



# EN-ROADS

## Climate Action Simulation



Sustainability  
Initiative



Developed by:



# Agenda:

- Introduction
- Welcome to the Summit
- Plenary Rounds
- Debrief



# ***Introduction***

The **Climate Action Simulation** is a group roleplaying game to explore solutions for mitigating climate change.

Real data



Computer Simulator



Mock UN summit



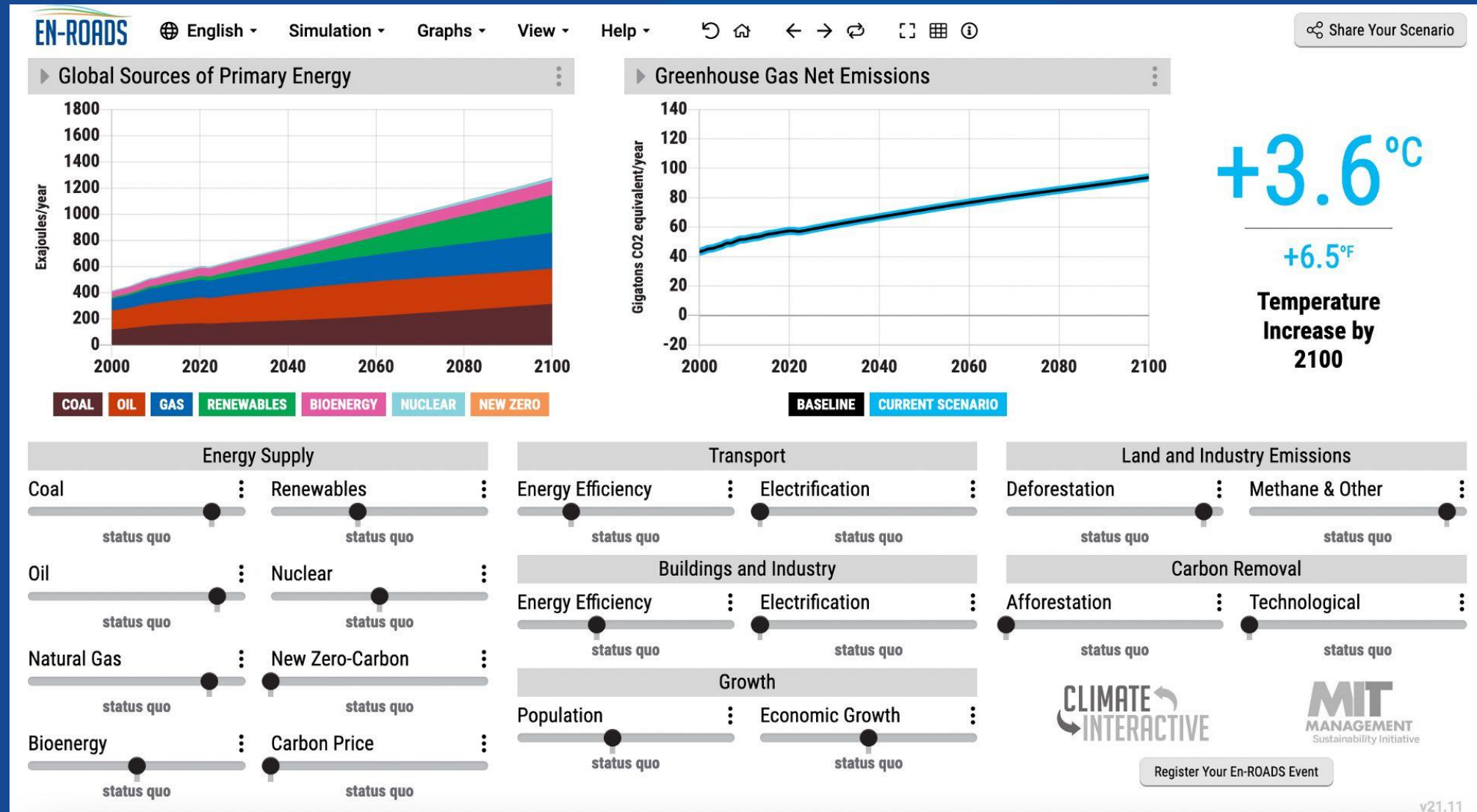
## How the Climate Action Simulation game works...

“Global leaders” from sectors across business, government, and civil society gather to negotiate a climate solutions plan to limit global warming to less than 2°C and ideally 1.5°C above pre-industrial levels.



# Backed by data...

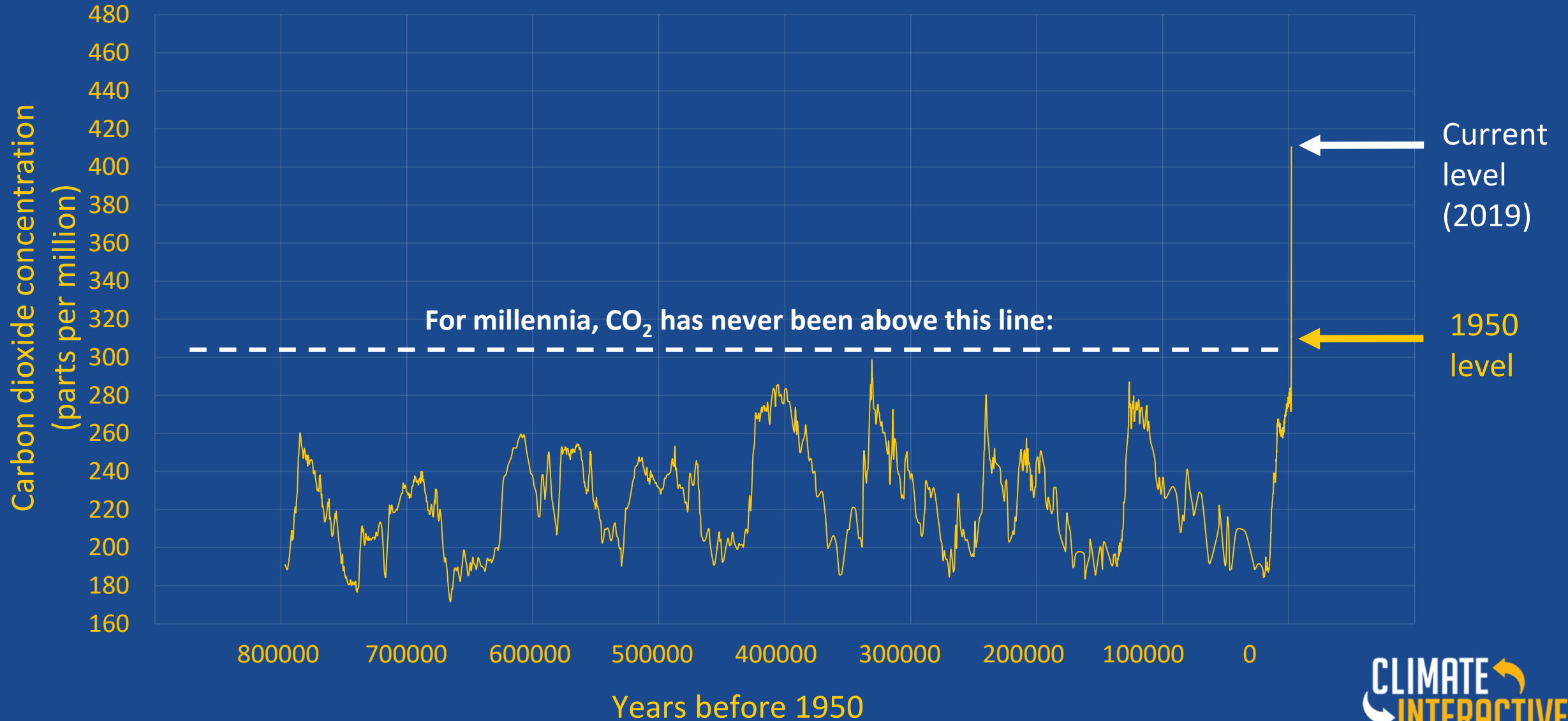
We will use **En-ROADS**, a cutting-edge simulation model, to test climate solutions and generate climate scenarios for the future.



