

# *Osher Lifelong Learning Institute, Summer 2022*

## Contemporary Economic Policy

University of Casper College  
Sep-Oct, 2022

Host: Jon Haveman, Ph.D.  
National Economic Education Delegation



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## Course Outline

### • Contemporary Economic Policy

- Week 1 (9/2): Economic Update (Geoffrey Woglom, Amherst College)
- Week 2 (9/9): Trade and Globalization (Alan Deardorff, University of Michigan)
- **Week 3 (9/16): Climate Change Economics (Sarah Jacobson, Williams College)**
- Week 4 (9/23): The Black-White Wealth Gap (Jon Haveman, NEED)
- Week 5 (9/30): Economic Inequality (Chris Herrington, VA Commonwealth)
- Week 6 (10/7): Autonomous Vehicles (Jon Haveman, NEED)



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# Submitting Questions

- Please submit questions of clarification in the chat.
  - I will try to handle them as they come up.
- We will do a verbal Q&A once the material has been presented.
- OLLI allowing, we can stay beyond the end of class to have further discussion.
- Slides will be available from the NEED website tomorrow ([https://needelegation.org/delivered\\_presentations.php](https://needelegation.org/delivered_presentations.php))

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## Climate Change Economics

Sarah Jacobson, Ph.D.  
Williams College

**Casper College**

September 16, 2022



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## Credits and Disclaimer

- **This slide deck was authored by:**
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  - NEED presentations are designed to be nonpartisan.
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## Outline

- **Economic Building Blocks**
- **Climate Change**
- **Impacts of Climate Change**
- **Reducing Emissions**
- **Climate Change Policy**
- **Policy in Action**



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# Economic Building Blocks



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## How Can Economists Help Fight Climate Change?

- By assessing behavioral reactions to climate change.
- By measuring climate change damages and estimating the costs of fighting climate change.
- By designing smart policies that minimize costs to society.



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## Econ 101: When Everything Is Simple, No Regulation Is Needed for Efficiency

- Simple transactions: buyer and seller feel all costs and benefits of sales
- They choose based on the costs & benefits they feel
- → Efficient number of transactions! (Maximizes social benefits)

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## When Our Decisions Affect Others, We Need Regulation

- Pollution causes an **EXTERNALITY**: a side effect (here, a cost) that affects someone else
  - Polluting things have an “unfair cost advantage” because part of cost is offloaded on others
  - → Too much pollution is generated
  - Regulation limiting pollution has net benefits
- *The “efficient” amount of pollution balances costs & benefits of pollution*

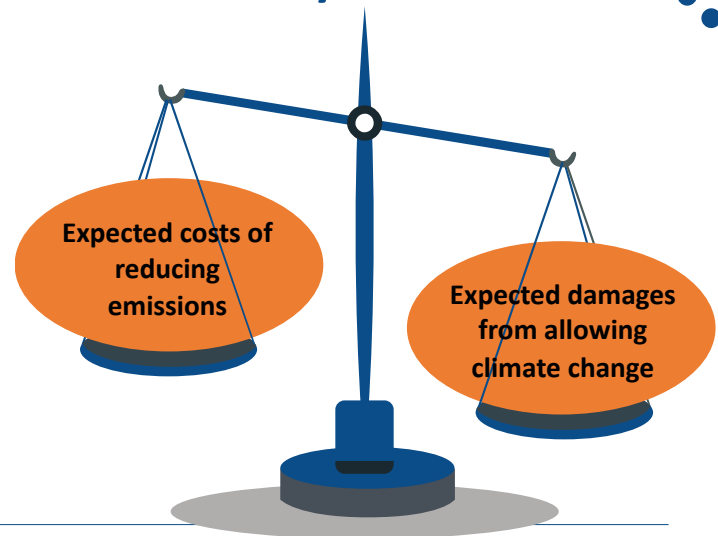


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## How Economists Decide How Much to Fight Climate Change: Cost Benefit Analysis

Abating greenhouse gas emissions is costly...  
... but without action, climate change damages are even more costly.

Goal is not zero emissions, but efficient level that achieves a balance.



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## Cost-Benefit Analysis of Fighting Climate Change

- Most economic models suggest the costs of keeping warming below 2°C are relatively small, amounting to **1-4% of GDP by 2030.**
- Costs of acting to keep warming below 2°C are almost certainly less than future economic damages they would avoid.
  - Damages estimated to be between: **7-20% of worldwide GDP.**



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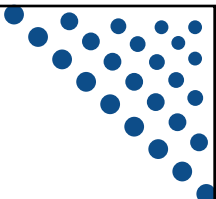
# Climate Change



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## **A** Climate Change Ladder

- Emissions
- Mitigation (a.k.a. Abatement)
- Adaptation
- Damages



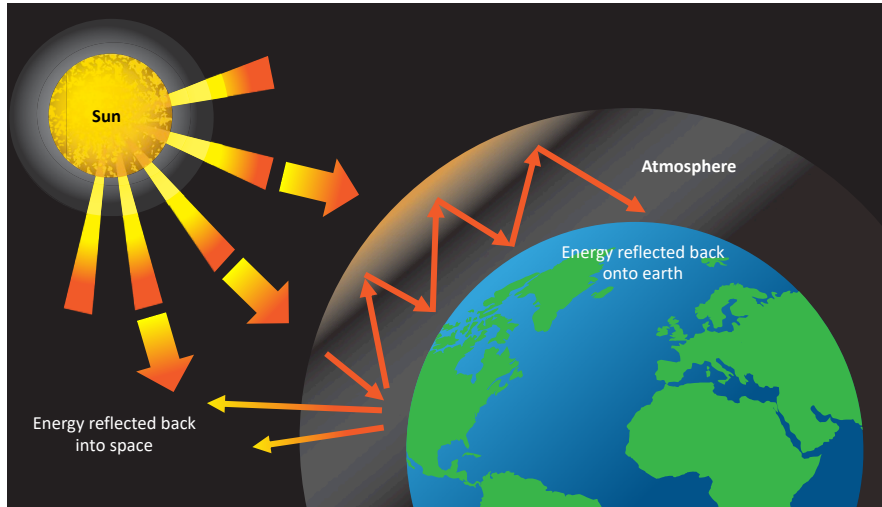
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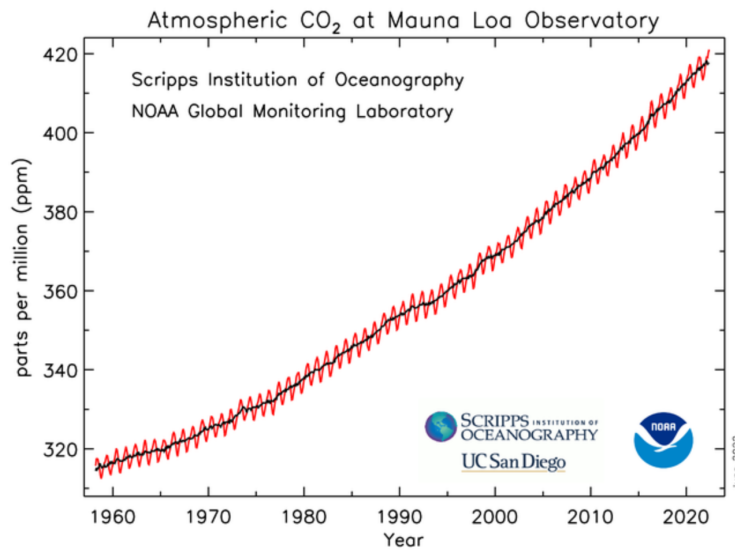
# The Atmospheric Greenhouse Effect



