Osher Lifelong Learning Institute, Winter 2022

Contemporary Economic Policy

Clemson University
January-February, 2022

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

Course Outline

- **Contemporary Economic Policy**
  - Week 1 (1/31): US Economy & Coronavirus Economics
  - Week 2 (2/7): Monetary Policy (Geoffrey Woglom, Amherst College)
  - Week 3 (2/14): Trade (Alan Deardorff, University of Michigan)
  - **Week 4 (2/21): Climate Change Economics (Sarah Jacobson, Williams College)**

Asking Questions

- **Please submit questions in the chat or unmute to ask at any time.**
  - I will also pause to ask for questions periodically.
- **We will do a final Q&A after I've finished the slides.**
- **OLLI allowing, we can stay beyond the end of class to have further discussion.**

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Climate Change Economics

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Clemson University OLLI

February 21, 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

Economic Building Blocks

How Can Economists Help Fight Climate Change?

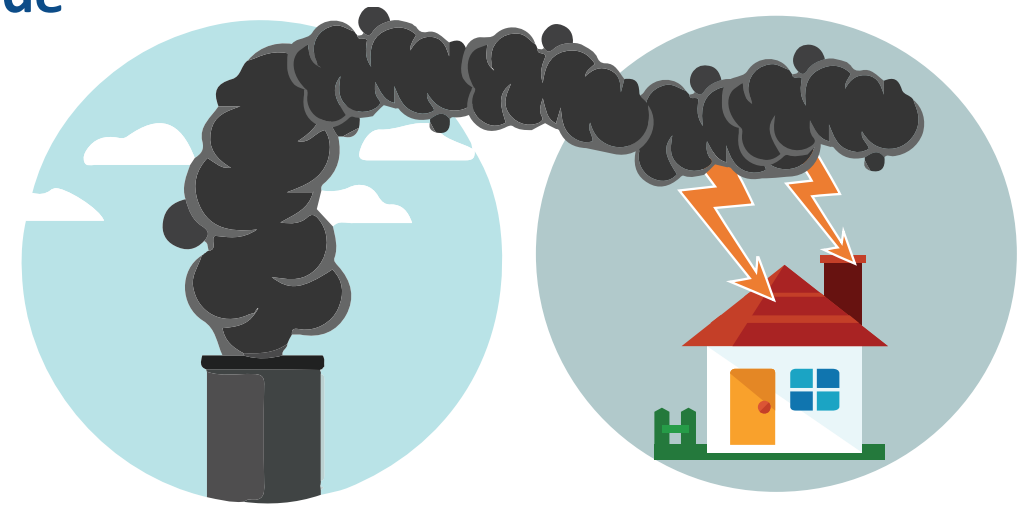
- By assessing behavioral reactions to climate change.
- By measuring climate change damages and estimating the costs of fighting climate change.
- By designing smart policies that minimize costs to society.

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)