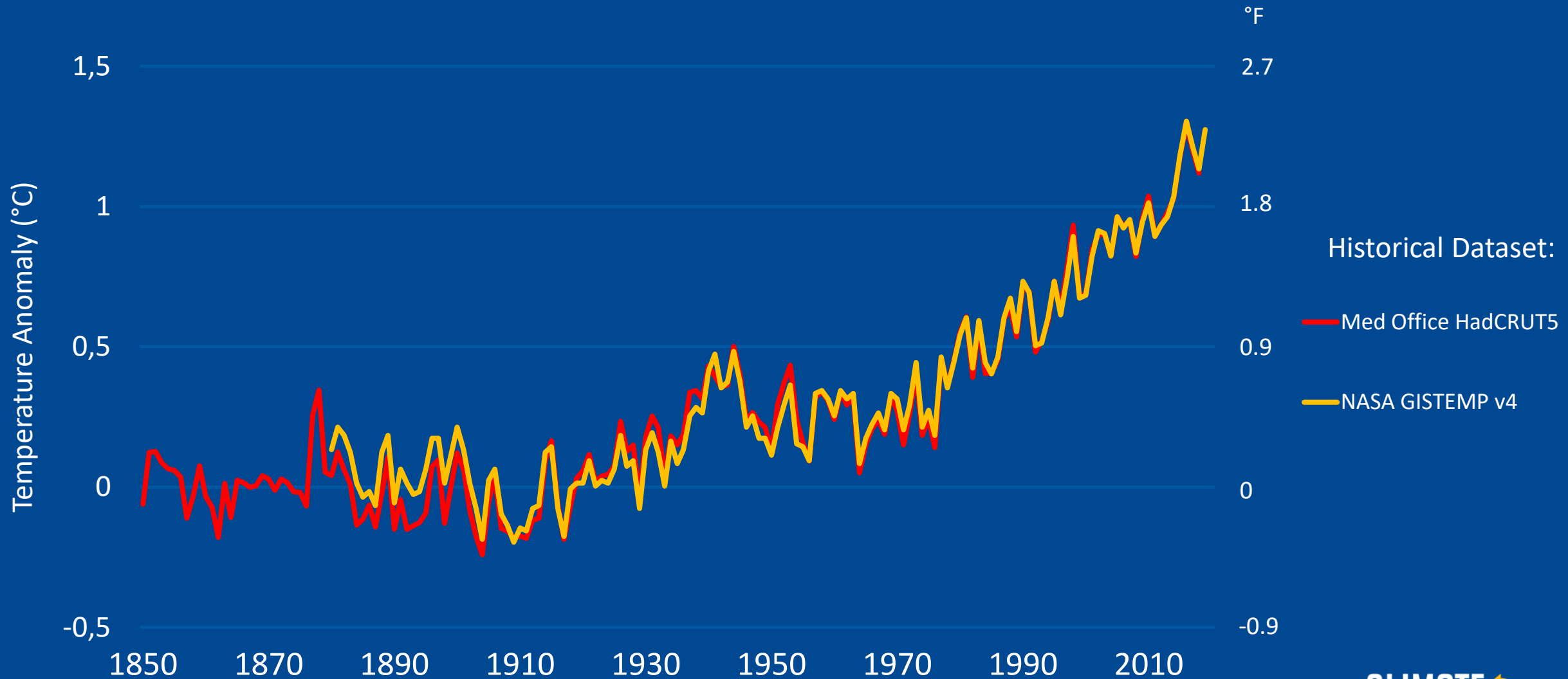
*Let's briefly review the science  
and what's at stake....*



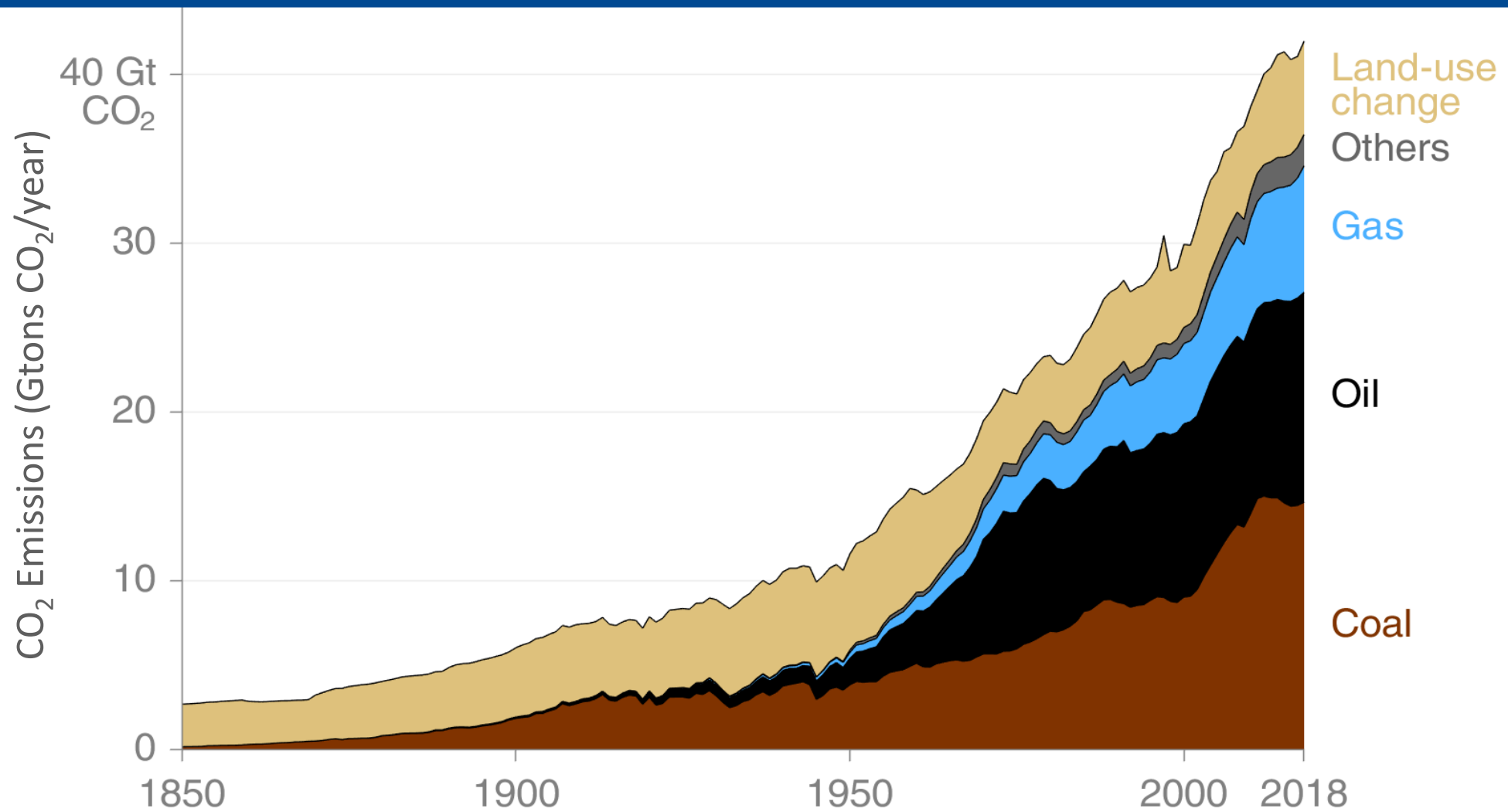
**Atmospheric CO<sub>2</sub> is higher than any time in that last 800,000 years, and levels are increasing faster than any time in millions of years.**



