Osher Lifelong Learning Institute, Summer 2022

Contemporary Economic Policy

Emory University
June-July, 2022

Jon Haveman, Ph.D.
National Economic Education Delegation

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Available NEED Topics Include:

- Coronavirus 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
- US Social Policy

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Course Outline

- **Contemporary Economic Policy**
  - Week 1 (6/30): US Economic Update
  - Week 2 (7/7): The U.S. Federal Debt (Geoffrey Woglom, Amherst College)
  - **Week 3 (7/14): Climate Change**
  - Week 4 (7/21): Economic Inequality
  - Week 5 (8/4): The Black-White Wealth Gap
  - Week 6 (8/11): Discriminatory Policies
  - Week 7 (8/18): Cryptocurrencies

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Climate Change Economics

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NEED

Emory University

July 14, 2022

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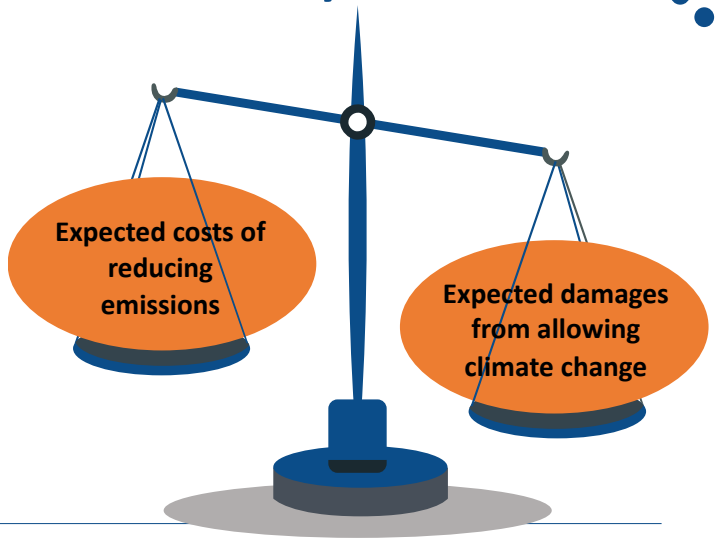
How Economists Decide How Much to Fight Climate Change: Cost Benefit Analysis

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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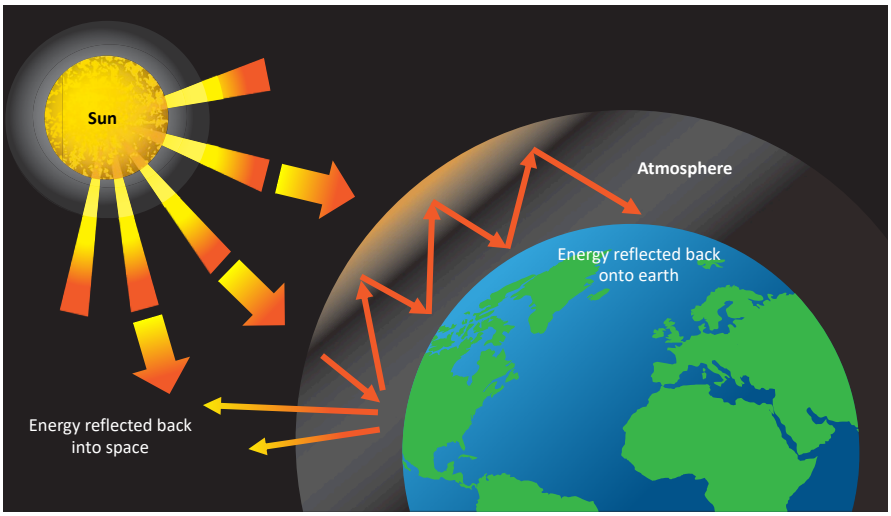
The Atmospheric Greenhouse Effect