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***

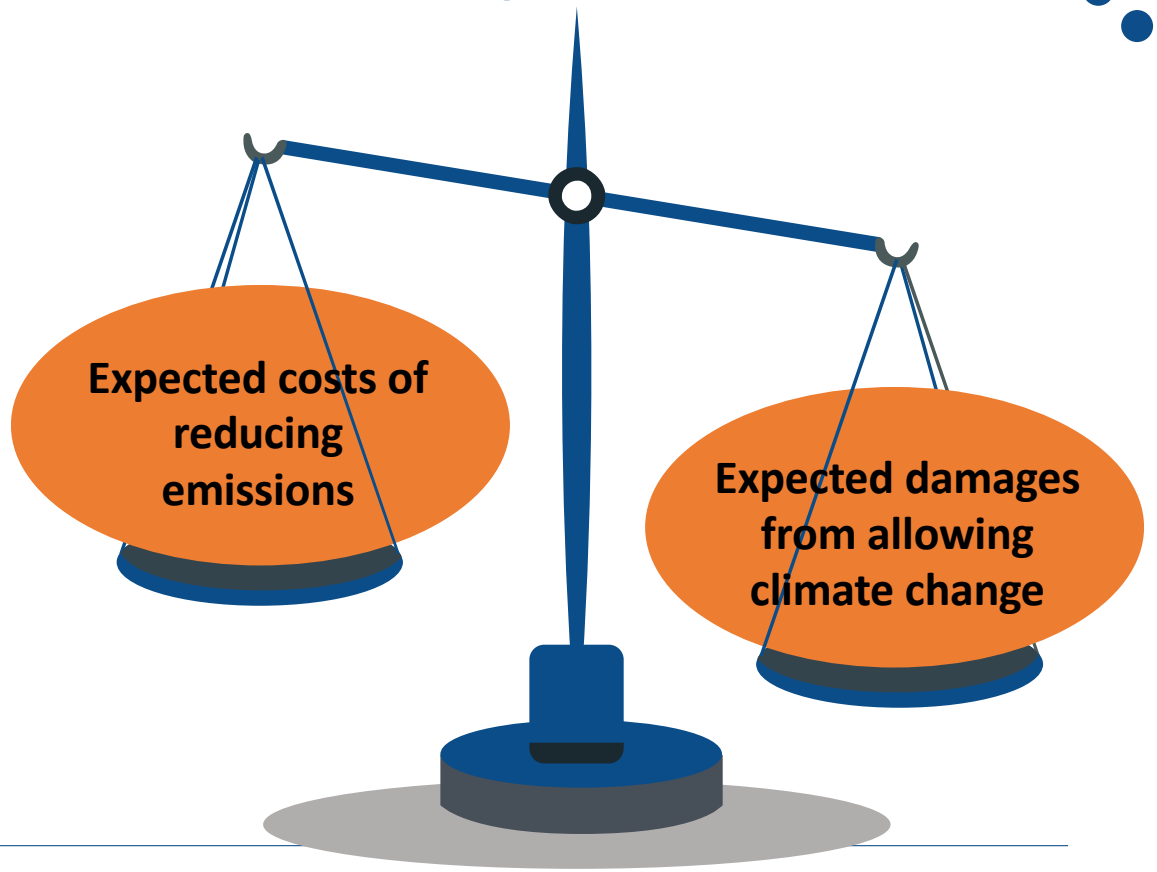


How Economists Decide How Much to Fight Climate Change: Cost Benefit Analysis

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.



Will the Efficient Balance of Greenhouse Gas Emissions Happen on Its Own?

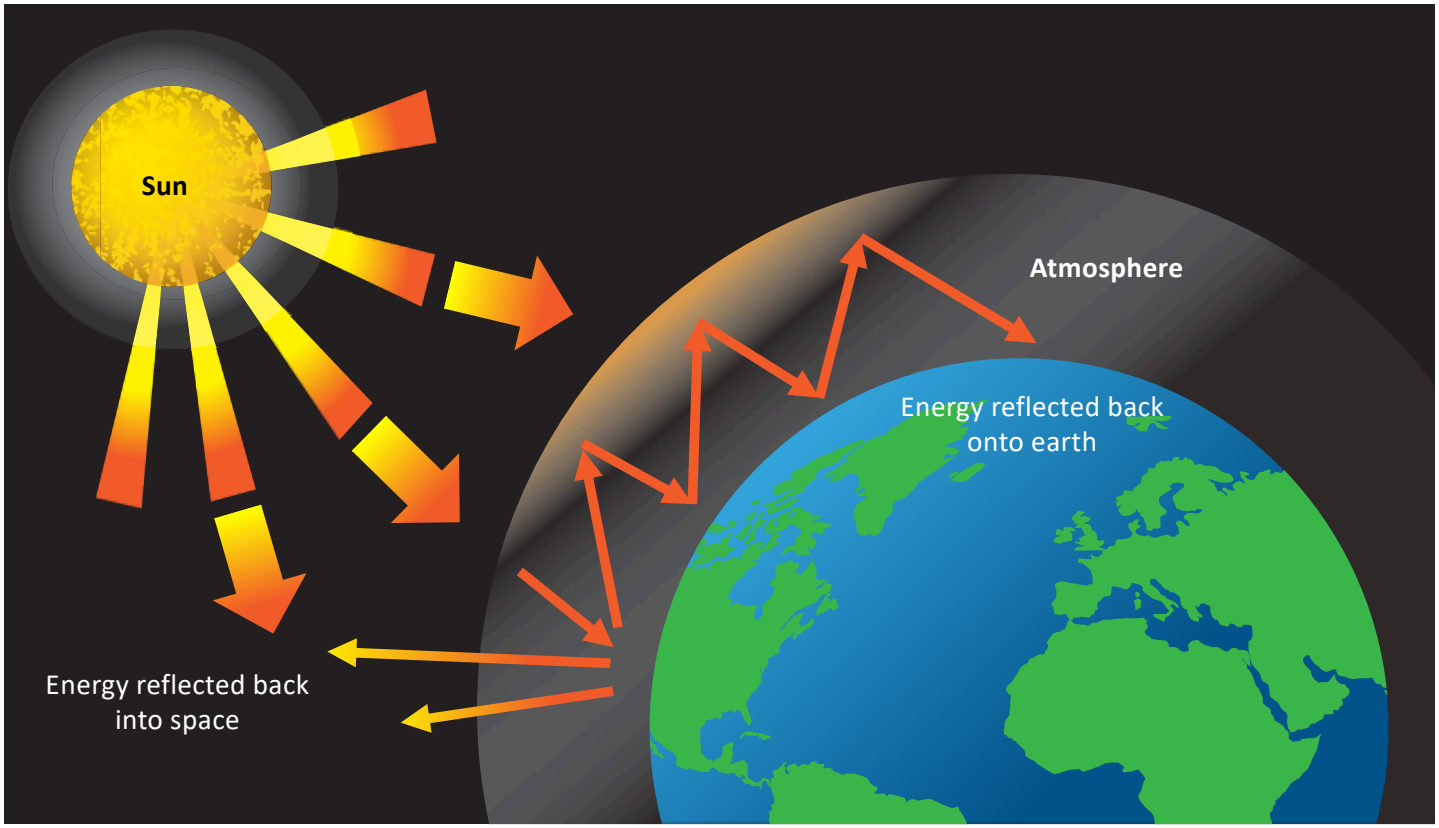
- The damage costs from allowing climate change to progress are externalities
- Therefore they are costs that are not naturally factored into prices
- Until we fix that, products that cause emissions will have an unfair advantage → policy can help

