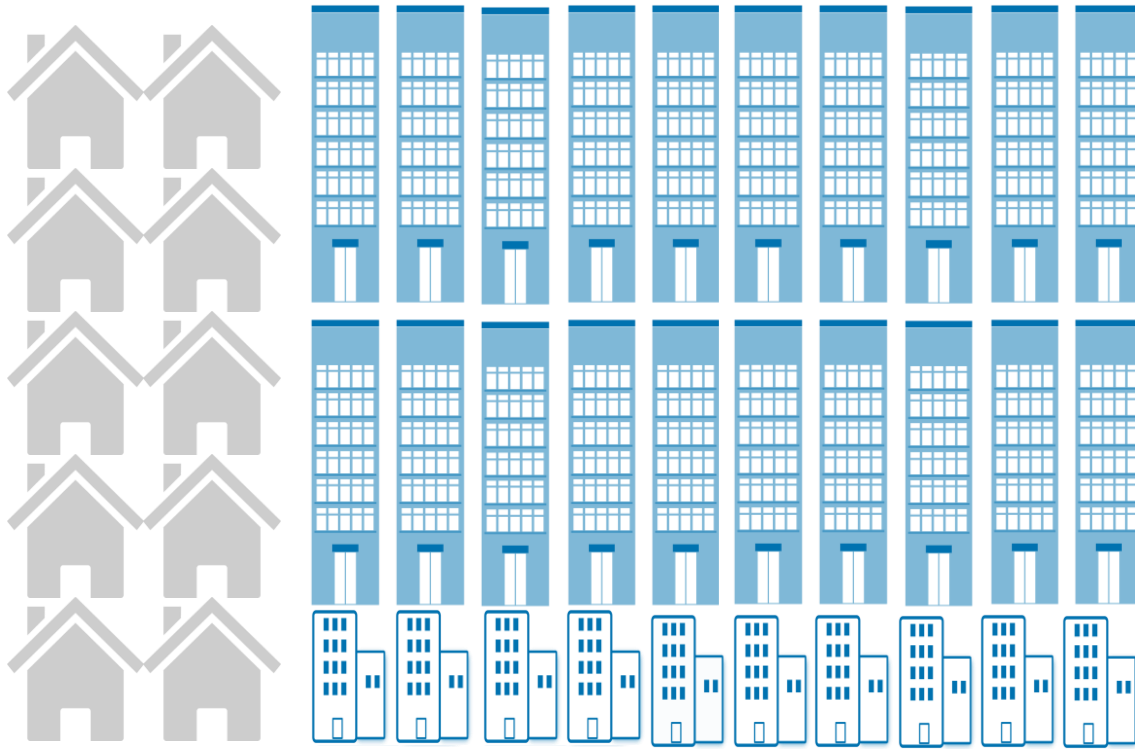


51% GHG

# 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.



LEARN MORE AT  
[energystar.gov](http://energystar.gov)

# ENERGY STAR<sup>®</sup> Scorecard

# 66

ENERGY STAR<sup>®</sup>  
Score

## City and County Building

**Primary Function:** Courthouse  
**Gross Floor Area (ft<sup>2</sup>):** 419,387  
**Built:** 1980

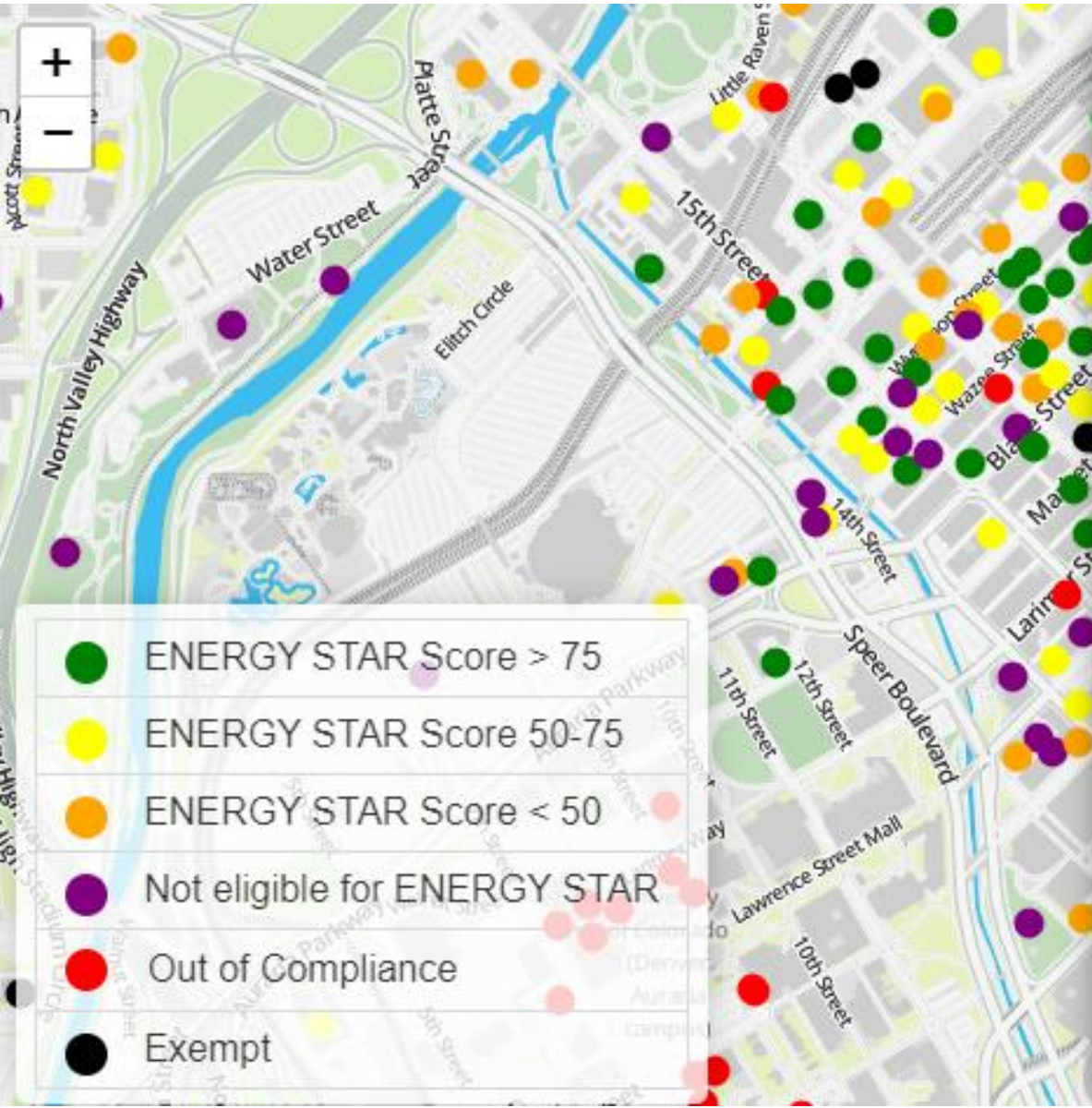
**Property Address:**  
City and County Building  
1431 Bannock St  
Denver, Colorado 80202