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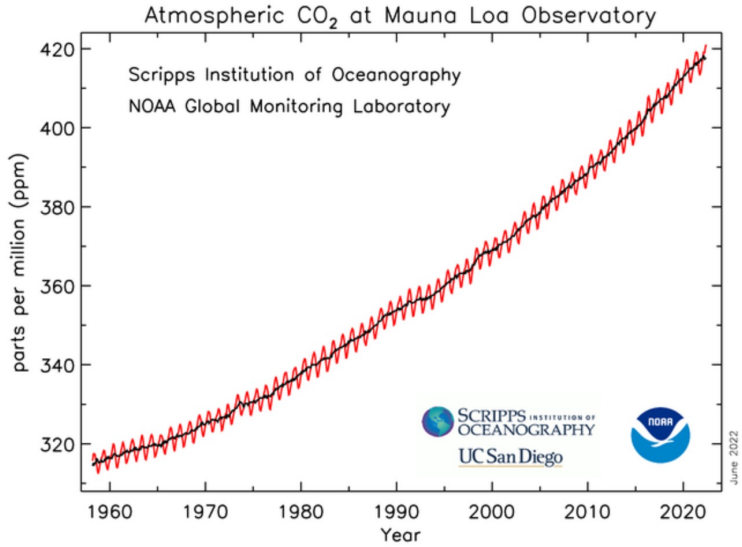
Atmospheric CO_2 Concentrations Up To Now



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Source: NOAA

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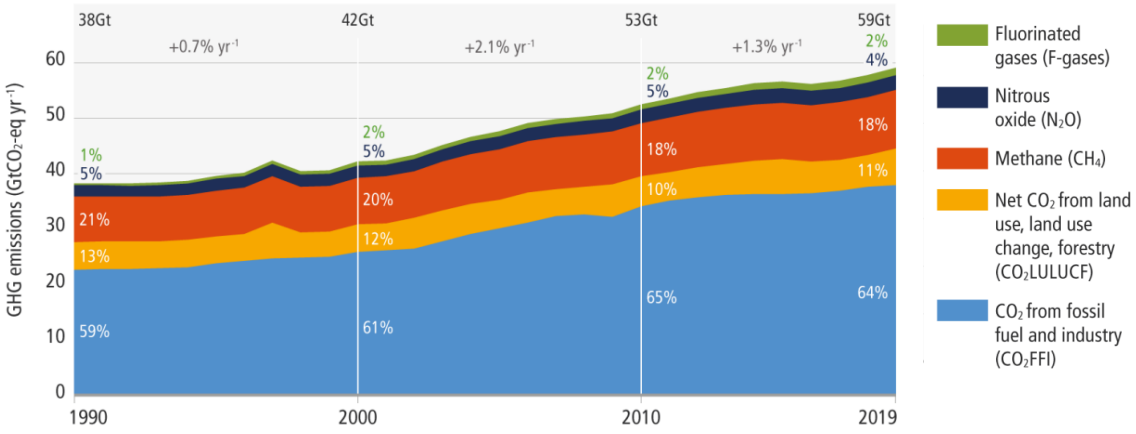
Greenhouse Gas Emissions 1990-2019

a. Global net anthropogenic GHG emissions 1990–2019 (6)



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Source: IPCC

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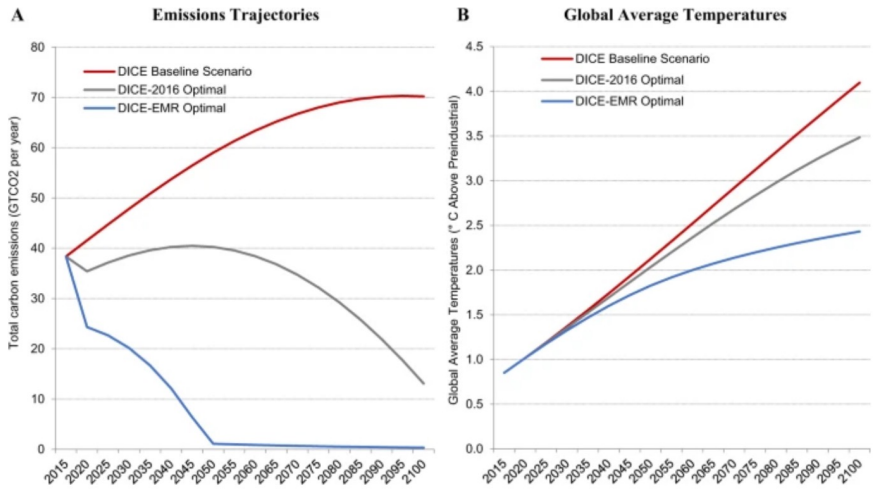
Emissions Trajectories into the Future

Fig. 2: Optimal Climate Policy.



