Climate Change and Rotary Club

Katy Rotary Club
November 14, 2019

Citizens' Climate Lobby

http://bit.ly/36Z4UVF

Slides and Notes (on my idiotprogrammer blog)

Citizens' Climate Lobby

Introductions

Robert Nagle
Katherine Argueta

Citizens' Climate Lobby

Why I am so smart (not!)

- Not a scientist/expert
- Information Overload
- Different Hats
  - Scientist
  - Policymaker
  - Business
  - Citizen

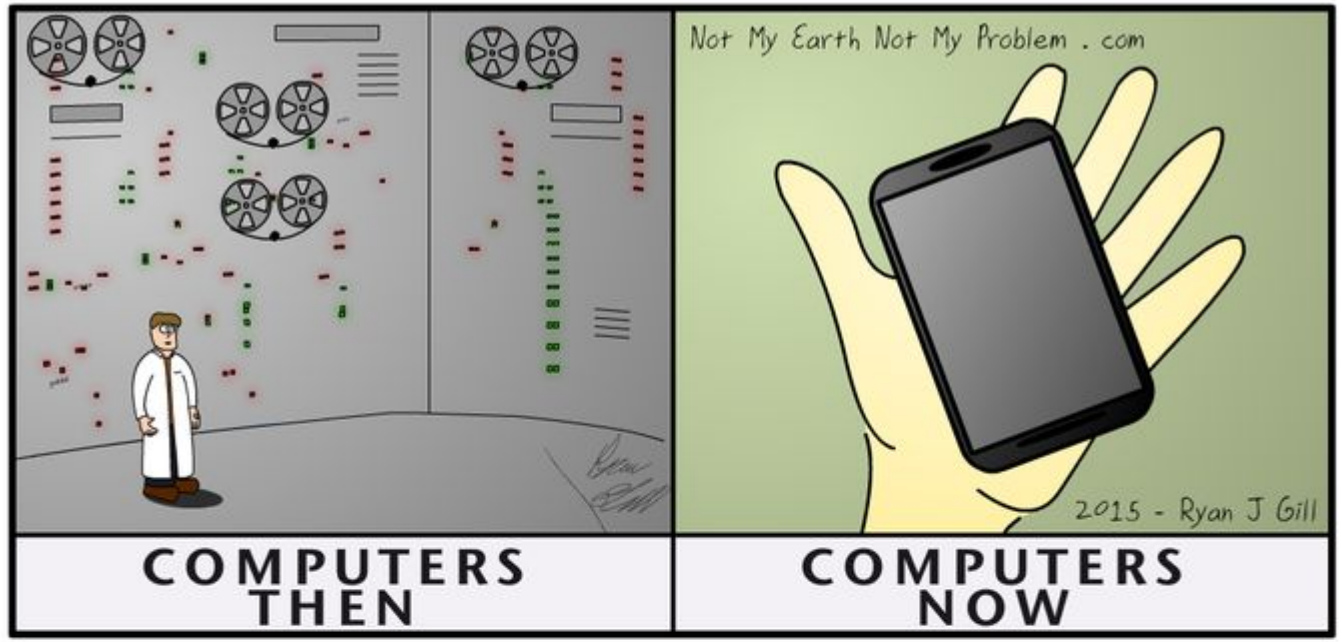
Consequences of New Technology

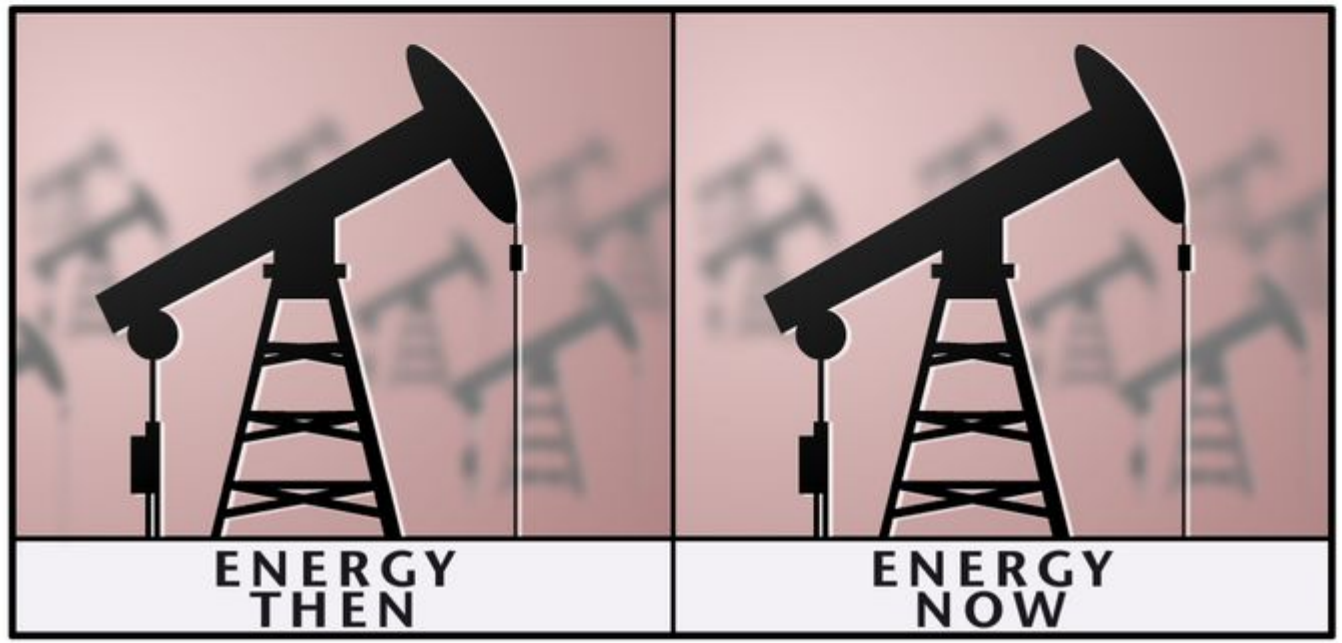
"New occasions teach new duties, Time makes ancient good uncouth.”

Poet James Russell Lowell

Thomas Midgley (1889-1944)

- Inventor, chemist
- Removed knock by adding lead. Developed leaded gas
- Improved efficiency & safety of refrigeration by using freon
- Died of polio, 51
- Tackling dangers
  - Catalytic converters to phase out use of lead (1970s)
  - Hole in ozone → phaseout of freon


Not My Earth Not My Problem . com
2015 - Ryan J Gill
COMPUTERS THEN
COMPUTERS NOW


ENERGY THEN
ENERGY NOW

Wind, Water, Solar (WWS) Solution

Electrify or Provide Direct Heat For All Sectors and Provid the Electricity and Heat with 100% WWS

ELECTRICITY	TRANSPORTATION	HEATING/COOLING	INDUSTRY
Wind	Battery-electric	Electric heat pumps	Electric arc furnaces
Solar PV/CSP	HFC-BE hybrids	Solar water preheat	Induction furnaces
Geothermal			Dielectric heating
Hydro			
Tidal/Wave			

Mark Z. Jacobson, Professor Stanford University

Transitioning towns, cities, and countries to 100% clean, renewable energy for all purposes

The underlying problem

- Fossil fuel + biofuel pollution cause **4-7 million premature air pollution deaths** per year worldwide ($20-25 trillion/year)
  (WHO Report, 2014; Lancet Commission, 2017)

- US: Air pollution causes about **200,000 early deaths each year**. Emissions from road transportation are the most significant contributor, causing **53,000** premature deaths, followed closely by power generation, with **52,000**.
  (MIT's Laboratory for Aviation and the Environment, 2013)

Air pollution and your health

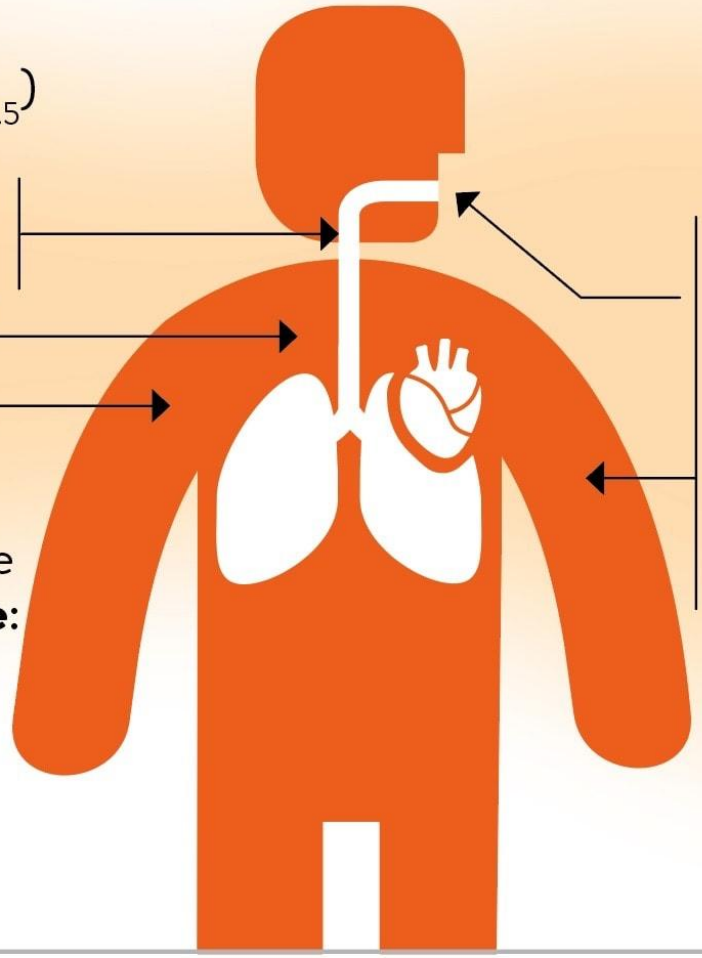
Fine particles and ground-level ozone (often called smog) are widespread pollutants linked to health effects.

Fine particles ($PM_{2.5}$) pollution can cause:

- Shortness of breath
- Wheezing, coughing
- Chest pain
- Fatigue

Fine particles can make these conditions **worse**:

- Cardiovascular and heart disease
- Asthma and COPD



Ground-level ozone pollution can cause:

- Difficulty breathing deeply
- Shortness of breath
- Sore throat
- Wheezing, coughing
- Fatigue

Ozone can make these conditions **worse**:

- Asthma and COPD
- Emphysema

Climate Change: Effects of rising CO2

- Has both global and regional effects (US → Bangladash, China → US)
- Depend on each country's political and economic systems
- Delayed consequences
  - Initially, heat from CO2 emissions goes into oceans, then distributes across the world over a 30-70 year period
  - By the time we can understand a tipping point, we might have already passed the point at which we can make changes to prevent it.

Carbon Dioxide? Guilty?

It is colorless and odorless.