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





# Benchmarking Data: [www.energizedenver.org](http://www.energizedenver.org)



## Wellington Webb Municipal Office Building

201 W Colfax Avenue

ENERGY STAR Score

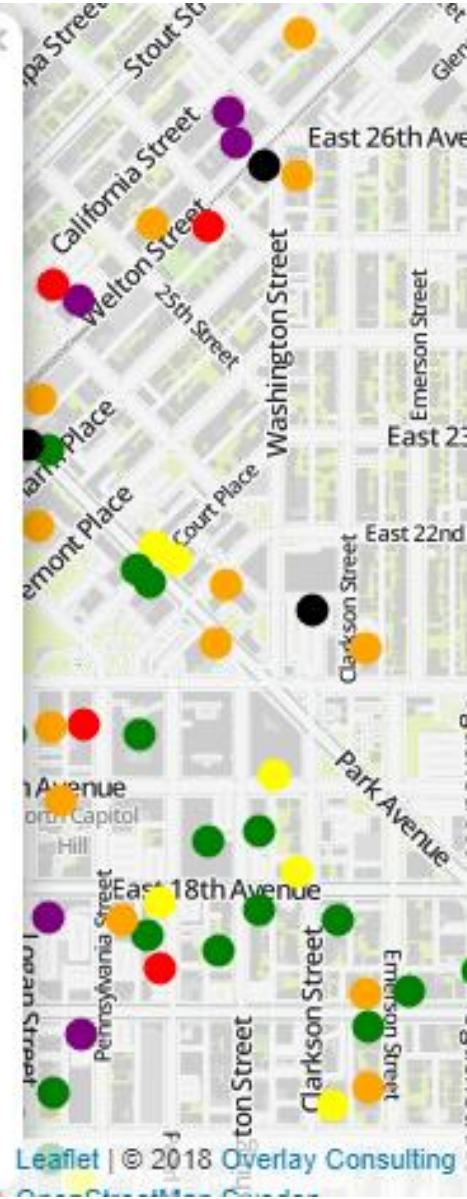
**86**

This building has the 3rd highest  
ENERGY STAR score out of 22  
Municipal Buildings in Denver.

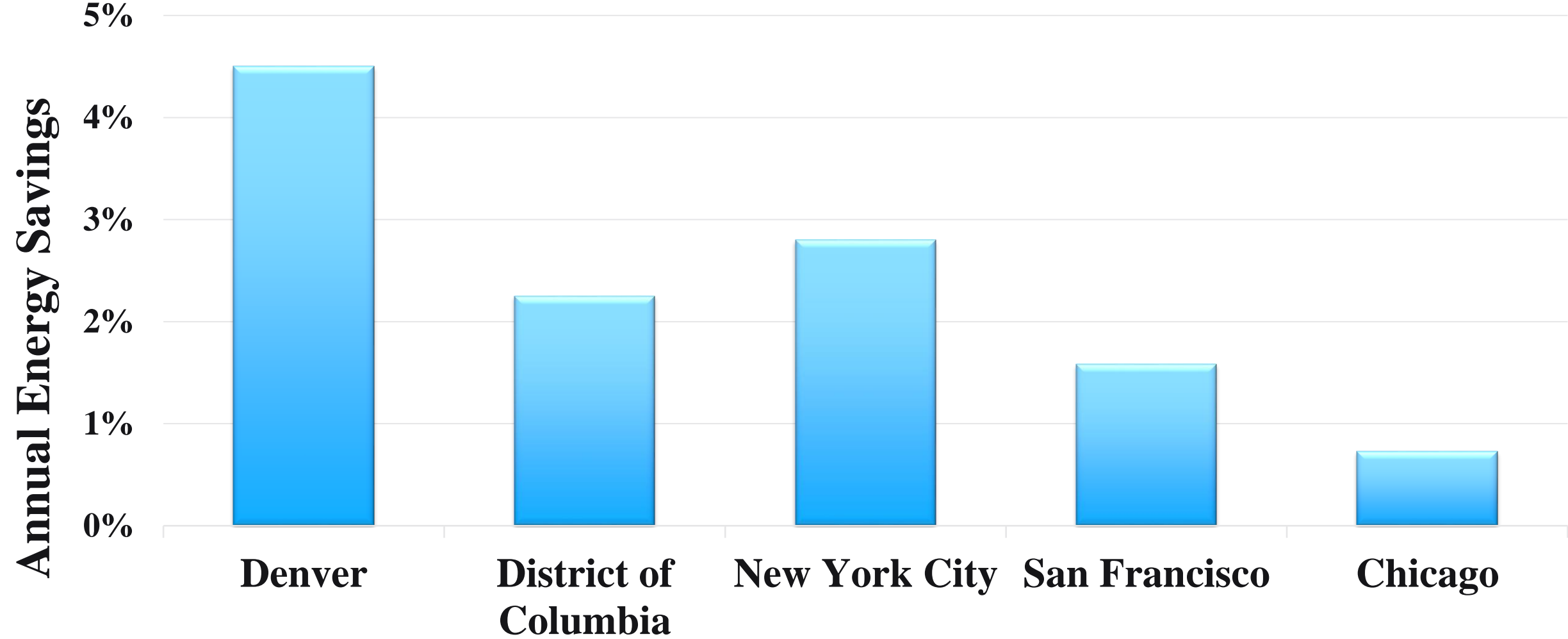
To achieve our City's Climate goals all  
buildings need to become 30% more  
energy efficient, which could annually  
save this building **\$310,433**

[Similar Buildings](#)

[More Information](#)

