*Osher Lifelong Learning Institute, Winter 2022*

# Contemporary Economic Policy

Florida Atlantic University/Johns Hopkins University
Fall, 2022

Jon Haveman, Ph.D.
National Economic Education Delegation

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## Available NEED Topics Include:

- US Economy
- Healthcare Economics
- 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: Johns Hopkins University

- **Contemporary Economic Policy**
  - Week 1 (11/3): The Black-White Wealth Gap (Jon Haveman, NEED)
  - Week 2 (11/10): Economic Inequality (Adina Ardelean, Santa Clara Univ.)
  - Week 3 (11/17): Economics of Immigration (Jennifer Alix-Garcia, Oregon State Univ.)
  - Week 4 (12/1): U.S. Economic Update (Jon Haveman, NEED)
  - Week 5 (12/8): Trade and Globalization (Adina Ardelean, Santa Clara Univ.)
  - **Week 6 (12/15): Climate Change Economics (Sarah Jacobson, Williams College)**



# 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)**

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# Climate Change Economics

Sarah Jacobson, Ph.D.
Williams College

## University of Minnesota

November 1, 2022

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## Credits and Disclaimer

- **This slide deck was authored by:**
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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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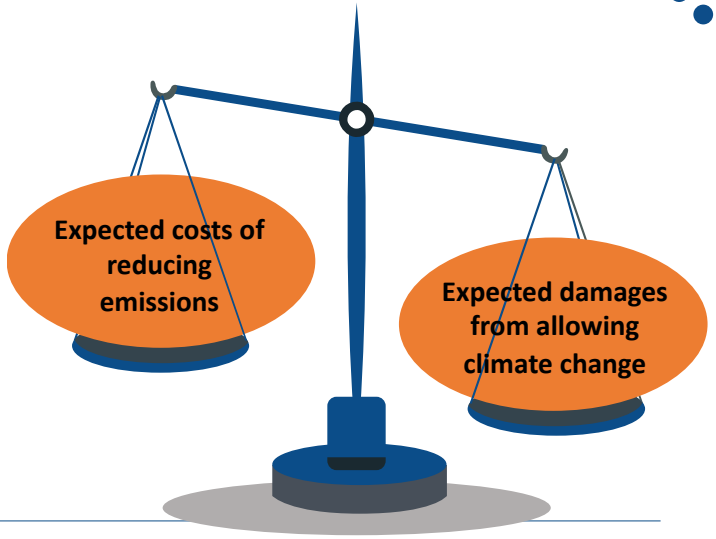
## How Economists Decide How Much to Fight Climate Change: Cost Benefit Analysis

**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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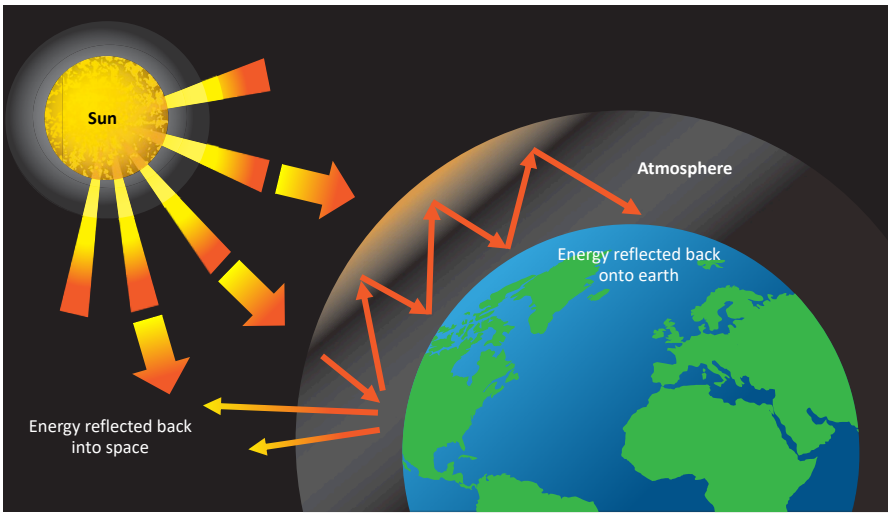
# The Atmospheric Greenhouse Effect