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Source: https://www.nature.com/articles/s41467-021-24487-w

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What Do Greenhouse Gas Emissions Do to the Planet?

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

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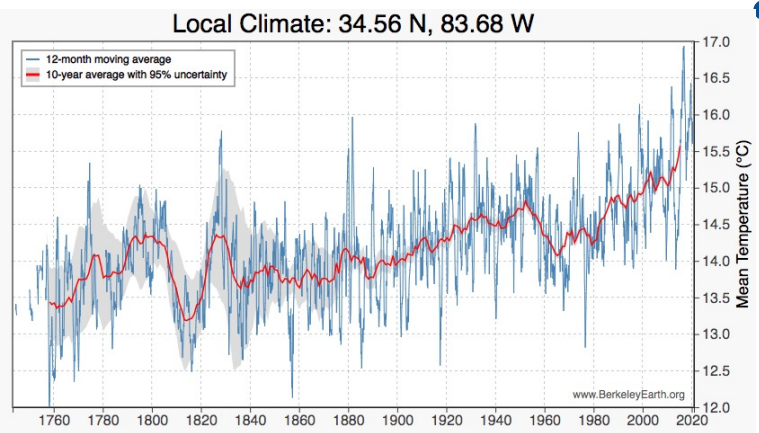
These Changes Are Already Underway

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

Here's Atlanta, GA.



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Source: IPCC Assessment Report 5

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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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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_2 (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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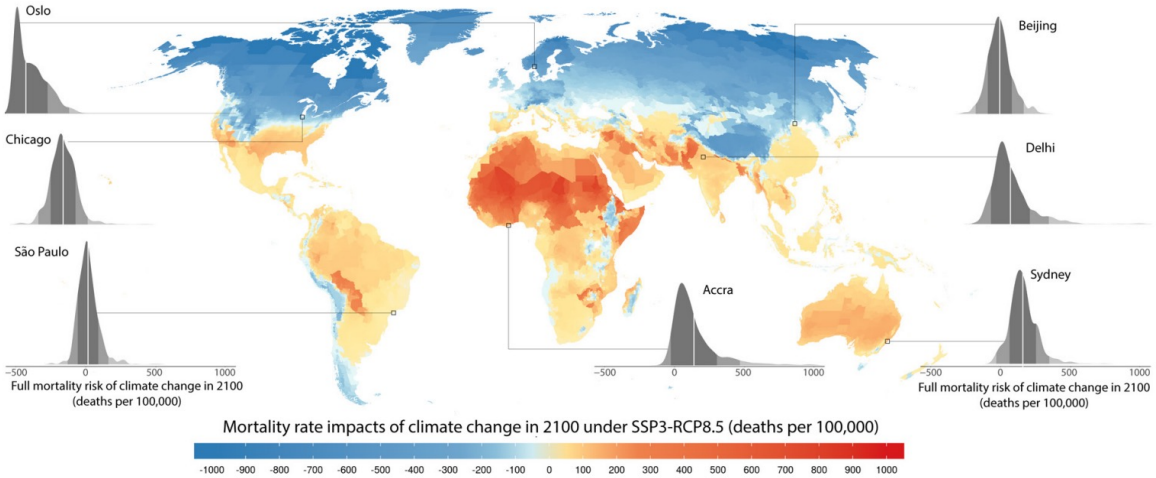
How Damages Will Vary Globally: Mortality as an Example



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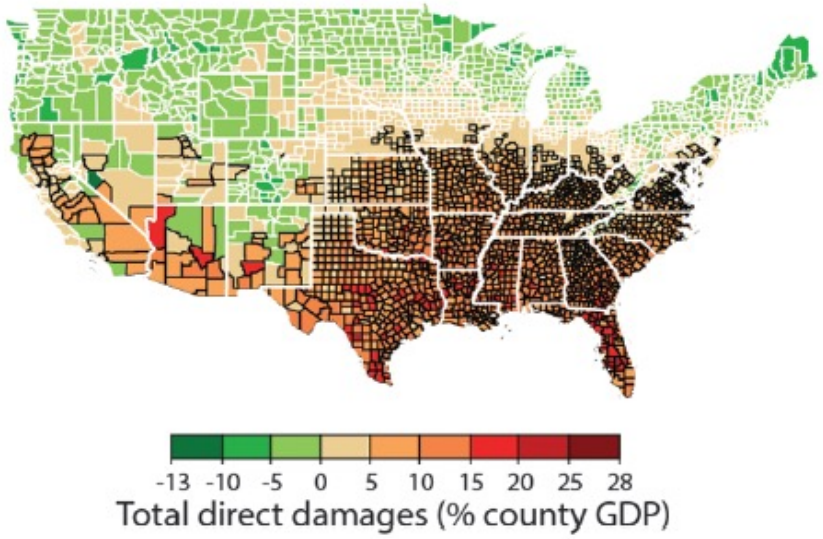
How Damages Will Vary in the US