Climate Change

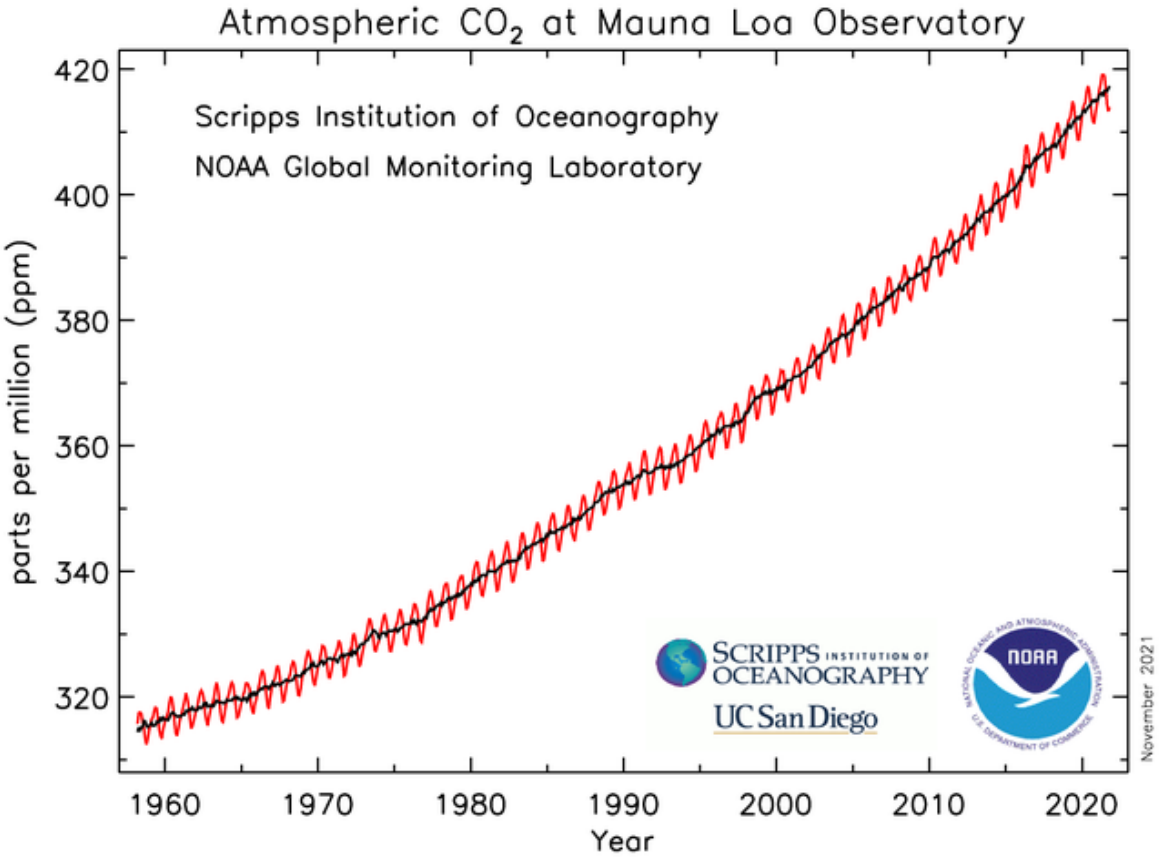
A Climate Change Ladder

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

The Atmospheric Greenhouse Effect

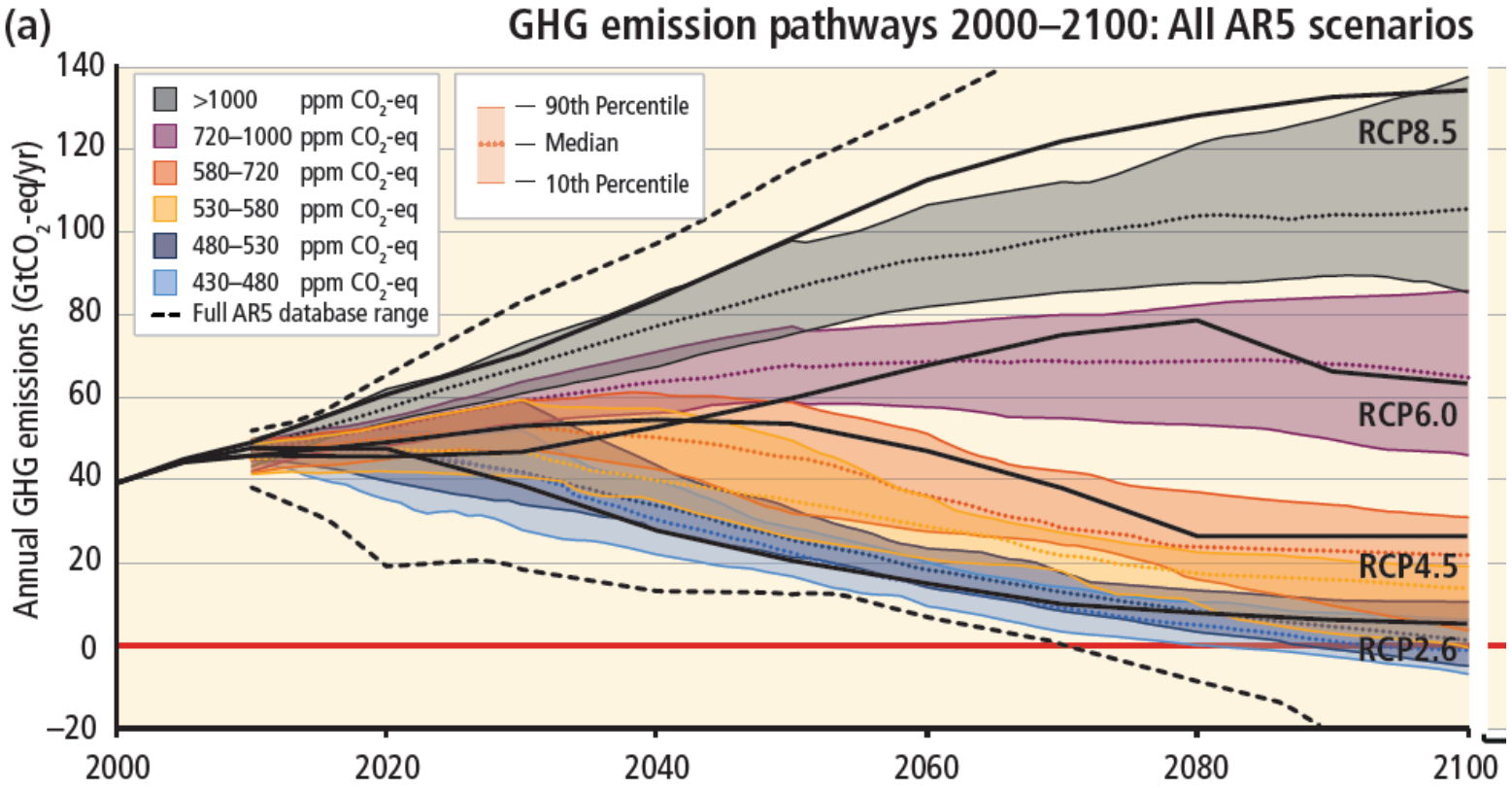


Atmospheric CO_2 Concentrations



Source: NOAA