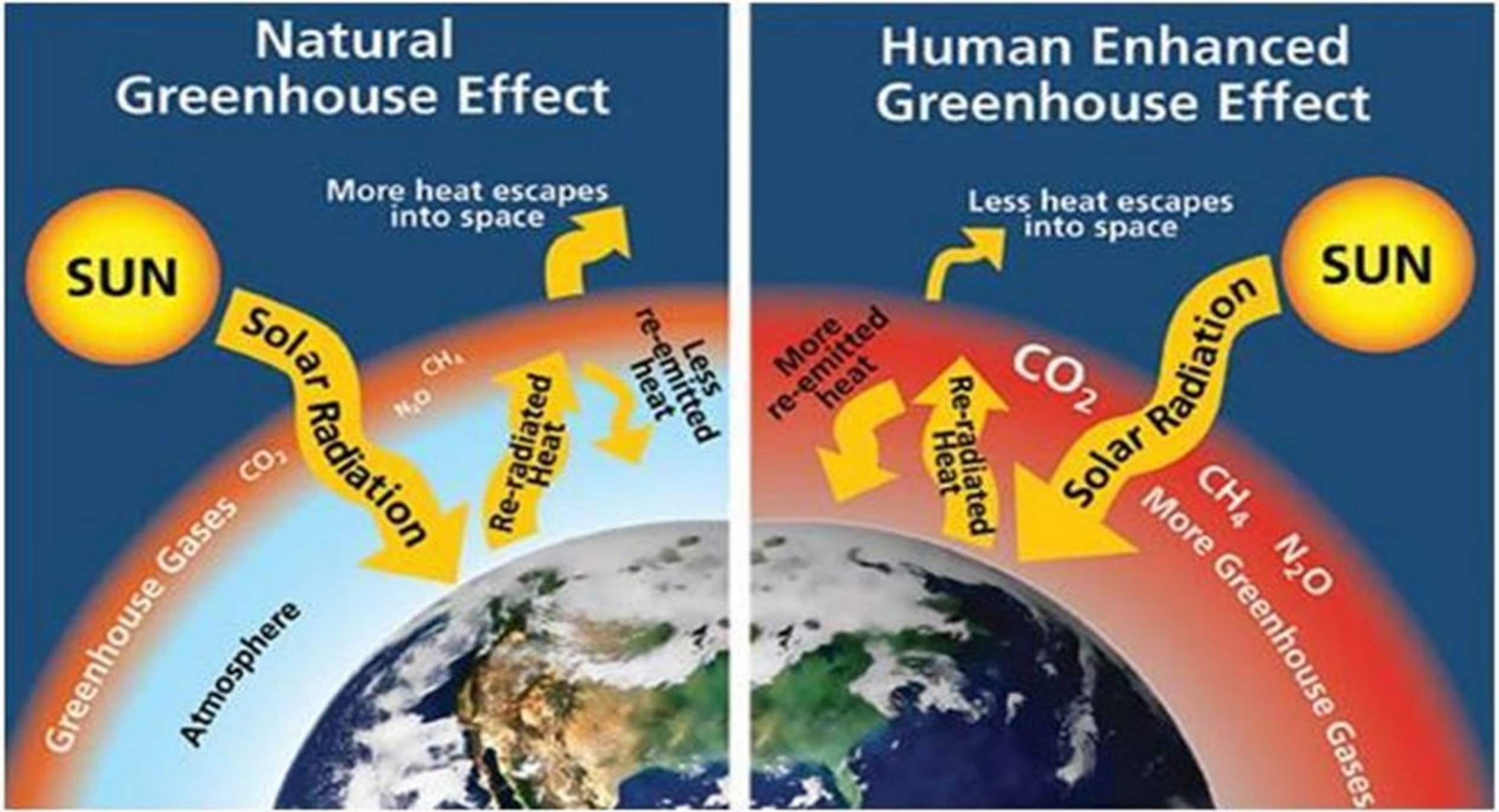
We breathe it out.

So do all animals.

Plants need it for photosynthesis.

It makes up only 0.04% of our atmosphere.

How can it possibly be a problem??


Natural
Greenhouse Effect
More heat escapes
into space
SUN
Solar Radiation
Re-radiated
Heat
Less
re-emitted
heat
Greenhouse Gases
Atmosphere
Human Enhanced
Greenhouse Effect
Less heat escapes
into space
SUN
More
re-emitted
heat
Re-radiated
Heat
Solar Radiation
More Greenhouse Gases

High Confidence

- Increasing CO2 leads to higher temperature
- global impacts
- ice-free North Pole
- Carbon buried underground in Iceland and Siberia -- if released -- could accelerate global warming even more
- humans can adapt, but plants and animals will have a harder time

Less Confidence

- Regional impacts
- impacts over 4 degrees C
- Unknown Tipping Points
  - Antarctic
- How quickly we can transition to renewables
- Climate Sensitivity

Climate Sensitivity

What is the effect of doubling CO2 in the atmosphere over preindustrial levels?

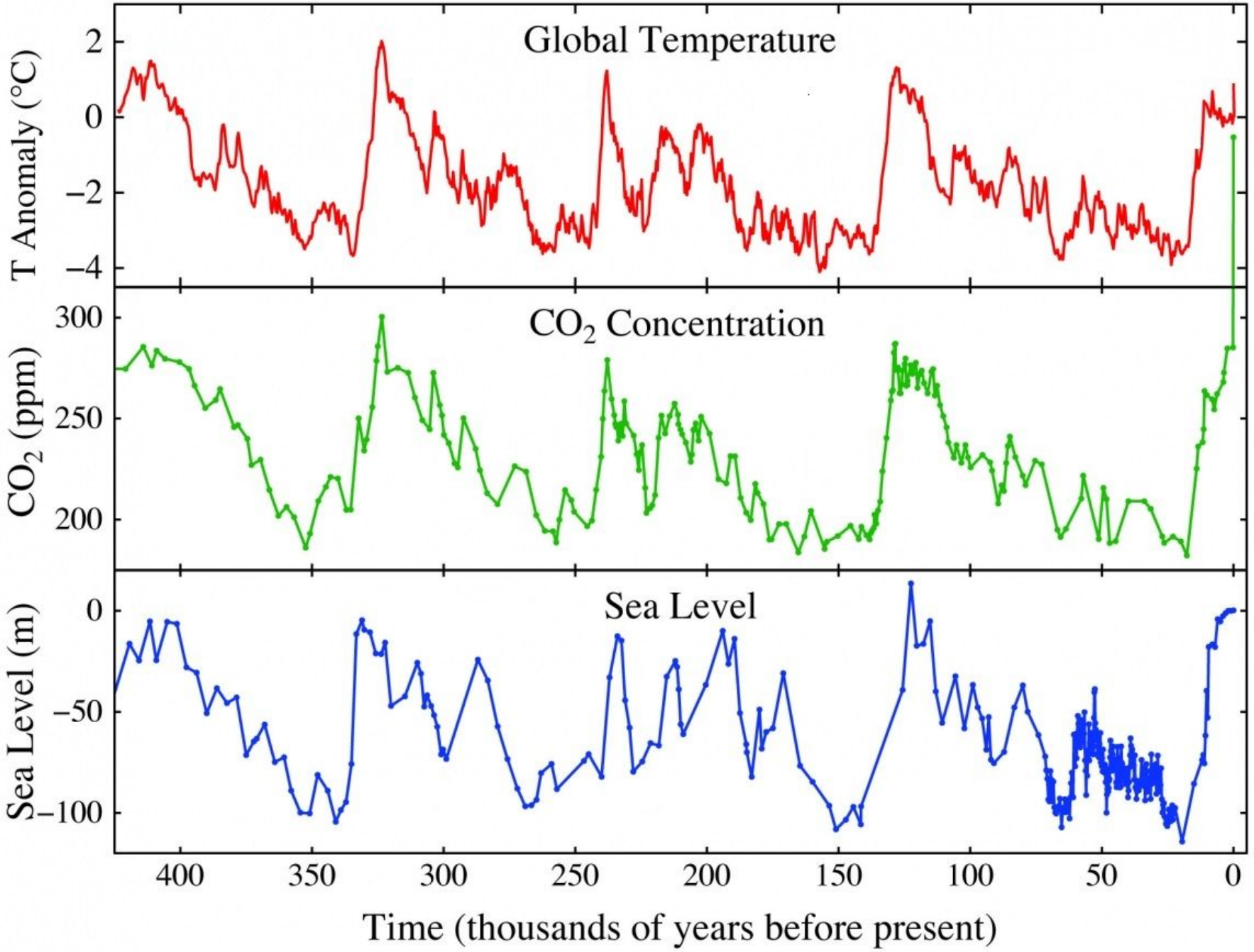
IPCC 5 2014: Equilibrium climate sensitivity is likely in the range 1.5 °C to 4.5 °C (high confidence), extremely unlikely less than 1 °C (high confidence), and very unlikely greater than 6 °C (medium confidence).

best guess: **2.0 -2. 5**

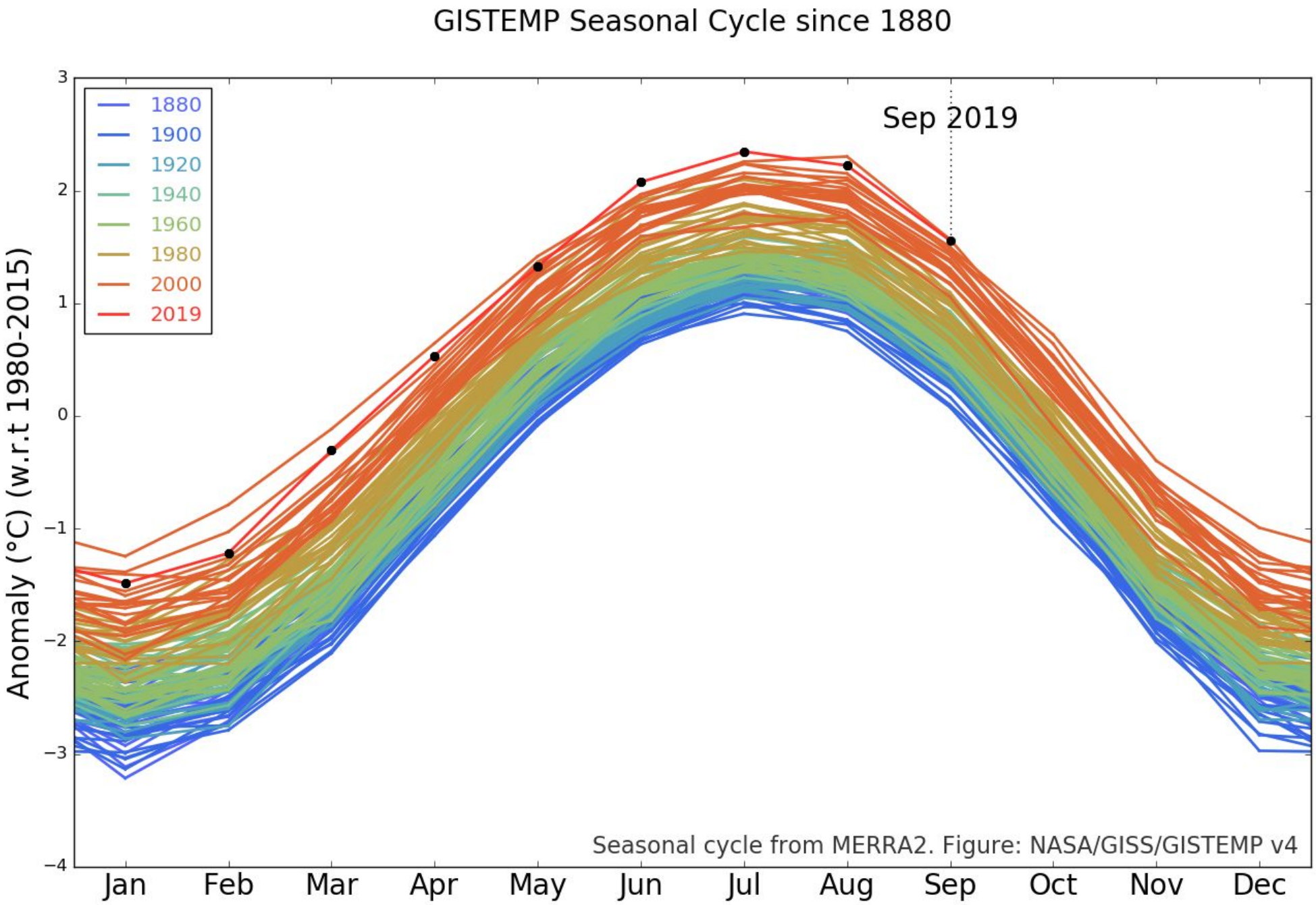
IPCC 6 2021 (preliminary) -- 4-5 degrees?