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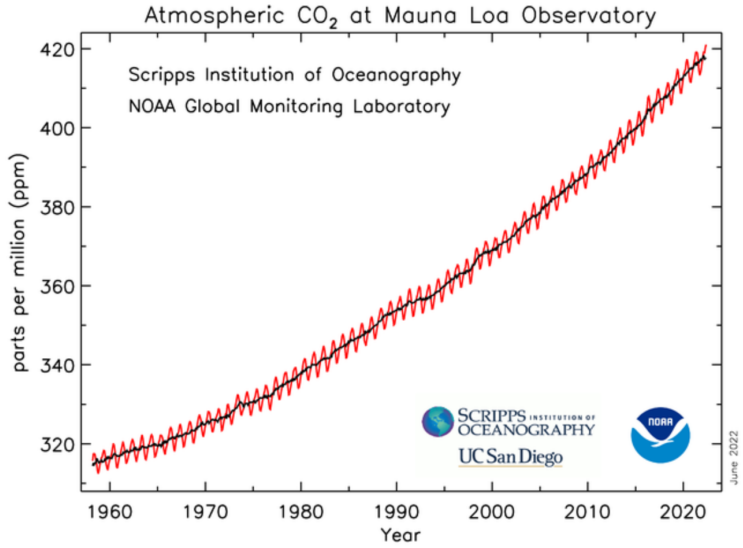
# Atmospheric $CO_2$ Concentrations Up To Now

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Source: NOAA

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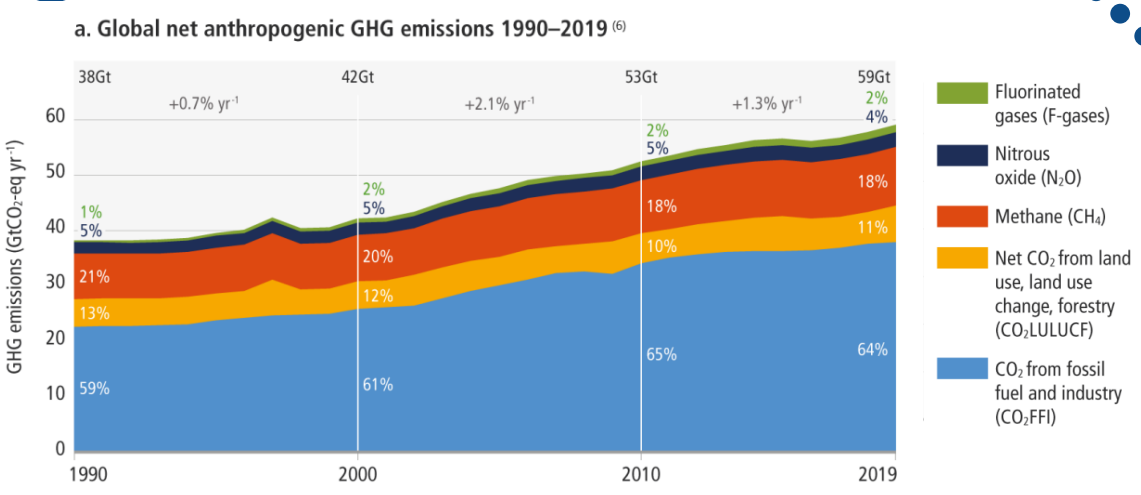
# Greenhouse Gas Emissions 1990-2019