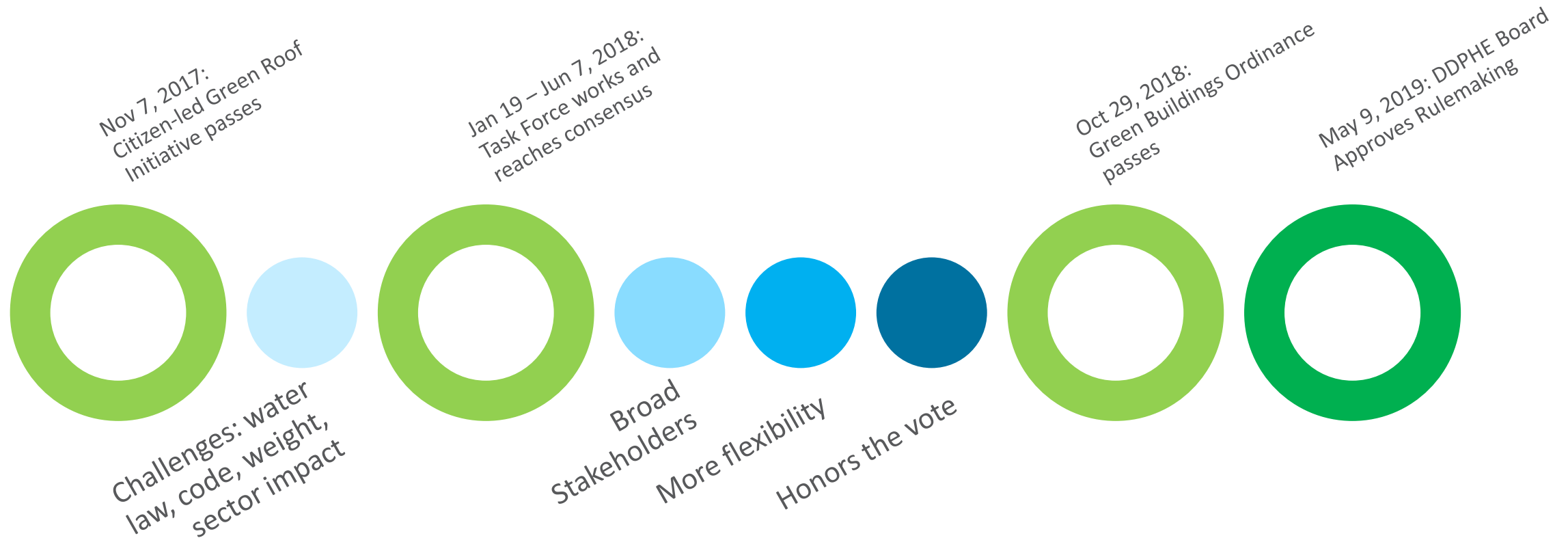


# Comparing Benchmarking Programs Nationwide





# 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



**Green Roof / Space**



**Pay for Offsite Green**



**Solar or Energy Efficiency**



**Certification**



**Energy Program**

# 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**



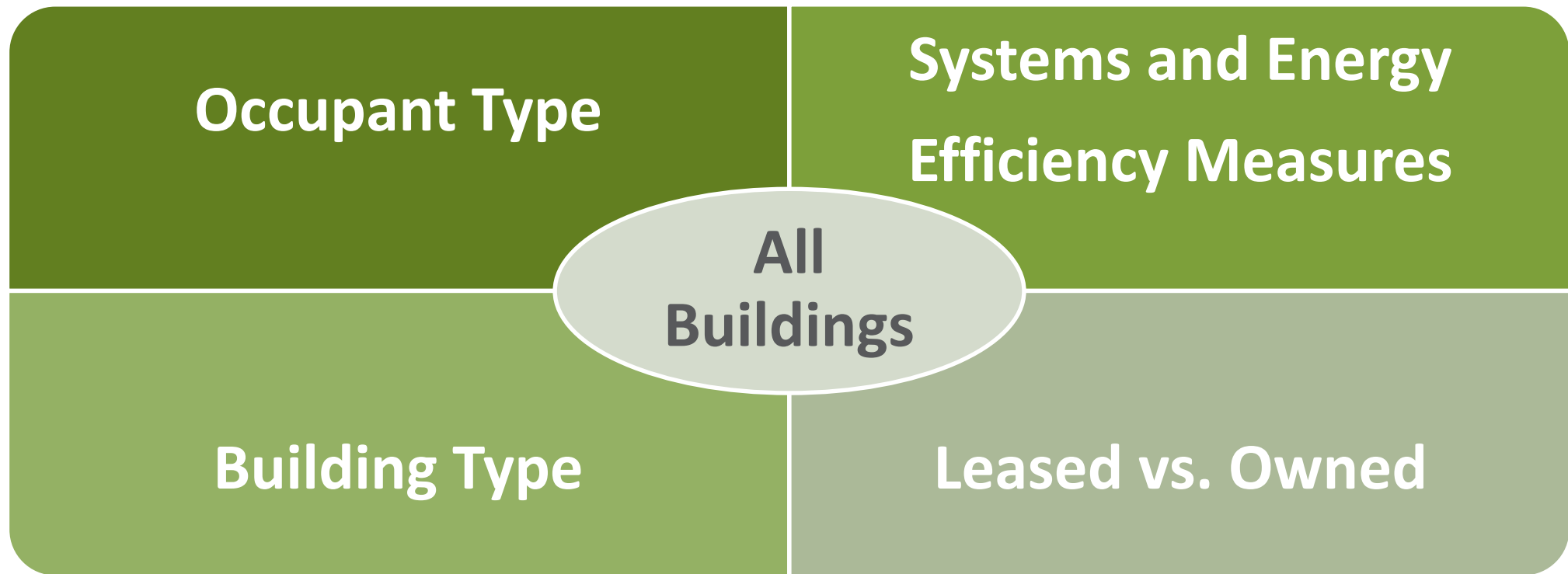
**Onsite / Offsite Solar**



**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.

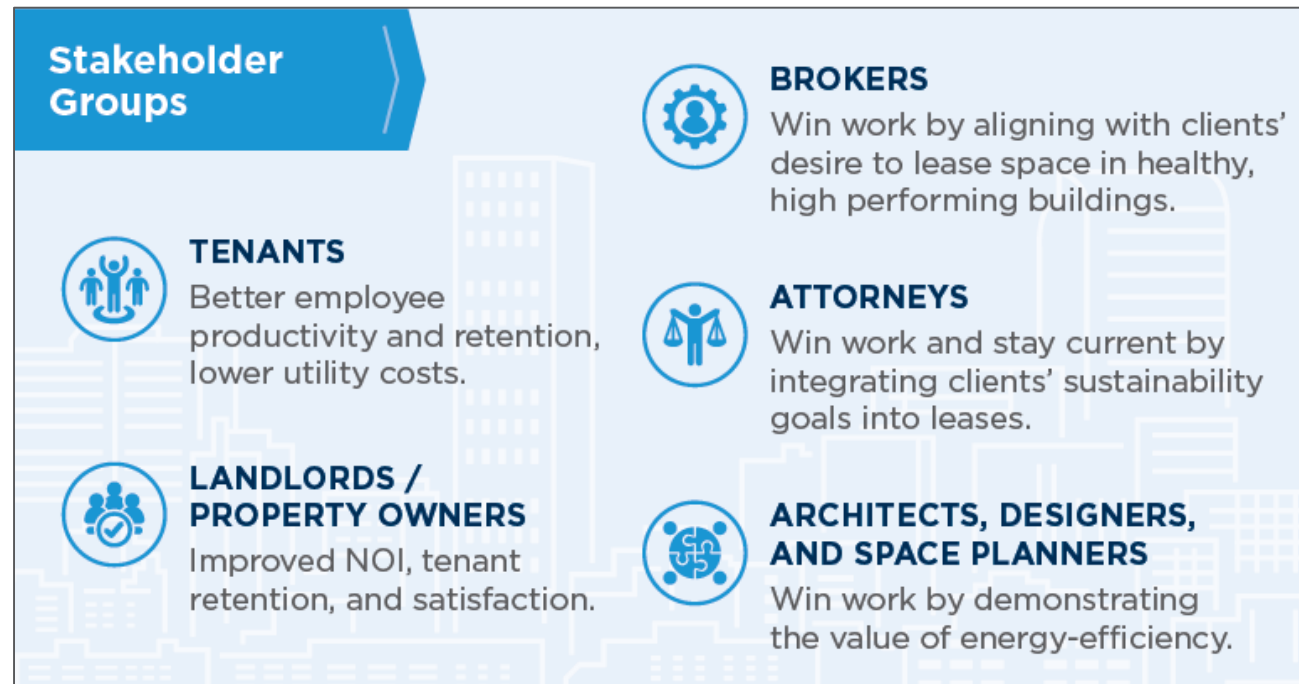