:
Climate Scientist Michael Mann
"There is a great asymmetry in risk between the high and low end estimates. Uncertainty cuts both ways and is not our friend."

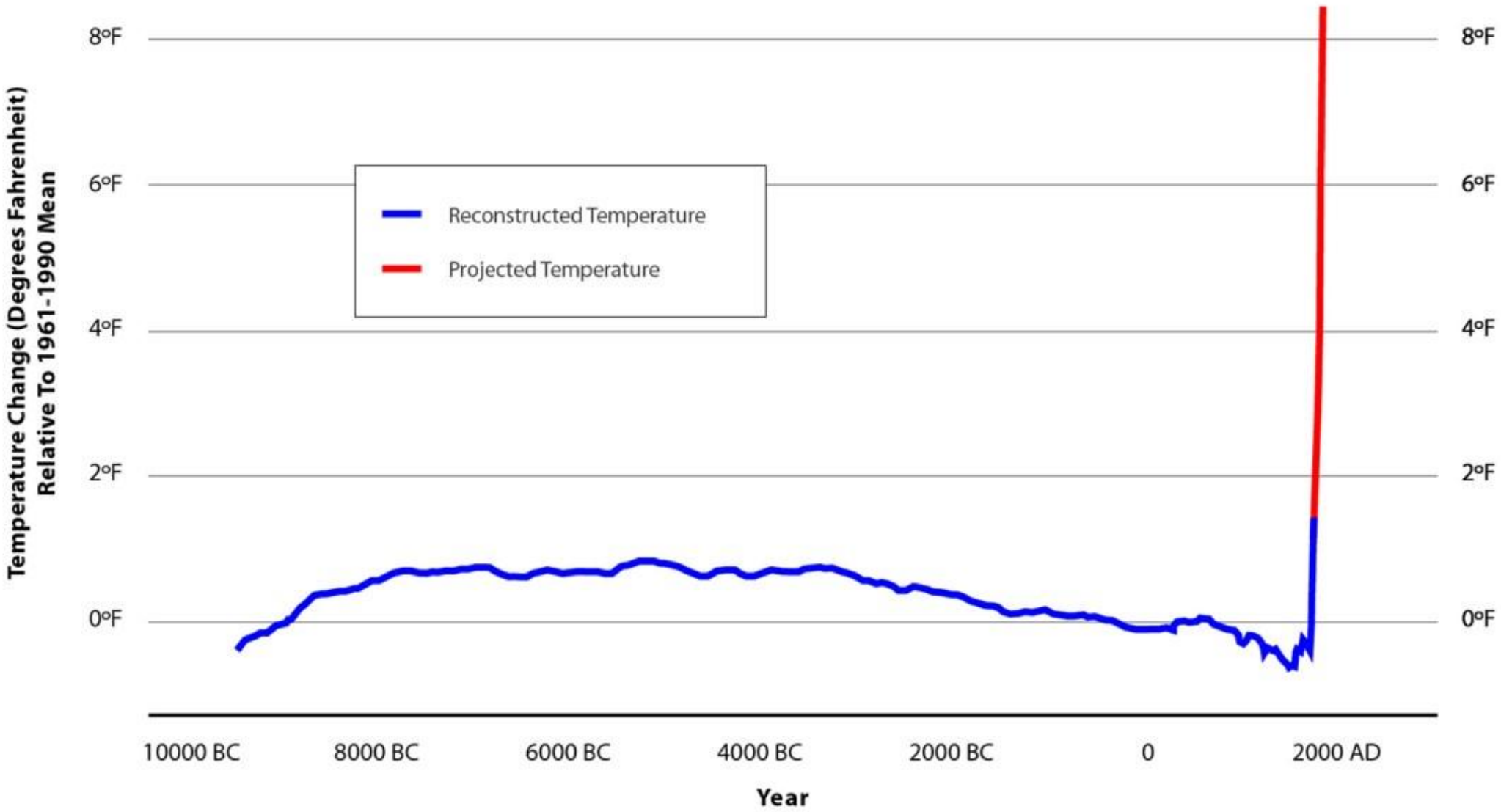
But what if we tripled our CO2 emissions?



Source:
NASA Website


GISTEMP Seasonal Cycle since 1880
1880
1900
1920
1940
1960
1980
2000
2019
Sep 2019
Anomaly (°C) (w.r.t 1980-2015)
3
2
1
0
−1
−2
−3
−4
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Seasonal cycle from MERRA2. Figure: NASA/GISS/GISTEMP v4

Carbon Pollution has Ended the Era of Stable Climate



Source: *Science* & ClimateProgress.org

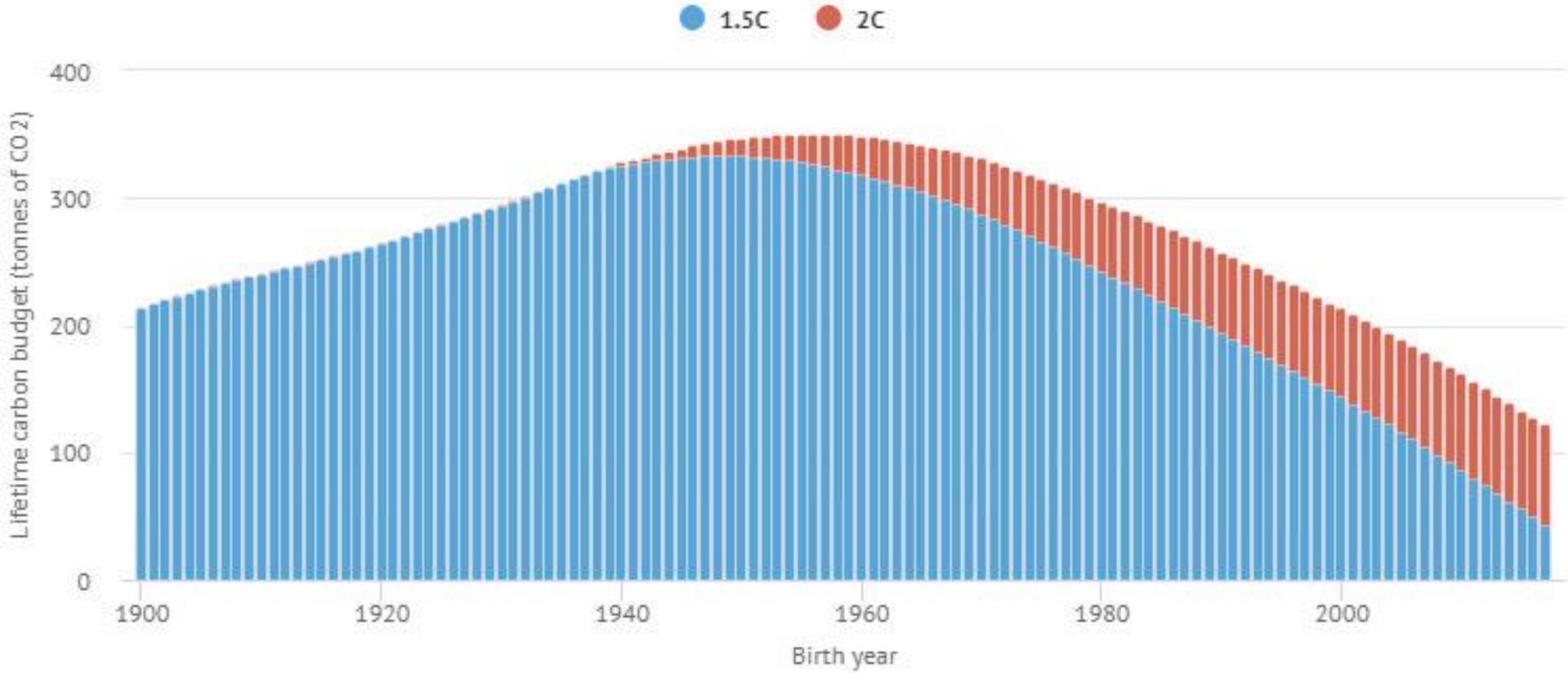
Is climate change fair to all concerned?

Justice and Climate Change

- Rich vs. Poor
  - cars, where to live, who should pay more in taxes?
  - countries: which should pay more for past pollution?
- Young vs. Old
- Companies vs. Consumers
  - who bears the liability?
- Urban vs. Rural
  - rural -- need cars, more agriculture
- Compensation
  - who should be compensated for their losses? How?

Younger generations will have much lower lifetime carbon budgets

Overall emissions must fall rapidly to limit warming to 1.5 or 2C by 2100



Pre-Boomers | Boomers | Gen X | Millenials | Gen Z

Maldive Islands

World Earth Day

Children moving plants to higher ground

Impacts upon Poorer Populations

- Poorer Countries are most affected (Bangladesh, Vietnam, India,African countries, Island countries). They also have the least money to spend to improve resiliency.
- Deaths from Heatstroke (Record temperatures 129+ degrees)
- Poorer countries depend more on subsidence farming (Central America, Africa)
- More mosquito-borne illnesses

Here's the reality of climate change...

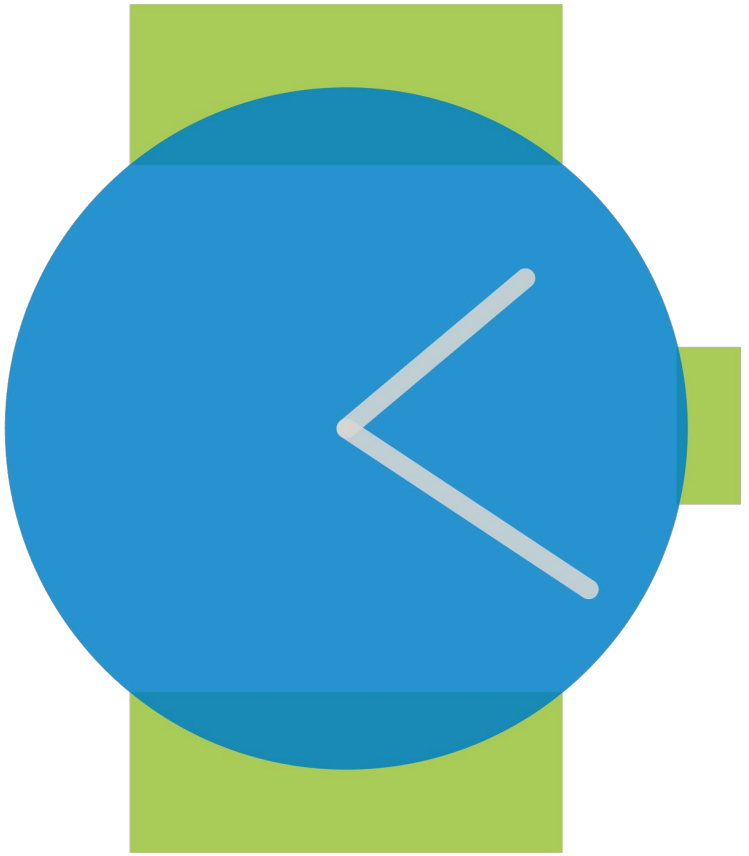
Global Warming has become "**Global Weirding**"

For instance:

- Global High T records are broken almost annually
- Seasonality is no longer dependable for many
- Droughts are sometimes followed by massive floods
- Forest fires are 5 times as frequent, over 6 times the area
- Sea levels are rising and oceans are acidifying

How Much Time Do We Have?

The IPCC reports we have **12 years** to cut global emissions **by more than 40%**



Paris Accord is not enough

- Voluntary global agreement which all parties agreed was inadequate.
- Even if the world met its Paris Accord targets, it would still require lots of carbon removal ($$$$$$) by midcentury
- Rationale: Once we create a global framework for reducing emissions, we could have a mechanism to reduce even more later on, as needed.