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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.**
  - Net damage = cost of adaptation + 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 more hospitable place.

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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_2) we put out.**
- **Greenhouse gas sinks: ways to pull CO_2 out of the air.**
  - Existing: oceans, forests.
  - Increase sinkage by planting trees, or other measures.

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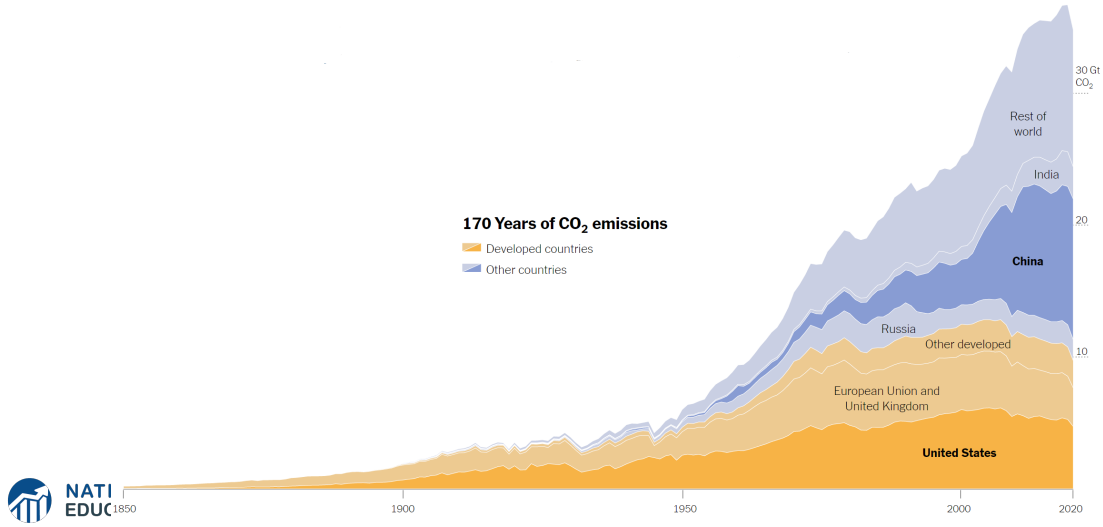
Sources of the Global Flow of Emissions



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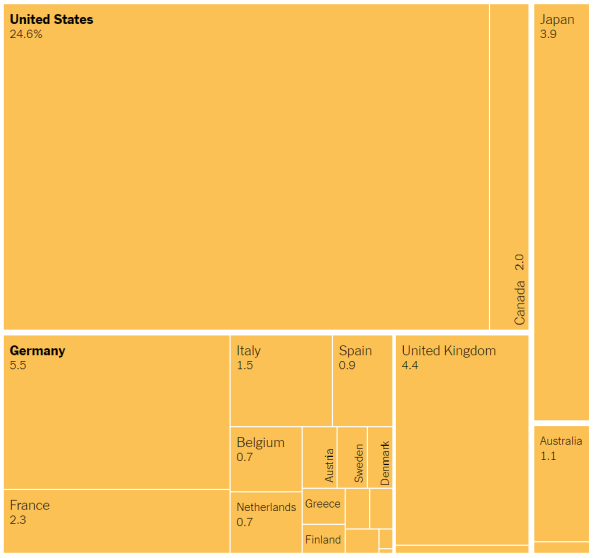
Sources of the Global Stock of Emissions

23 rich, developed countries are responsible for half of all historical CO_2 emissions.