# SMART LEASING DENVER

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



# Smart Leasing Pledge!

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



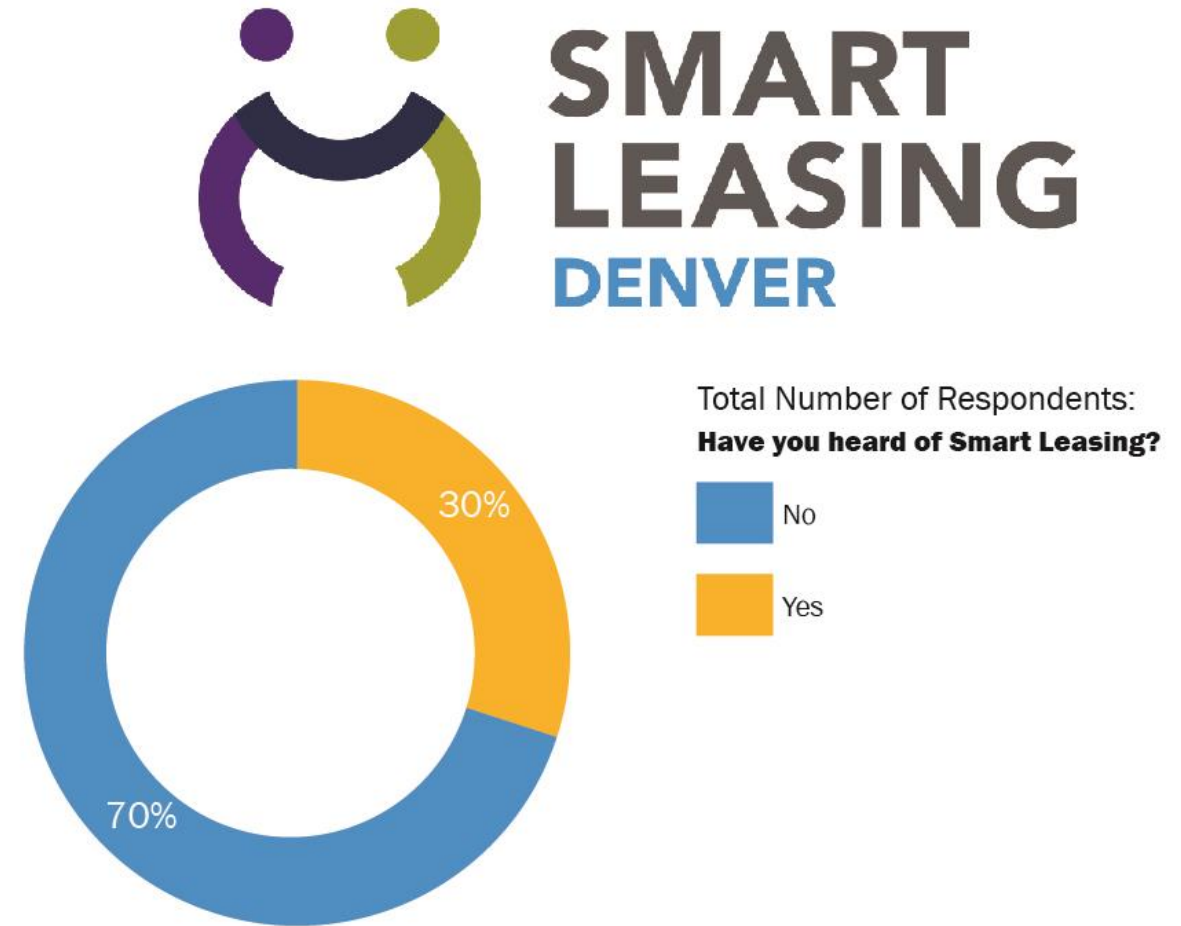
## Resources:

- 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.



# 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](http://www.copace.com)





# General Services Municipal Building Plans

Energy Performance Contracting

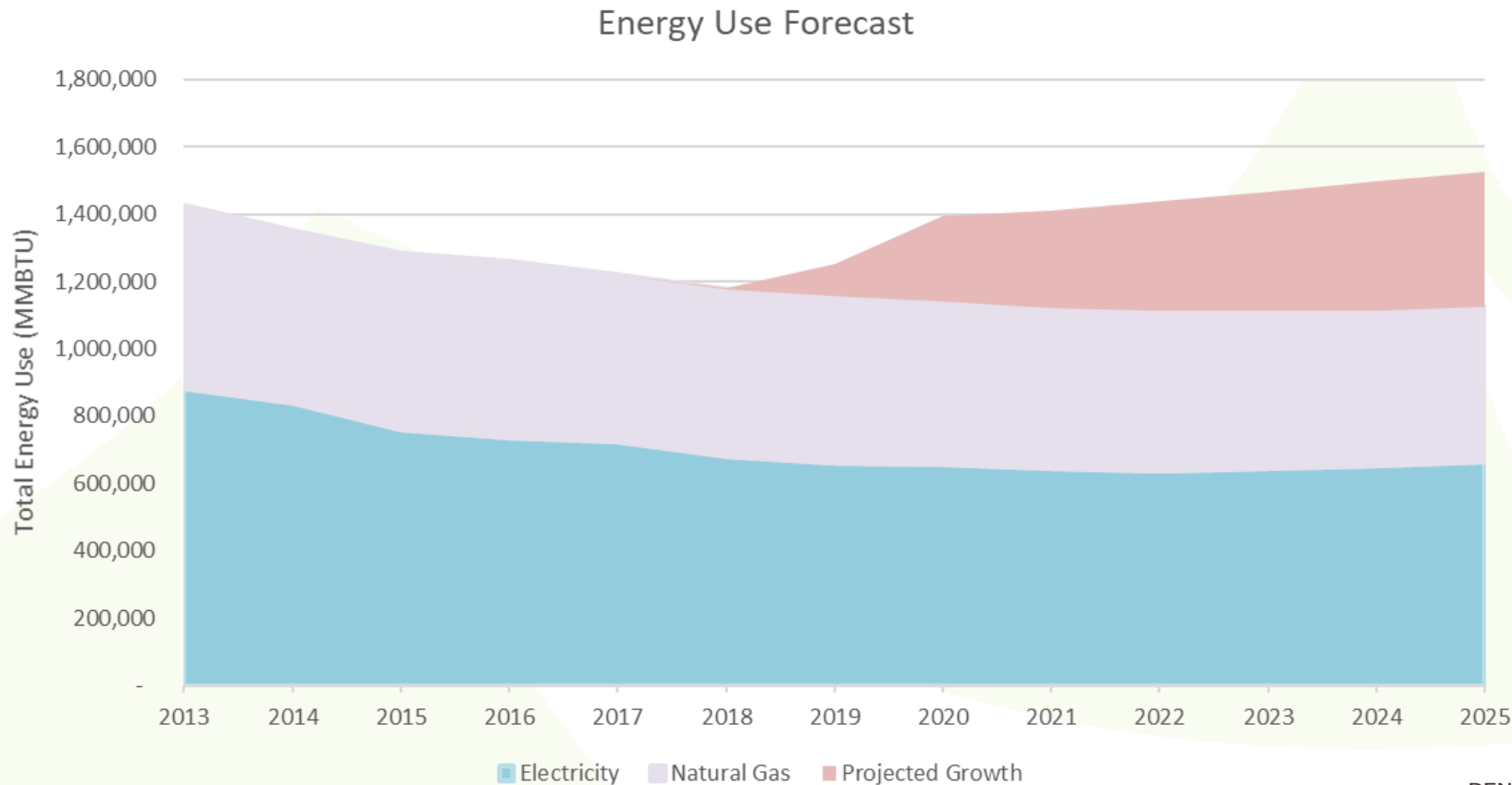
Facility Condition and Assessment Program