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Source: IPCC

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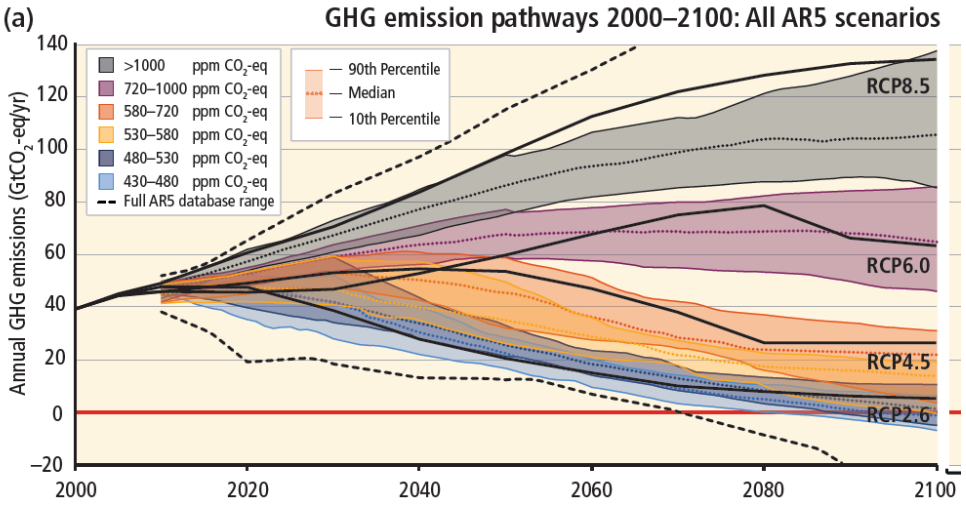
# Emissions Trajectories into the Future

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Source: IPCC Assessment Report 5

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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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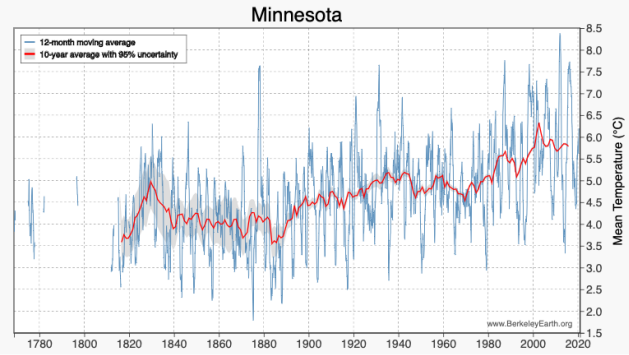
# These Changes Are Already Underway

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

**Here's Minnesota.**




Data Table | Download Image

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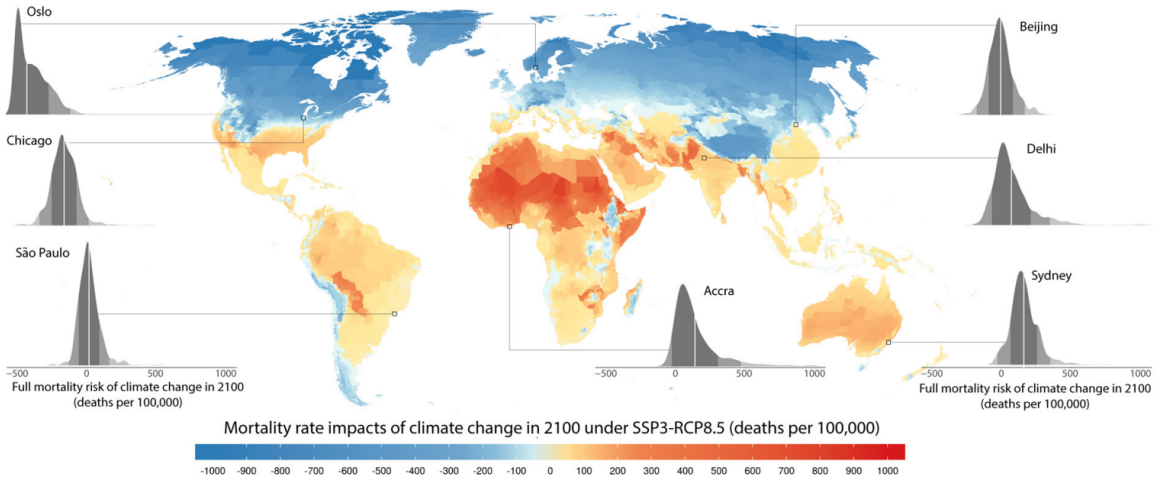
# How Damages Will Vary Globally: Mortality as an Example