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# Atmospheric CO<sub>2</sub> Concentrations Up To Now

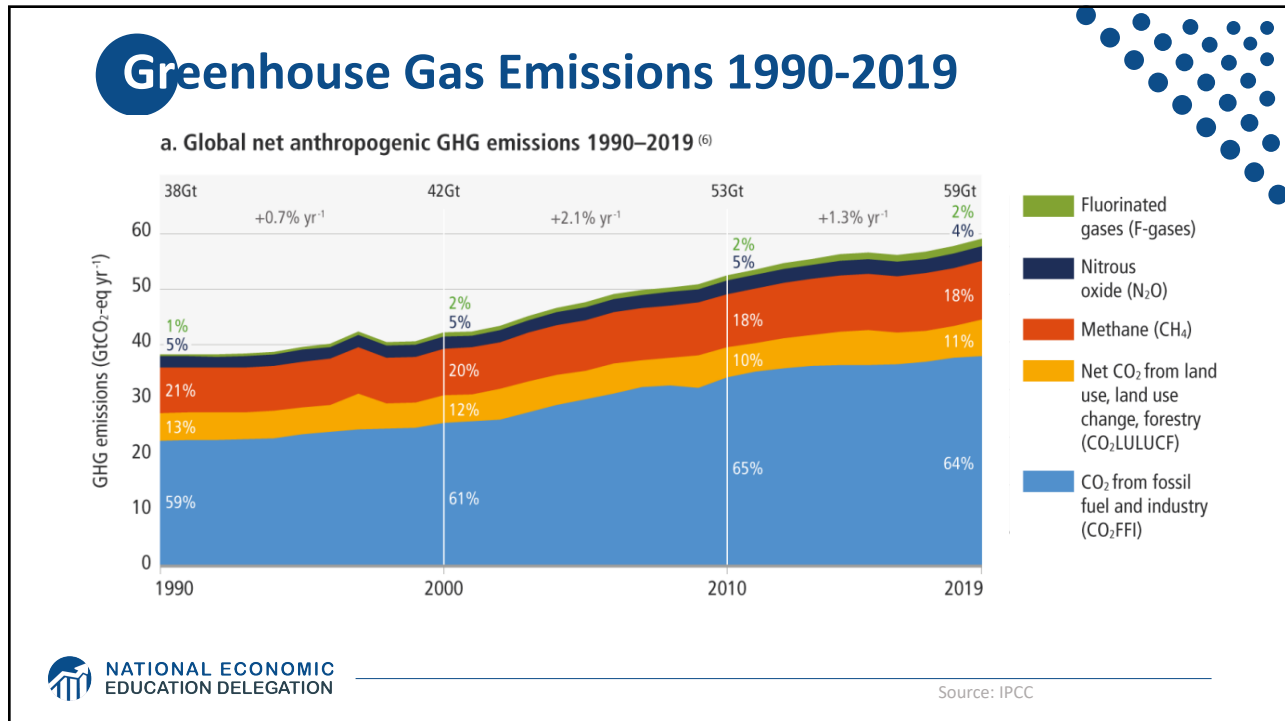


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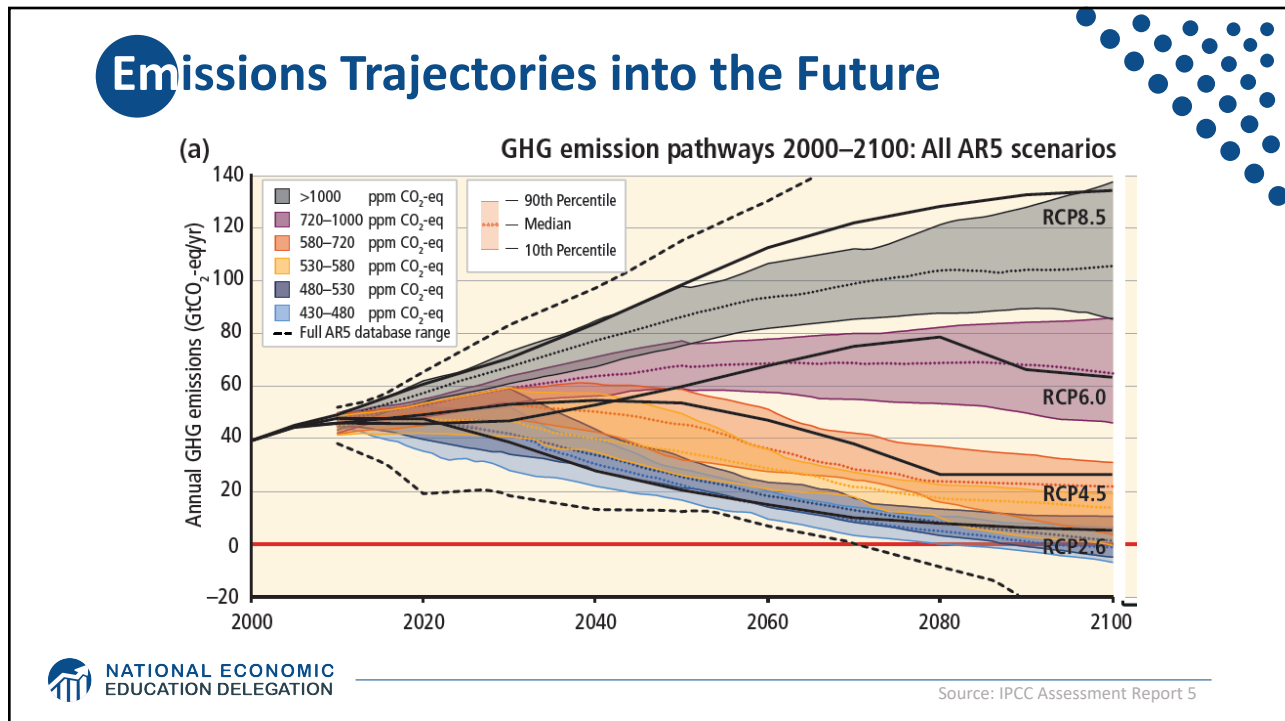
Source: NOAA

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# What Do Greenhouse Gas Emissions Do to the Planet?