Projects noncompliant with Paris Accords

Project	Resource theme	2019-2030 capex	Country	Partners (* denotes operator)
LNG Canada T1	 Conventional (land/shelf)	**$6.5** bn	Canada	**Shell***, Petronas, Mitsubishi Corp, Korea Gas, PetroChina
LNG Canada T2	 Conventional (land/shelf)	**$6.5** bn	Canada	**Shell***, Petronas, Mitsubishi Corp, Korea Gas, PetroChina
Gorgon/Jansz Stage 2	 Deep water	**$3.6** bn	Australia	**Shell**, **Chevron***, **ExxonMobil**, Osaka Gas, Tokyo Gas, Chubu Electric
Aspen Phase 1	 Oil sands	**$2.6** bn	Canada	**ExxonMobil***, Imperial Oil
Amoca FFD	 Conventional (land/shelf)	**$1.4** bn	Mexico	**Eni***, Qatar Petroleum
Zinia 2	 Deep water	**$1.3** bn	Angola	**BP**, **ExxonMobil**, **Total***, **Equinor**

Carbon Tracker Initiative

Source: Rystad Energy, CTI analysis

U.S. GREENHOUSE GAS POLLUTION INCLUDES:

CARBON DIOXIDE (CO_2) 82%

Enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, trees and wood products, and also as a result of certain chemical reactions (e.g., manufacture of cement).

FLUORINATED GASES 3%

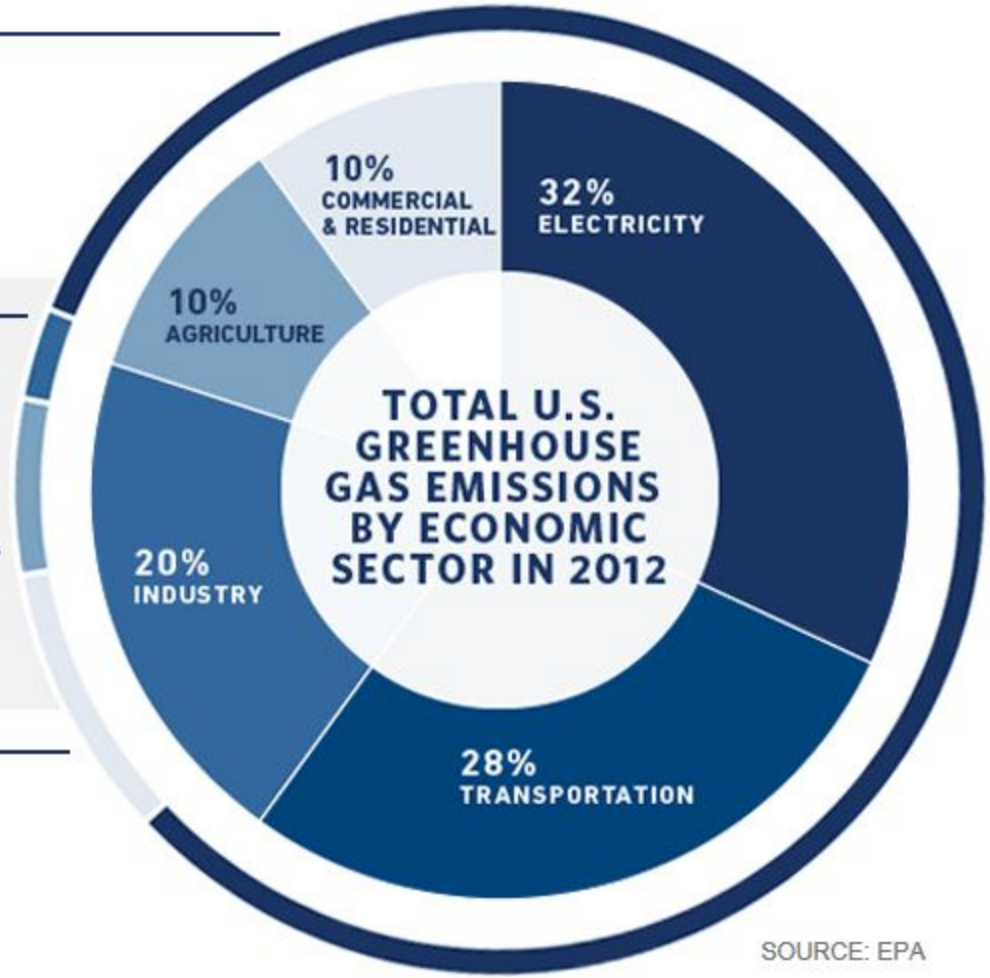
Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes.

NITROUS OXIDE (N_2O) 6%

Emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.

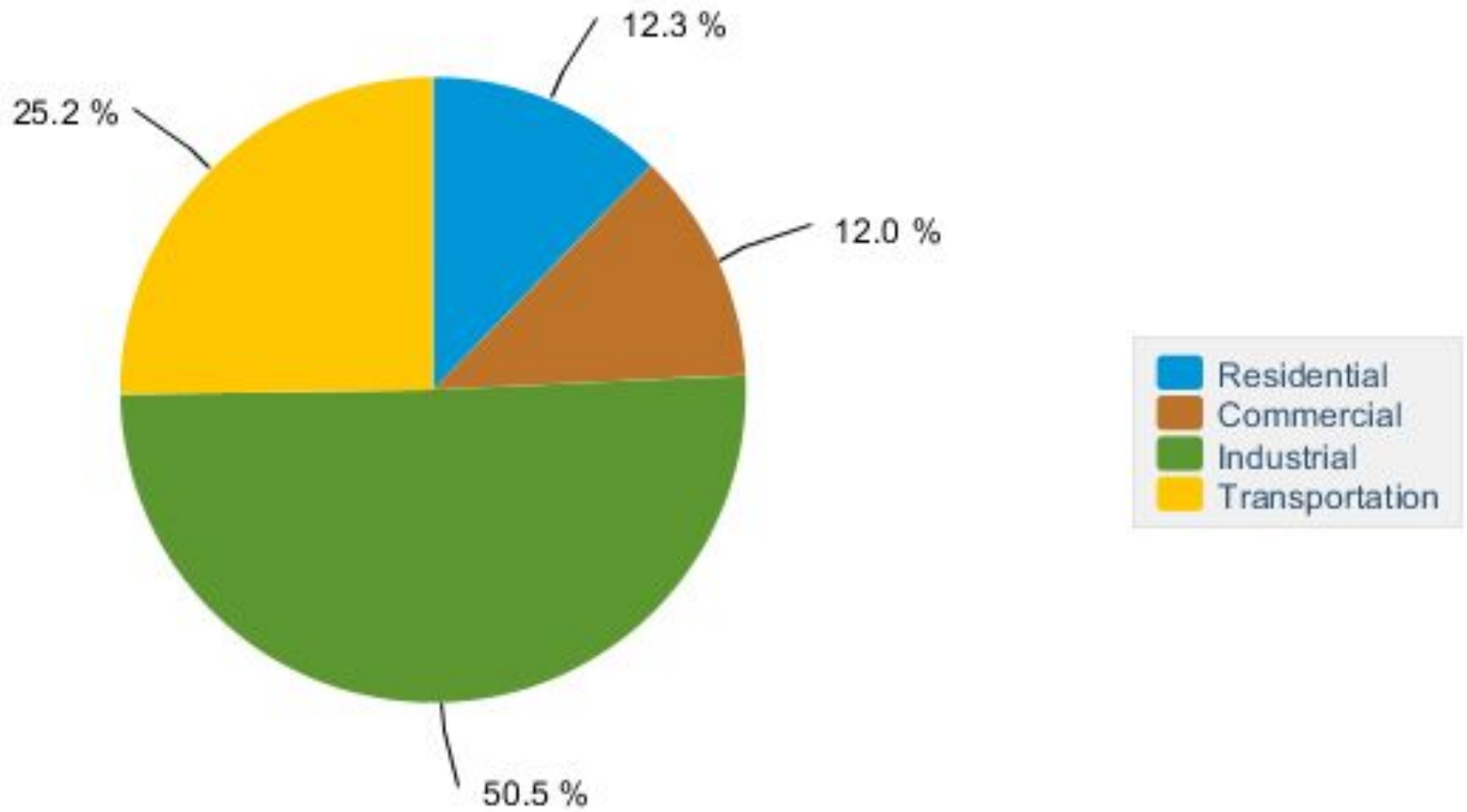
METHANE (CH_4) 9%

Emitted during the production and transport of coal, natural gas, and oil as well as from landfills.



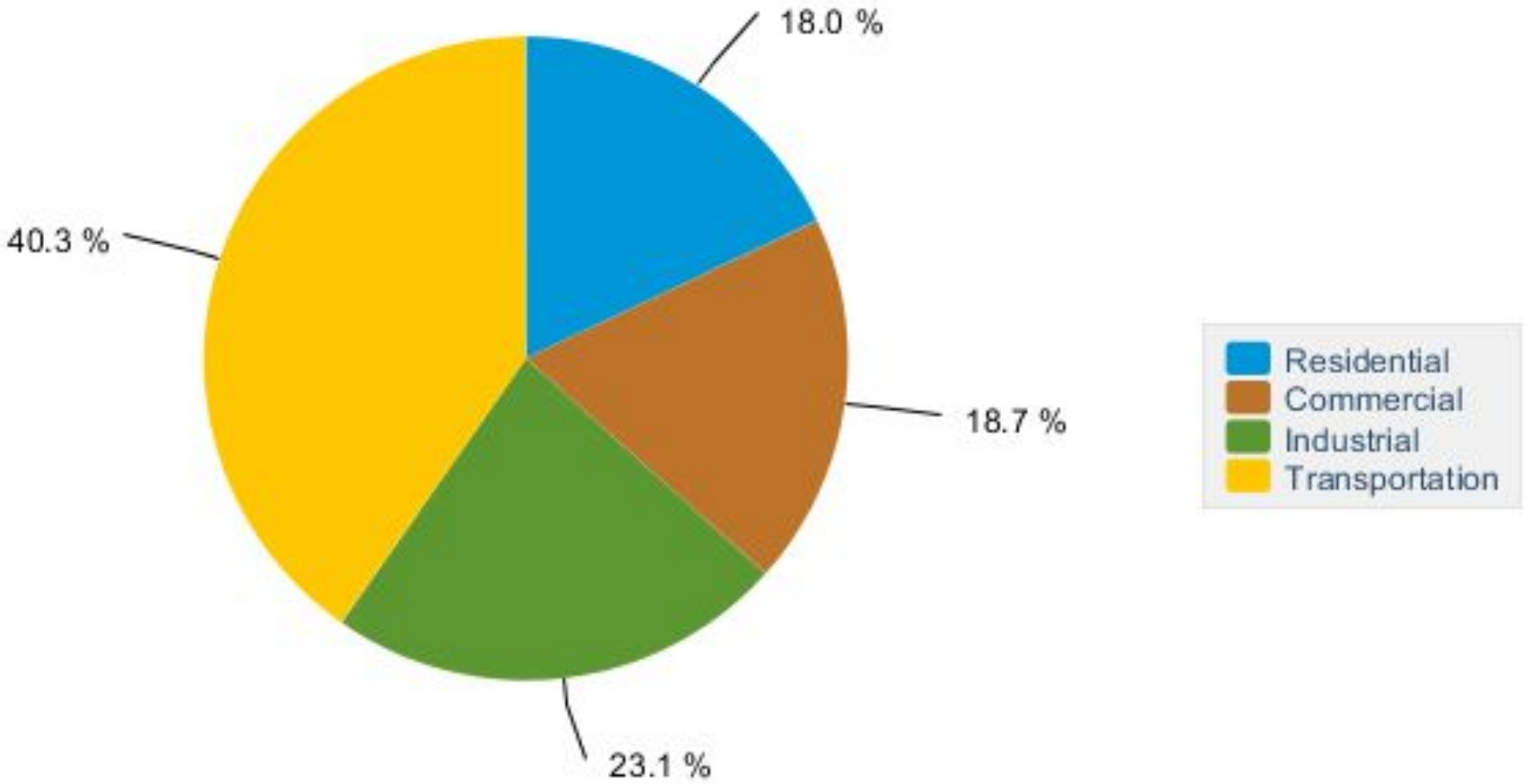
SOURCE: EPA

Texas Energy Consumption by End-Use Sector, 2017



Source: Energy Information Administration, State Energy Data System

California Energy Consumption by End-Use Sector, 2017



eia Source: Energy Information Administration, State Energy Data System

Electric plants in Texas (population 25 million) emit as much CO_2 as electric plants **in the COMBINED** states of New York, California, Florida, Massachusetts and Oregon (population: 86 million)
Source: EIA data, 2012

Test Yourself #1

Rank what you believe proves to be the biggest effect against climate change

A. Cook over clean stoves
B. Eat a plant based diet
C. Compost your waste
D. Throw away less food

Test Yourself #1

Answers:

A. Throw away less food
B. Eat a plant based diet
C. Cook over clean stoves
D. Compost your waste

According to Project Drawdown's analysis, food waste counts towards 8% of carbon emissions, so reducing the amount of food we throw out greatly helps the planet. Cutting down on meat consumption also proves to be a great way to reduce carbon emissions, as the New York Times states that cattle contribute to 14.5 to 18 percent of worldwide greenhouse gas emissions.

