

# Inflation Reduction Act of 2022

- Psssst.... It's not about reducing inflation, but that's ok.
- Major provisions include:
  - Clean Electricity Tax Credits
  - Funding Programs to Support Local Clean Investment
  - Clean Vehicles Incentives
  - Agriculture and Conservation
  - Funding, Investments, and Incentives for Heavy Industry and Manufacturing
- Result: Emissions reductions of 40% or more by 2030.



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Source: <https://www.nrdc.org/experts/amanda-levin/top-climate-elements-senate-budget-reconciliation>

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## *Osher Lifelong Learning Institute, Summer 2022* **Contemporary Economic Policy**

Rochester Institute of Technology  
July-Aug, 2022

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



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## Available NEED Topics Include:

- Healthcare Economics
- US Economy
- Climate Change
- Economic Inequality
- Economic Mobility
- Trade and Globalization
- Minimum Wages
- Immigration Economics
- Housing Policy
- Federal Budgets
- Federal Debt
- Black-White Wealth Gap
- Autonomous Vehicles
- Healthcare Economics



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## Course Outline

- **Contemporary Economic Policy**
  - Week 1 (7/11): Economic Update (Jon Haveman, NEED)
  - Week 2 (7/18): Economic Inequality (Christopher Herrington VCU)
  - Week 3 (7/25): Trade and Globalization (Alan Deardorff, University of Michigan)
  - ~~Week 4 (8/1): *The Black-White Wealth Gap (Mike Shor, UConn)*~~
  - Week 5 (8/8): Economic Mobility (Jon Haveman, NEED)
  - **Week 6 (8/15): Climate Change Economics (Jon Haveman, NEED)**
  - Week 7 (8/22): Autonomous Vehicles (Jon Haveman, NEED)
  - Week 8 (8/29): The Black-White Wealth Gap (Mike Shor, Uconn)



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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))



# Climate Change Economics

Jon Haveman, Ph.D.  
NEED

OLLI – Rochester Institute of Technology

August 15, 2022



## Credits and Disclaimer

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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*

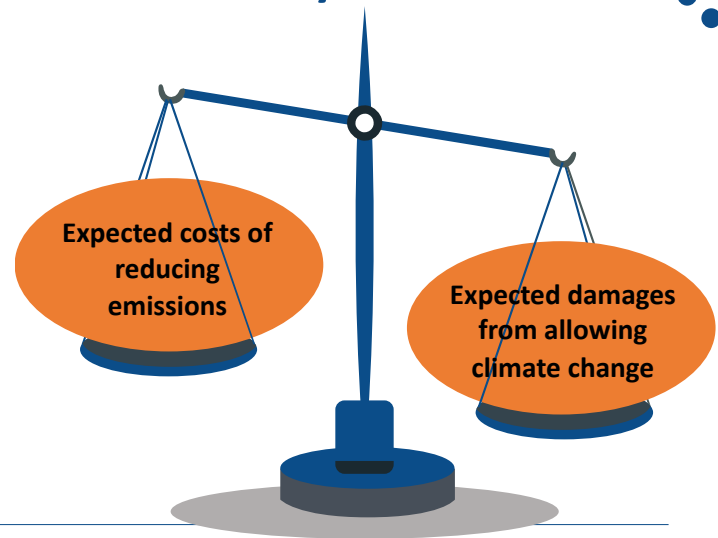


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## How Economists Decide How Much to Fight Climate Change: Cost Benefit Analysis

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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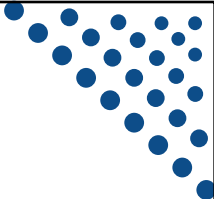
# Climate Change



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## **A** Climate Change Ladder

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



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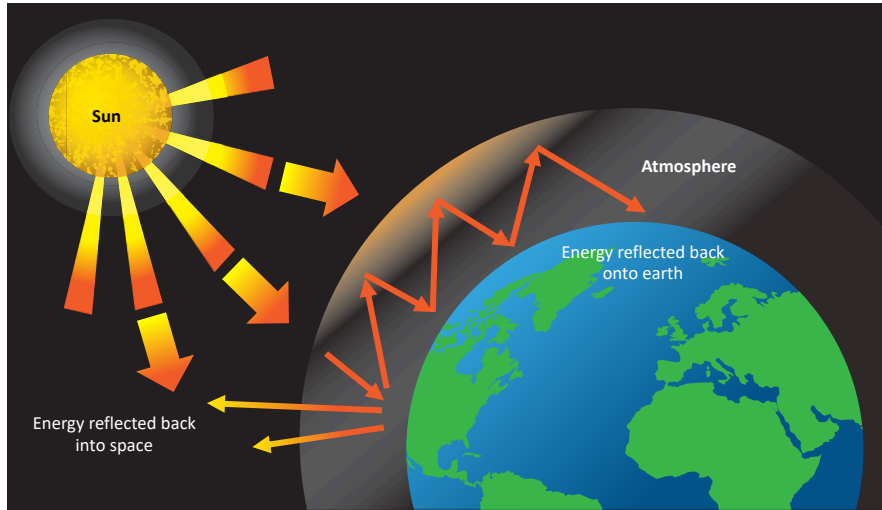
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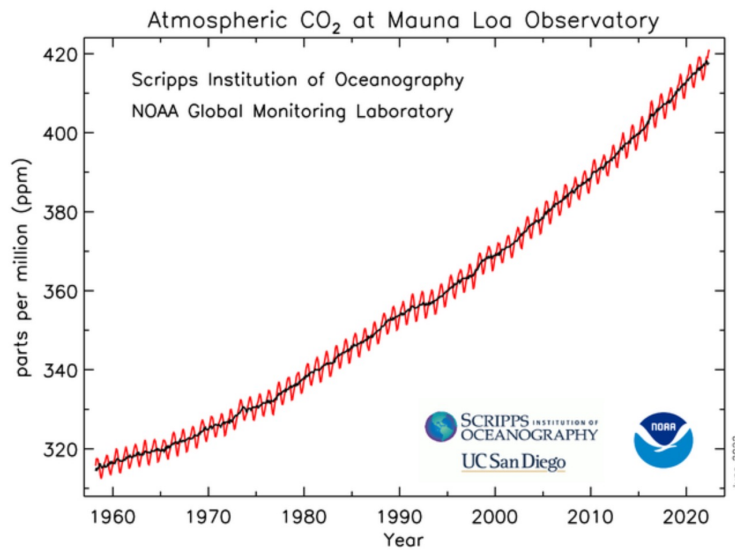
# The Atmospheric Greenhouse Effect