Atmospheric CO_2 Concentrations



Source: IPCC Assessment Report 5

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**

Impacts of Climate Change

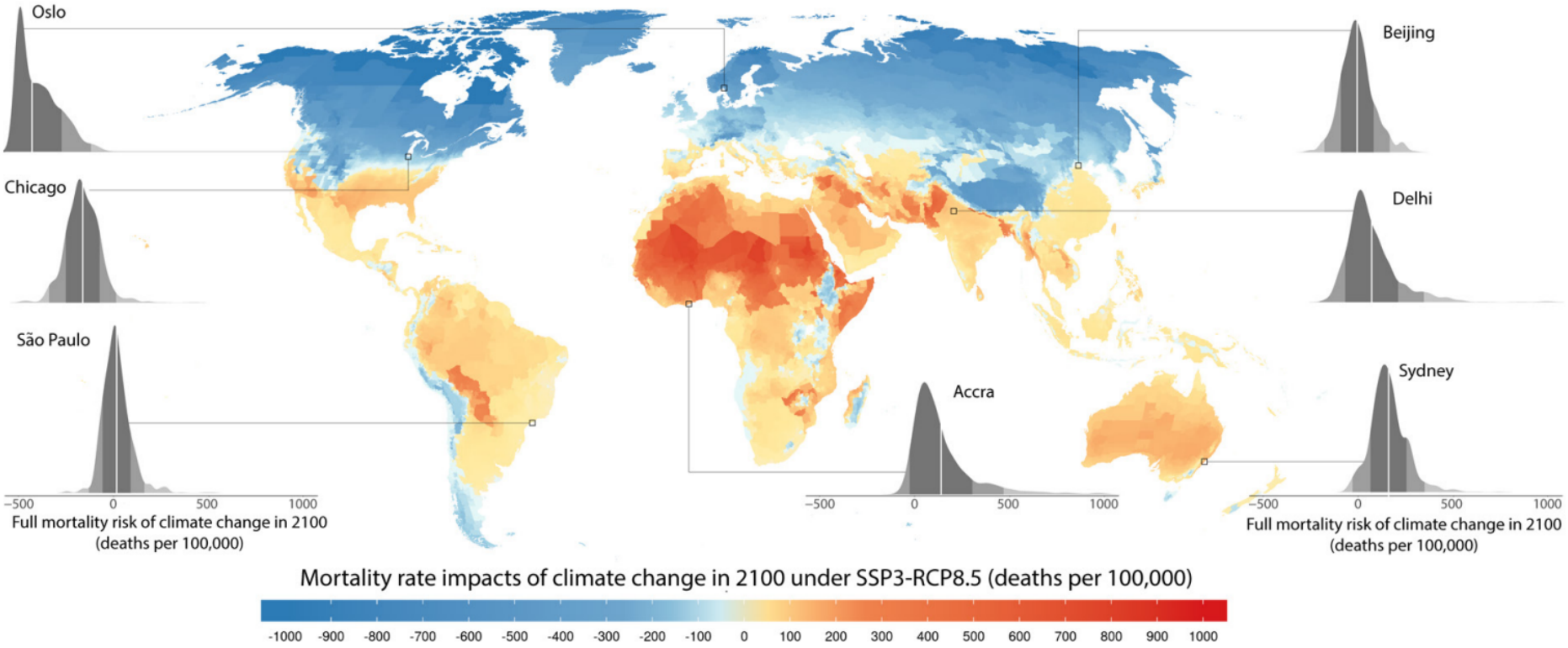
How Climate Change Affects Humans

- 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