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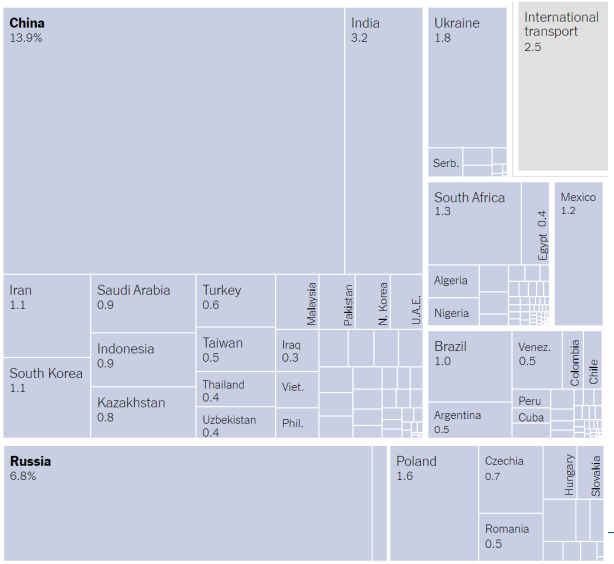
Sources of the Global Stock of Emissions

More than 150 countries are responsible for the other half.



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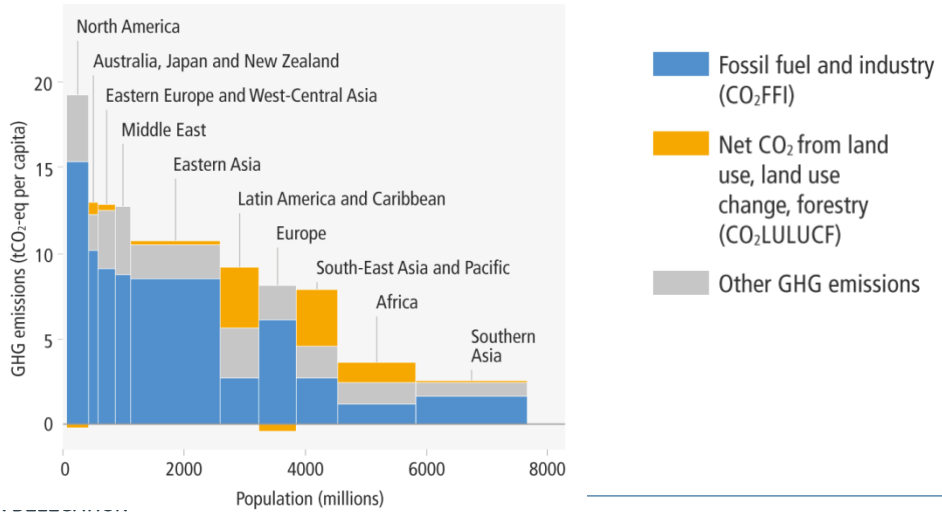
How Does This Look Per Capita (Per Person)?

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



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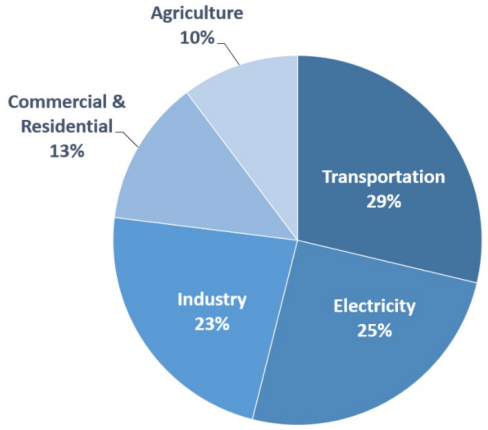
Total US Greenhouse Gas Emissions by Economic Sector in 2020



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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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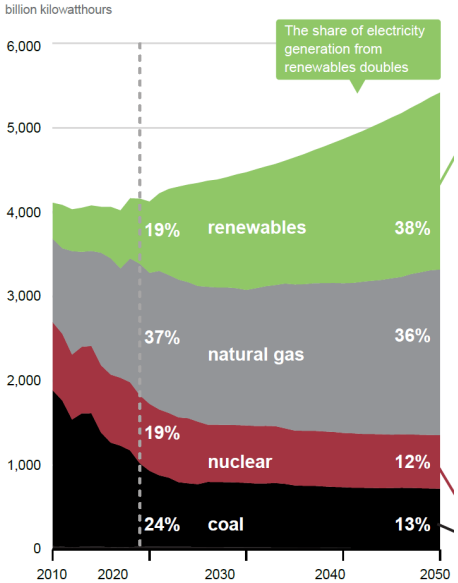
US Electricity Sources



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Which Emissions Should We Cut?