Test Yourself #2

Rank what you believe proves to be the biggest effect against climate change

A. Harnessing wind energy on land
B. Invest in nuclear power
C. Capture the power of waves
D. Build solar farms

Test Yourself #2

Answers:

A. Harnessing wind energy on land
B. Build solar farms
C. Invest in nuclear power
D. Capture the power of waves

Project Drawdown indicates that investing in onshore wind farms provides the most reduction in CO2 emissions, even though solar energy is on the rise of becoming a dominant energy source. Land utilized from these wind farms can also be used for grazing as well as farming, not to mention that wind farms are built in a quick process.

Test Yourself #3

Rank what you believe proves to be the biggest effect against climate change

A. Cut down on food waste
B. Restore our tropical rainforests
C. Manage Refrigeration Chemicals
D. Eat more plants and eat less meat
E. Install onshore wind turbines

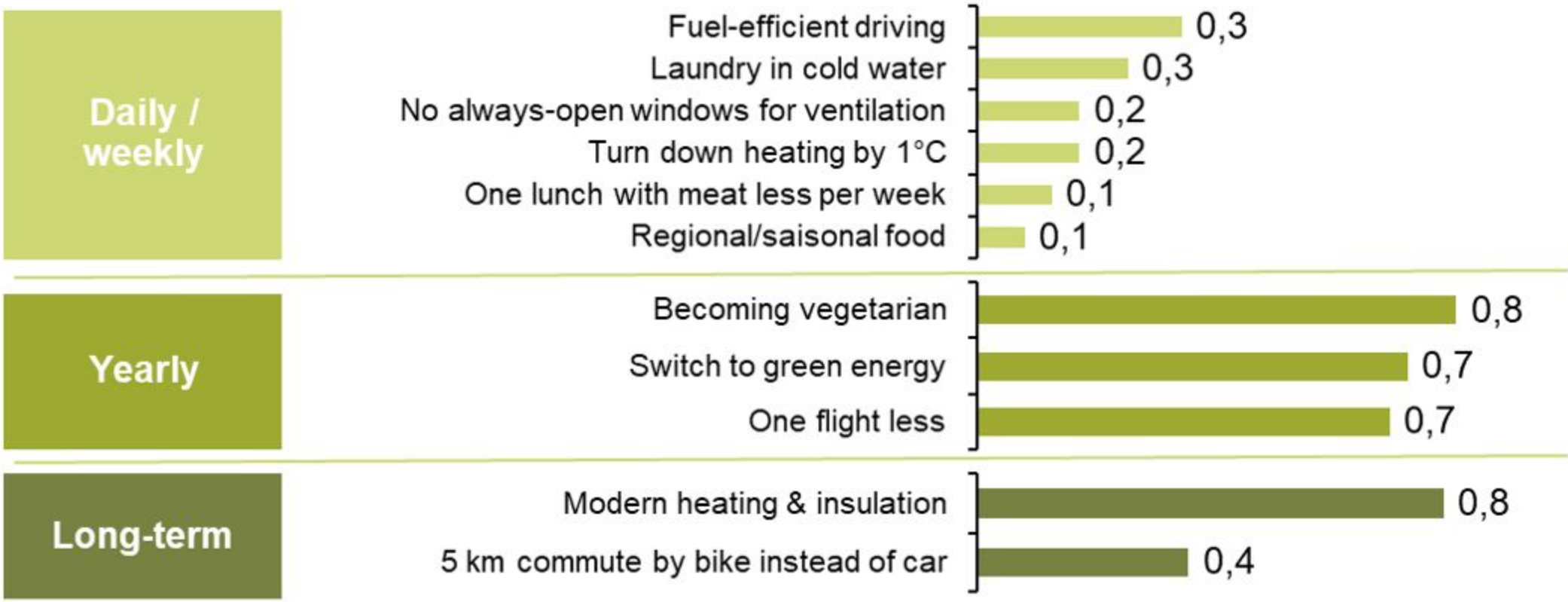
Test Yourself #3

Answers

A. Manage Refrigeration Chemicals
B. Install onshore wind turbines
C. Cut down on food waste
D. Eat more plants and eat less meat
E. Restore our tropical rainforests

In 2016, the United States, along with 167 other countries, adopted an amendment to phase out these refrigerants over the next 30 years, but the amendment has not yet been ratified by the Trump administration. Please contact your senator or representative in order to address the importance of this issue.

Personal actions to meet CO_2 reduction goals
(t CO_2 per year per person)



A.T. Kearney calculations based on German Environment Agency, co2online, Federal Statistical Office, etc.

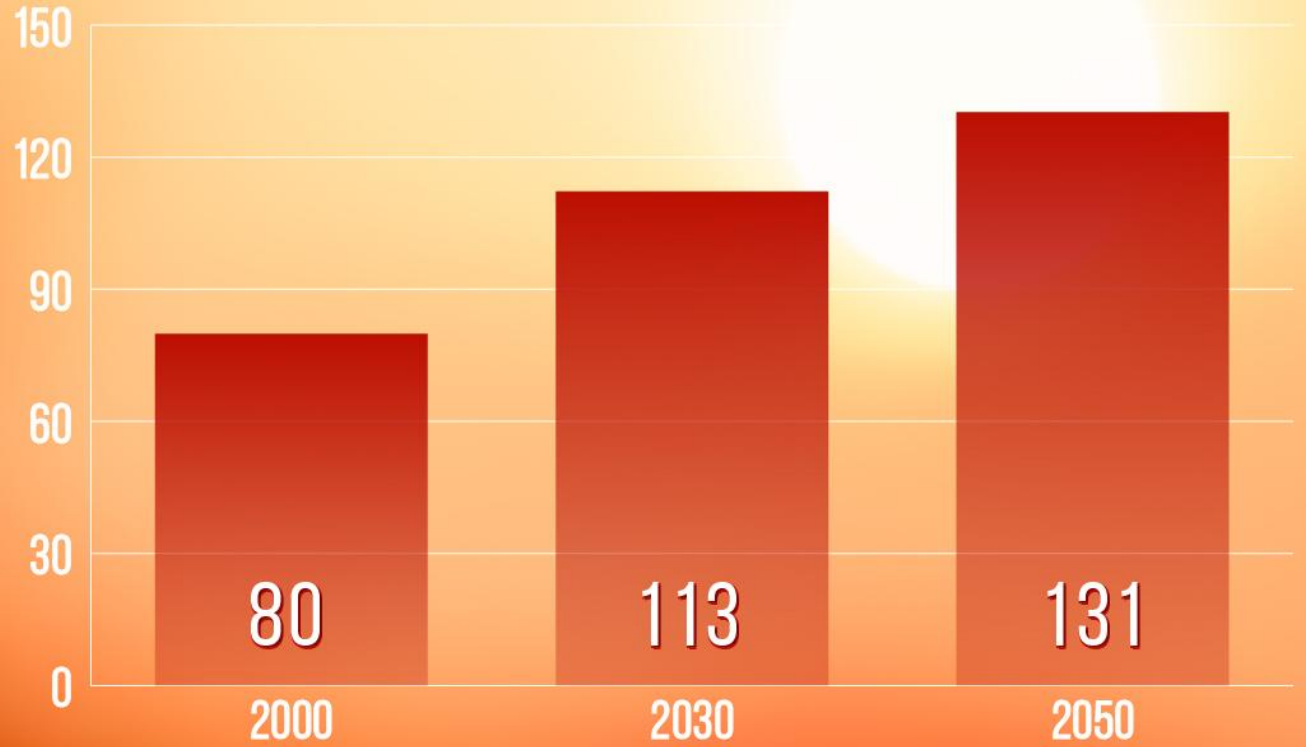
Climate and Texas

- Coastal -- hurricanes (stronger?)
- Central Texas -- Drought (Fires?) Water Shortages
- Southern Texas -- agriculture, climate refugees