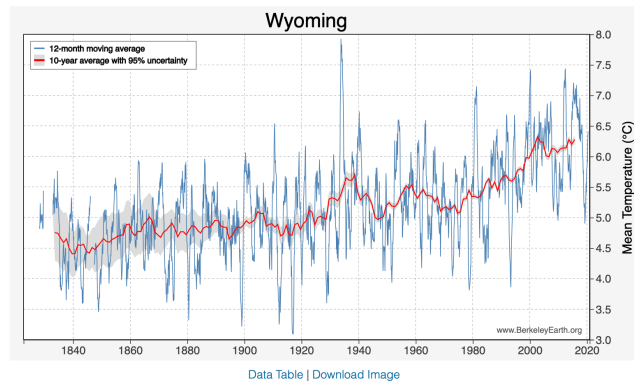
- **Increased temperatures**
  - Sea level rise
  - Storm surges
- **Altered precipitation patterns**
- **More variable weather**
- **More / more powerful storms**
- **Carbon dissolves in ocean**

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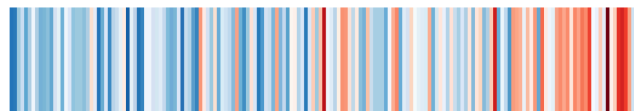
# These Changes Are Already Underway

Use <http://berkeleyearth.lbl.gov/city-list/> to see the temperature history of an area!

Here's Wyoming.



Climate Stripes



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# Impacts of Climate Change



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## How Climate Change Affects Humans

- Agriculture
- Fisheries
- Coastal damages
- Direct health effects, including sickness and death (temperature & drought; also pollution)
- Indirect health effects (vector-borne disease)
- Reduced fresh water availability
- Wildfires
- Shifting zones for important ecosystems, and desertification
- Reduced worker productivity
- Increased violence
- Some of these may cause human migration and/or conflict



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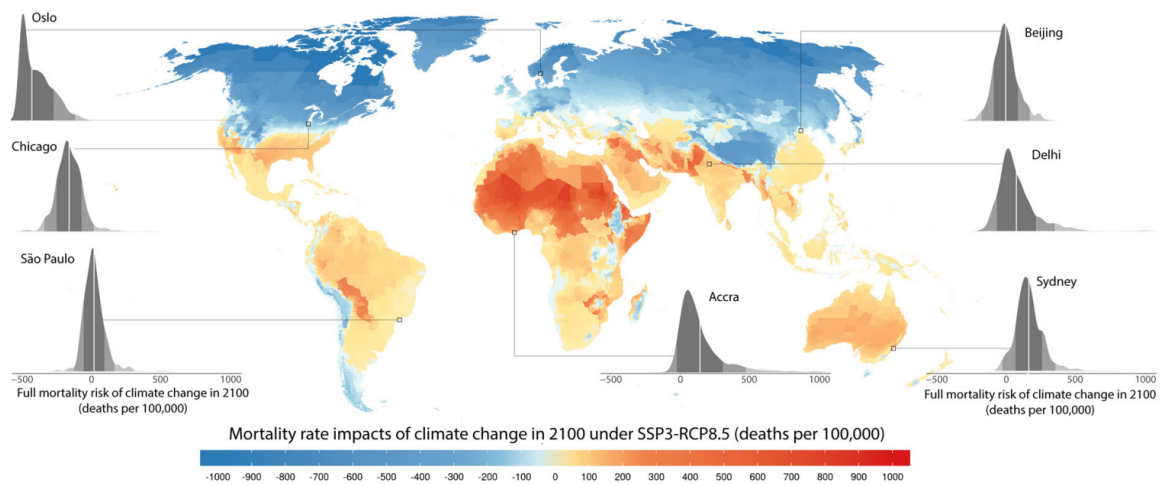
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## Social Cost of Carbon

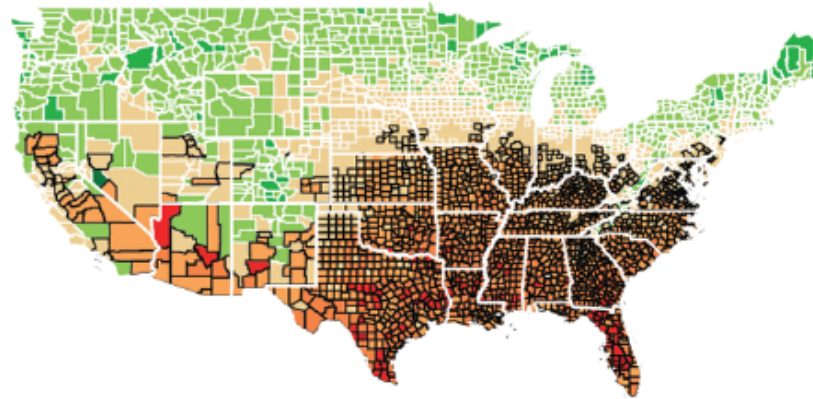
- The expected cost of damages from each unit of greenhouse gas emissions.
- Current EPA estimate: ~\$51 per metric ton of CO<sub>2</sub> (but estimates vary a lot!)
  - About \$157/car per year.
  - \$32 Billion for all vehicles in the US.
- Social cost of carbon will increase over time.



## How Damages Will Vary Globally: Mortality as an Example



## How Damages Will Vary in the US



Total direct damages (% county GDP)



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## Adaptation Reduces Damages

- *Adaptation*: costly action that reduce damages from climate change.
- The **net damage cost to society** is the **cost of adaptation** plus the **cost of remaining damages**.
- People and firms will take some actions on their own, up to the point where they find it worthwhile.
- Some adaptation requires government involvement.



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## Individual-Level Adaptation

- **Perhaps you...**
  - Stay inside more.
  - Turn on the air conditioning.
- **Farmers may:**
  - Plant at different times.
  - Plant new crops.
- **Businesses may:**
  - Give outdoor workers water / shade breaks.
- **Everyone might:**
  - Think about moving to a safer place.