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

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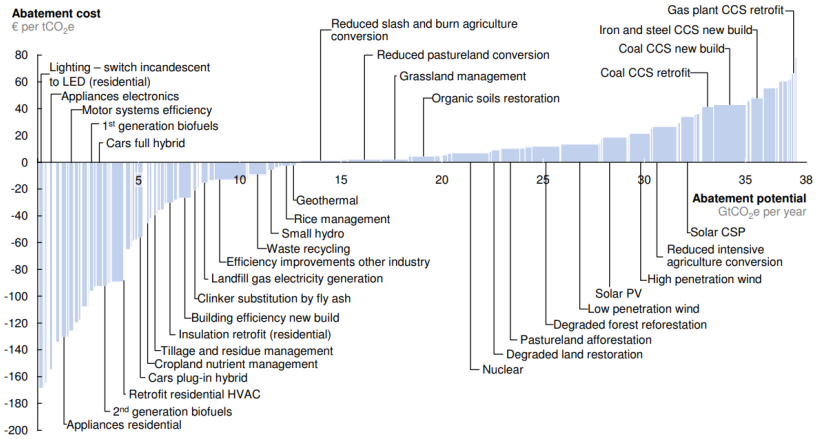
Example Abatement Cost Curve

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

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



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Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €80 per tCO_2e 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 CO2 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)

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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 may have 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.

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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**

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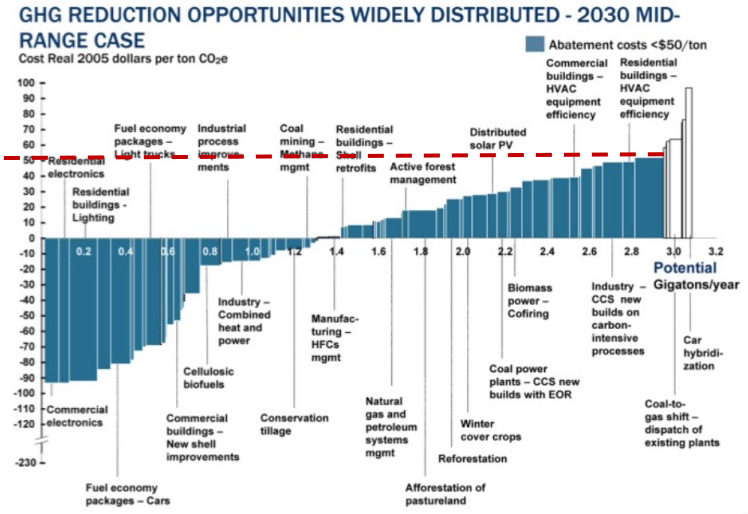
How Does Cap and Trade Work?

- **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:
    - 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.

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Examples of Other Policies that Reduce Emissions

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

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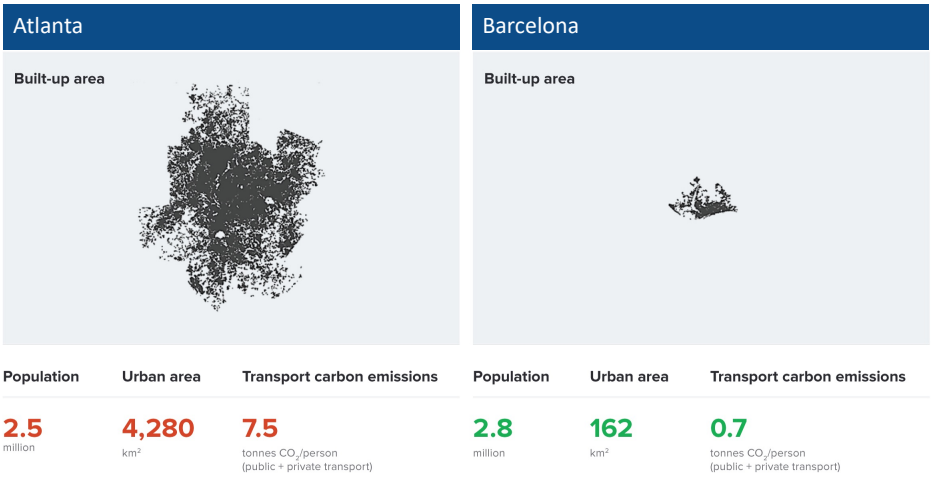
Atlanta and Barcelona Have Similar Populations but Very Different Carbon Productivity