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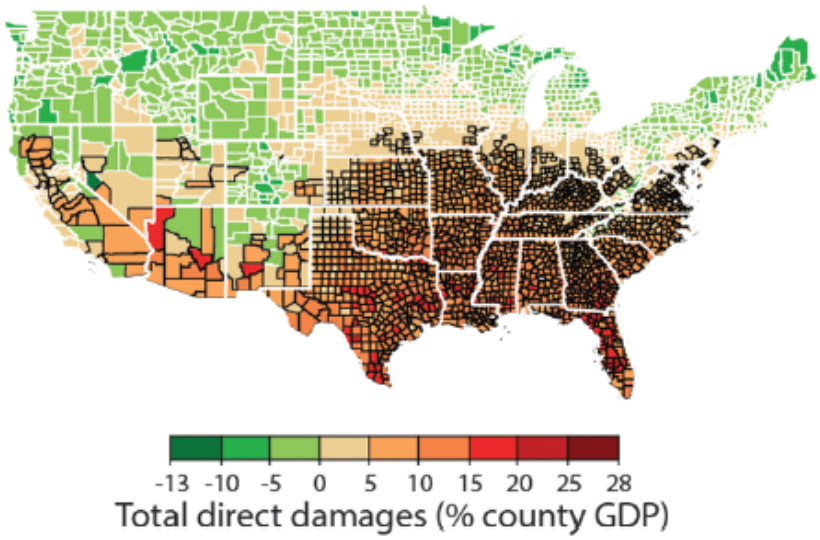
# How Damages Will Vary in the US

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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.**
- **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.

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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 CO2) we put out**
- **Greenhouse gas sinks: ways to pull CO2 out of the air**
  - Existing: oceans, forests
  - Increase sinkage by planting trees, or other measures

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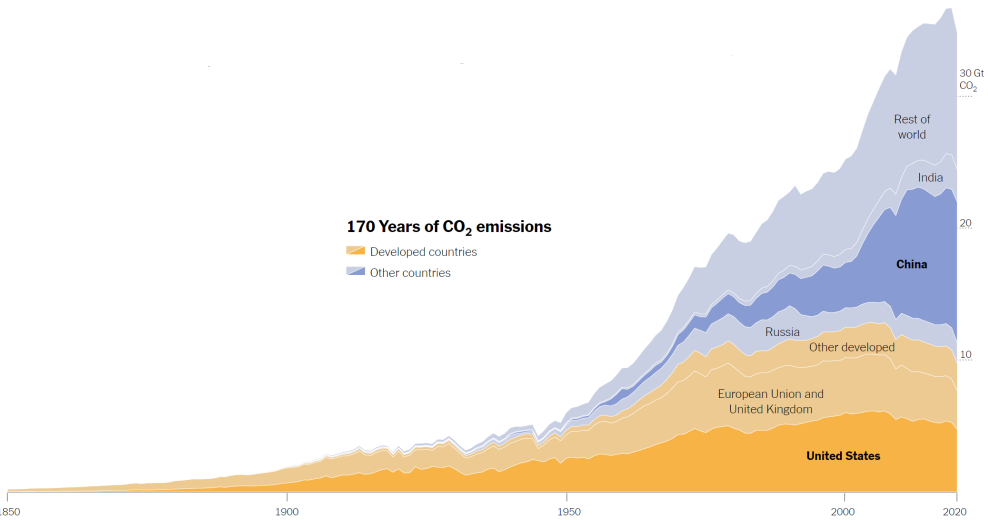
## Sources of the Global Flow of Emissions

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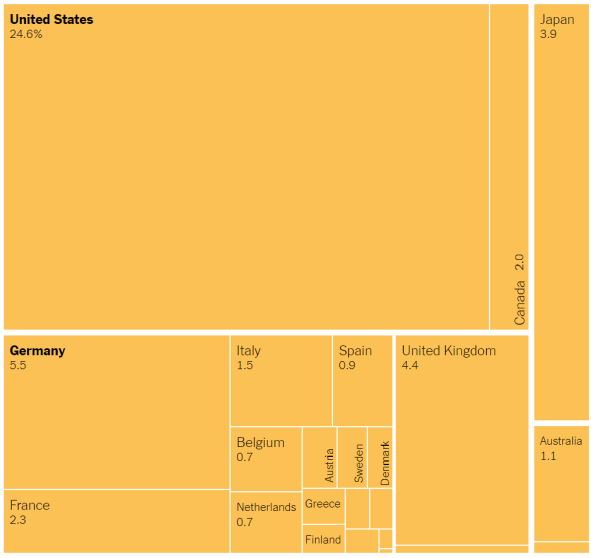
# Sources of the Global Stock of Emissions