MORE DANGER DAYS

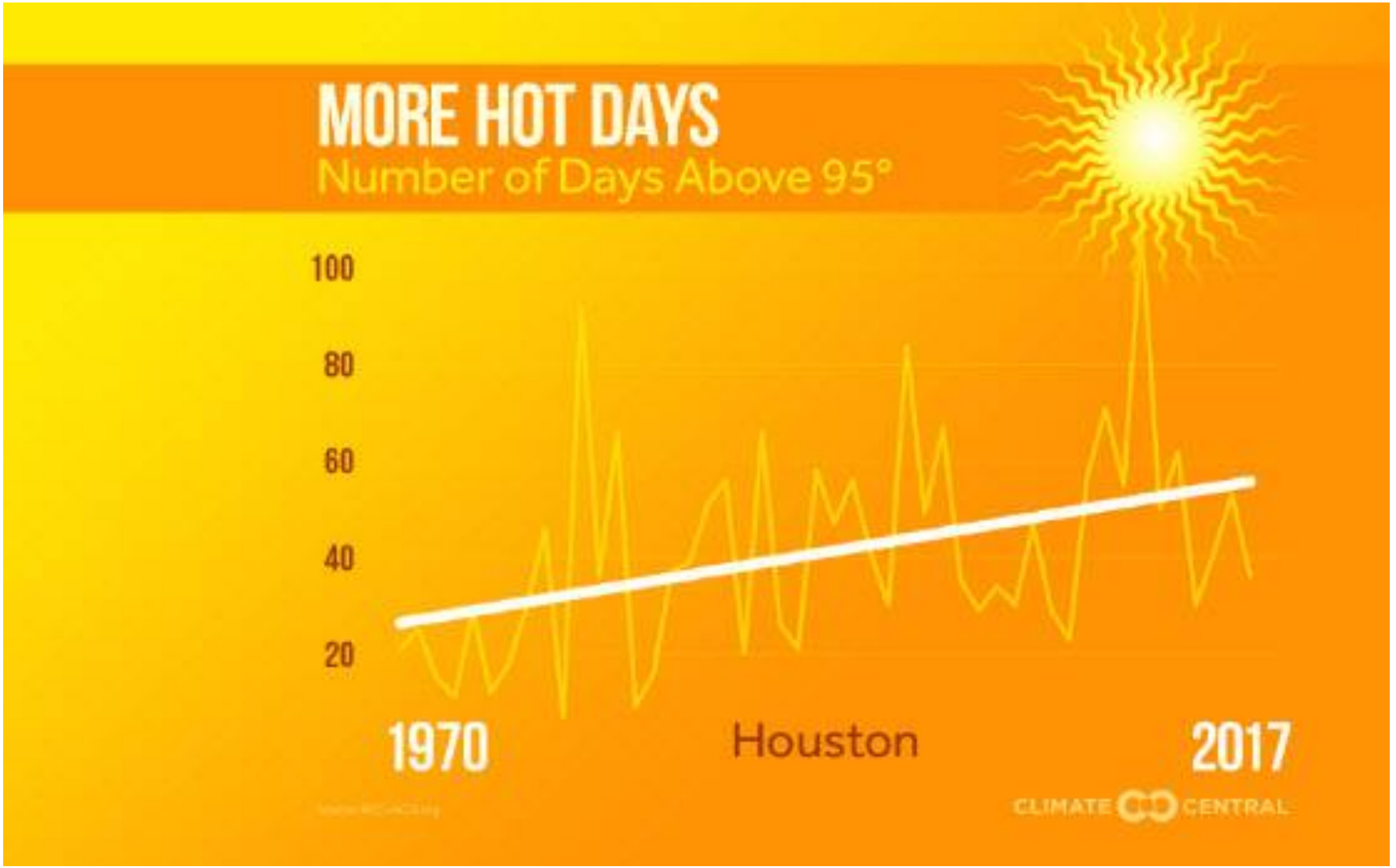
HEAT INDEX ABOVE 105°

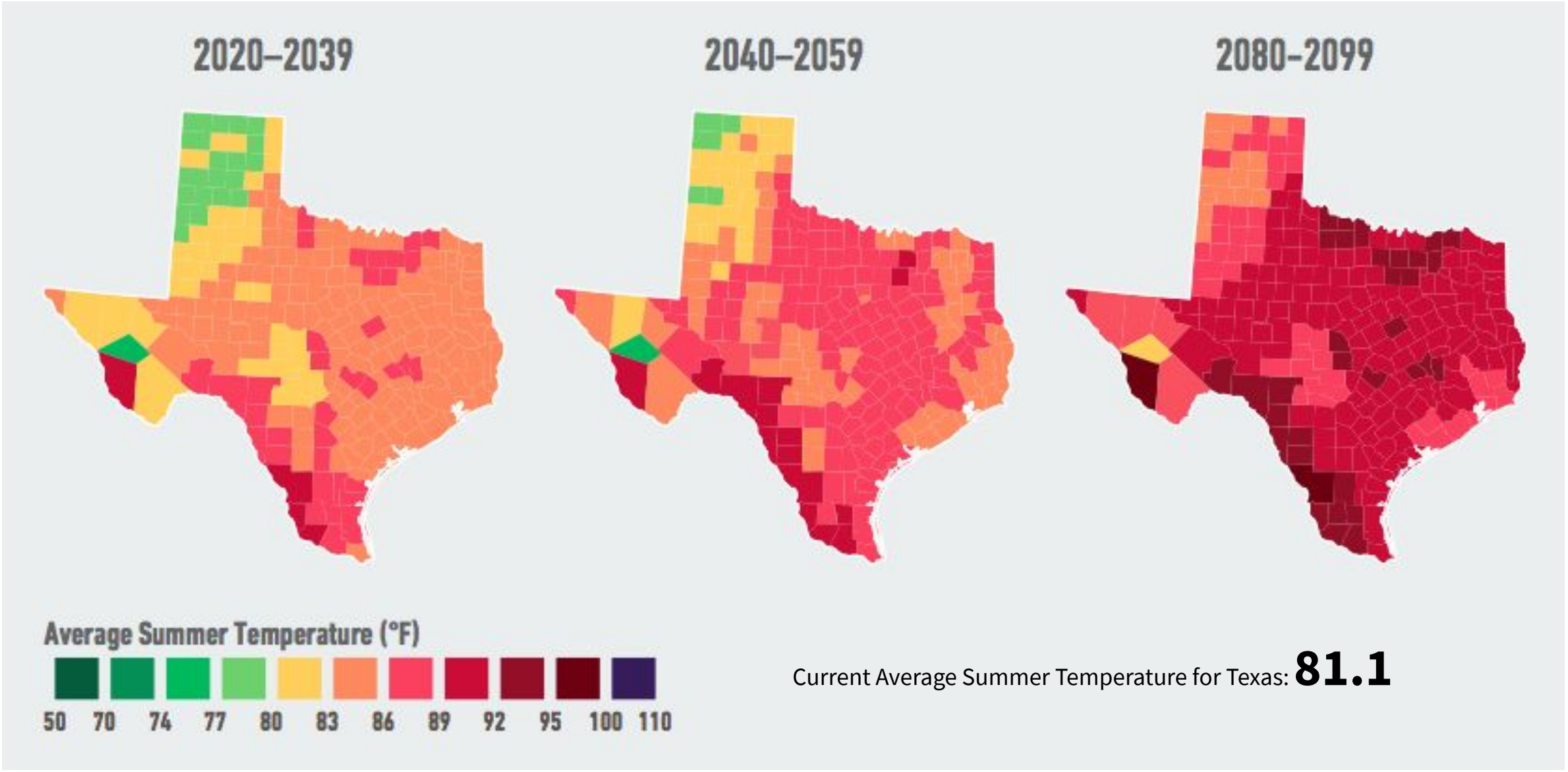
San Antonio, TX



Annual average danger day count based on current emissions trends.
Projected temp and humidity: Climate Central analysis of CMIP5 multi-model ensemble dataset.

CLIMATE CENTRAL


MORE HOT DAYS
Number of Days Above 95°
100
80
60
40
20
1970
Houston
2017
CLIMATE CENTRAL



Current Average Summer Temperature for Texas: **81.1**

Heat-related Deaths

FIGURE 29. Extremely hot and humid temperatures will lead to more heat-related deaths in Texas, with additional deaths in the thousands likely by mid-century, if not sooner. Source: American Climate Prospectus.

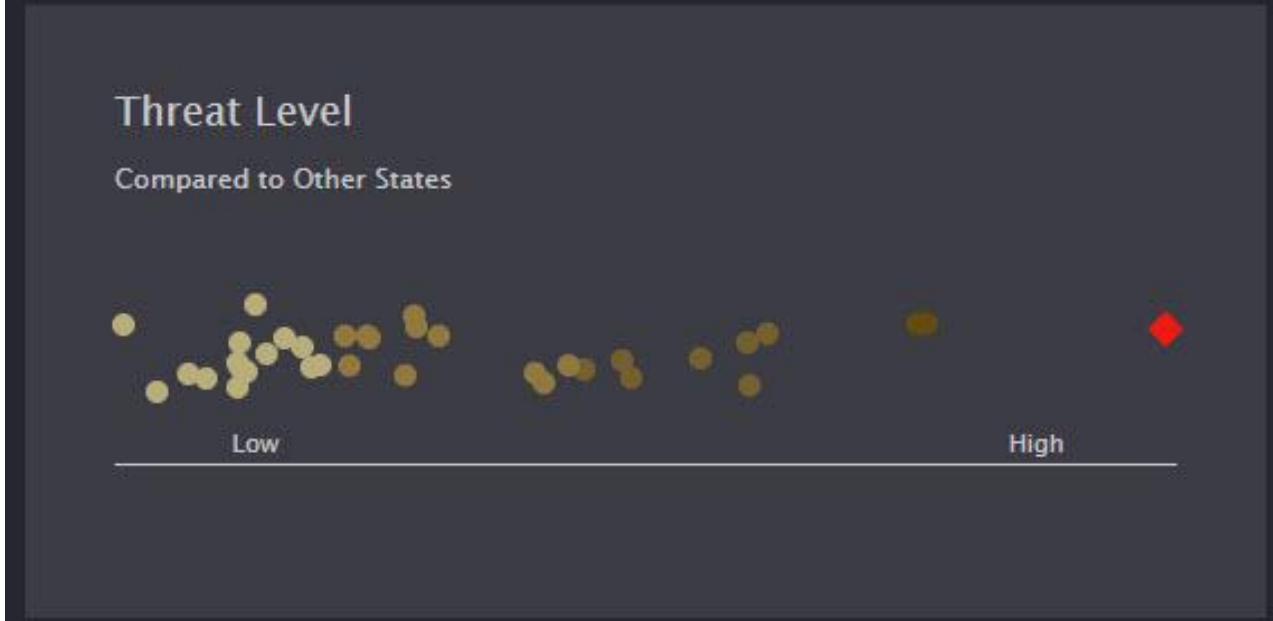
Heat-Related Mortality (Additional Annual Deaths)