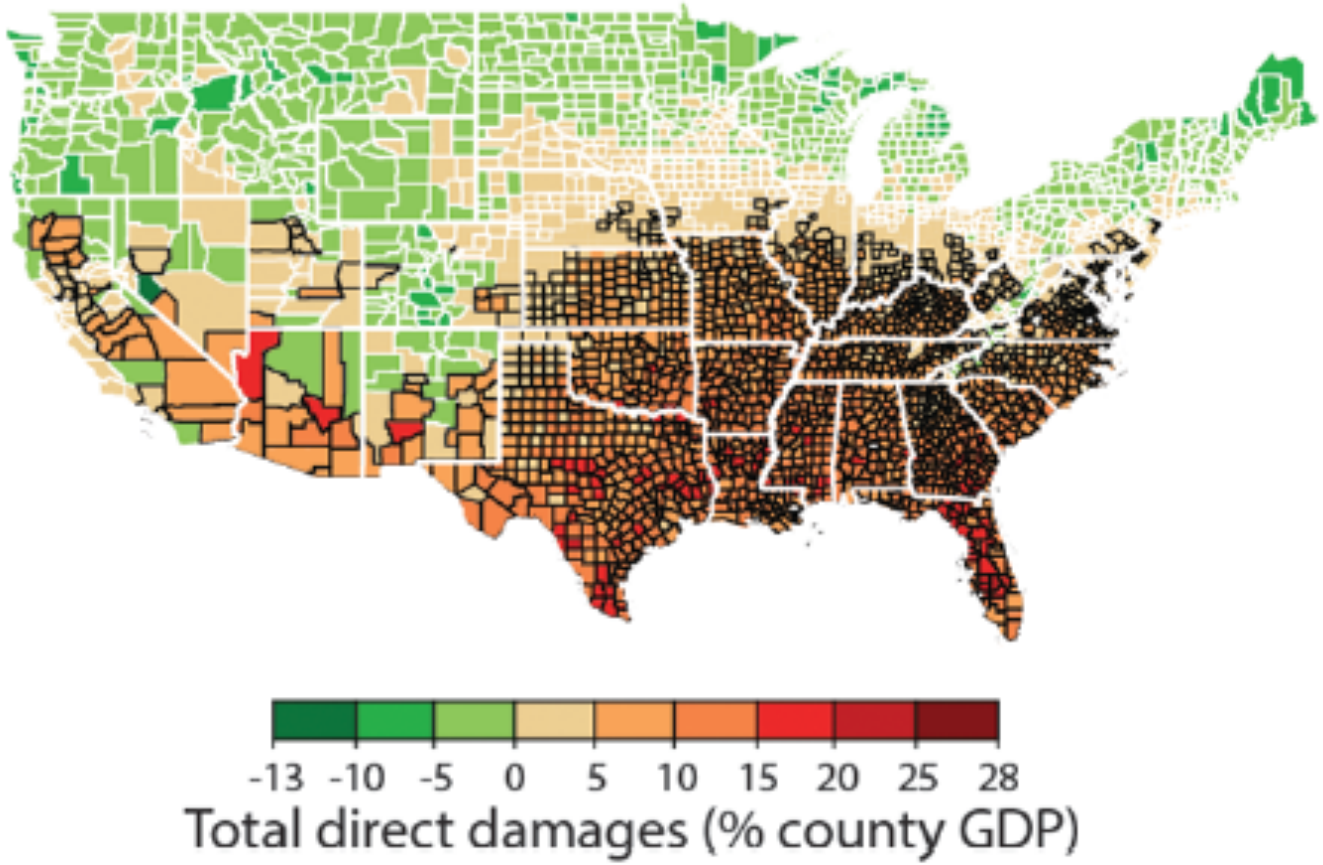
Social Cost of Carbon

- **The expected cost of damages from each unit of greenhouse gas emissions.**
- **Current EPA estimate: ~$51 per metric ton of CO_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.**