# Global Temperature Change from Preindustrial (°C)



# CO<sub>2</sub> Emissions by Source

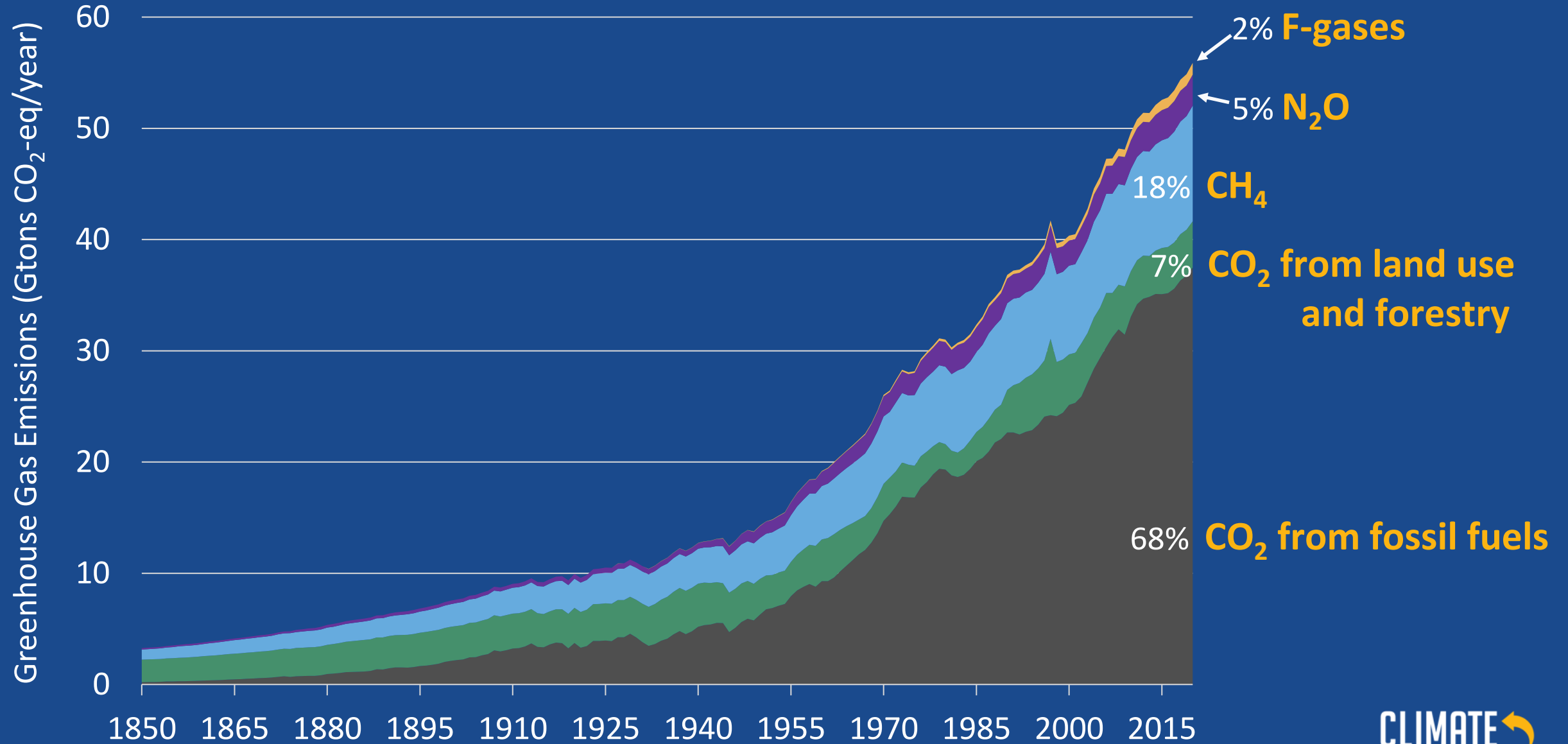


© Global Carbon Project • Data: CDIAC/GCP/UNFCCC/BP/USGS

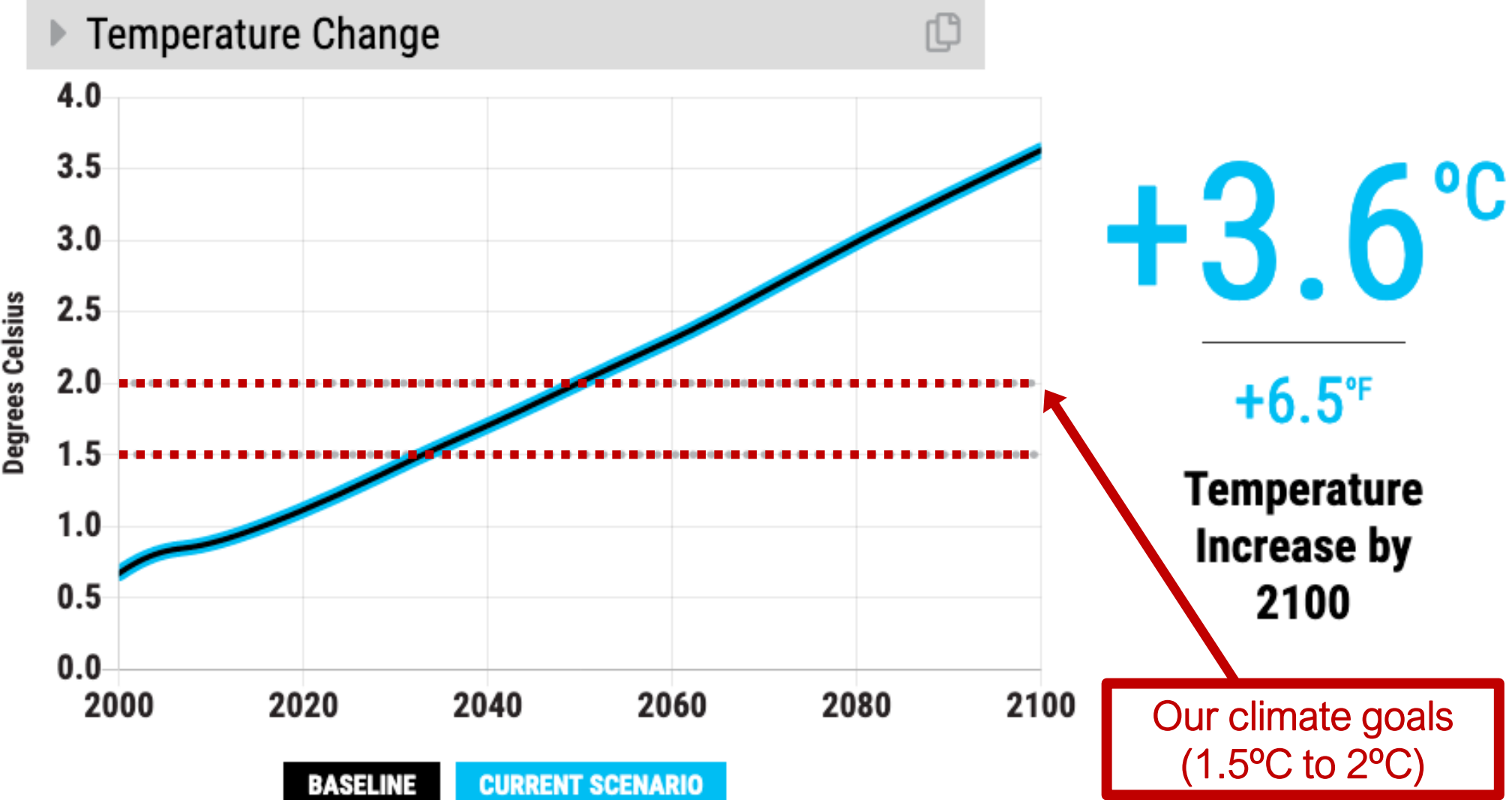
Source: Carbon Dioxide  
Information Analysis Center (CDIAC)