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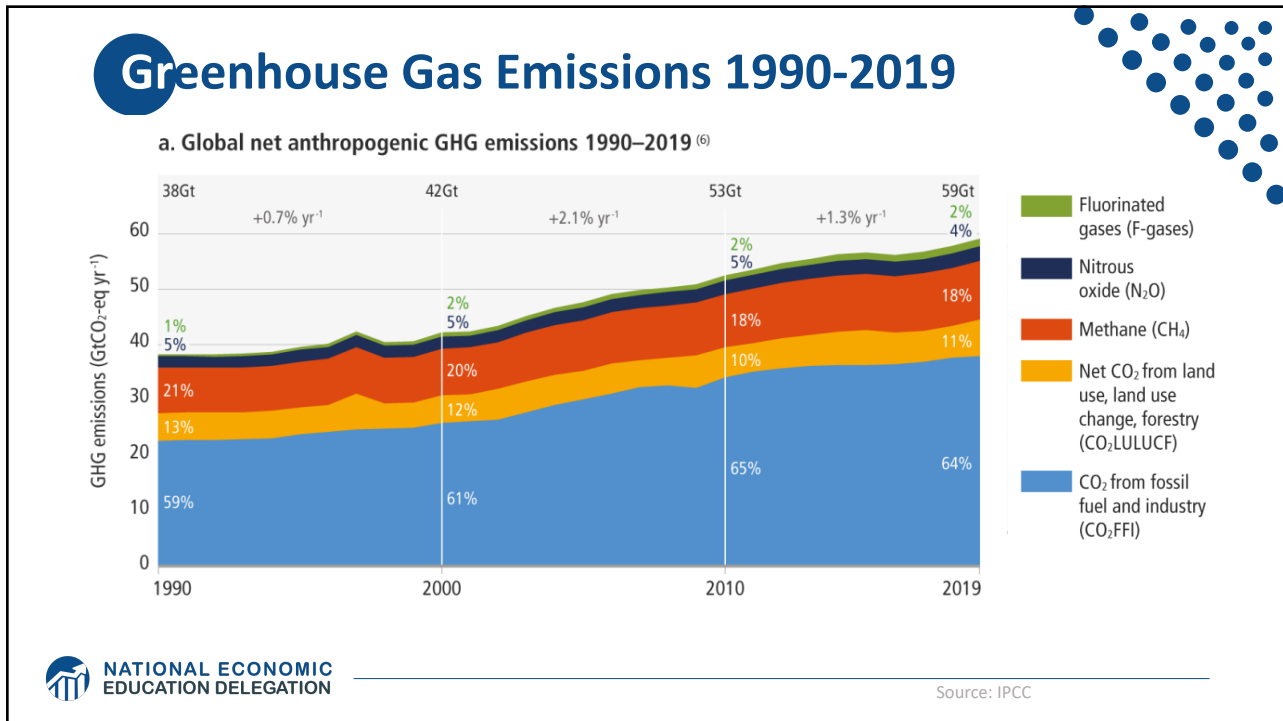
# Atmospheric CO<sub>2</sub> Concentrations Up To Now



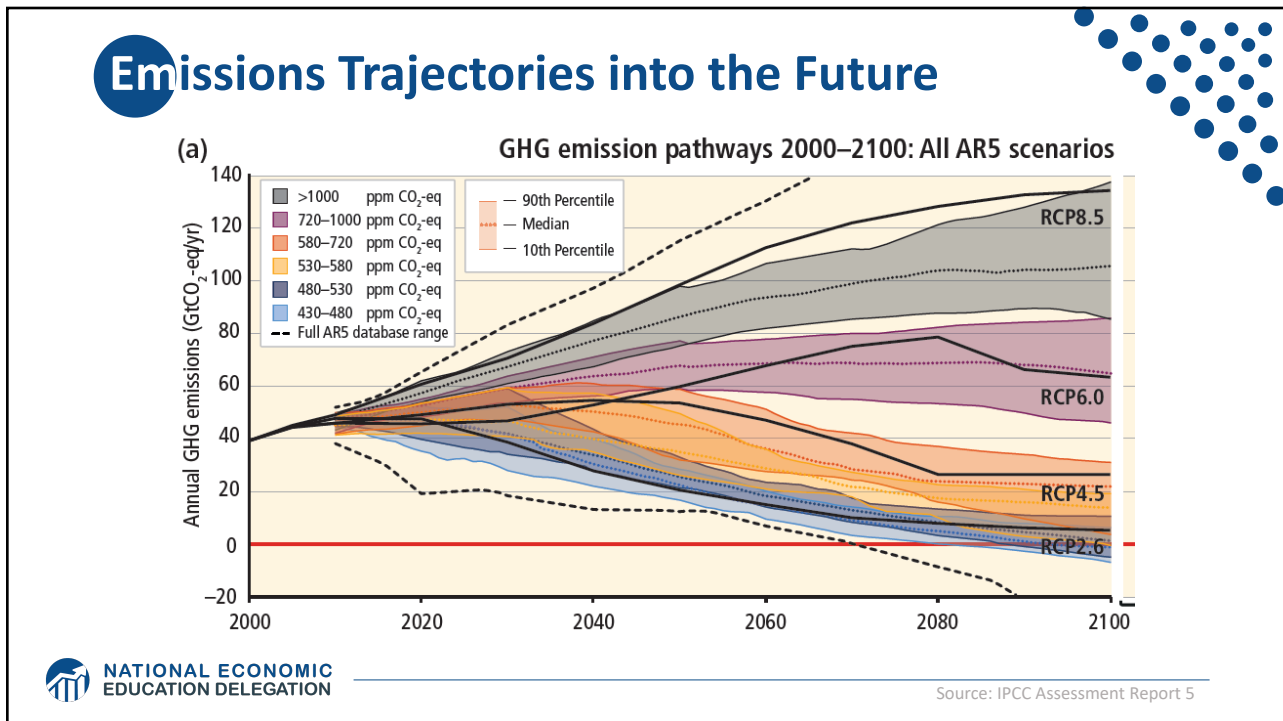
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Source: NOAA