## Public Adaptation

- **Governments can help:**
  - When collective action is less costly than everyone acting alone.
  - When individual action is not possible or likely.
  - When some people can't protect themselves.
- **Sea walls**
- **Ecosystems that provide protection**
- **Policies that protect workers or low-income and vulnerable populations**
- **Planned retreat (moving a community)**



# Reducing Emissions



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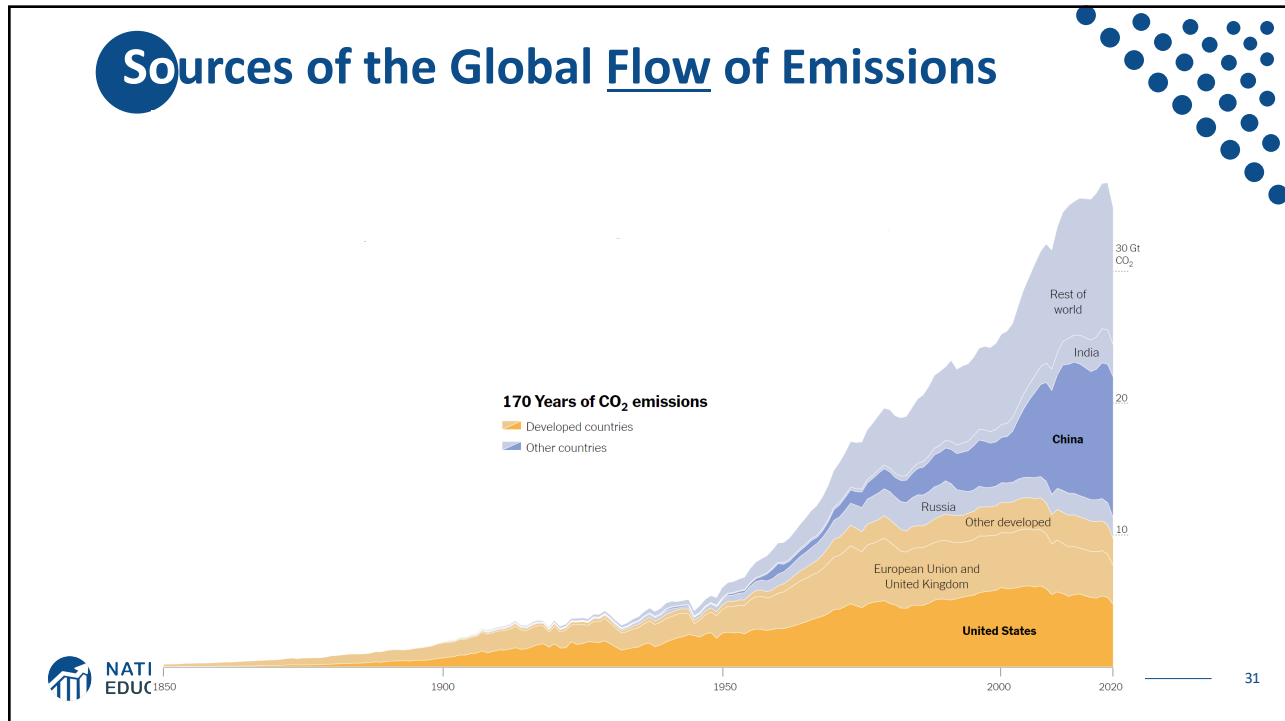
## **Global Net Emissions** Are What We Care About

- **For climate impacts, we don't care where they are emitted, only how much**
  - There may be other local impacts
- **Gross emissions (greenhouse gas sources): how much greenhouse gases (including CO<sub>2</sub>) we put out**
- **Greenhouse gas sinks: ways to pull CO<sub>2</sub> out of the air**
  - Existing: oceans, forests
  - Increase sinkage by planting trees, or other measures