How Damages Will Vary Globally: Mortality as an Example



How Damages Will Vary in the US



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 Examples

- **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)**

Weighing those Damages in a Cost-Benefit Analysis of Fighting Climate Change

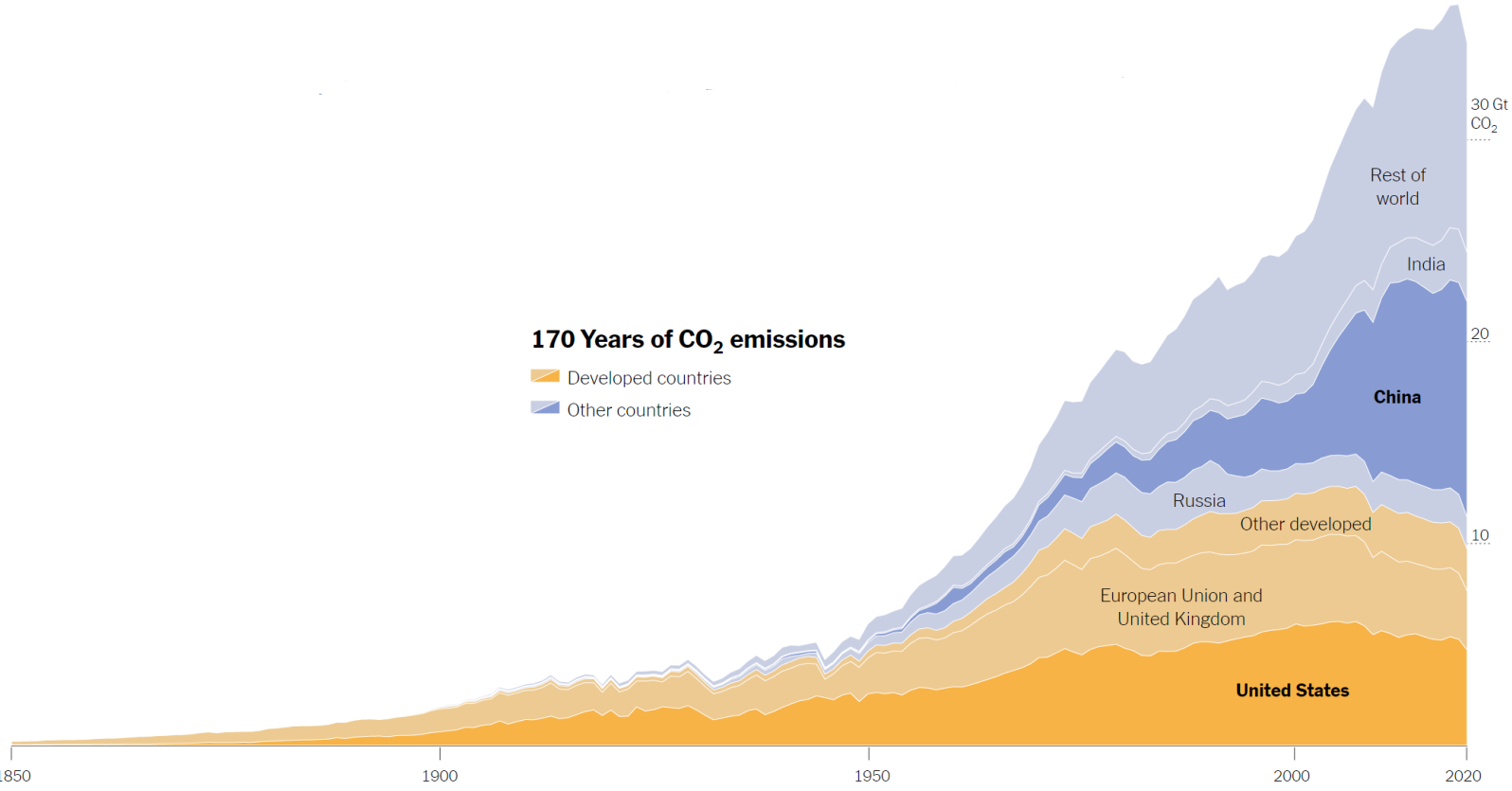
- **Most economic models suggest the costs of keeping warming below 2°C are relatively small, amounting to 1-4% of GDP by 2030.**
- **Costs of acting to keep warming below 2°C are almost certainly less than future economic damages they would avoid.**
  - Damages estimated to be between: **7-20% of worldwide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