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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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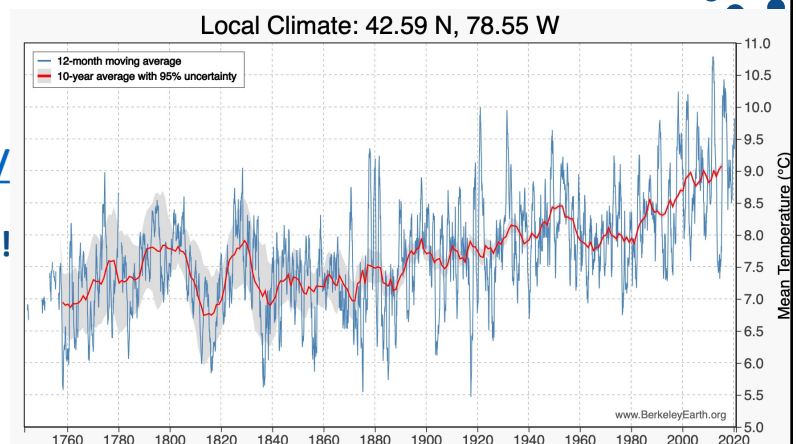
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## These Changes Are Already Underway

Use  
[http://berkeleyearth.lbl.gov/  
city-list/](http://berkeleyearth.lbl.gov/city-list/) to see the  
temperature history of a city!

Here's Rochester.

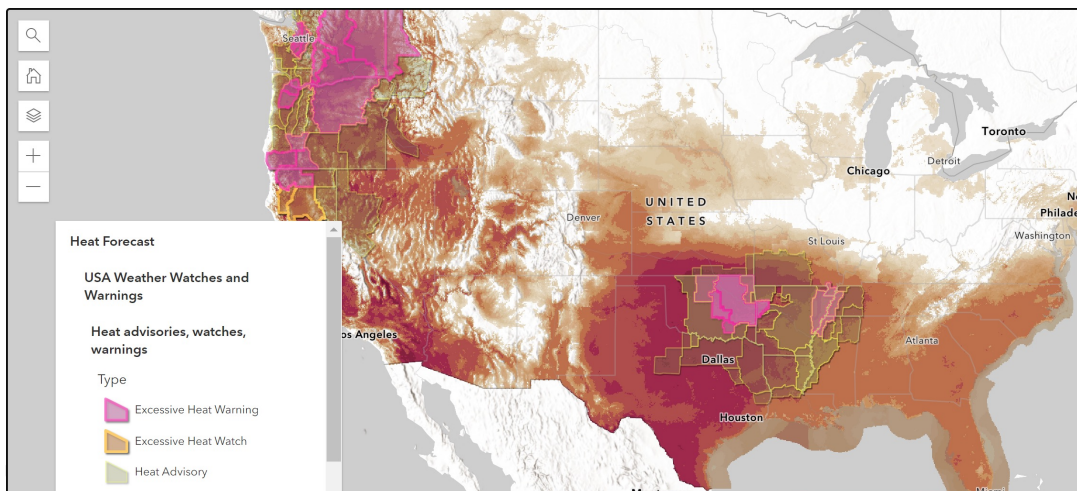


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# These Changes Are Already Underway

See [heat.gov](https://heat.gov) for analysis and forecasts of heat



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# Impacts of Climate Change

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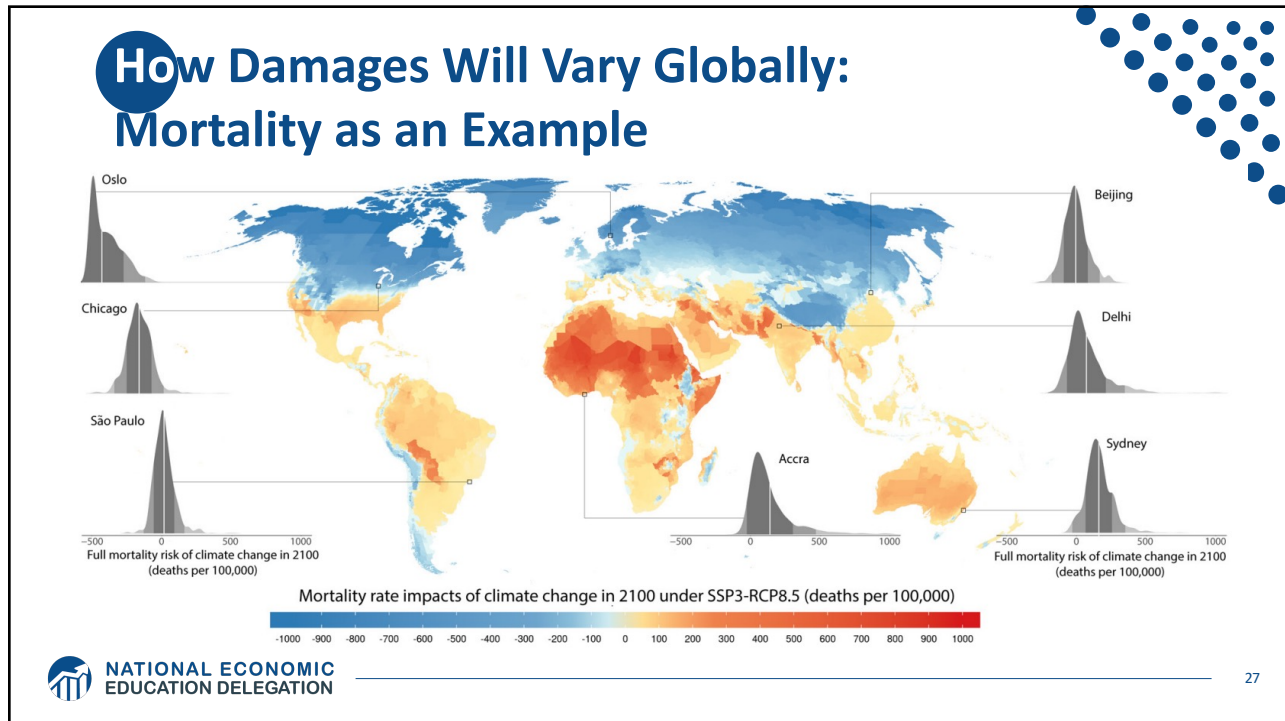
## How Climate Change Affects Humans