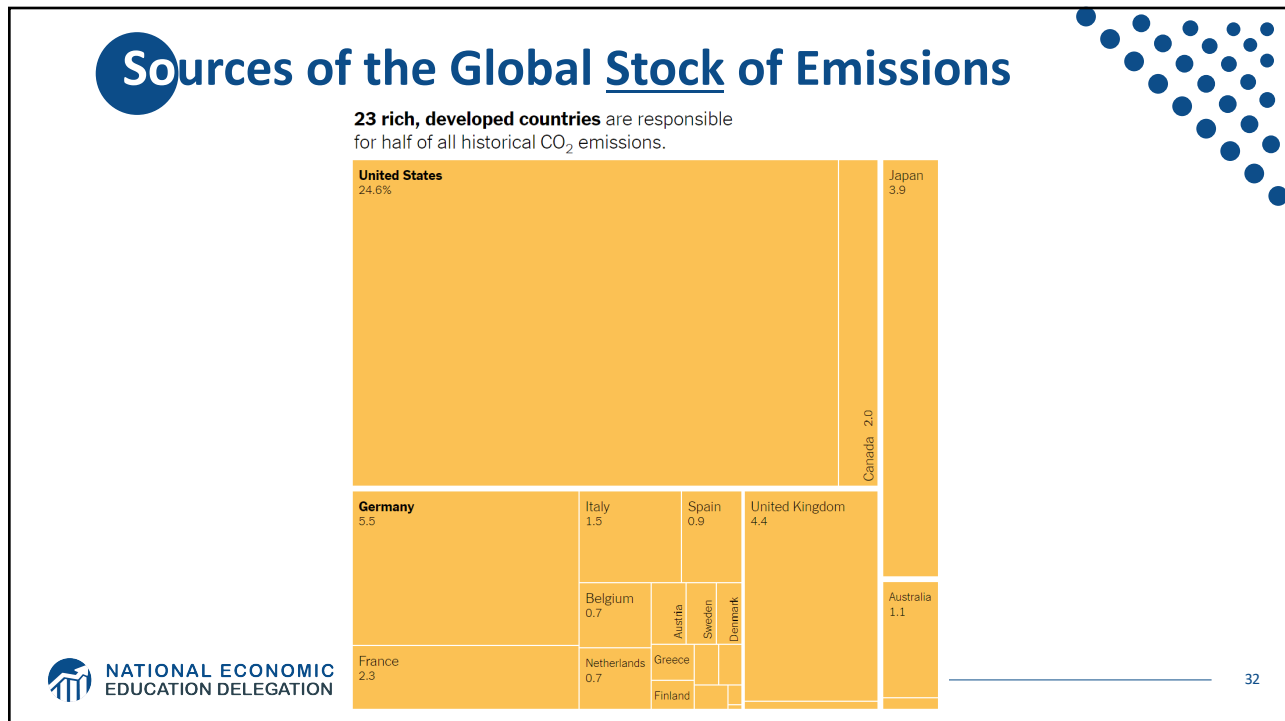


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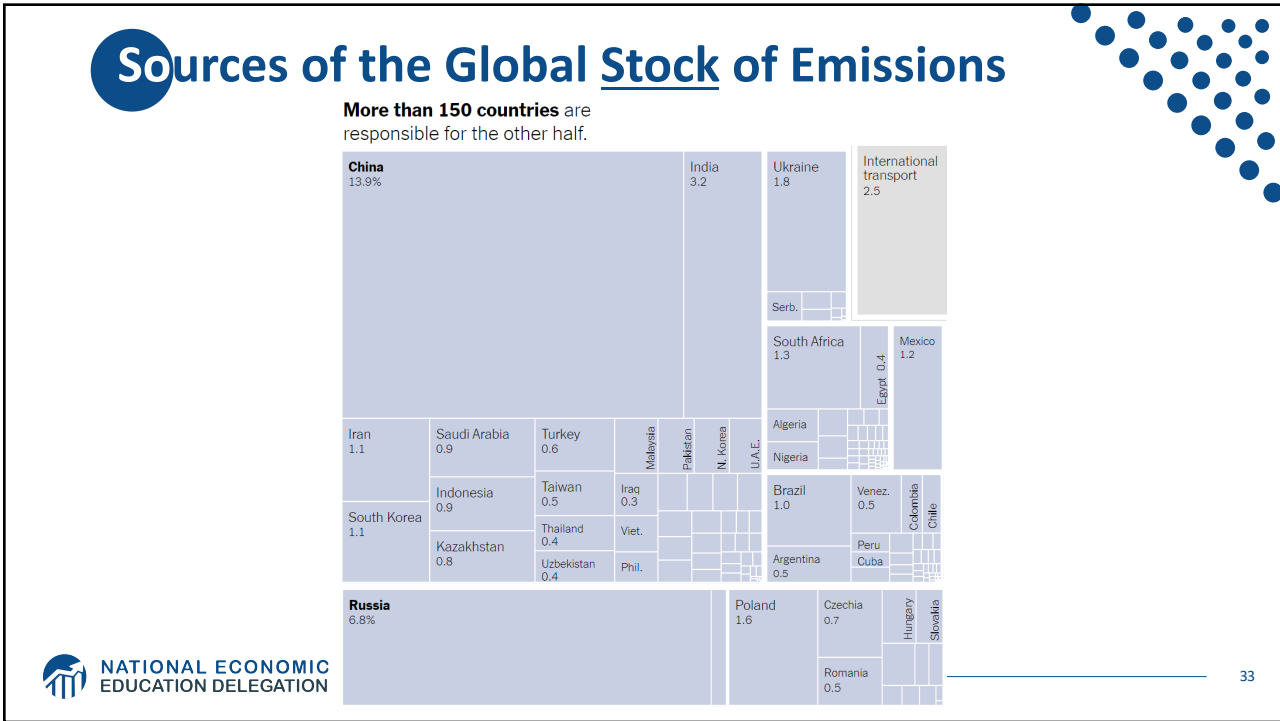


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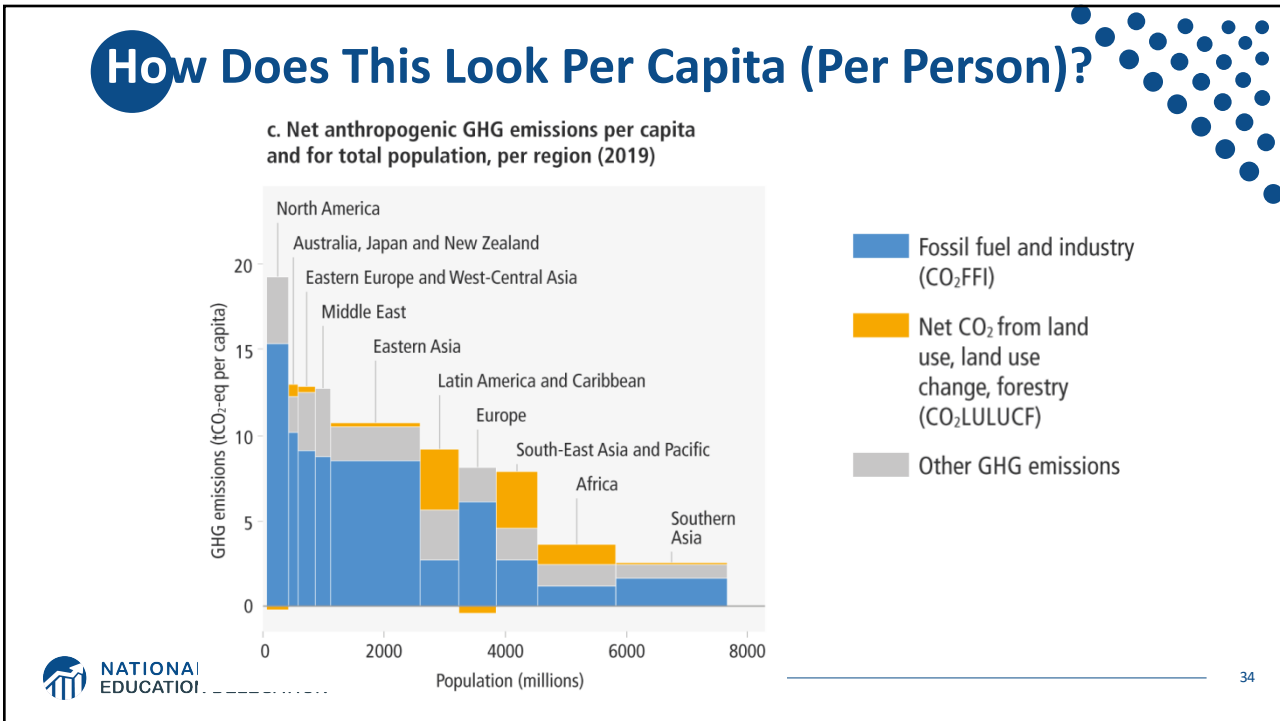


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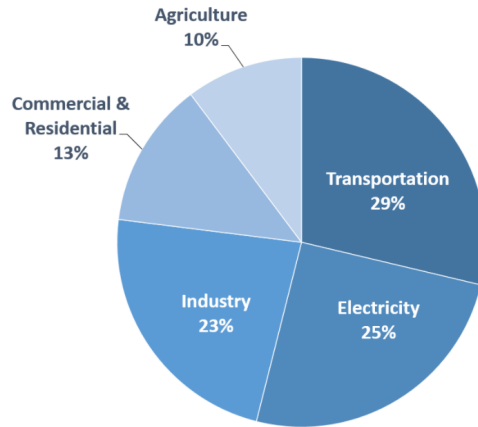


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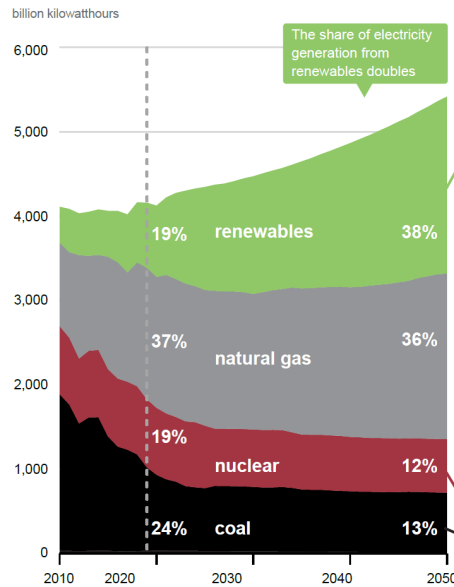
# Total US Greenhouse Gas Emissions by Economic Sector in 2020



Total Emissions in 2019 = 6,558 Million Metric Tons of CO2 equivalent. Percentages may not add up to 100% due to independent rounding.

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# US Electricity Sources



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# Which Emissions Should We Cut?

- List all possible ways to reduce emissions
- Figure out how much each can reduce in total
- Figure out how much each costs per unit of emissions reduced
- Line them up in order: cheapest to costliest (“marginal abatement cost curve”)
  - → Tackle first the cheapest ones!