Reducing Emissions

Global Net Emissions Are What We Care About

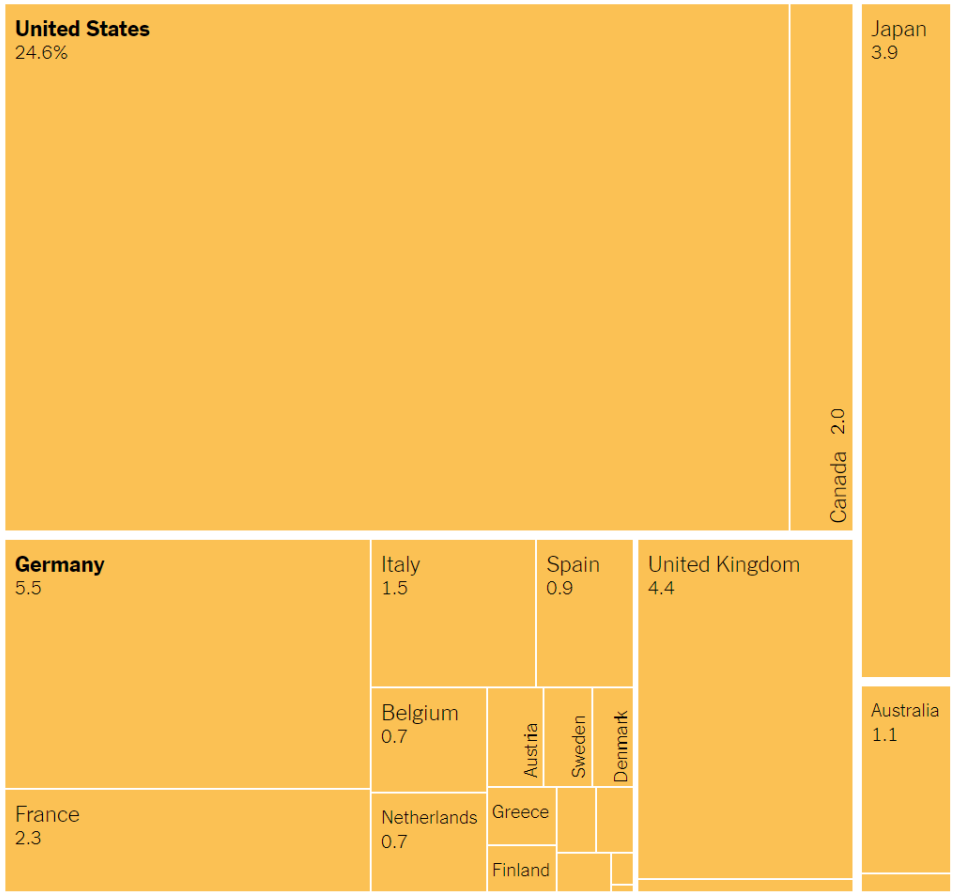
- **For climate impacts, we don't care where they are emitted, only how much**
  - There may be other local impacts
- **Gross emissions (greenhouse gas sources): how much greenhouse gases (including CO2) we put out**
- **Greenhouse gas sinks: ways to pull CO2 out of the air**
  - Existing: oceans, forests
  - Increase sinkage by planting trees, or other measures

Sources of the Global Flow of Emissions



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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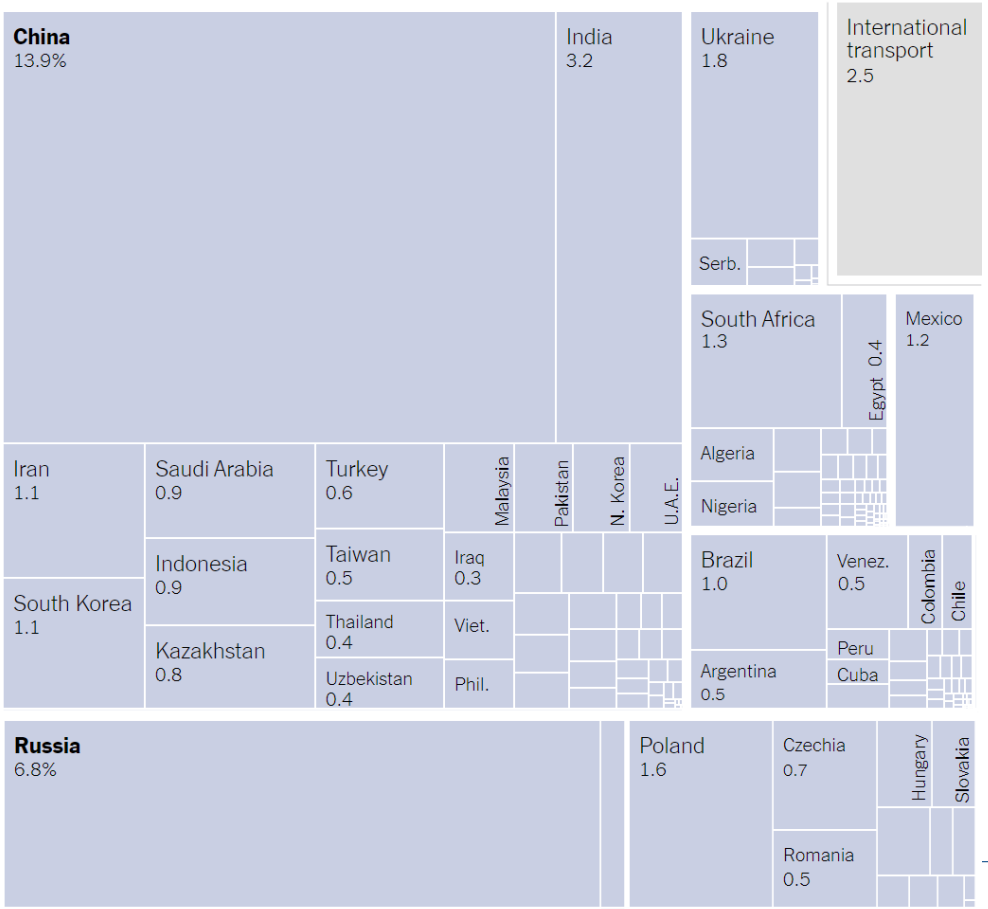
Sources of the Global Stock of Emissions

More than 150 countries are responsible for the other half.