- 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

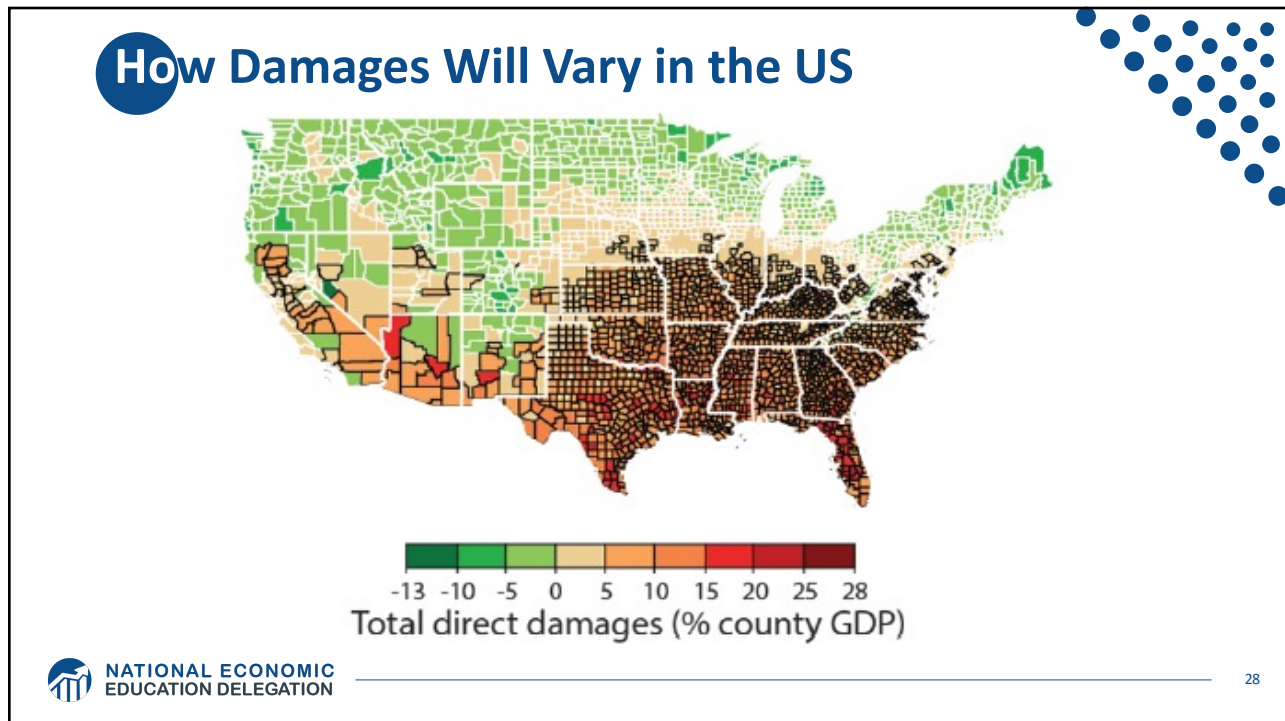
## Social Cost of Carbon

- 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.





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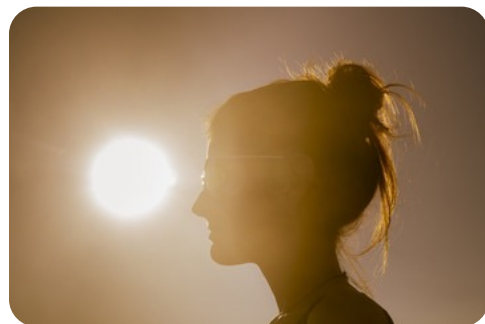
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## Adaptation Reduces Damages

- **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.

## 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)**



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## Reducing Emissions



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## Global Net Emissions Are What We Care About

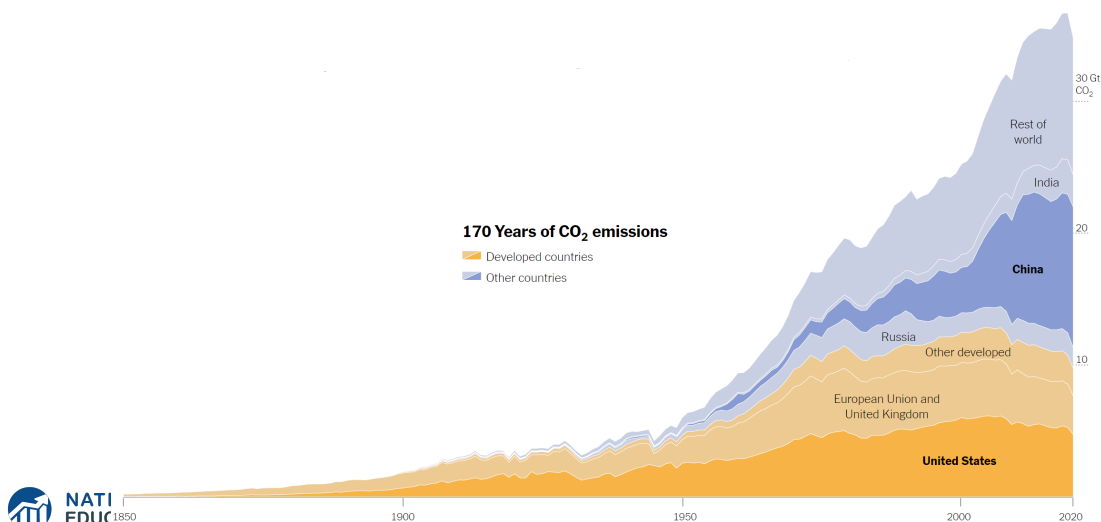
- **For climate impacts, we don't care where they are emitted, only how much**
  - There may be other local impacts
- **Gross emissions (greenhouse gas sources): how much greenhouse gases (including CO<sub>2</sub>) we put out**
- **Greenhouse gas sinks: ways to pull CO<sub>2</sub> out of the air**
 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