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

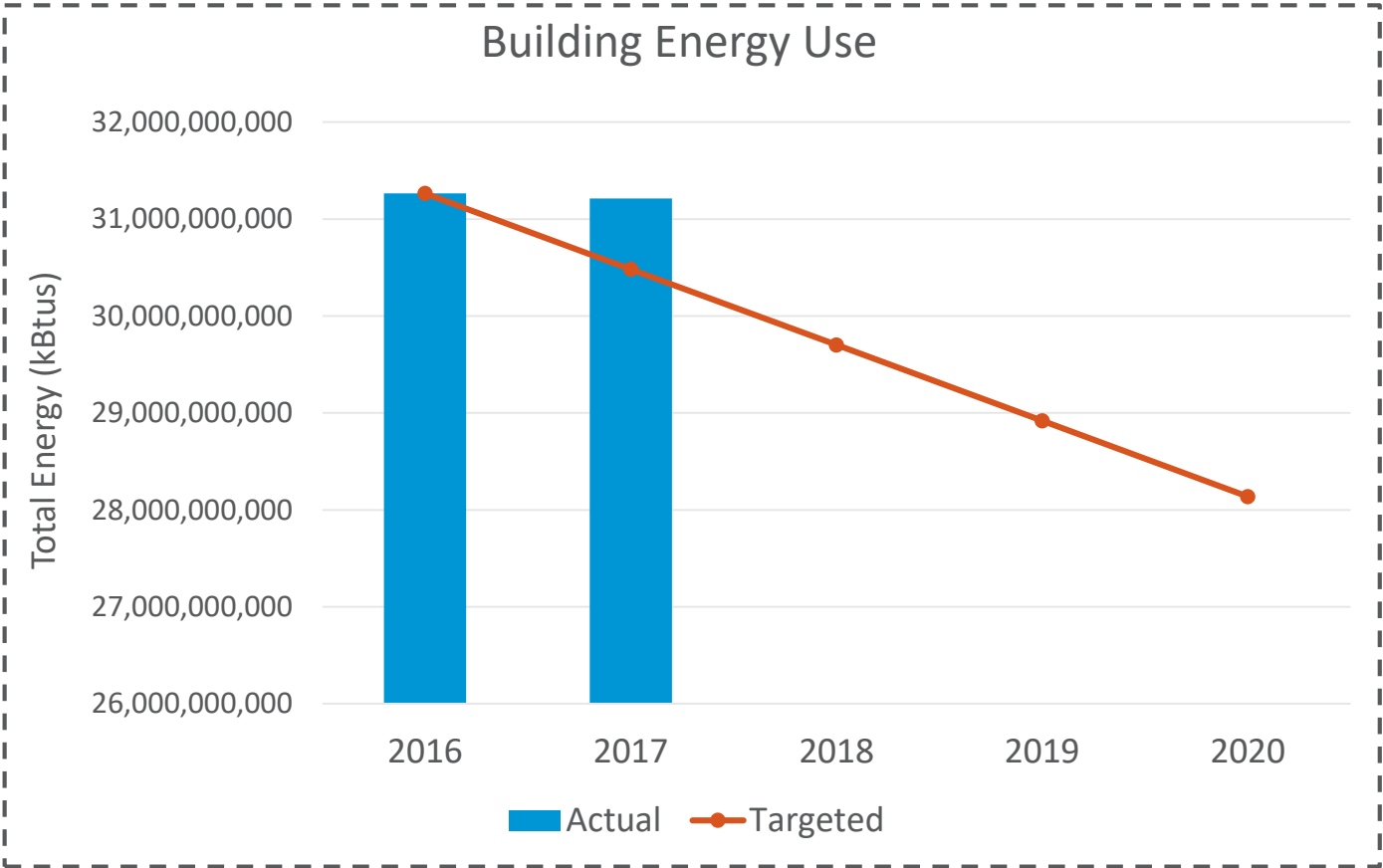
- Comprehensive energy audits/Energy Performance Contract
- New large-scale solar project
- Planning first net-zero energy building
- DEN Real Estate energy goals
- Xcel Community Resiliency Initiative application