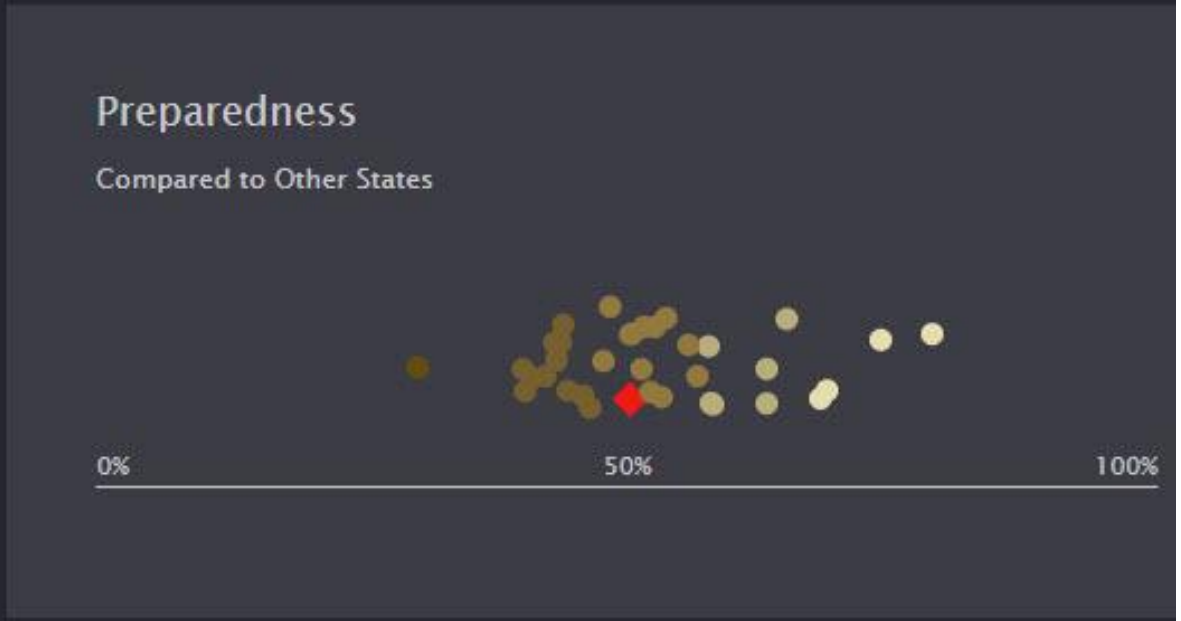
Source: riskybusiness.org

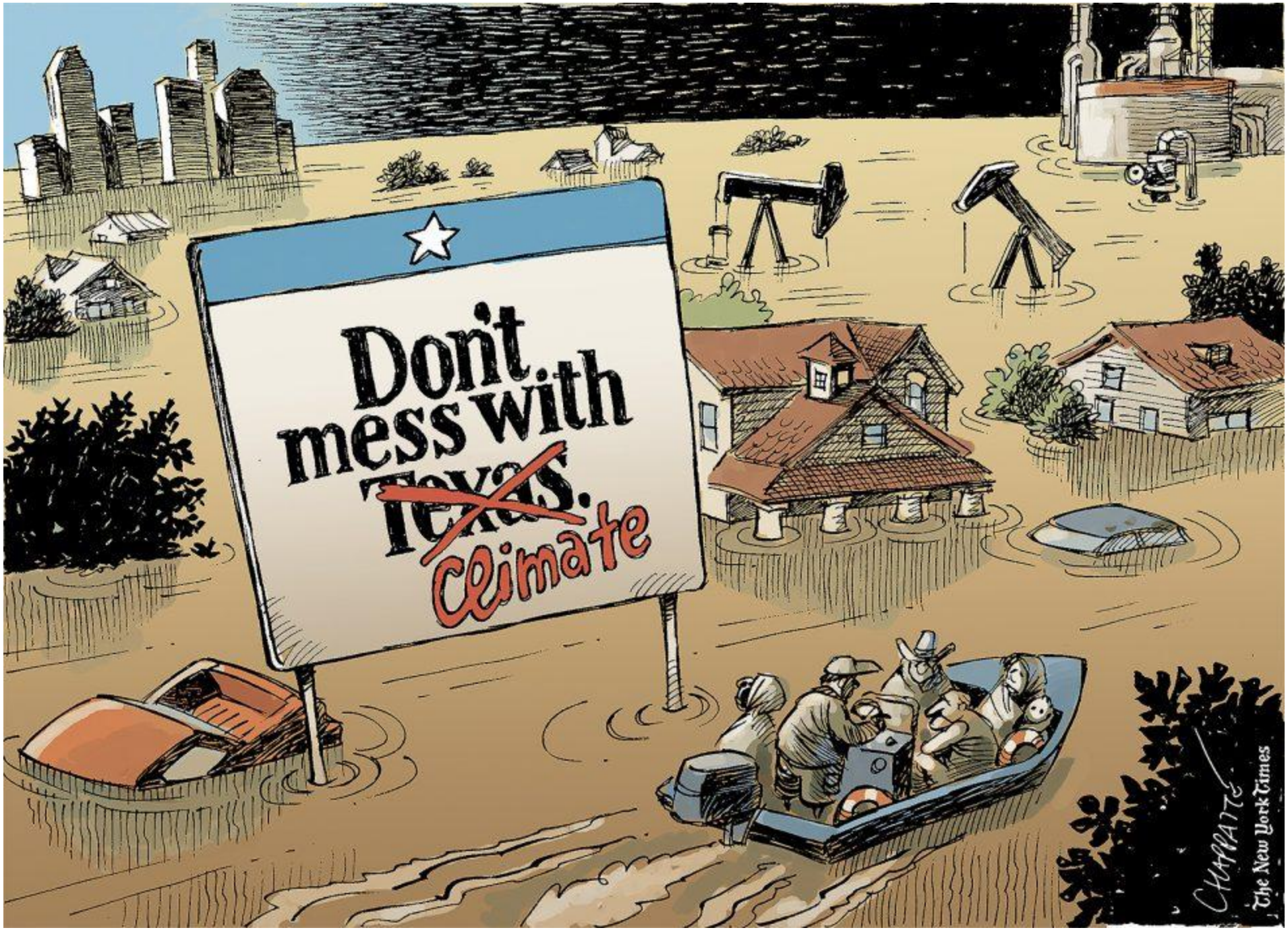
TEXAS DROUGHT

Source: www.statesatrisk.org

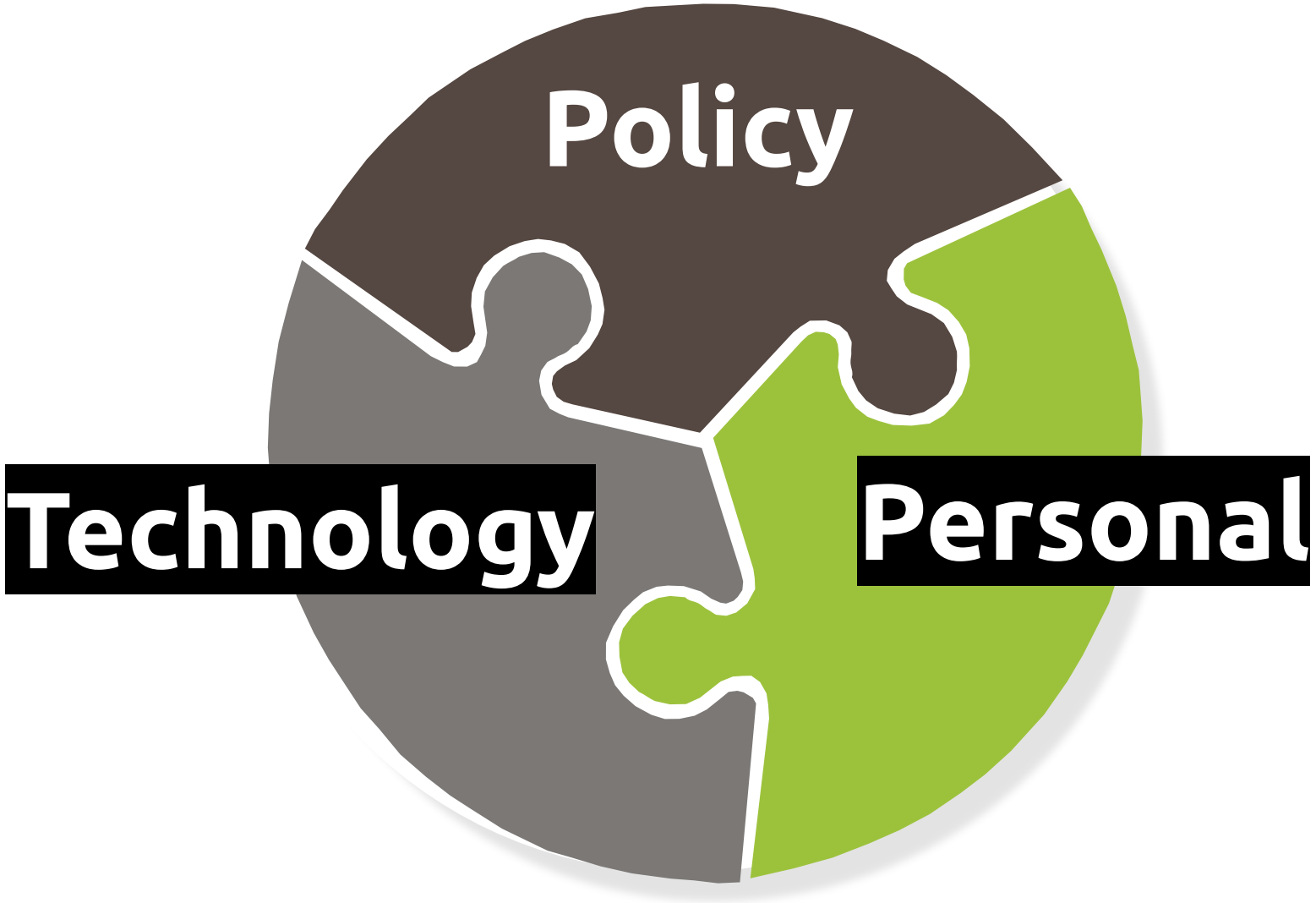
Texas faces the worst widespread summer drought threat in the nation. Unlike most other states with drought threats, Texas has taken very few steps to plan or prepare for its future drought risks.






Don't mess with Texas. climate
CHAPPATTE
The New York Times

We have a three-part puzzle to solve



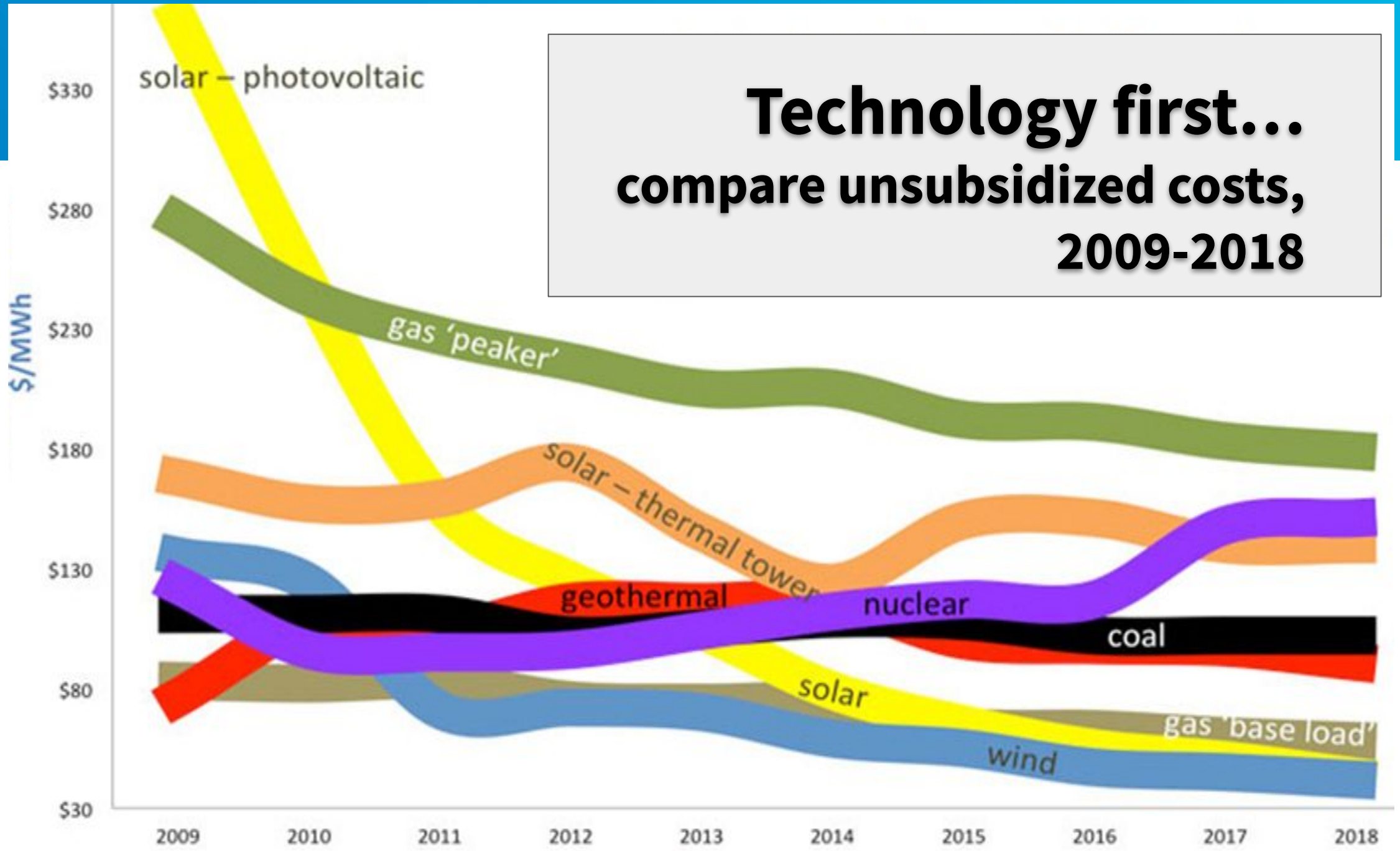
Cost of Delay

- International Energy Agency:
  - For every $1 of investment in cleaner technology that is avoided in the power sector before 2020, an additional $4.30 would need to be spent after 2020 to compensate for the increased emissions." (International Energy Agency)
  - "The world will have to spend an extra $500 billion to cut carbon emissions for each year it delays implementing a major assault on global warming."
  - the longer we wait, the more expensive it becomes to transform our energy system."
- Naomi Oreskes (science historian)
  - Historians call this the "infrastructure trap." The aggressive development of natural gas, not to mention tar sands, and oil in the melting Arctic, threaten to trap us into a commitment to fossil fuels that may be impossible to escape before it is too late.