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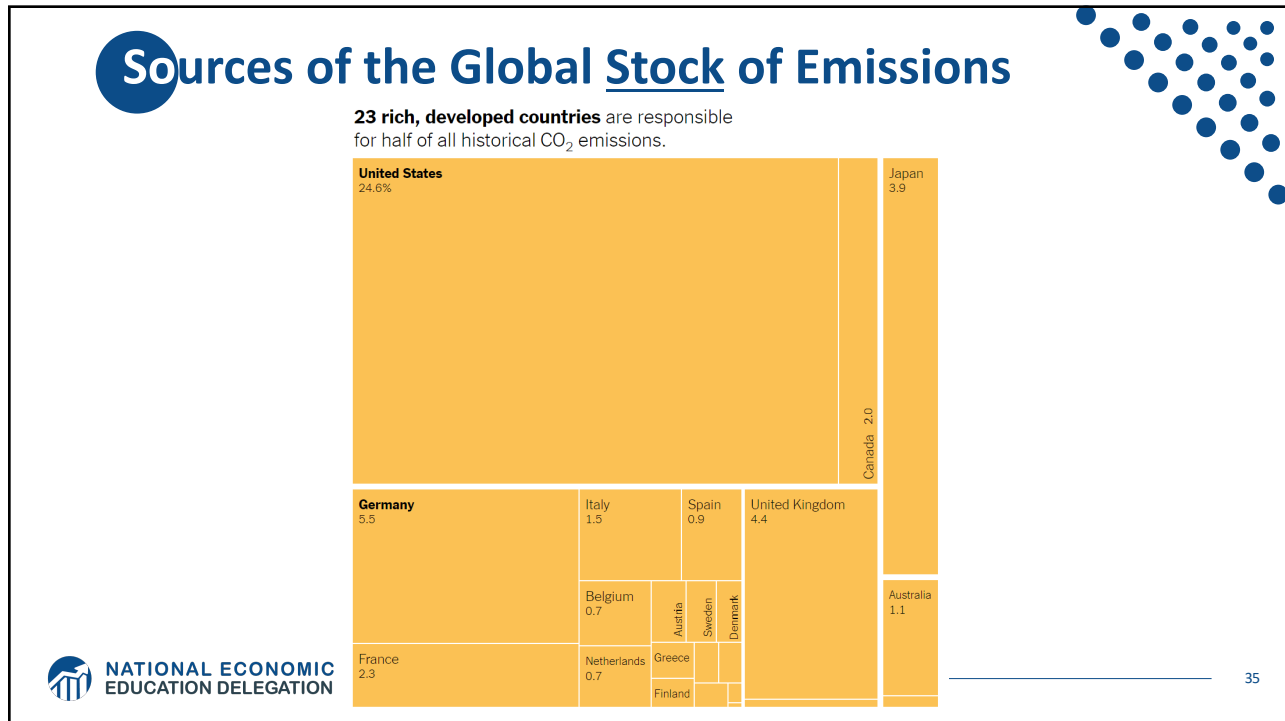
## Sources of the Global Flow of Emissions



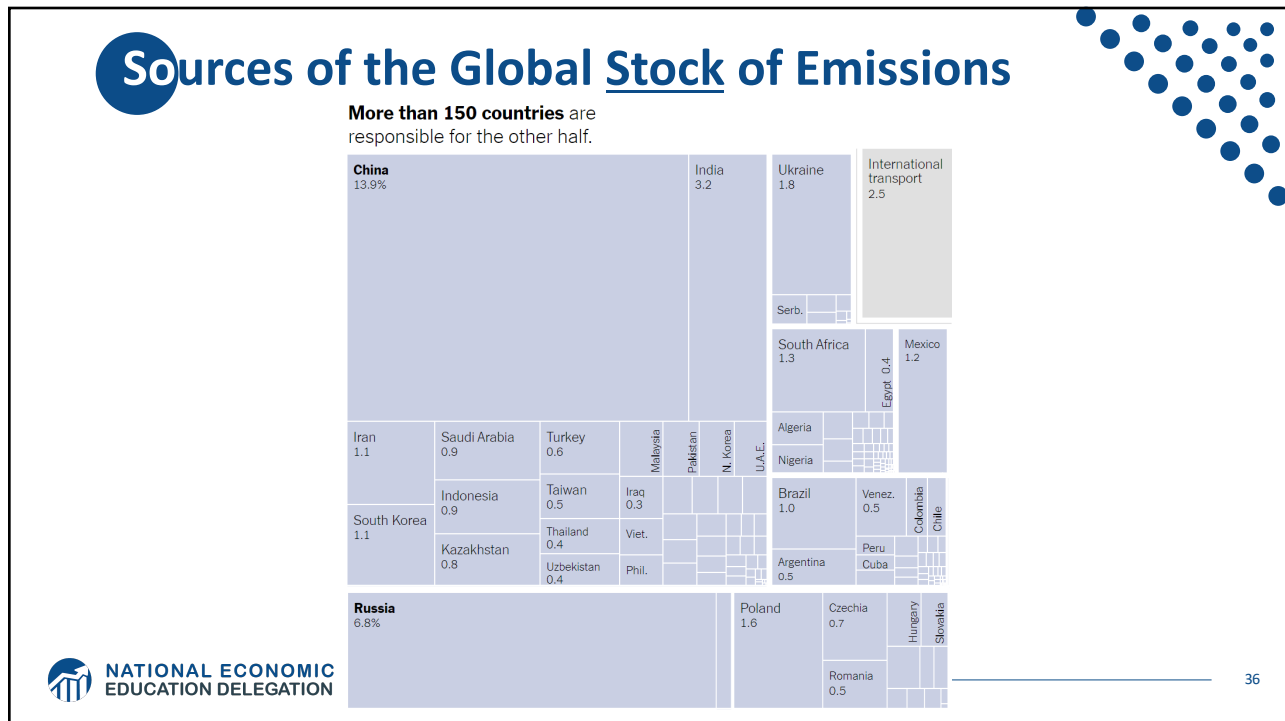
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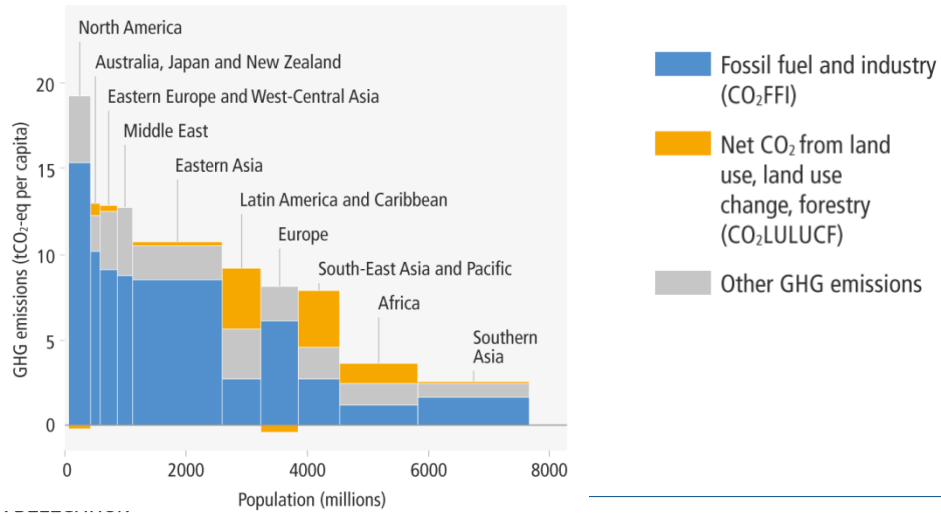
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## How Does This Look Per Capita (Per Person)?