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

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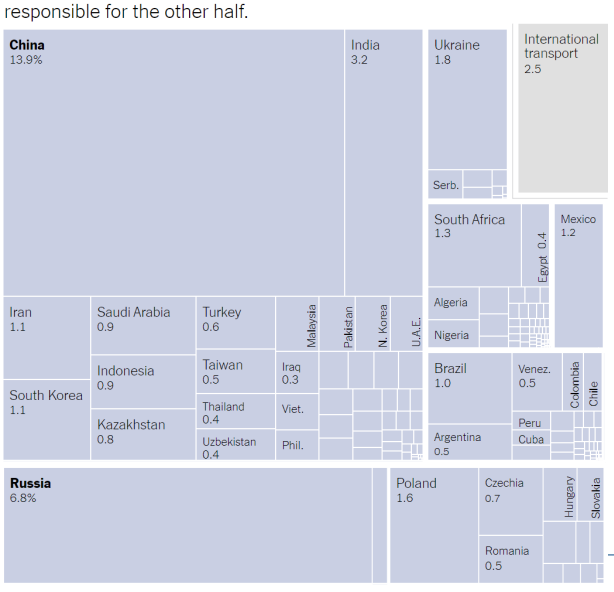
# Sources of the Global Stock of Emissions

**More than 150 countries** are responsible for the other half.

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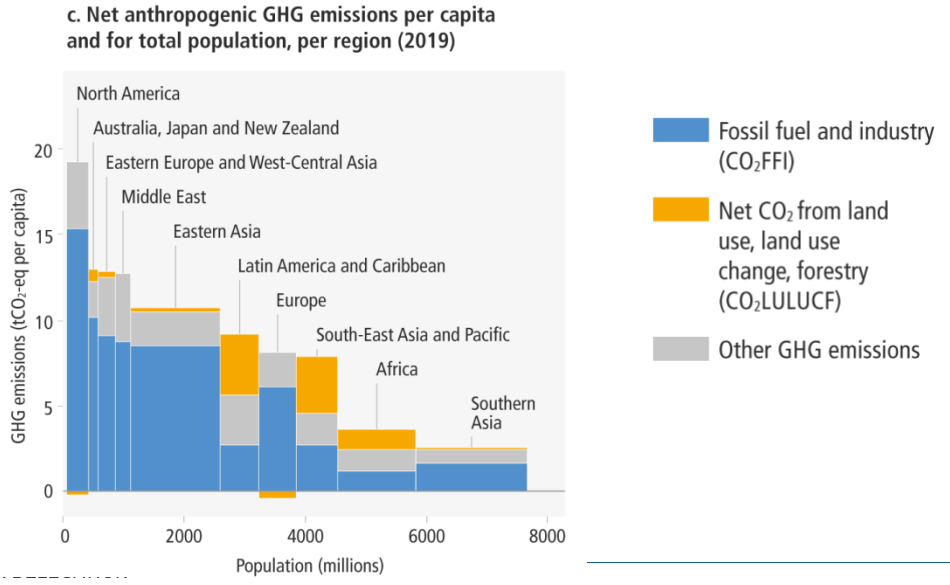
# How Does This Look Per Capita (Per Person)?



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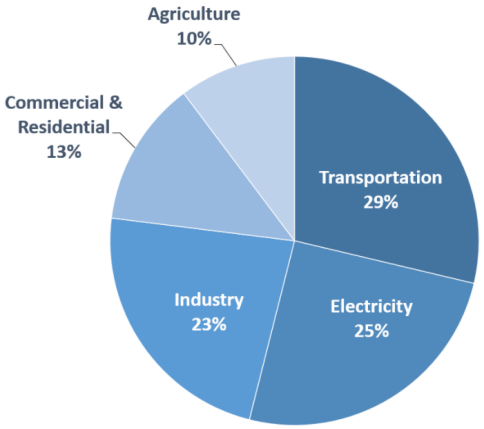
# Total US Greenhouse Gas Emissions by Economic Sector in 2020