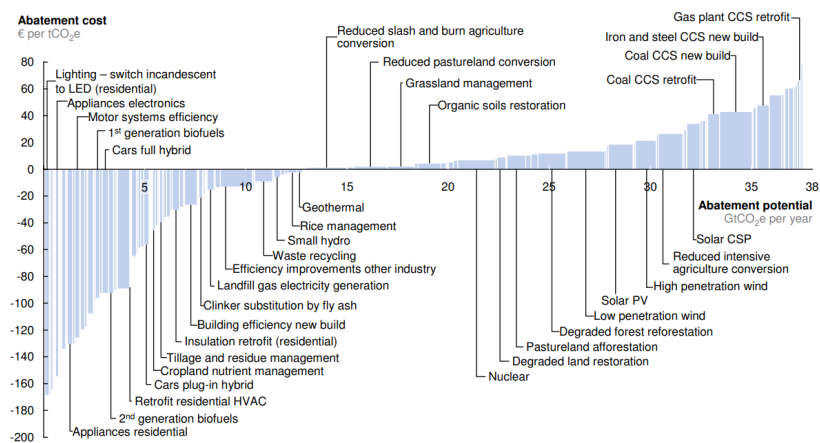


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## Example Abatement Cost Curve

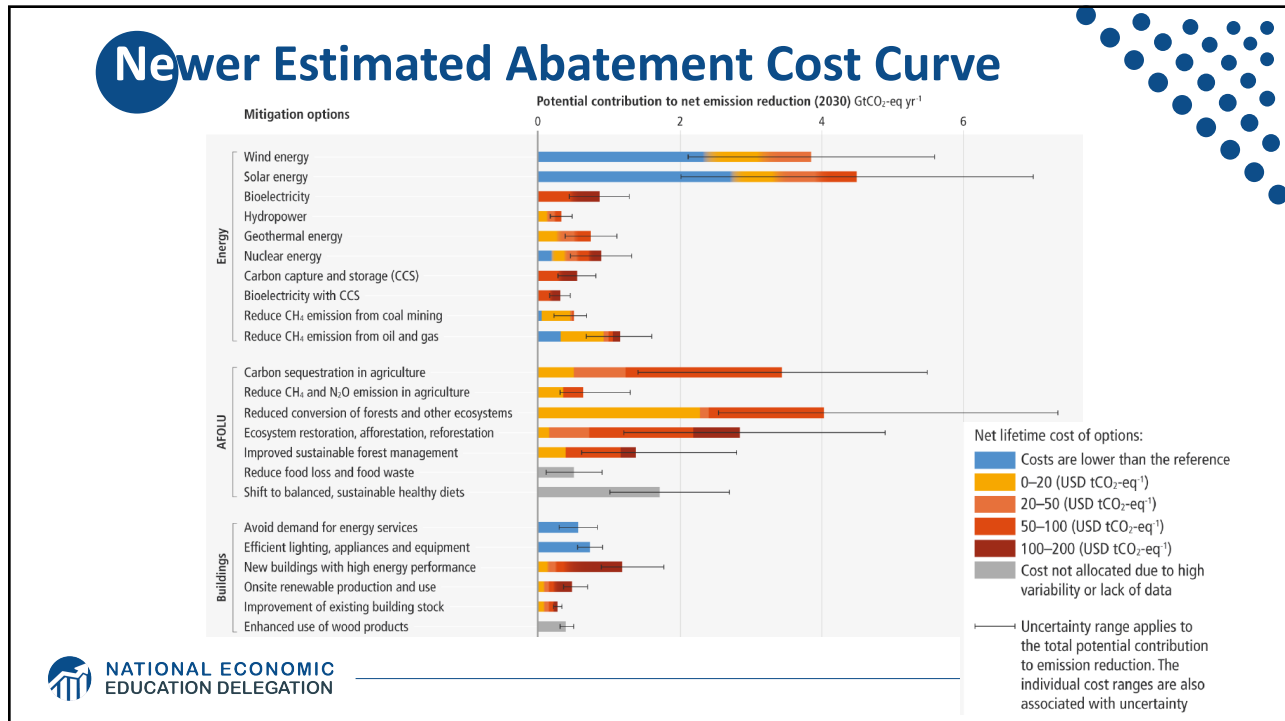
(Don't trust these numbers, this is just to show the idea)

V2.1 Global GHG abatement cost curve beyond BAU – 2030

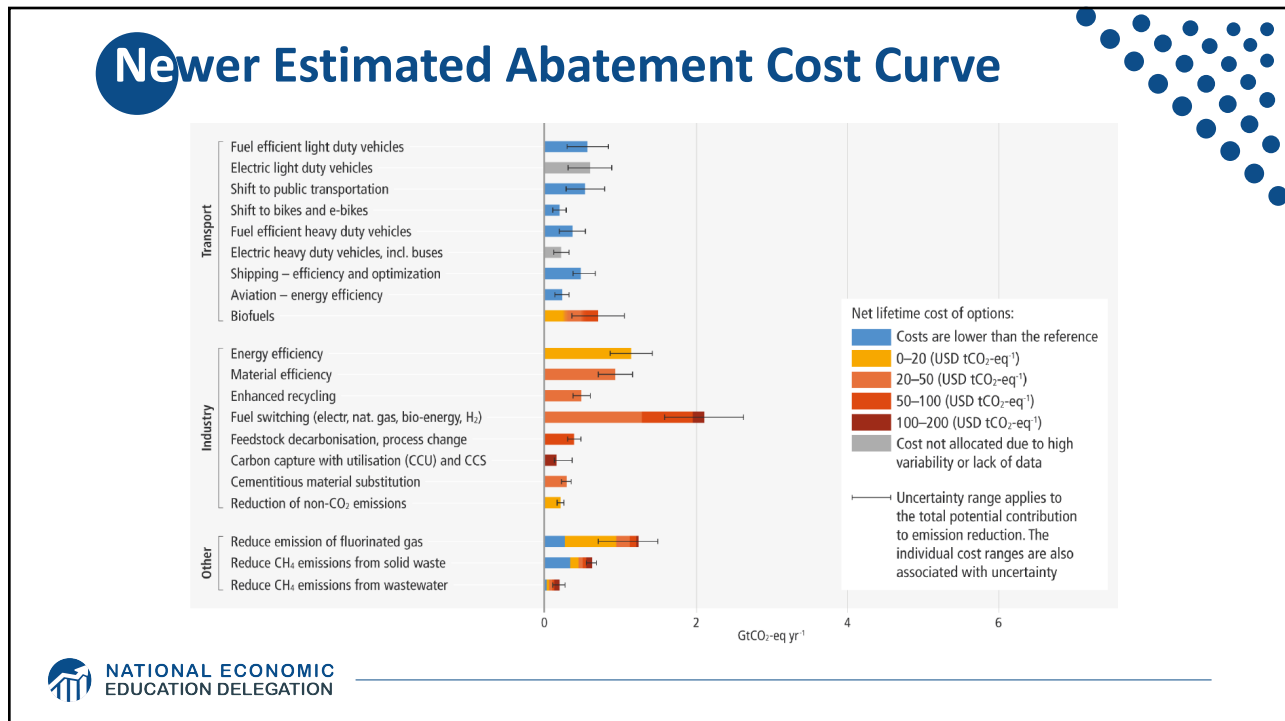


Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €80 per tCO<sub>2</sub>e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.  
Source: Global GHG Abatement Cost Curve v2.1