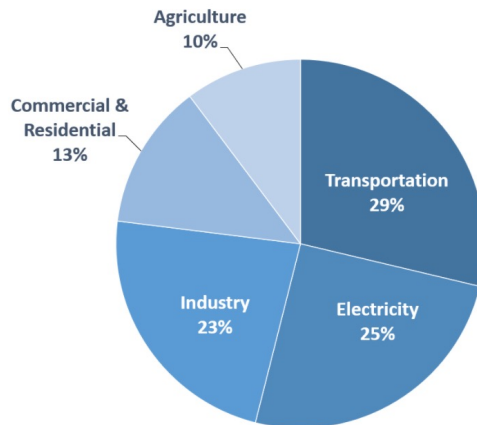
c. Net anthropogenic GHG emissions per capita and for total population, per region (2019)



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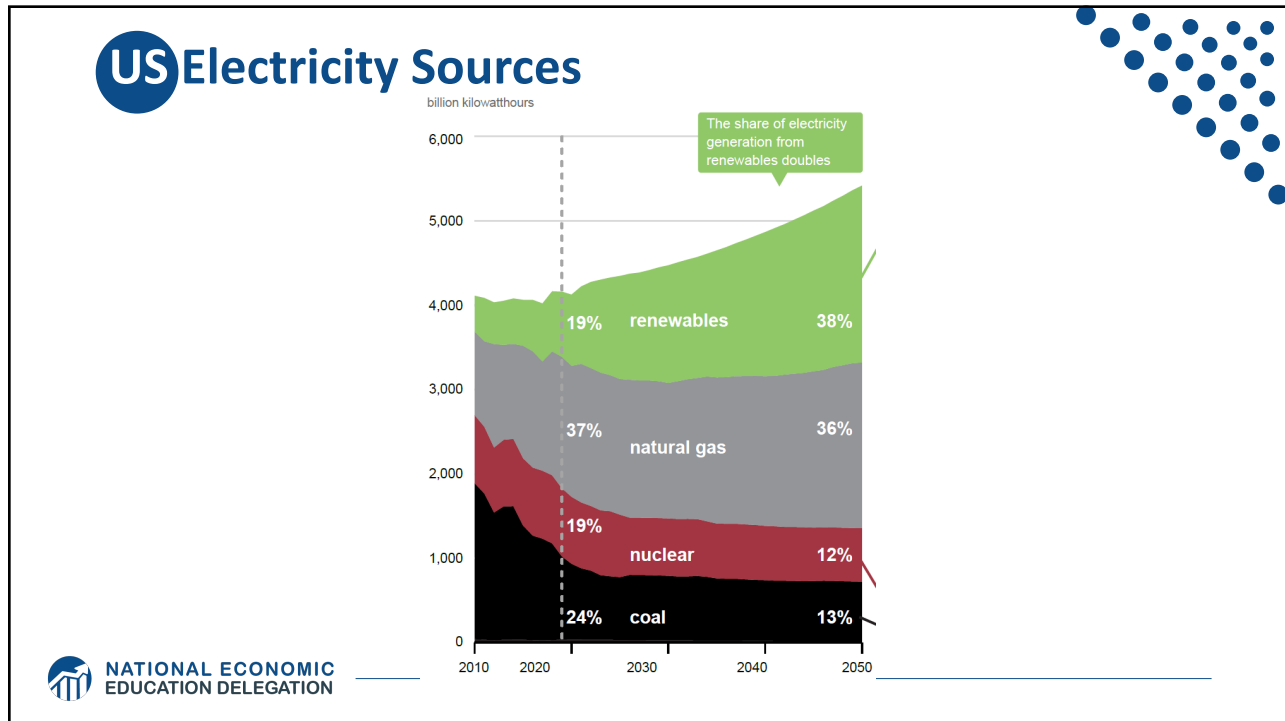
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## Total US Greenhouse Gas Emissions by Economic Sector in 2020



Total Emissions in 2019 = 6,558 Million Metric Tons of CO<sub>2</sub> equivalent. Percentages may not add up to 100% due to independent rounding.

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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
  - → Tackle first the cheapest ones!

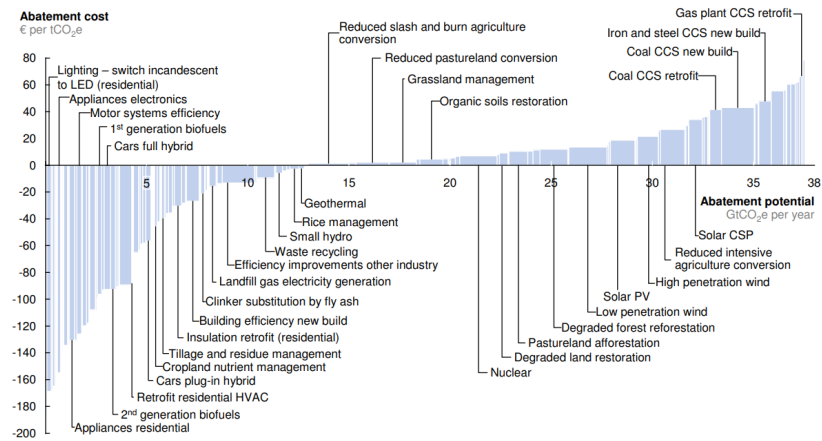
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## Example Abatement Cost Curve

(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



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## 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



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## 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)