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

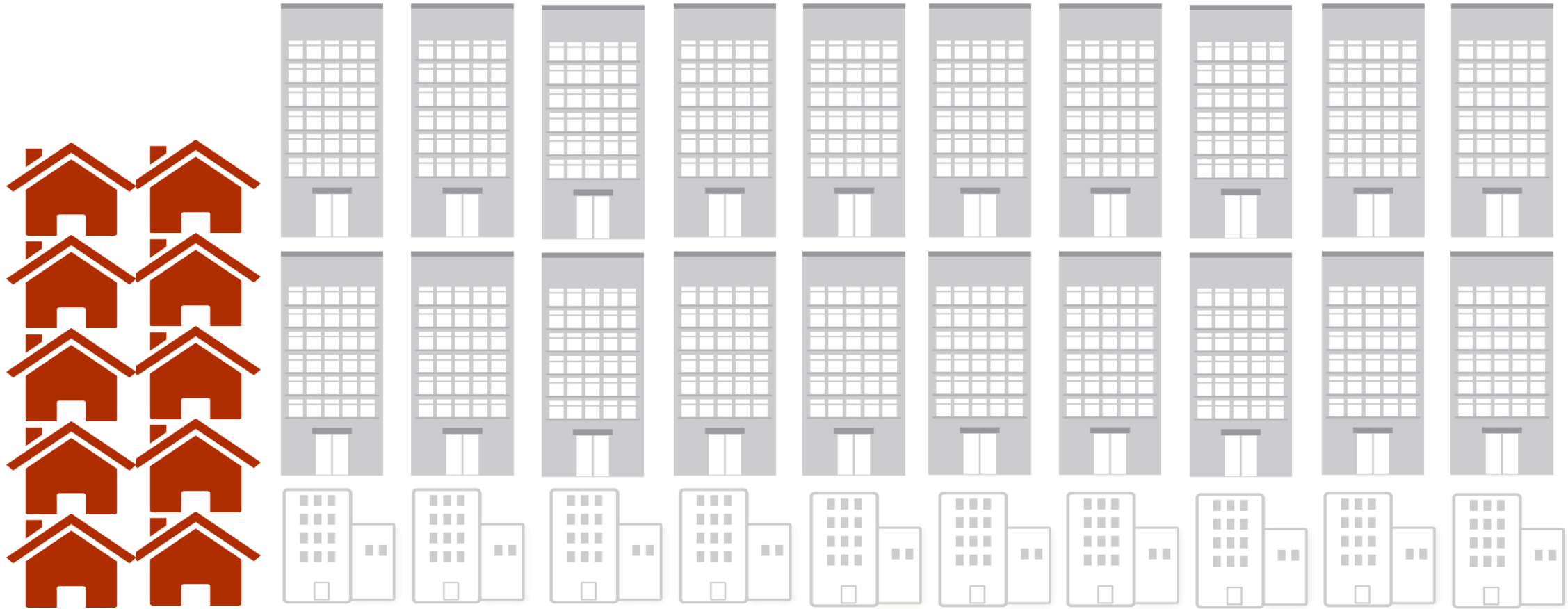
From 2016 to 2017:

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





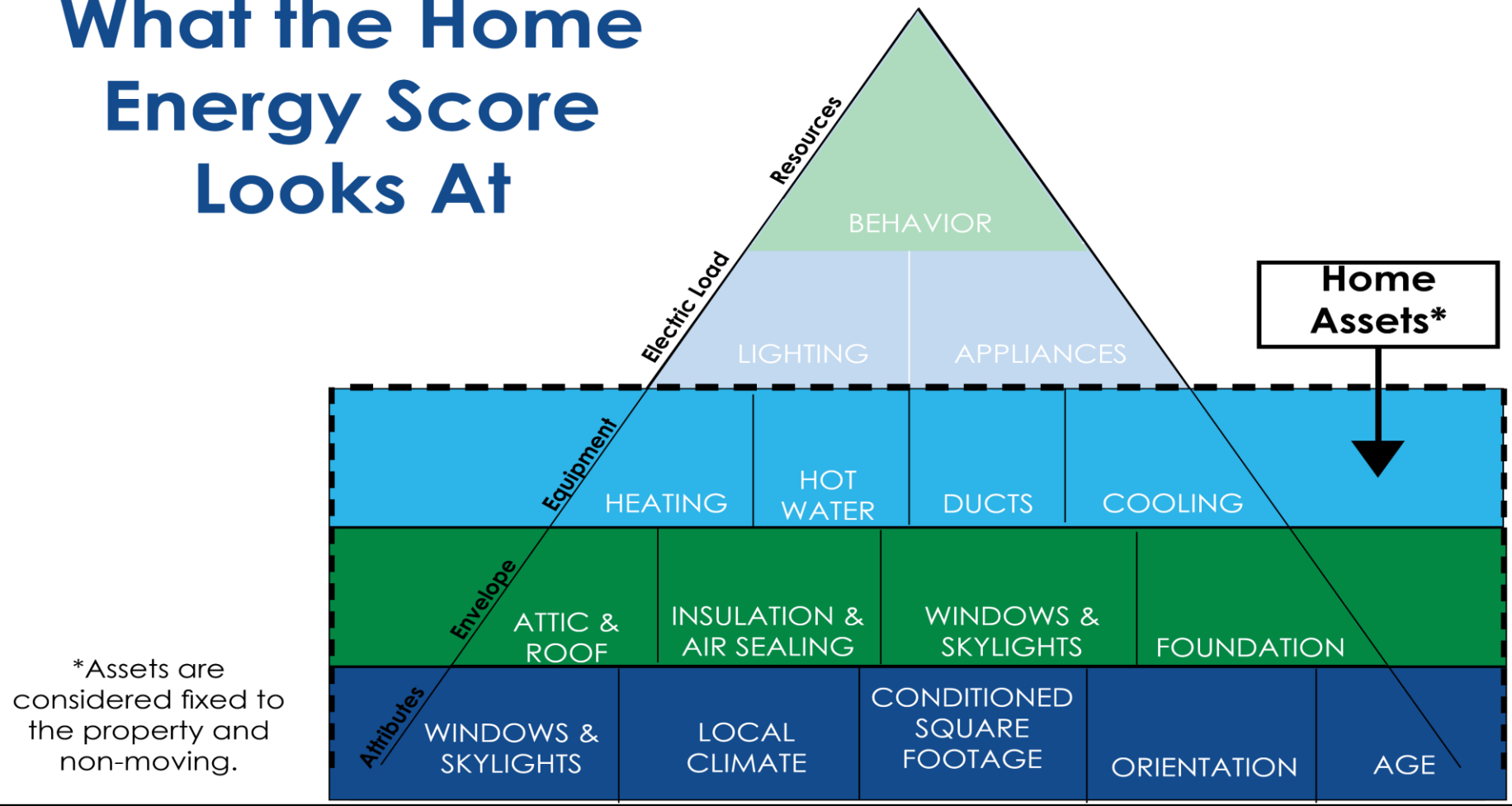
# Denver's 80x50 Climate Action Plan calls for Residential Single-Family homes use 20% less energy by 2035