Other: Emissions from cement production and gas flaring

# Total Annual Global Greenhouse Gas Emissions by Gas



# Baseline scenario



# What would 3+ °C (or 5.4+ °F) of warming mean?



Arctic sea ice is gone in **2 out of every 3** summers<sup>1</sup>



**50%** of insect species lose >50% of their habitat range<sup>2</sup>



Drought: **11 months longer**

*Increase in average drought length<sup>3</sup>*



Area burned by summer wildfires in Mediterranean **doubles<sup>4</sup>**

*Compared to today*

# Welcome to the UN Climate Action Summit



# Our Goal Today

Limit global warming to less than 2°C, and as close to 1.5°C as possible, above pre-industrial levels.







## Conventional Energy

Largest energy suppliers in the world:

- Coal
- Oil
- Gas
- Nuclear
- Electric Utilities



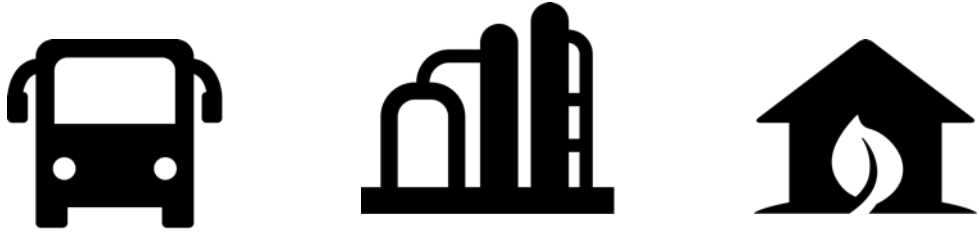


## Clean Tech

Global leaders in clean tech:

- Wind, Solar, and other renewable energy sources
- Energy storage, electric vehicles
- Energy efficiency, green buildings
- Technological carbon removal
- New energy for the future



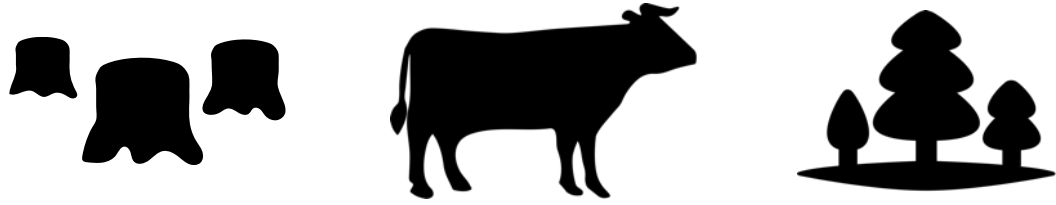


## Industry & Commerce

Largest energy consuming corporations:

- Automakers, Airlines, Shipping & Freight, Other Transport
- Construction
- Industrial machinery
- Manufacturing
- Consumer products
- High tech





## Land, Agriculture, & Forestry

Global alliance of:

- Food & agriculture companies
- Large landowners and farmer advocacy groups
- Logging companies
- Land conservation groups





## Climate Justice Hawks

- Leading environmental nonprofits
- Climate justice organizations
- Grassroots & youth movements
- Global citizens from communities harmed by climate change

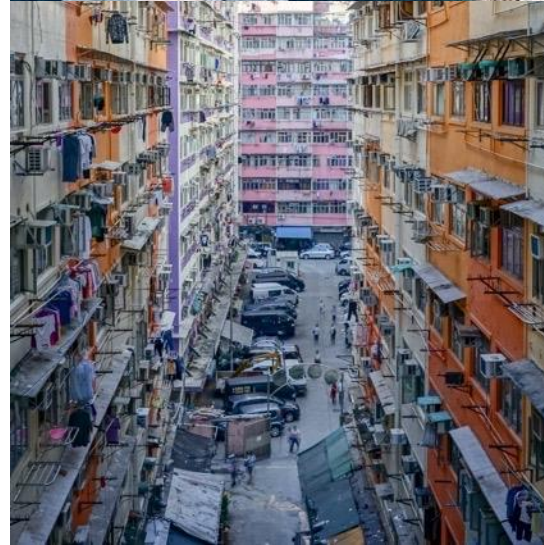




# World Governments

Government leaders from around the world representing:

- Developed countries – EU, USA, Canada, etc.
- Rapidly developing countries – China, India, etc.
- Small island nations



# *Plenary Rounds*

# Process

Each team may propose one action per round. You may propose to:

- **Add a new solution** to the plan by choosing to change one of the 18 levers in En-ROADS
- Or **reverse a previous action** that another group proposed.

We will review the impact of your proposed actions in En-ROADS.