Atlanta			Barcelona		
Population	Urban area	Transport carbon emissions	Population	Urban area	Transport carbon emissions
2.5 million	4,280 km²	7.5 tonnes CO_2/person (public + private transport)	2.8 million	162 km²	0.7 tonnes CO_2/person (public + private transport)

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Source: New Climate Economy Report, 2014

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Climate Change Policy in Action

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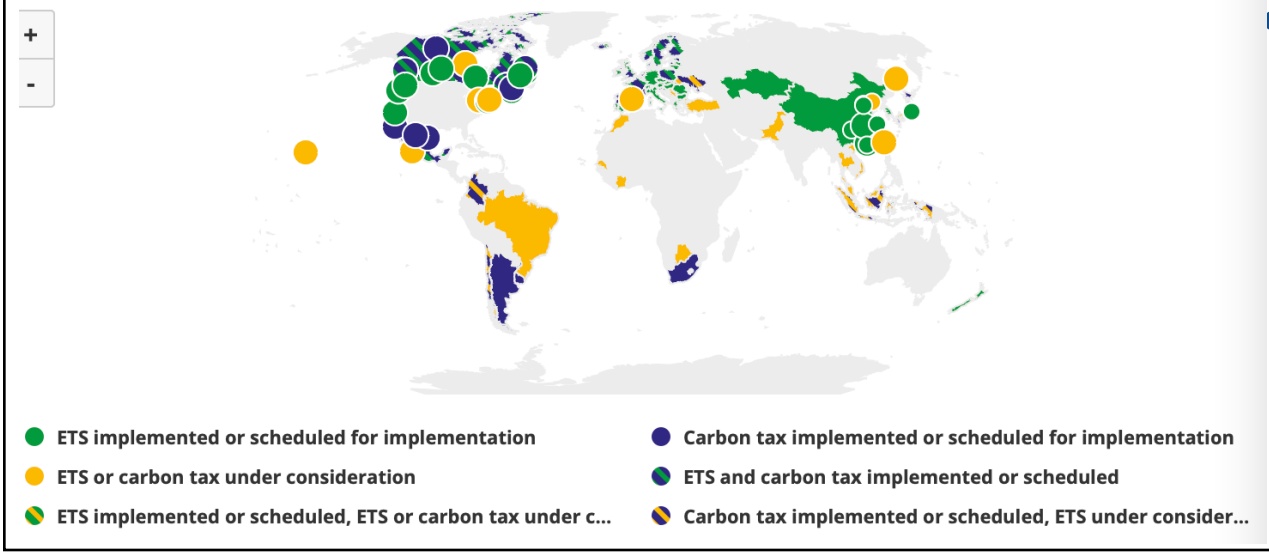
Incentive-Based Climate Policies Right Now

Summary map of regional, national and subnational carbon pricing initiatives



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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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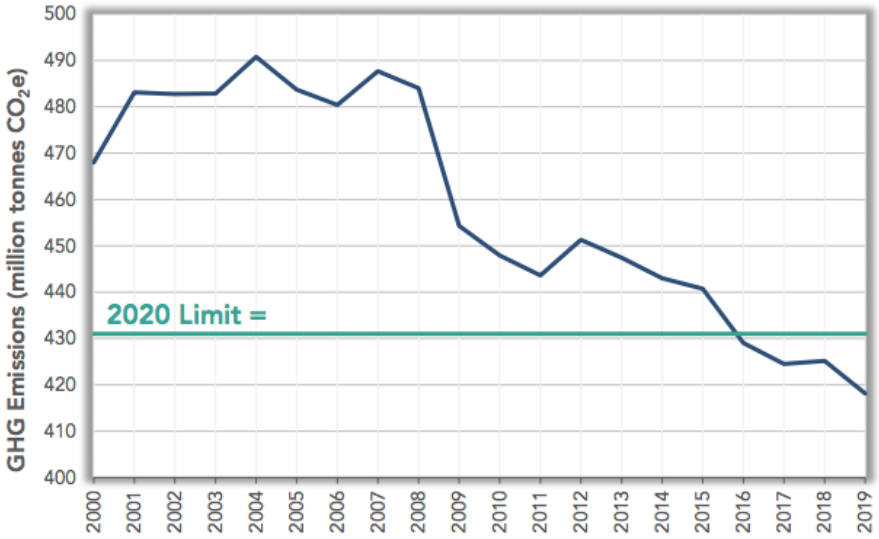
CA Relative to Goals: How Are We Doing?