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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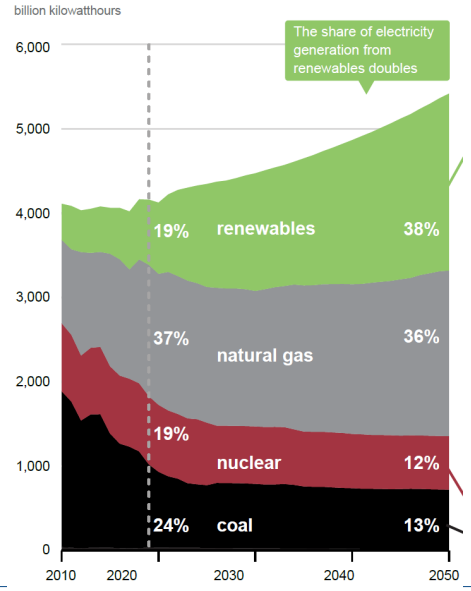
# US Electricity Sources

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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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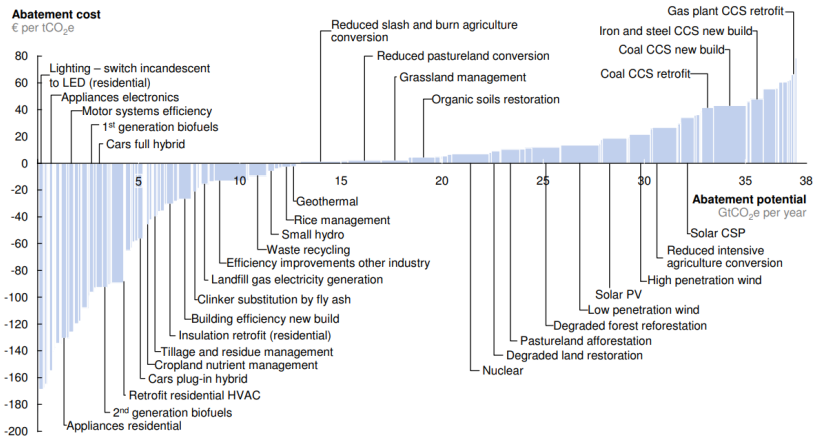
# Example Abatement Cost Curve

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

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

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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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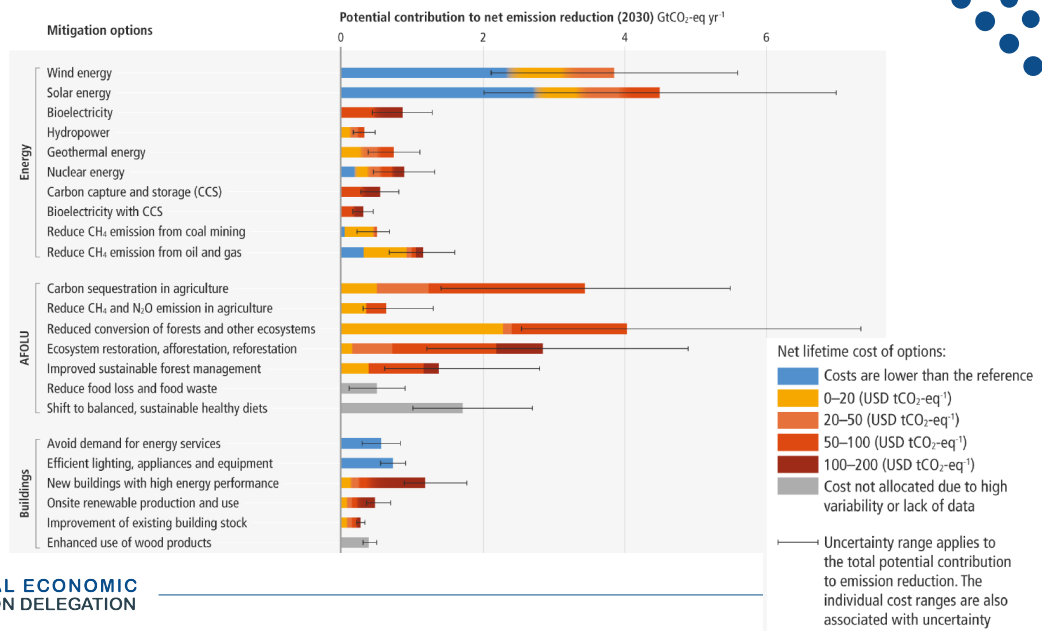
# Newer Estimated Abatement Cost Curve