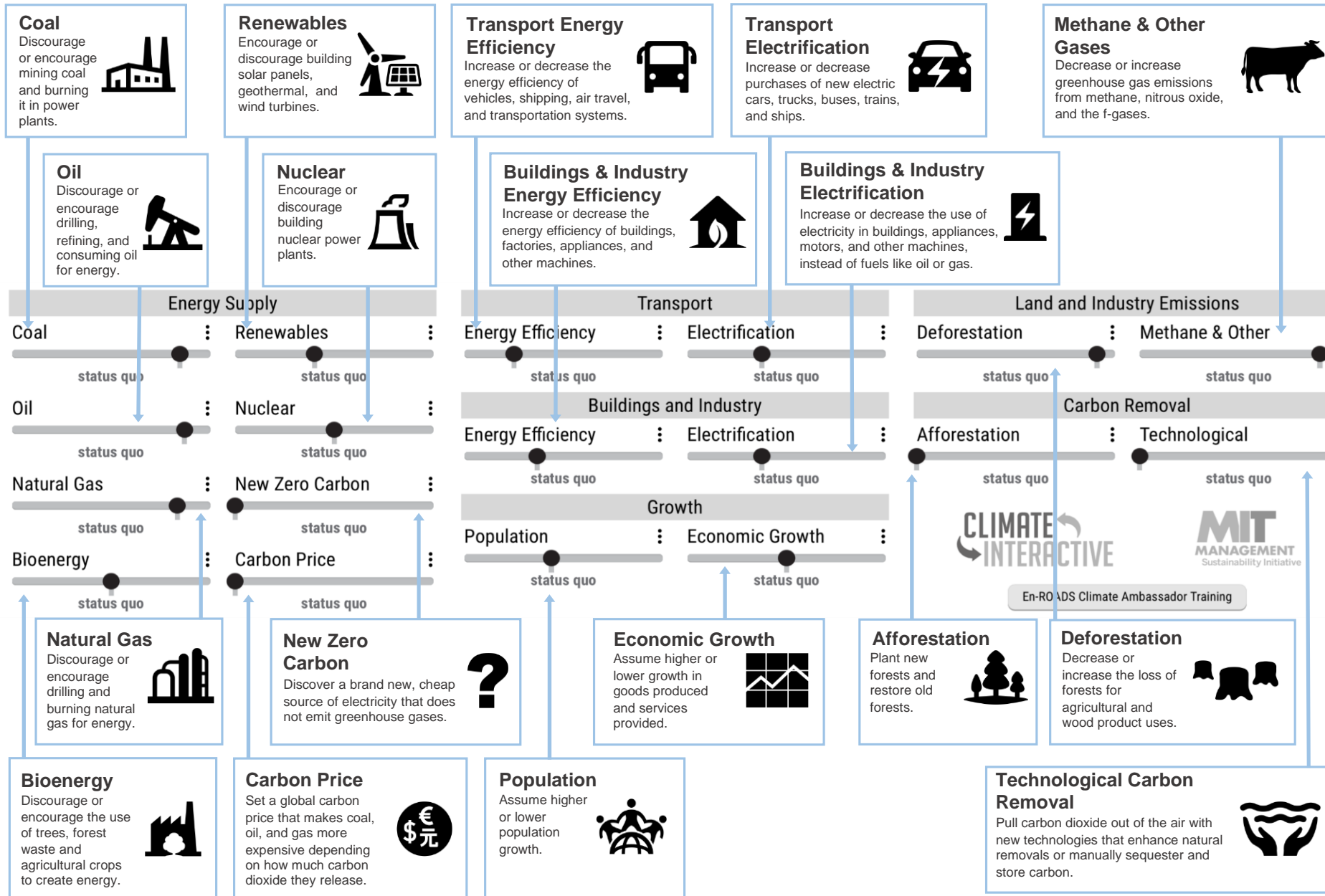
# Multisolving Lens

Consider:

- A near-term co-benefit from your proposal. How can you address more than one problem with one action?
- How might you ensure that marginalized communities are not disproportionately burdened and/or left out of opportunities to address and act on climate change?

# En-ROADS Control Panel

climateinteractive.org



# Overall Process

1. Break for round 1 team meetings
2. Each team will send up a delegate to make a 2-minute speech to propose one action per round. You may propose to:
  - **Add a new solution** – OR –
  - **Reverse a previous action**
3. We will input each action into En-ROADS and evaluate the results together. This round closes when every team has offered one solution.
4. Plenary rounds end when we achieve our climate goals or run out of time.

# Guidelines for Respectful Roleplay

Please be respectful to your fellow participants and the group you are representing. In particular, please follow these guidelines:

## Accents

- Do not pretend to have an accent or similar speech characteristics of the group of people you are portraying. This could be offensive to other participants or observers and detracts from the goals of the game.

## Clothing & head coverings

- Do not wear the traditional or religious clothing or head coverings of any nation or culture as part of your role, unless you yourself are of that culture or religion and it is a part of your personal practice.

# Round 1 Team Meeting

(10-15 minutes)

1. Start by looking over the En-ROADS control panel. Try circling the 2-3 actions you most strongly support vs. oppose
  - An “action” is any change one of the 18 levers in En-ROADS
2. Talk with your team to form your overall strategy
3. Discuss with your team to reach an agreement on your first action, including details – e.g., level of change, start year
4. Select your delegate and prepare a 2-minute speech

# Round 1 Team Meeting

(10-15 minutes)

- For each proposal, consider these questions:

*What are your vital interests?*

*What is politically feasible?*

*What do you need from the other groups?*

*What can you offer them?*

*What is a near-term co-benefit from your proposal?*

*How can you solve more than one problem with one solution?*

*How do you ensure that vulnerable communities are not*

*disproportionately affected by your proposal?*

# *Round 1*

# *Plenary Presentations*

(10-15 minutes)

# 2<sup>nd</sup> Team Meeting & Negotiations

(15-20 minutes)

1. Discuss follow-up actions as a team
2. Negotiate with other groups and lobby them to change their position if necessary





# *Round 2*

# *Plenary Presentations*

(10-15 minutes)

***Debrief***

How are you **feeling**?

# Debriefing Discussion

- What surprised you?
- What were your key insights?
- What will you take away from today, and how can you apply what you learned to the real world?

# Looking ahead

- We have the tools
- Solar and wind are growing and getting cheaper
- Corporations are investing in clean tech
- Countries and states are stepping up
- The general public is becoming more educated and engaged

## Companies are starting to take action



Clothing brand  
H&M has promised  
to **double its  
energy efficiency**  
by 2030



Over 260 of the world's  
largest companies have  
committed to using **100%  
renewable electricity** by  
2050, with an average  
target date of 2028



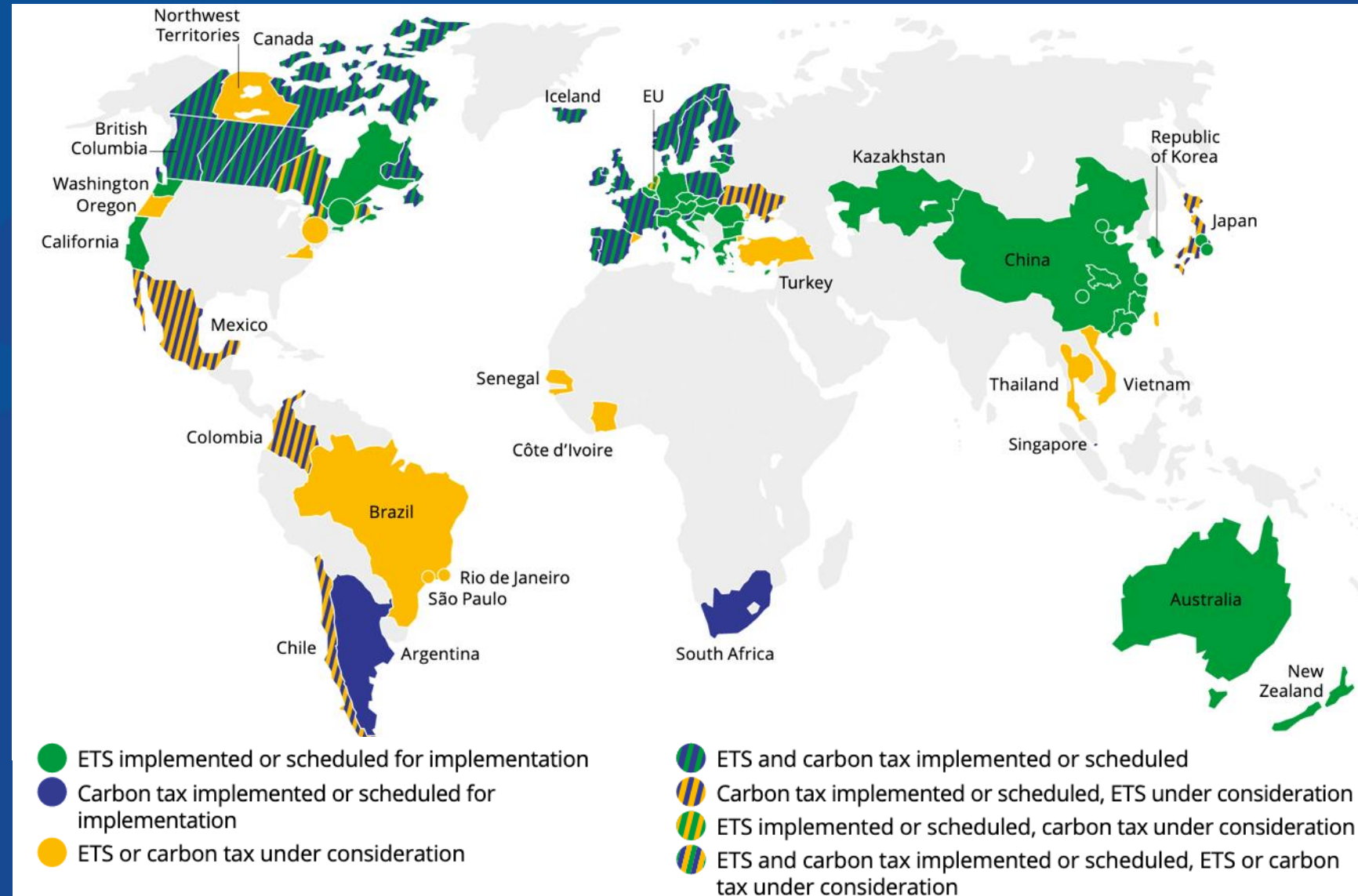
Microsoft has pledged to  
be carbon negative by  
2030, **removing more  
carbon than it emits**