~160,000 Residential Single-Family homes in Denver

# Free Home Energy Label Pilot Program

## What the Home Energy Score Looks At



# Benefits of a Home Energy Label

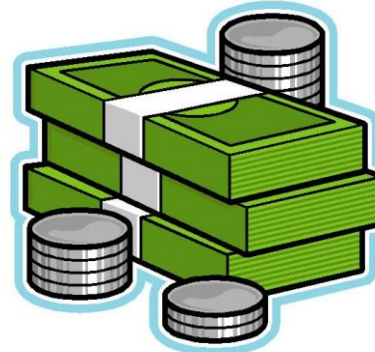
Healthier  
Climate



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!**



# Denver Energy Challenge (2010-2017)



Over  
12,500  
homes  
served



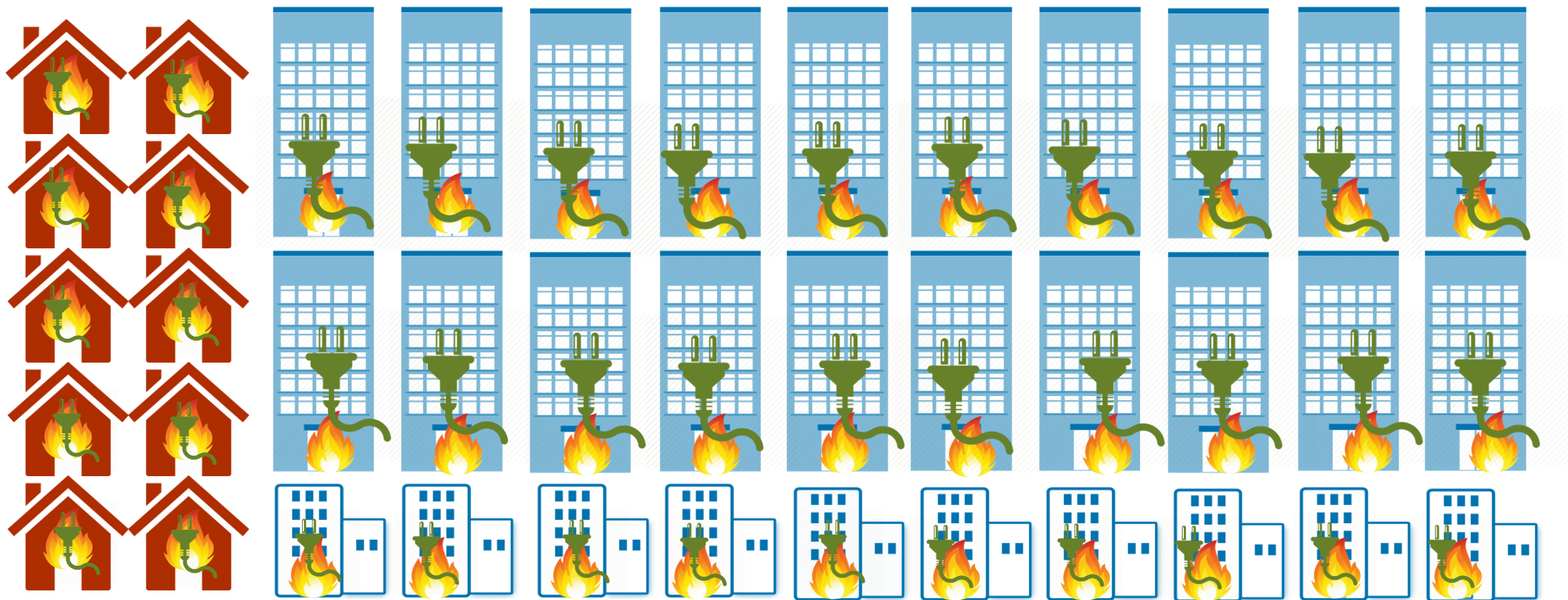
Over  
\$1.7M  
saved  
on  
energy  
bills



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



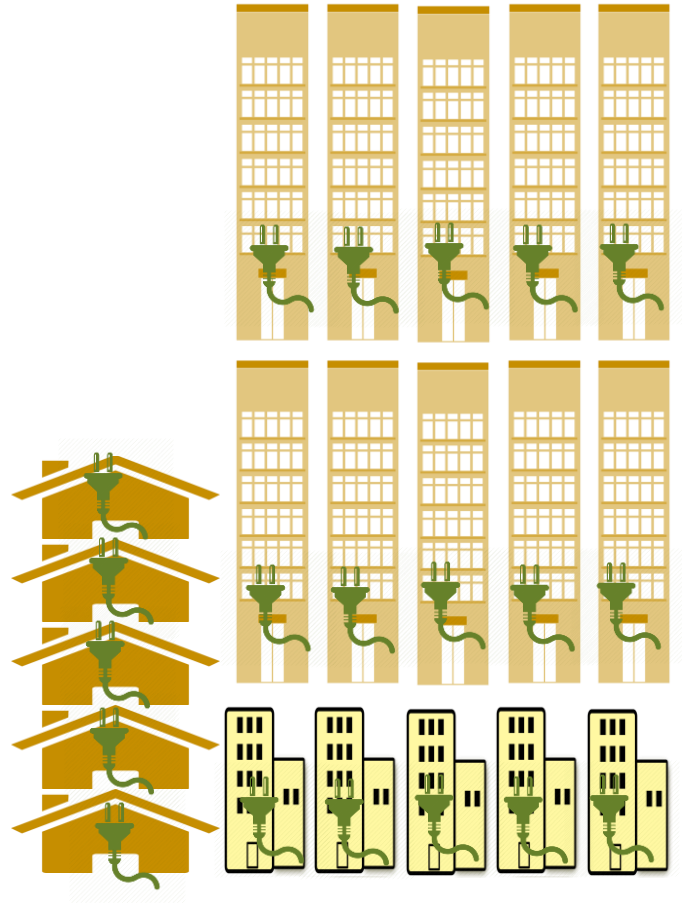
# Energy Future Collaboration: Strategic Building Electrification Working Group