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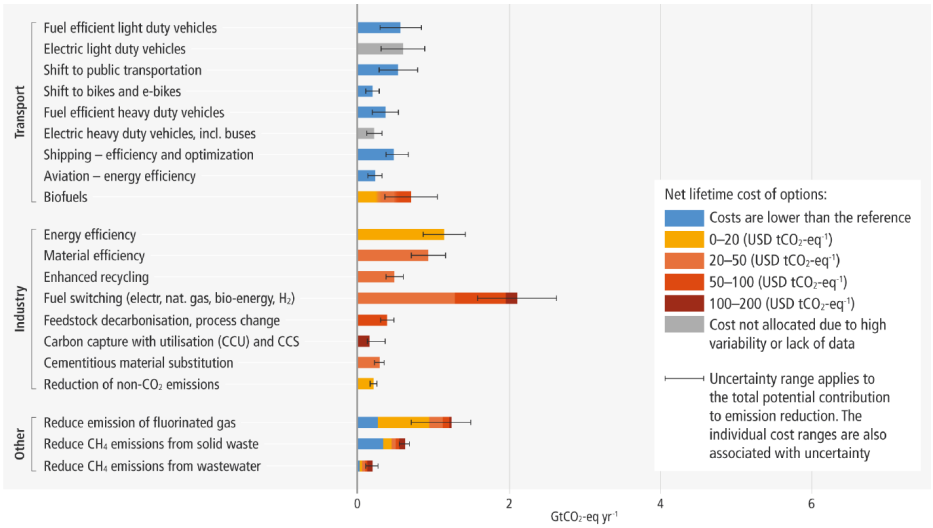
# Newer Estimated Abatement Cost Curve

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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)



# 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**



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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**



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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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# Climate Change Policy in Action

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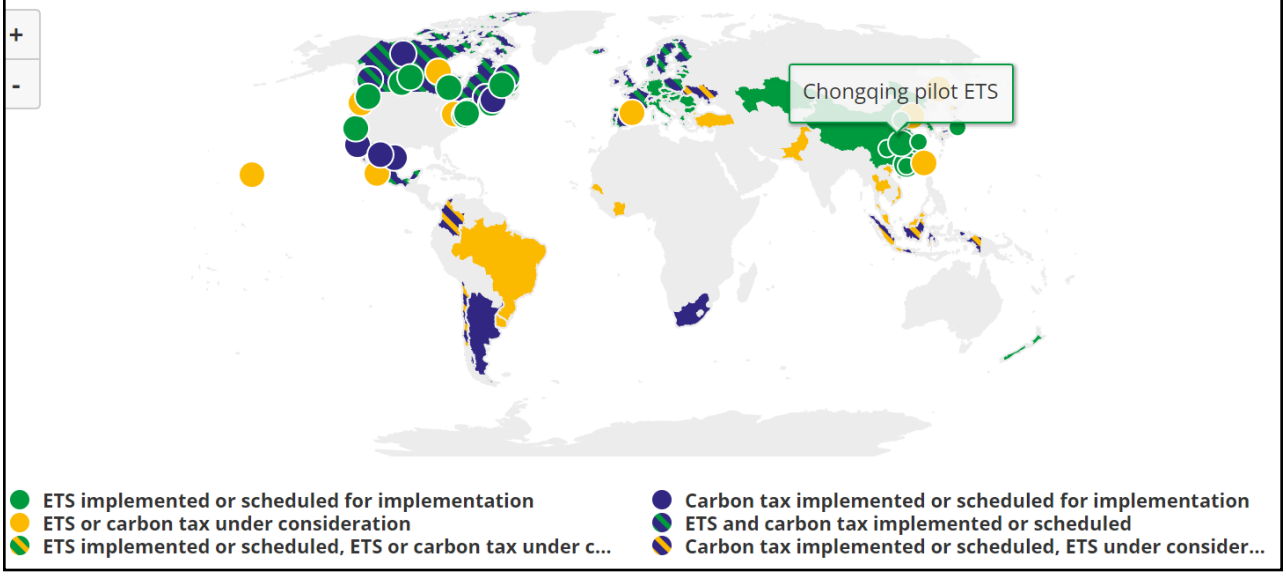
# Incentive-Based Climate Policies Right Now