# Carbon prices are being enacted around the world

Current or planned carbon pricing covers **22%** of global emissions

**80+** jurisdictions (regional, national or sub-national) have implemented or are considering carbon prices

Source: World Bank, 2020



September 2019: Over 7 million people in 185 countries

# Global Climate Strikes





# *What can you do?*

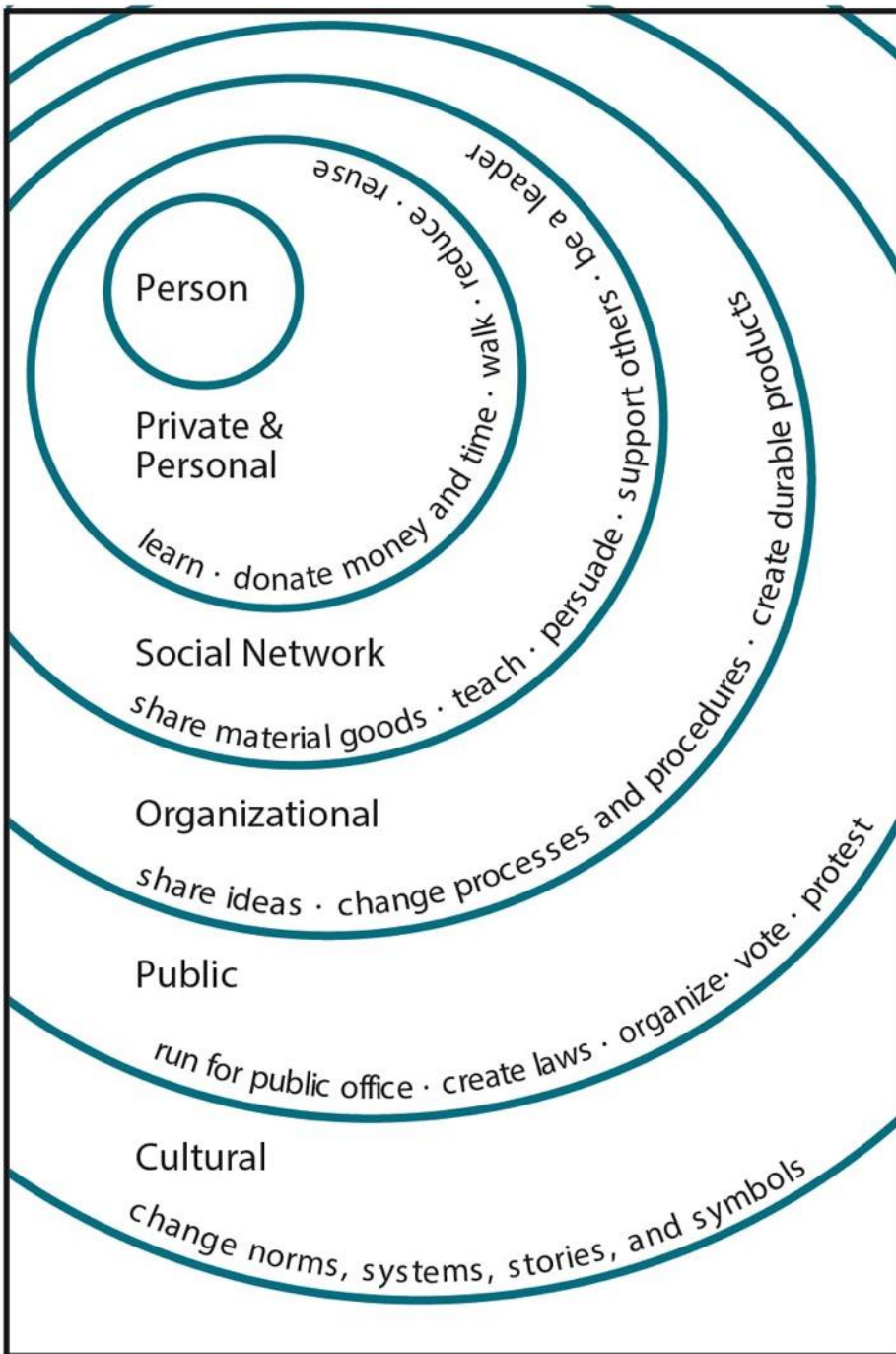


Illustration by Elise Amel



# Thank You!

Visit:  
[climateinteractive.org](https://climateinteractive.org)

# En-ROADS simulations:



Over **80,000** participants in **86** countries



# Appendix

# The Mastering En-ROADS Training Series

Join this free, self-paced online course to...

- Learn more about the En-ROADS simulator
- Facilitate engaging events to spark climate action – both online and in-person
- Gain valuable insights on systems thinking, multisolving, advanced facilitation tips, and more
- Begin your journey as an En-ROADS Climate Ambassador
  - So far, we have over 400 En-ROADS Climate Ambassadors from more than 50 different countries!



Register at: <https://learn.climateinteractive.org>

# Insights from En-ROADS

1. There is **no silver bullet** – there's no one solution that will prevent climate change.
2. To achieve  $\sim 2^\circ$  requires “silver buckshot” – success with most everything.
3. **Highest leverage: Keeping fossil fuels in the ground.**
4. Even when low-carbon supply is encouraged and thrives, we still burn fossil fuels.
5. New technologies grow via reinforcing “learning” feedback loops.
6. Energy efficiency starves growth in renewables.
7. When energy becomes inexpensive (e.g., renewables, nuclear, new tech breakthroughs), **energy demand increases via a modest “rebound effect.”**
8. Accelerated growth in natural gas (e.g., via subsidy) absent a carbon price starves renewables and mitigates little greenhouse gases.
9. **A brand new technology is too delayed** to contribute much on its own.
10. The transition from high-carbon to low-carbon takes decades due to **long lifetime of fossil fuel capital infrastructure.**
11. In a high-mitigation scenario, more nuclear/new-tech/renewables just displaces the other low-carbon sources.
12. **“Other gases” reduction** mitigates a good bit.
13. GDP changes are high leverage.
14. **A carbon price is high leverage because it changes fuel mix and reduces energy demand.**
15. Reducing deforestation is lower leverage in long term than most expect.