# New Buildings and Homes

# 80x50 Goal: Net Zero New Construction by 2035

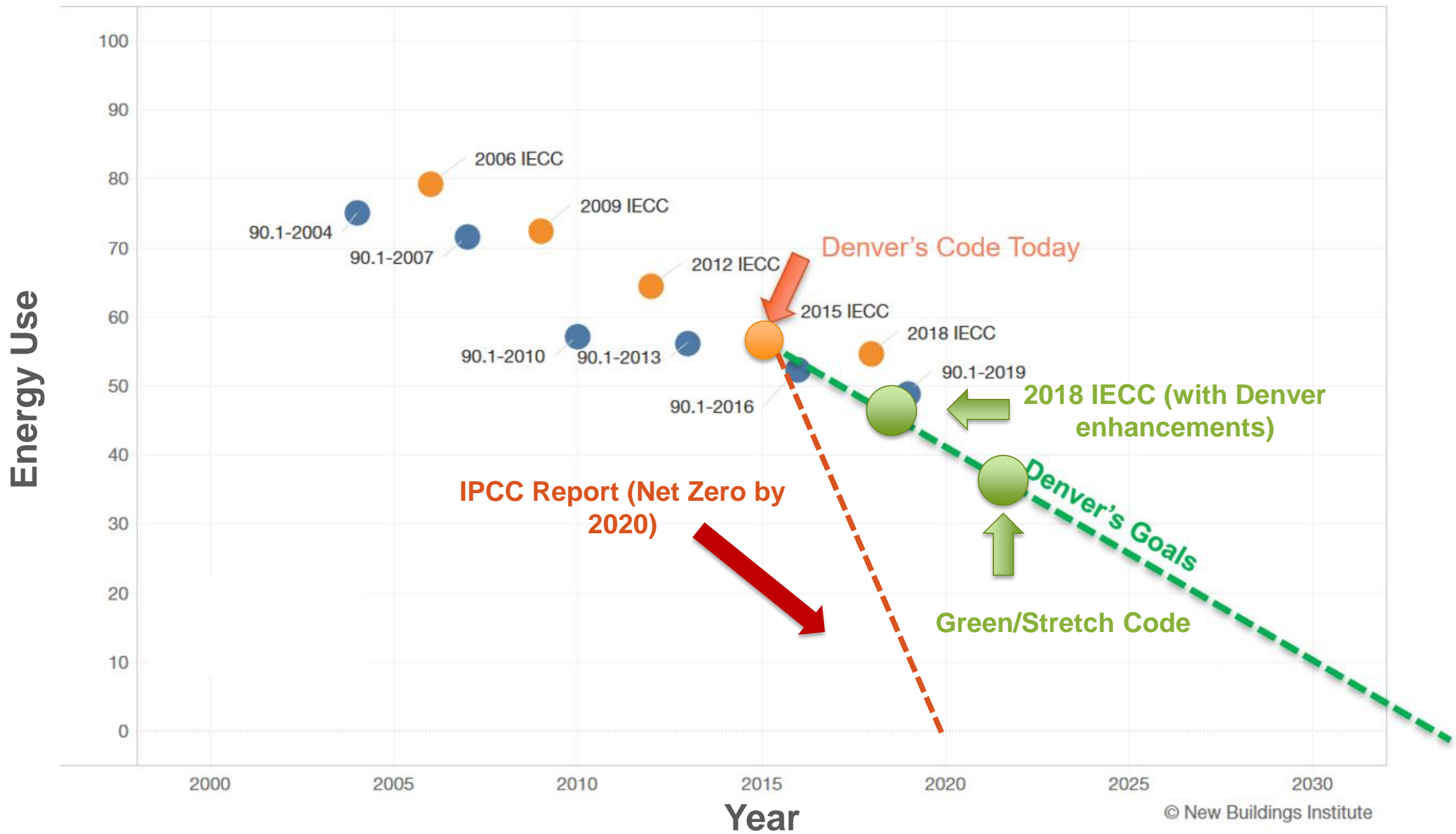


The IPCC tells us we must have net zero new construction in 2020.

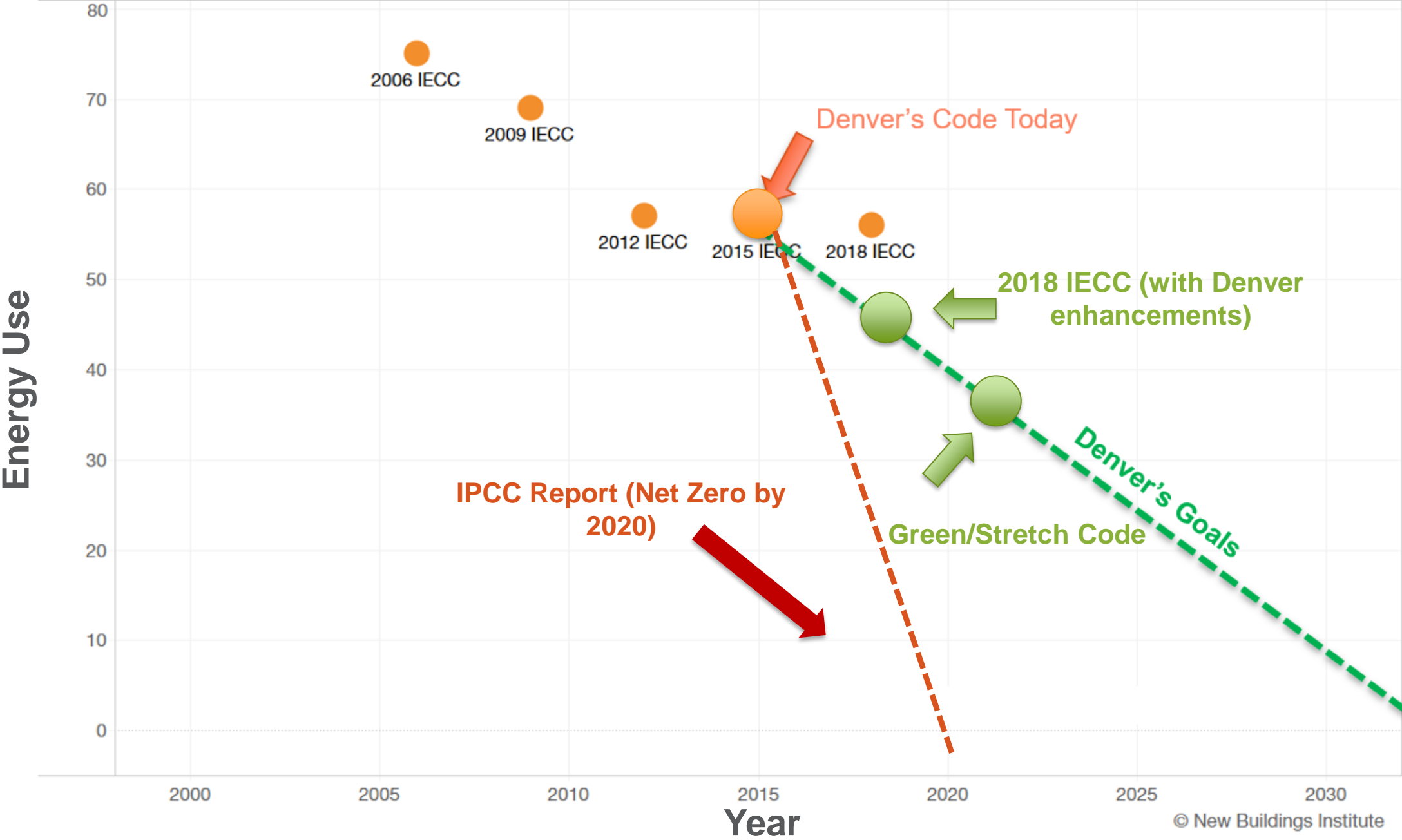
By 2050, ~40% of our building stock will be “new” construction



# 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



**Green Roof / Space**



**Pay for Offsite Green**



**Green + Solar or Energy  
Efficiency**



**Solar or Energy Efficiency**

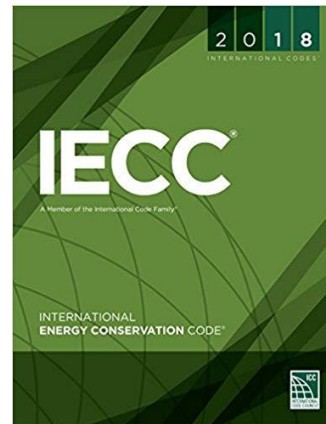


**Certification**

# 2019 Code Adoption Process



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?