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## Costs and Barriers Can Be Difficult to Assess

- **Difficult to project future costs for new technology**
  - Costs of renewables have been dropping fast
- **Investments in research and development and infrastructure (e.g., EV charging) can lower future costs**
- **Barrier to expanding renewable energy: intermittency**
  - Battery technology under development

## Geoengineering and Carbon Capture

- **Technical pathways to reduce climate change without reducing emissions**
- **Carbon capture: captures CO<sub>2</sub> emissions and stores them or “utilizes” them (for energy, pressure, etc.)**
  - Not yet proven at scale
- **Solar geoengineering: make the atmosphere reflect more light to regain earlier thermal balance**
  - Totally theoretical
  - Potentially risky

# Climate Change Policy



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## Policies That Reduce Emissions Directly

- **Command and control regulation**
  - Emissions standards or limits (e.g., Clean Water Act discharge limits)
  - Tech standards (e.g., require scrubbers on power plants)
- **Incentive-based policies**
  - Putting a price on emissions – leveling the playing field!
    - Tax or cap & trade
    - Subsidizing green energy (e.g., feed-in tariffs)



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## Command and Control vs. Incentive-Based Regulation

- **Efficiency**

- Both can achieve the same amount of emissions reduction.
- Incentive-based policies can achieve emissions reduction at much lower cost.

- **Equity**

- Both have may regressive impacts (low-income families bear costs that are a larger percent of their incomes vs hi-income families)
  - However, new evidence increasingly questions this.
- Cap and trade and carbon tax can generate revenues that can be used to offset the regressivity.
  - E.g.: “carbon dividend”
- Command and control regulations do not.



## How Does a Carbon Tax Work?

- **Choose activities to be covered (e.g., electricity sector, all emitters, etc.).**

- **Set tax level.**

- Optimally, it represents the social cost of polluting.

- **Polluters must pay a tax for every unit emitted.**

- Polluters with **low** abatement costs will **abate** to avoid the tax
- Polluters with **high** abatement costs will pollute and **pay the tax**



## How Does Cap and Trade Work?

- Choose activities to be covered (e.g., electricity sector, all emitters, etc.).
- Set maximum emissions level (“cap”).
- That many pollution permits are issued.
  - Can be auctioned off or given to polluters
- Every polluter in a covered sector must have a permit for every unit of pollution.
- Polluters buy and sell (“trade”) permits on a market as they wish.
  - Polluters with **low** abatement costs will make / save money by **abating** and selling / not buying permits
  - Polluters with **high** abatement costs will buy permits and **pollute**



## Examples of Other Policies that Reduce Emissions

- Research and development subsidies
- Renewable energy mandates (e.g., renewable portfolio standards)
- Energy efficiency mandates and subsidies (e.g. CAFE fuel economy standards)
- Grid / infrastructure improvements
- Public transportation
- Land use / zoning policies





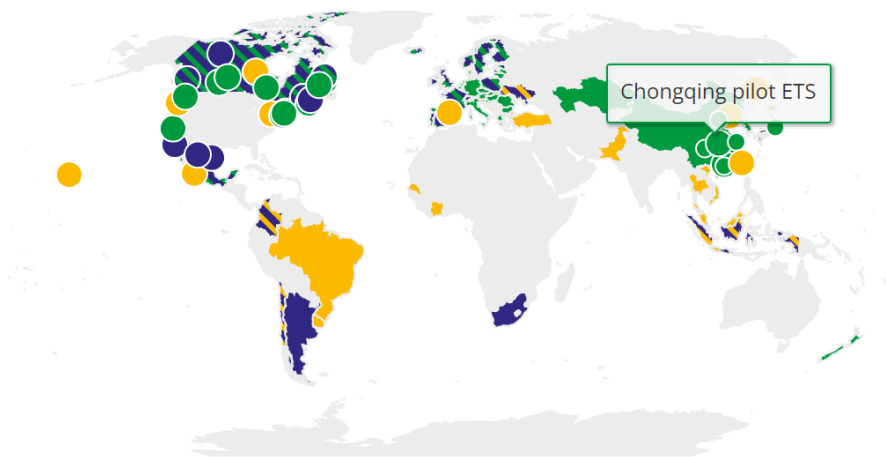
# Climate Change Policy in Action



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## Incentive-Based Climate Policies Right Now


Summary map of regional, national and subnational carbon pricing initiatives



- ETS implemented or scheduled for implementation
- ETS or carbon tax under consideration
- ETS implemented or scheduled, ETS or carbon tax under c...
- Carbon tax implemented or scheduled for implementation
- ETS and carbon tax implemented or scheduled
- Carbon tax implemented or scheduled, ETS under consider...


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## California's Cap and Trade System Since 2012



0.7%

of global greenhouse gas emissions



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## California's AB32: Global Warming Solutions