# System Dynamics In En-ROADS

1. **Capital Stock Turnover** - Changes to infrastructure take time
2. **Rebound Effect** - Price, demand, and supply are linked
3. **Economies of Scale and Learning** - Success builds success via Progress Ratio
4. **Crowding Out** – Low-carbon supplies compete for long-term market share
5. **Squeeze the Balloon** – Fossil fuel supplies experience compensating feedback
6. **Drivers of Growth** – Population and GDP growth drives emissions
7. **Limits to Growth** – Oil and gas gets expensive, coal doesn't
8. **No “Winner Takes All”** – Fossil fuel energy persists even when more expensive
9. **Other Gases Matter** – Reducing non-CO<sub>2</sub> emissions is powerful
10. **Bathtub Dynamics** – CO<sub>2</sub> concentration and temperature adjust slowly

# Features of En-ROADS

- **Transparent**

All equations and structure available in public documentation

- **Flexible**

Assumptions are adjustable

- **Highly aggregated to be fast**

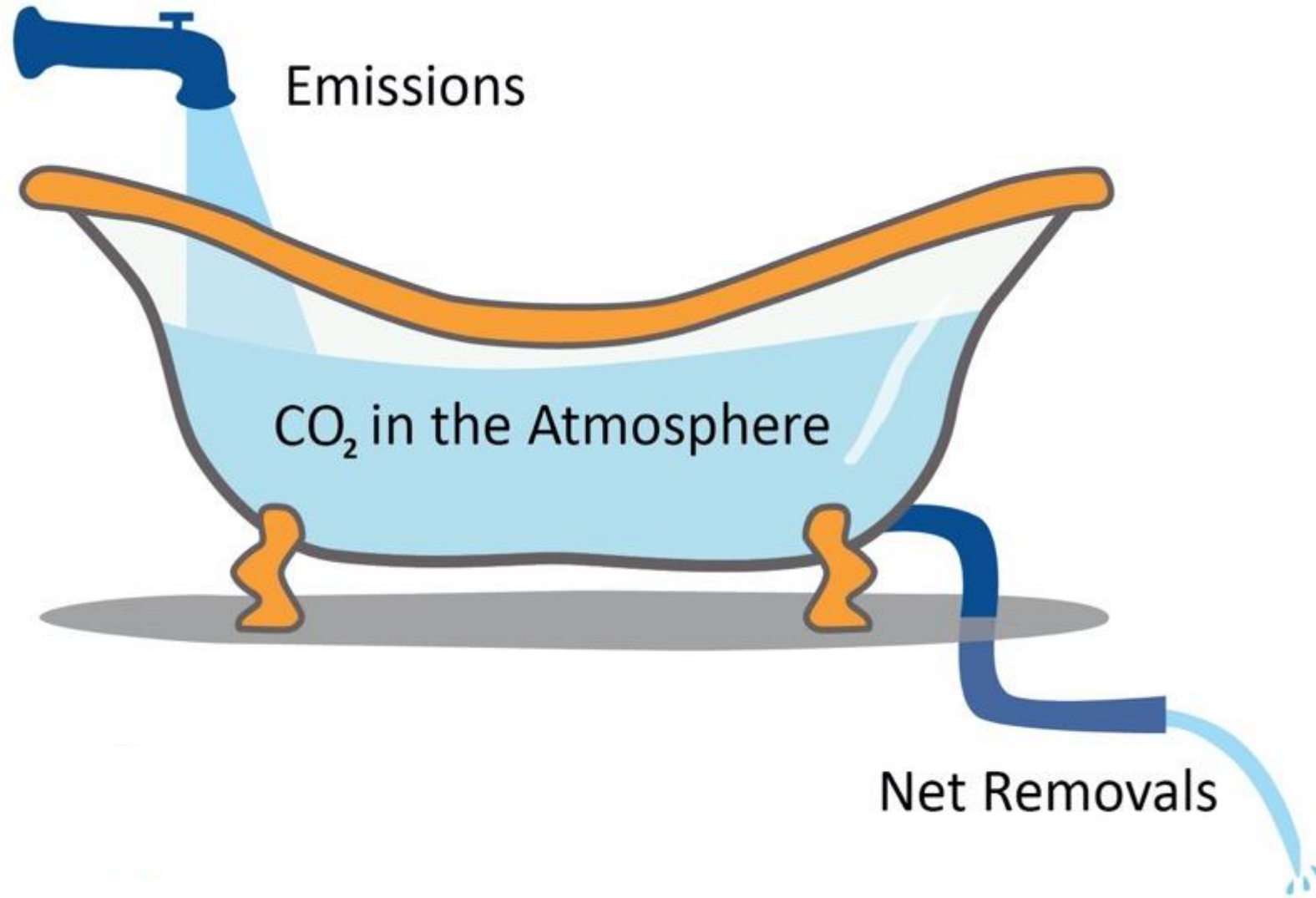
Complementing, not supplanting, the EMF22 and other more detailed models

- **Supports grounding discussions to learn and strategize, backed with real data & science**

However, not to serve as *predictions* for the future, which is dependent on too many behavioral variables