## 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?

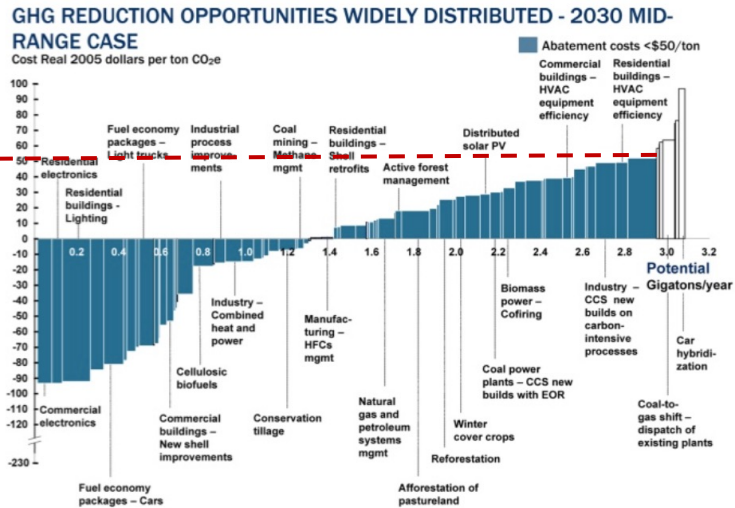
- **Choose activities to be covered (e.g., electricity sector, all emitters, etc.).**
- **Set maximum emissions level (“cap”).**
- **That many pollution permits are issued.**
  - Can be auctioned off or given to polluters.
- **Every polluter in a covered sector must have a permit for every unit of pollution.**
- **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**





# Putting a Price on Carbon

Suppose a Social Cost Of Carbon of \$50



# Efficiency: CAFÉ vs Carbon Tax

- **CAFÉ = Corporate Average Fuel Efficiency**

- A fuel economy standard mandating that an auto-maker's vehicle fleet must meet minimum fuel economy standards.

- **Horse Race**

- Tax on fuel applies to ALL vehicles, not just new.
- Rebound Effect:
  - o Driving a more efficient vehicle lowers the cost per mile driven,
    - leading to more miles driven.
- Slower turnover of inefficient vehicles: higher cost of new.

- **Summary**

- A given level of emission reductions **costs 3-14 times more with CAFÉ standards** than under a comparable carbon tax.



## Very Important Point

- People don't want a carbon tax because it will increase prices.
- Command and Control/Regulations:

ALSO INCREASE PRICES!



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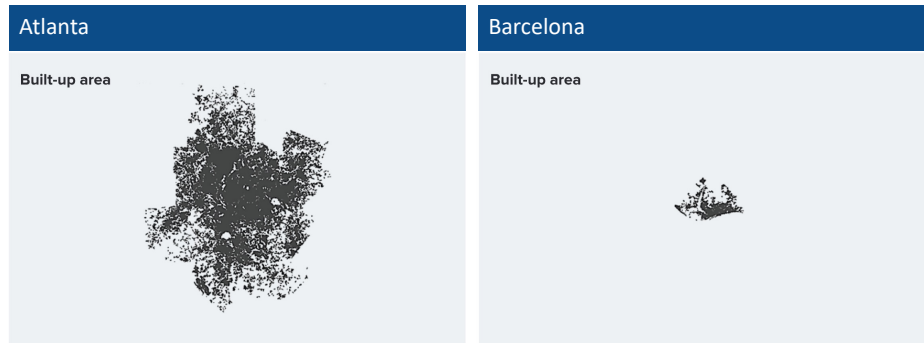
## Examples of Other Policies that Reduce Emissions

- 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



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## Atlanta and Barcelona Have Similar Populations but Very Different Carbon Productivity



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Source: New Climate Economy Report, 2014

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## Inflation Reduction Act of 2022

- Psssst.... It's not about reducing inflation, but that's ok.
- Major provisions include (\$370B):
  - Clean Electricity Tax Credits
  - Funding Programs to Support Local Clean Investment
  - Clean Vehicles Incentives
  - Agriculture and Conservation
  - Funding, Investments, and Incentives for Heavy Industry and Manufacturing
  - Methane tax!
- Result: Emissions reductions of 40% or more by 2030.



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Source: <https://www.nrdc.org/experts/amanda-levin/top-climate-elements-senate-budget-reconciliation>

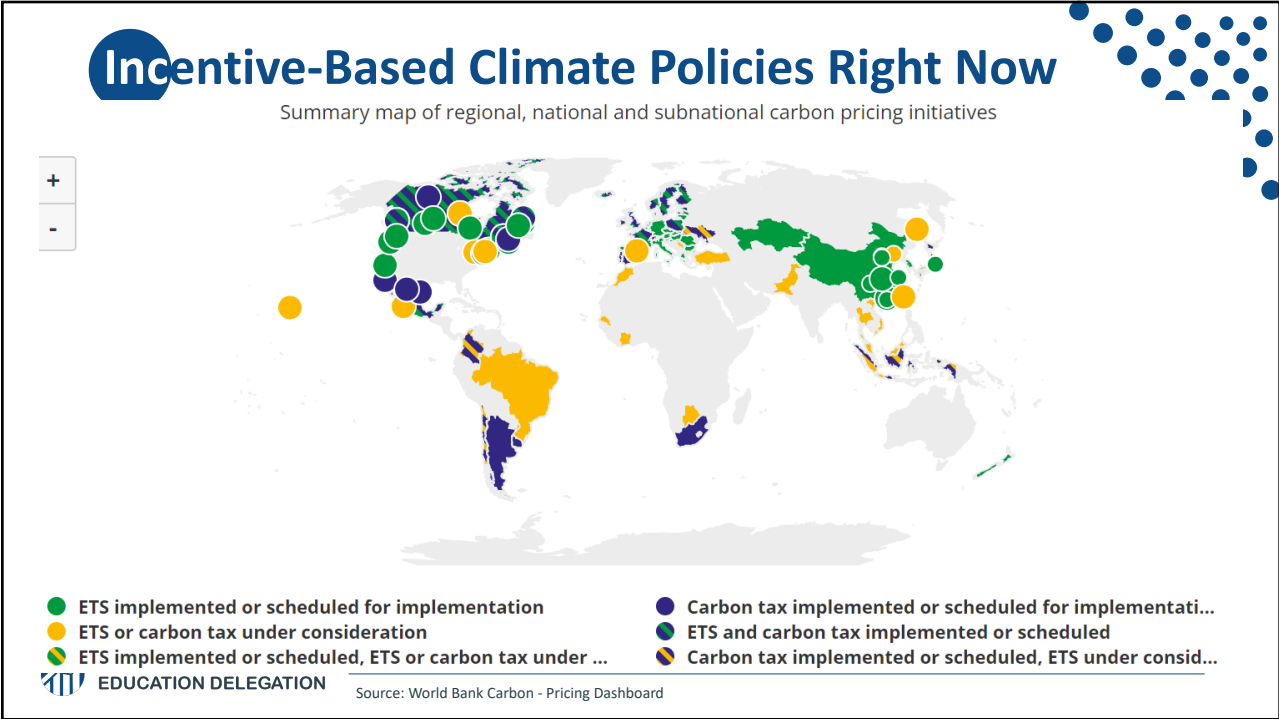
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# Climate Change Policy in Action