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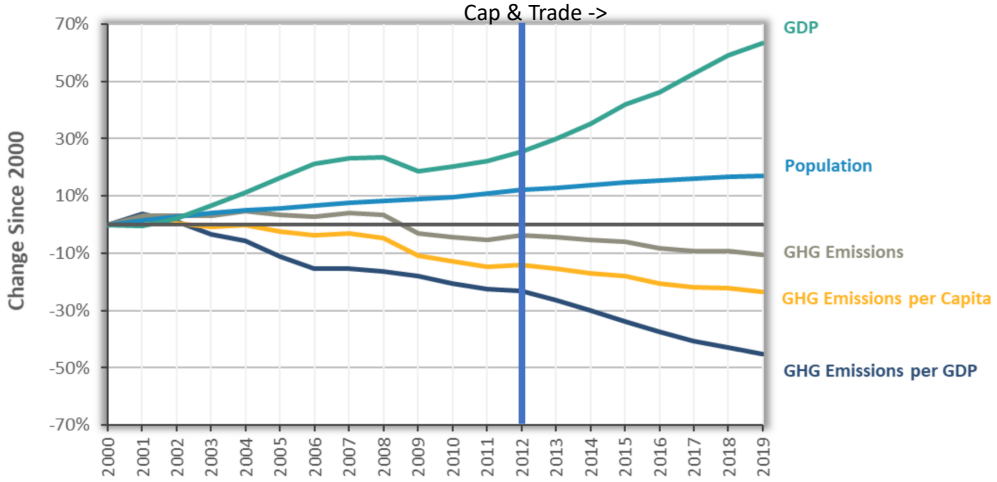
# Change in California GDP, Population, and GHG Emissions since 2000

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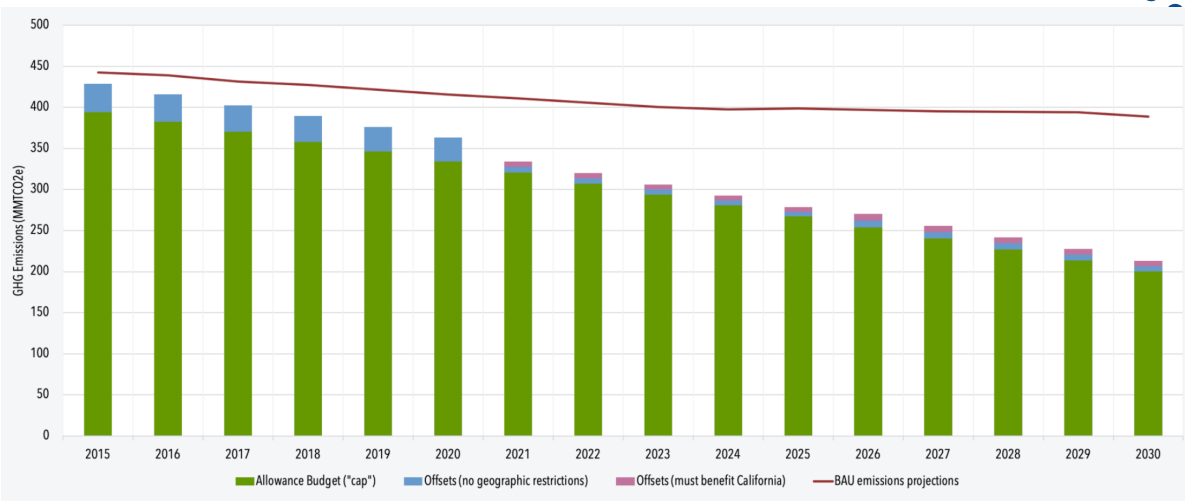
# Projected trends in California's emissions

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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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Thank you!

# Any Questions?

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