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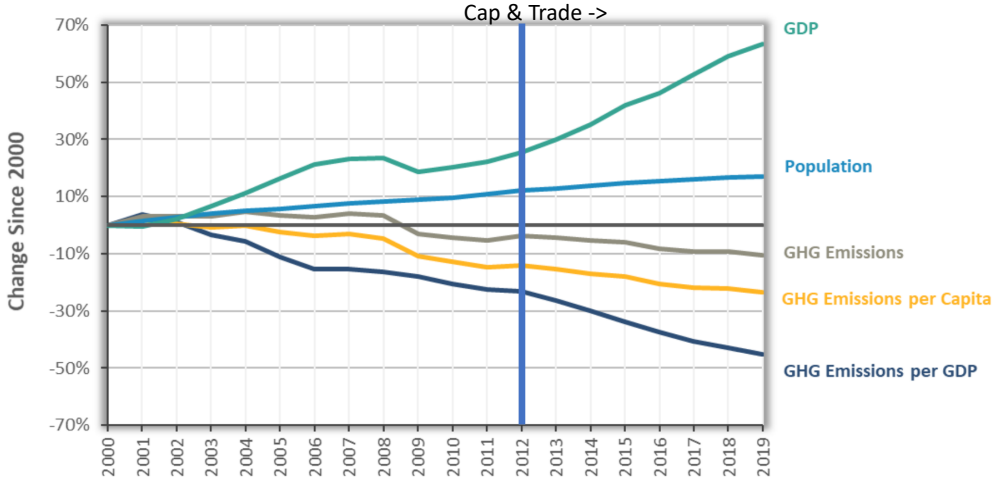
Change in California GDP, Population, and GHG Emissions since 2000



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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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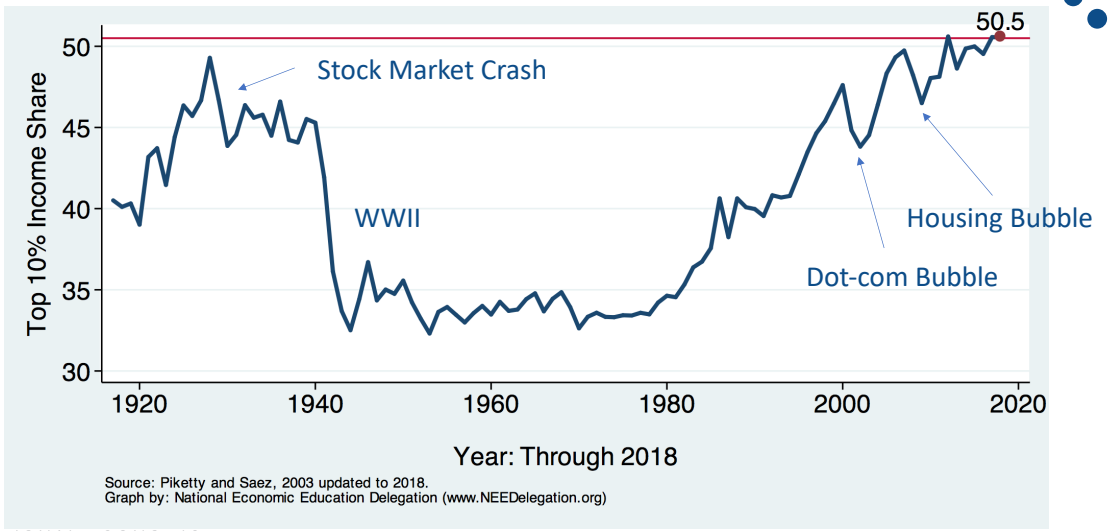
Income Inequality: Share of Top 10%



Source: Piketty and Saez, 2003 updated to 2018.
Graph by: National Economic Education Delegation (www.NEEDelegation.org)

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Thank you!

Any Questions?

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