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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

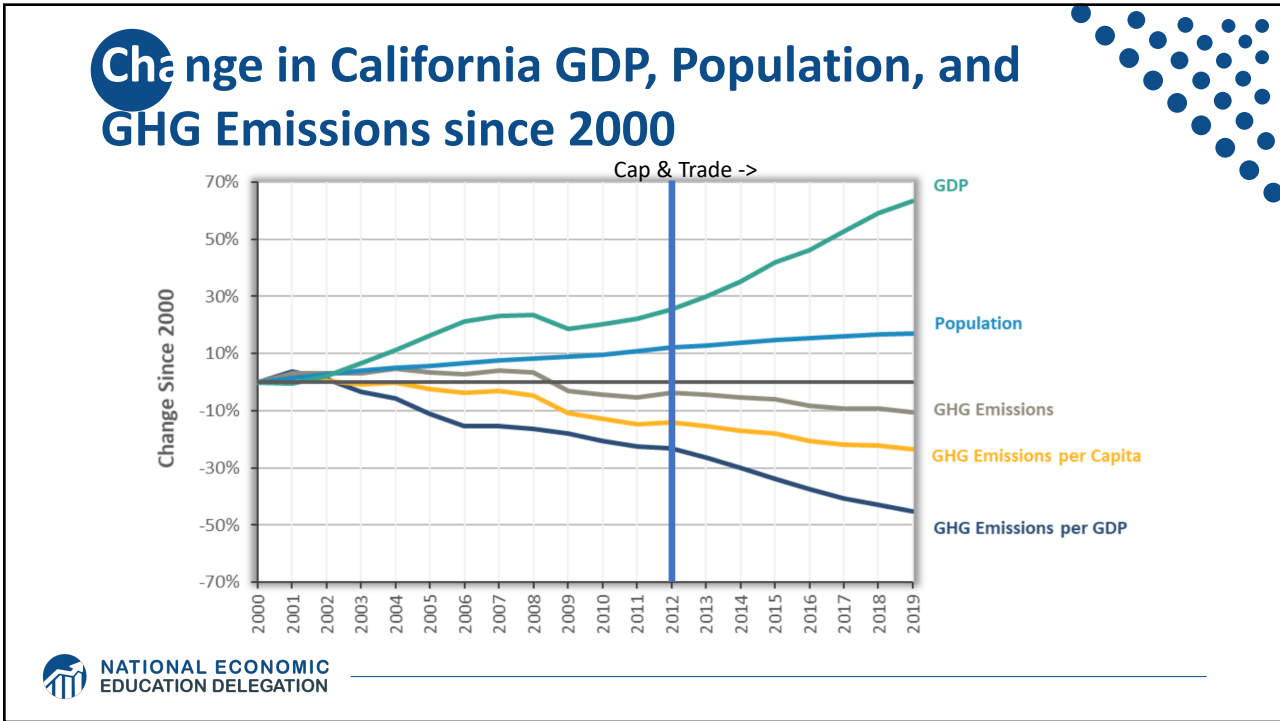
- **California's Tools:**

- Cap and Trade
- Renewable Portfolio Standard
- Clean Cars Program
- Low Carbon Fuel Standard

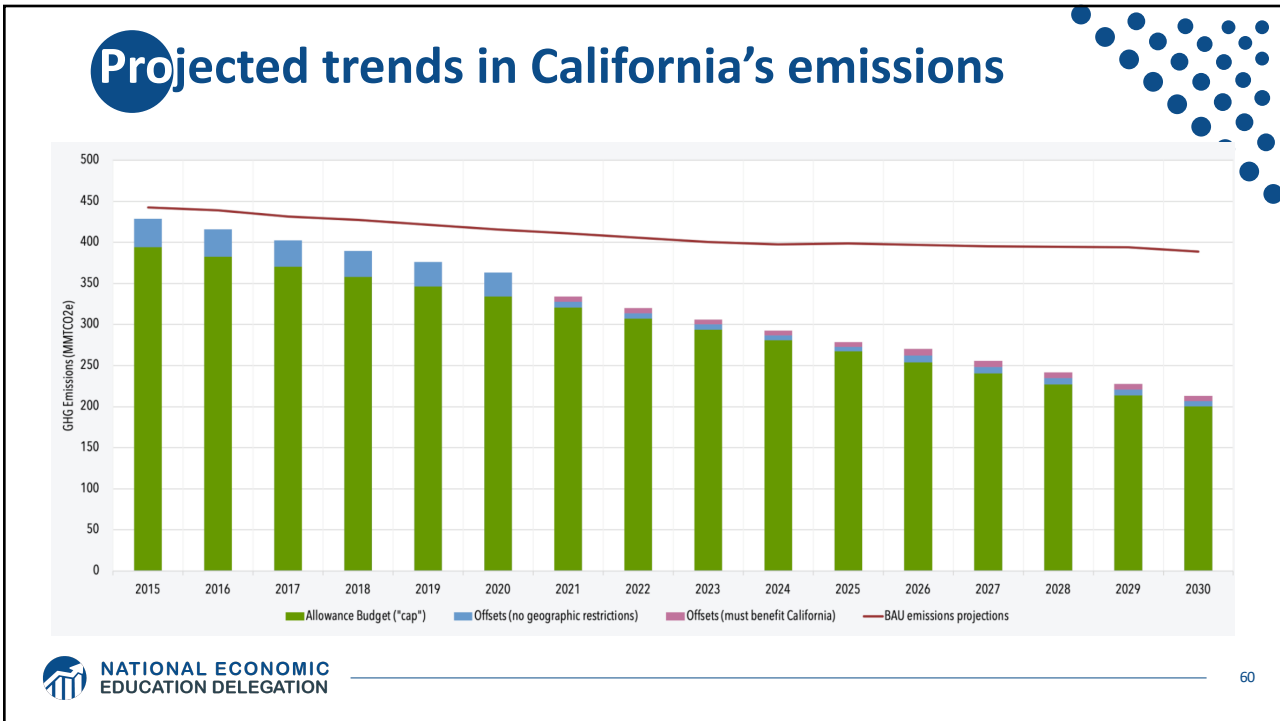


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## Summary

- **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.**



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## Autonomous Vehicles



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**Thank you!**

## Any Questions?

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