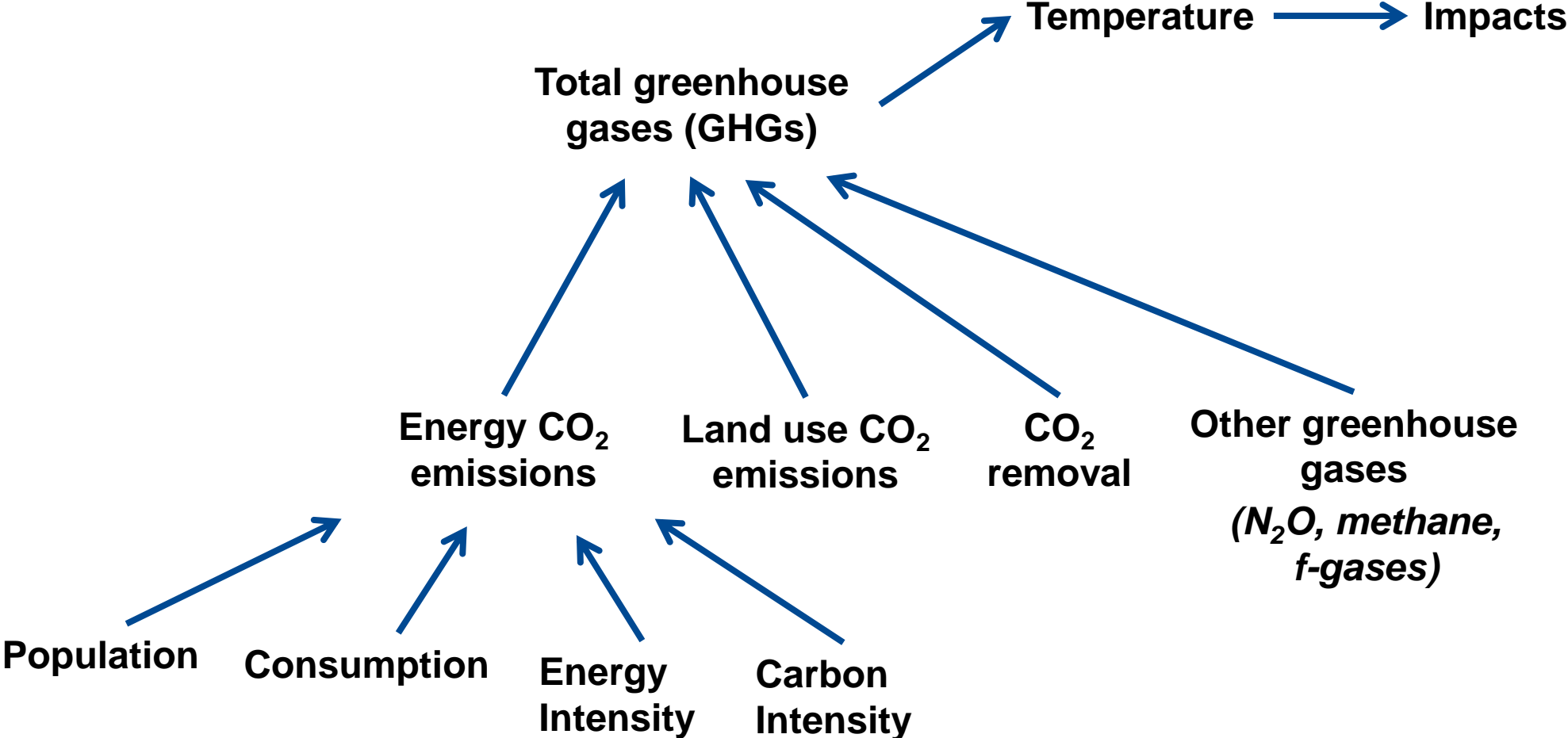


# Bathtub Dynamics



Overall framing by Dr. John Sterman, MIT Sloan

# En-ROADS Core Structure



# Multisolving

# Health benefits far outweigh the costs of meeting climate change goals

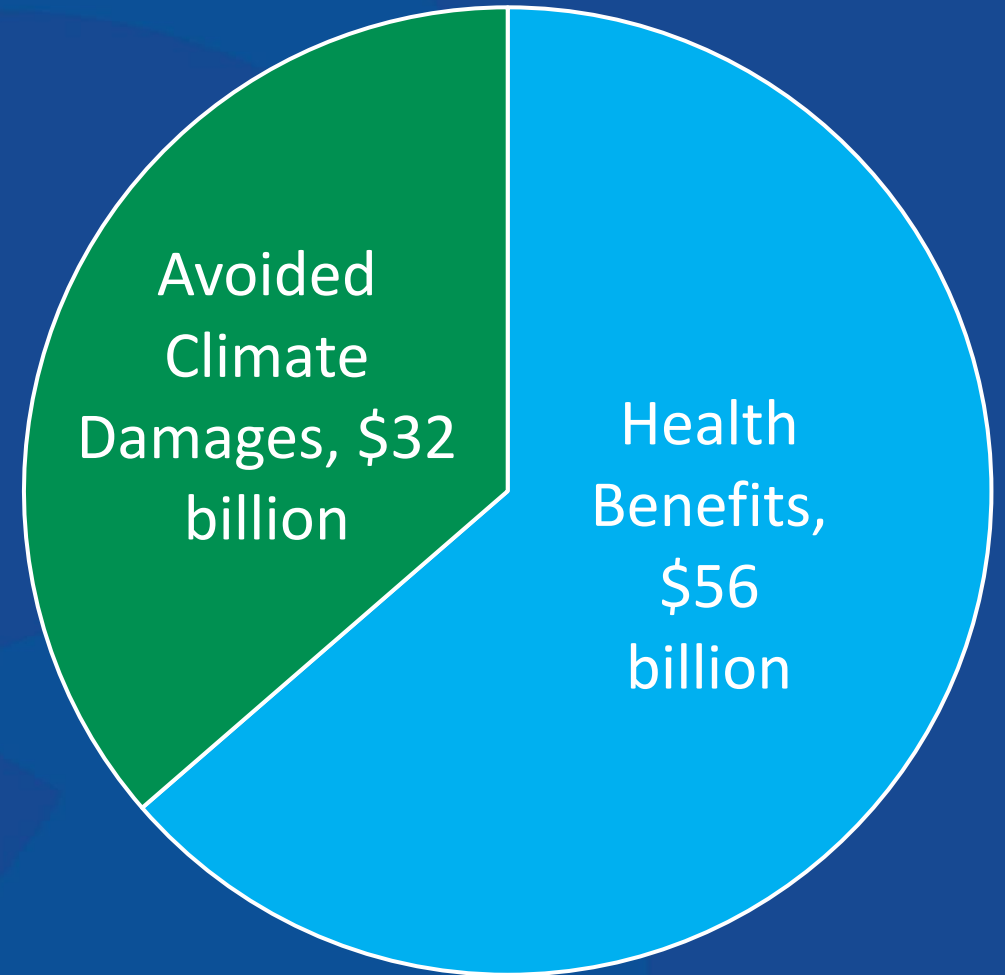
5 December 2018 | News Release | Katowice, Poland

**“The health burden of polluting energy sources is now so high, that moving to cleaner and more sustainable choices for energy supply, transport and food systems effectively pays for itself,”** says Dr Maria Neira, WHO Director of Public Health, Environmental and Social Determinants of Health.

“When health is taken into account, climate change mitigation is an opportunity, not a cost.”

# Clean Energy & Health

Health benefits from wind and solar power in the United States from 2007 to 2015 were *even greater* than their climate benefits.



# Clean Energy & Jobs

If \$200 billion was invested every year in energy efficiency and clean energy in the US, **4.2 million jobs** would be created by 2030, and the 2030 unemployment rate would be reduced by 1.5%.

# Health Benefits of Climate Action: Global

Limiting warming to 1.5-2°C by cutting fossil fuel emissions would:

- **Prevent ~153 million** premature deaths from air pollution by 2100<sup>1</sup>
- **Save** ~\$800 Billion per year due to health benefits from clean power and \$400 Billion per year from clean transportation
  - **~\$1.2 Trillion** per year total<sup>2</sup>



# Health Benefits of Climate Action: U.S.

The U.S. would save billions in health care costs by 2030<sup>2</sup>



Prevent **~295,000 premature deaths** by 2030  
from air pollution caused by fossil fuel use



Prevent **~29,000 Emergency Room** visits/year for  
childhood asthma



Prevent **15 million adult work hours** lost/year



# Impacts at different levels of warming

# 1.5°C of warming (or 2.7°F)



Increase of **3.0 - 4.5°C (5.4 - 8.1°F)** in extreme temperatures in some regions<sup>1</sup>



**70%** of coral reefs bleached<sup>2</sup>



Drought: **2 months longer**

*Increase in average drought length<sup>3</sup>*



**13%** of people face severe heat waves at least every 5 years<sup>4</sup>

# 2°C of warming (or 3.6°F)



Risk of river flooding **more than doubles**<sup>1</sup>

*Average 170% increase in river flooding, with highest risk in U.S., Asia, and Europe*



**90%** of coral reefs bleached<sup>2</sup>



Drought: **4 months longer**

*Increase in average drought length*<sup>3</sup>



**Over 50%** of world's population exposed to lethal heat for more than 20 days per year<sup>4</sup>

# 3°C of warming (or 5.4°F)



Arctic sea ice is gone in **2 out of every 3** summers<sup>1</sup>



**50%** of insect species lose >50% of their habitat range<sup>2</sup>



Drought: **11 months longer**

*Increase in average drought length<sup>3</sup>*



Area burned by summer wildfires in Mediterranean **doubles<sup>4</sup>**

*Compared to today*

# 4+°C of warming (or 7.2+°F)



Sea level rise this century: **~1.2 meters (~4 feet)**<sup>1</sup>



**More than two thirds** of glaciers in the Himalaya Mountains melted<sup>2</sup>



One in six species could go extinct<sup>3</sup>



**Three-quarters** of world population exposed to lethal heat for >20 days/year<sup>4</sup>



# Developed Nations

## *Leaders of:*

- Australia
- Canada
- European Union
- Japan
- New Zealand
- Russia & Former Soviet Republics
- South Korea
- USA





# Rapidly Emerging Nations

## *Leaders of:*

- China
- India
- Indonesia
- Brazil
- Mexico
- South Africa





# Developing Nations

Leaders of over 100 nations in

- Africa
- Central and Latin America
- South and Southeast Asia
- Middle East
- Small Island States