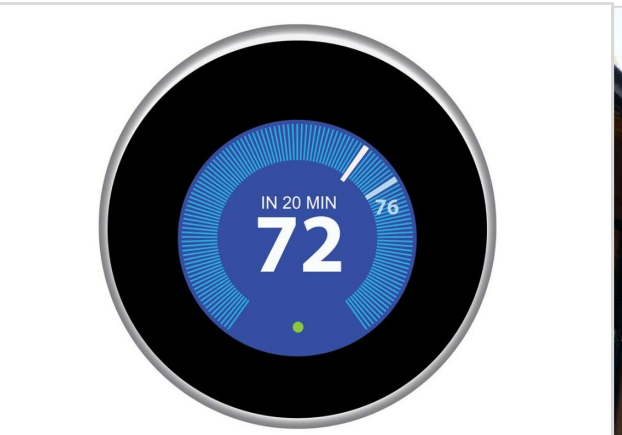
Possible Solutions

- No regrets/Low hanging fruit -- conservation
- Let the market solve the problem?
- Remove subsidies for fossil fuels and high-emitting activities?
- More research
- Better Education
- More laws & regulation?
- Geoengineering (Yuck!)
- Tax breaks for good behavior (electric cars, etc)
- Carbon pricing -- Polluter pays?

Technology first…
compare unsubsidized costs, 2009-2018



Personal options next… so many choices

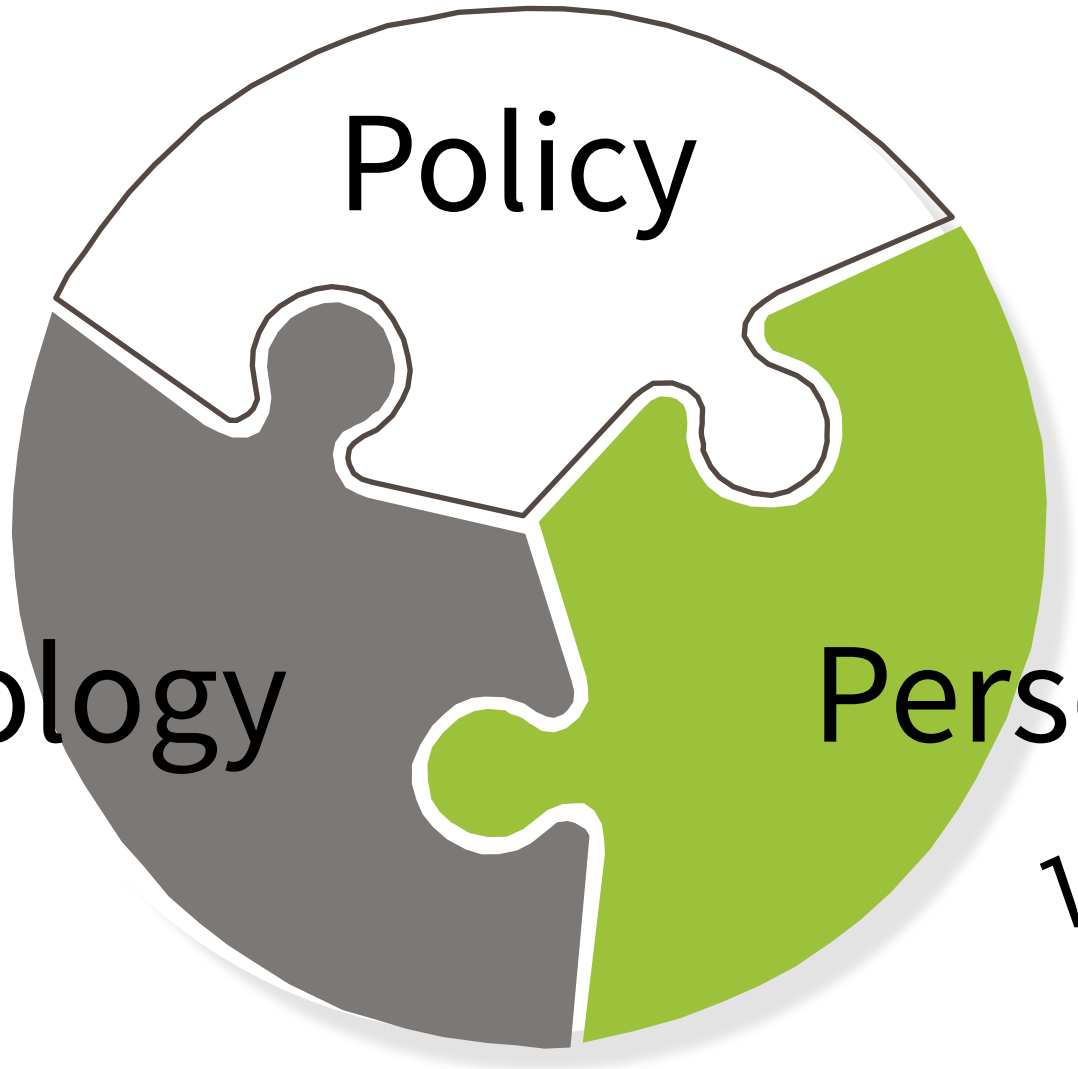


c.f., https://www.drawdown.org/ http://tinyurl.com/Evernote-What-I-can-do

Business: Dollars and Cents

- Personal long-term investment (heating/cooling systems, car)
- Lifestyle: air travel, local products, diet
- Impact on Real Estate
- Investment Opportunities (“Stranded Assets”)
- Business Opportunities
  - Tracking Energy Use
  - Competitive Advantage of Sustainable Practices

Policy last but most necessary...



Technology

√

Personal

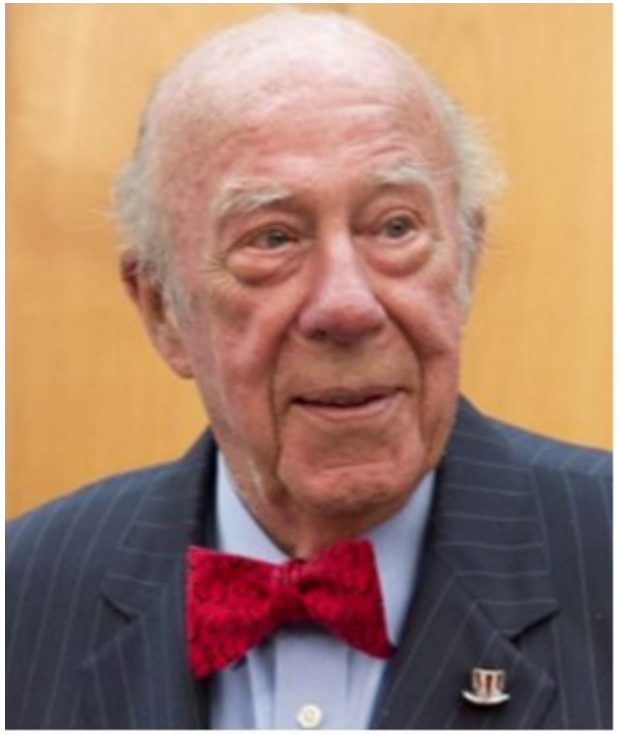
√

What makes for a good climate policy?

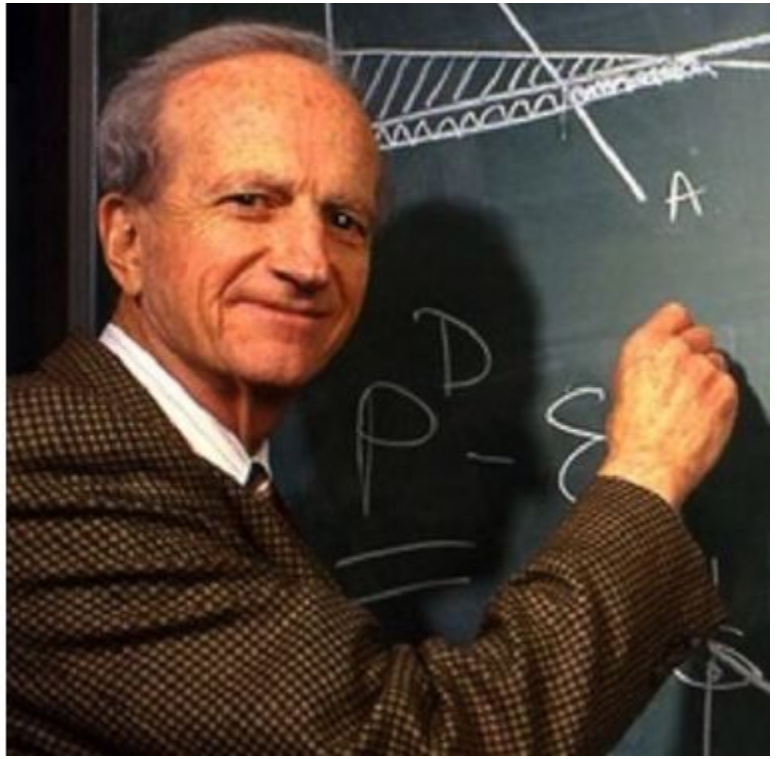
- Fair to All
- Beneficial for All
- Economy-wide change
- Effective in reducing emissions
- Market-driven
- National program that is “sticky”
- International reach

Consider this policy approach…

Carbon Fee & Dividend



Initially developed by economists George Shultz and Nobel Laureate Gary Becker



This policy has been introduced in Congress

The Energy Innovation and Carbon Dividend Act, H.R. 763

Energy Innovation AND Carbon Dividend Act

Carbon Fee → **Carbon Dividend**

The Basic Elements:

The Protections:

Carbon Border Adjustment

Agriculture Exemption

Limited Regulatory Adjustment

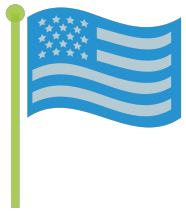
Energy Innovation AND Carbon Dividend Act

These are the very real Benefits…

Effective in reducing emissions

Good for People

Creates Jobs, builds the economy



Bipartisan

Revenue Neutral

Two Climate Change Plans

Energy Innovation Act (HR 763)

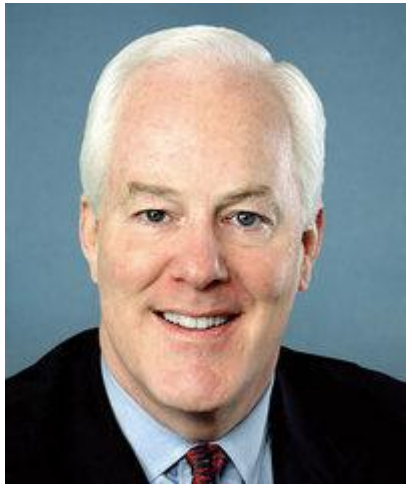
- Family of 4 -- receives annual dividend of **$3400** (500$/person). Will increase over time.
- Distributed automatically every month.
- Fee on fossil fuels at the source. starts at **$15** per metric ton of CO2, and increases **$10** per year.
- Border Carbon Adjustment -- Fees on product produced in countries without carbon tax
- 100% of revenues are returned to households
- Each $10 per metric ton carbon fee would add about 11¢ to a gallon of gasoline, about 6¢ to a therm of natural gas, and 0.9¢ to a kilowatt-hour of coal-generated electricity.
- Generate 2.1 million additional jobs in the first 10 years.

Climate Leadership Council

- Family of 4 receives **$2000** on a quarterly basis
- Quarterly dividend check.
- Sum will grow over time
- Fee on fossil fuels at the source
- Border Carbon Adjustment -- Fees on product produced in countries without carbon tax
- Fee on CO2 emissions starting at **$40** a ton (2017$) and increasing every year at **5%** above inflation.

Most importantly . . .

- We can beat climate change if we all exercise our citizenship
- **Please contact your Member of Congress.**
- Urge them to pass effective national climate legislation
- Will your company endorse climate change proposals?
- Rotarians, we need your help!



Quick Insights & Questions

More information

- **skepticalscience.com** (debunks climate myths)
- Wikipedia articles on Climate Change (Really!)
- News Source: *The Guardian*, *NYT*, *vox.com*, *climatebrief.org*
- Texas: *Texas Climate News*
- People:
  - Bill McKibben (environmental writer)
  - Katherine Hayhoe (Texas climate scientist & poli sci prof)
  - Mark Jacobson (Stanford U., Youtube “Keynote presentation”)

http://bit.ly/36Z4UVF

Slides and Notes (on my idiotprogrammer blog)

Citizens' Climate Lobby