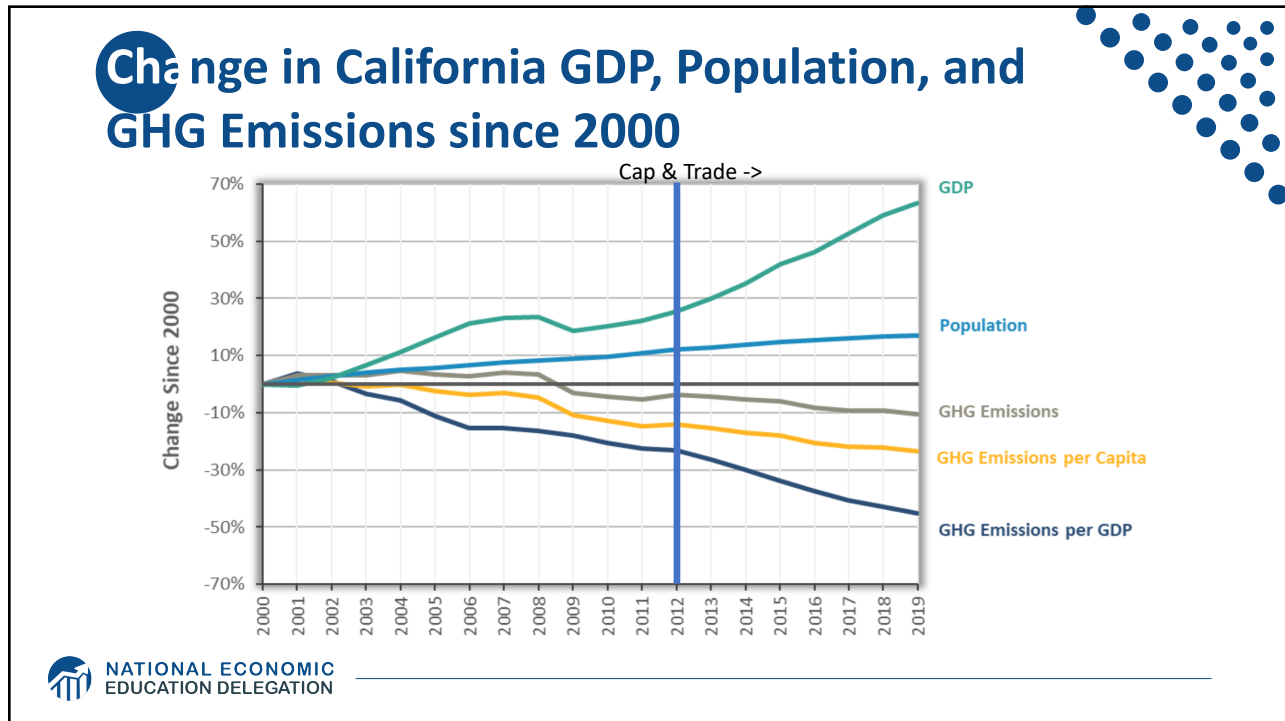


- **California's goals:**
  - Reduce emissions to 1990 levels by 2020
  - An 80% reduction in emissions from 1990 levels by 2030
- **California's Tools:**
  - Cap and Trade
  - Renewable Portfolio Standard
  - Clean Cars Program
  - Low Carbon Fuel Standard

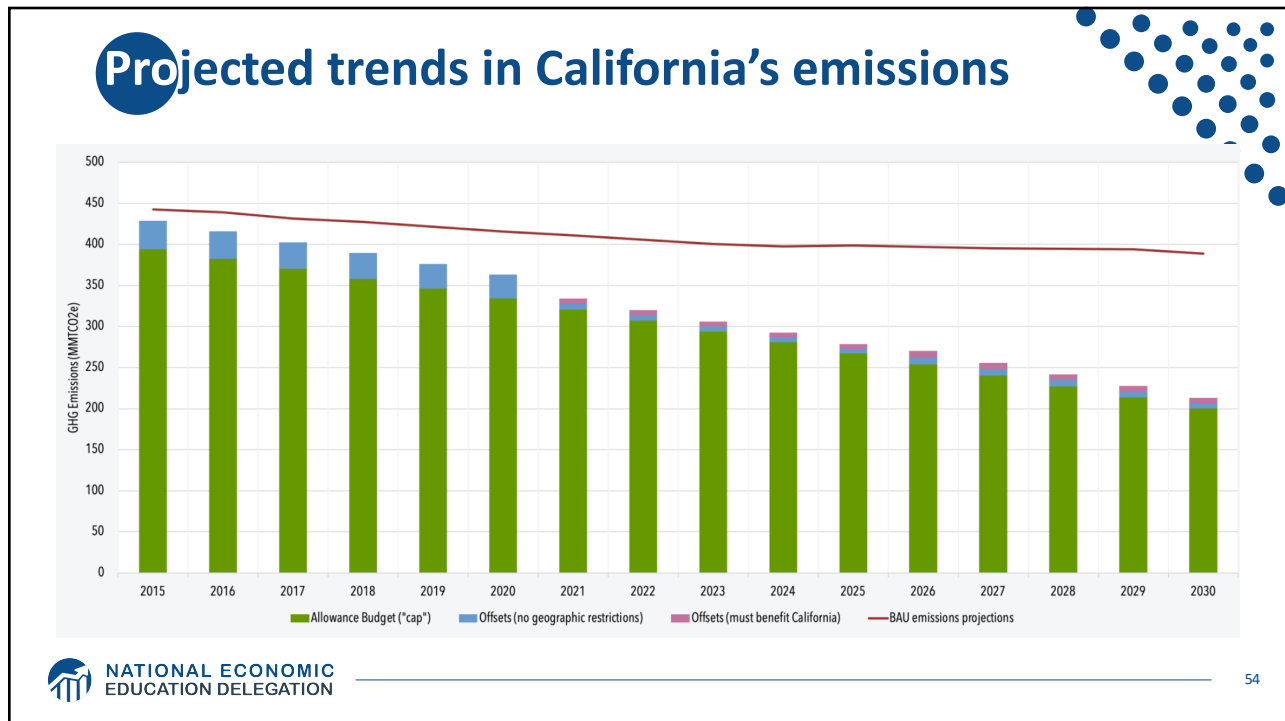


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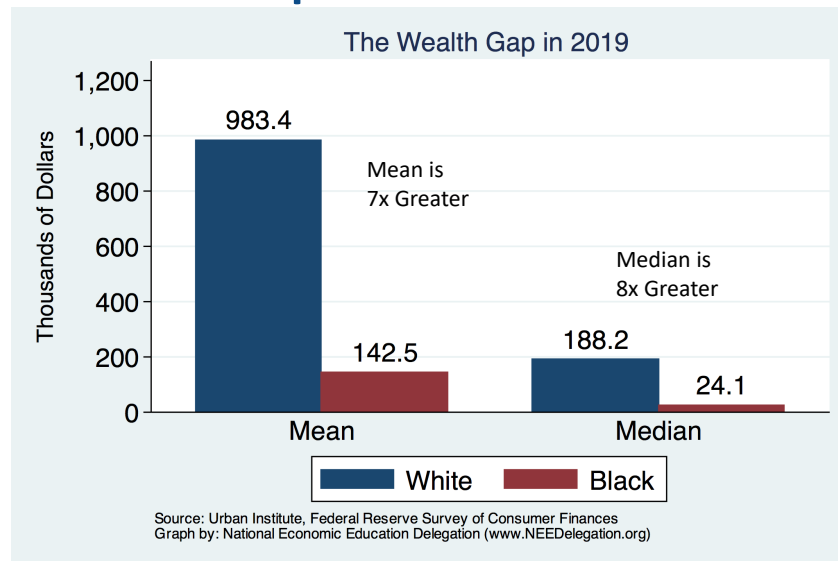


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## Summary

- Climate change is real, is caused by human actions, and has impacts we're already feeling.
- This problem won't solve itself; we need policy intervention, and fast.
- Smart policy can reduce greenhouse gas emissions by the right amount and at the lowest possible cost.
  - For example, cap and trade and emissions taxes!
- We also need policies to help with adaptation and support those bearing the greatest damages.

## The B-W Wealth Gap: Jon Haveman



**Thank you!**

## Any Questions?

[www.NEEDelegation.org](http://www.NEEDelegation.org)

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