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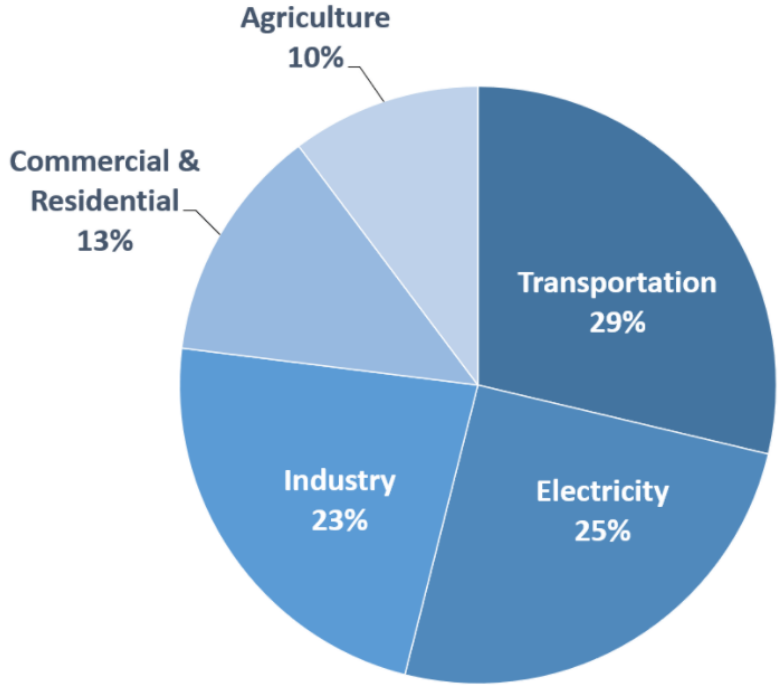
Total U.S. Greenhouse Gas Emissions by Economic Sector in 2020



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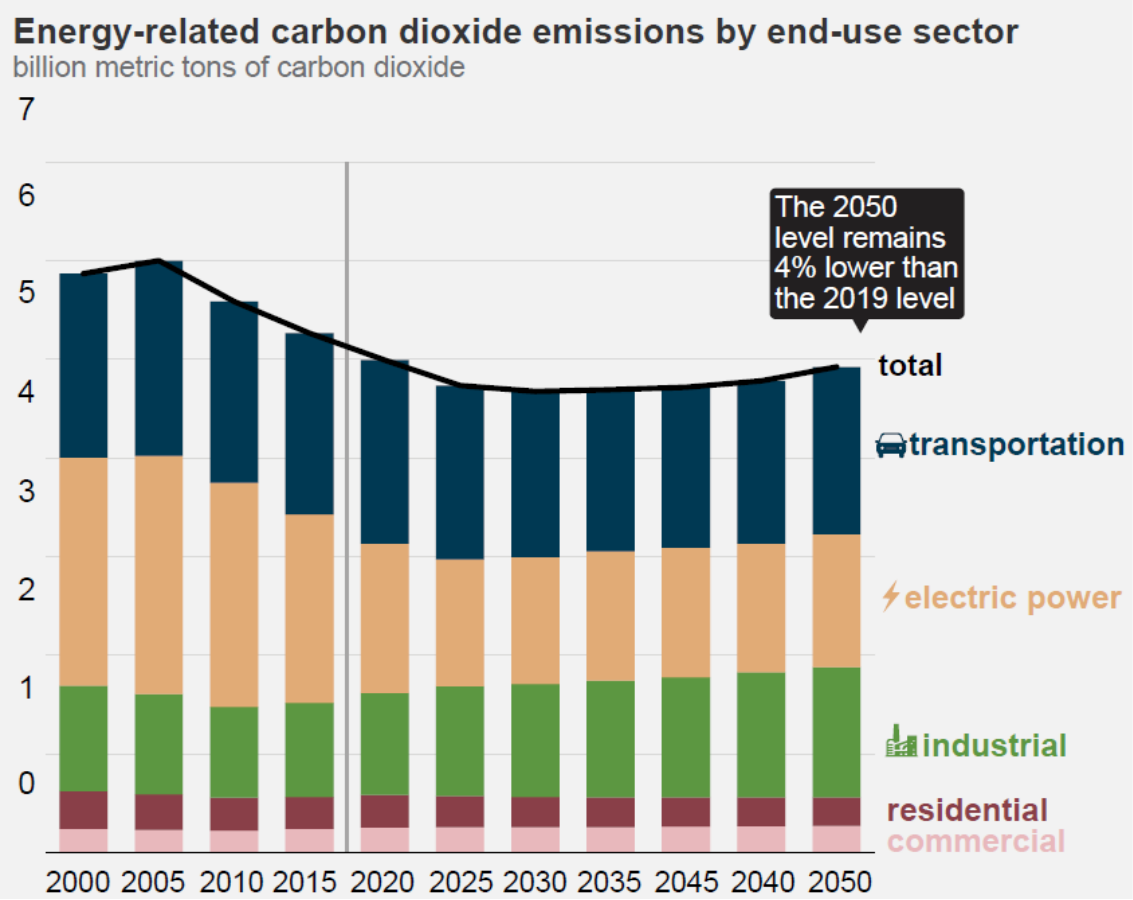
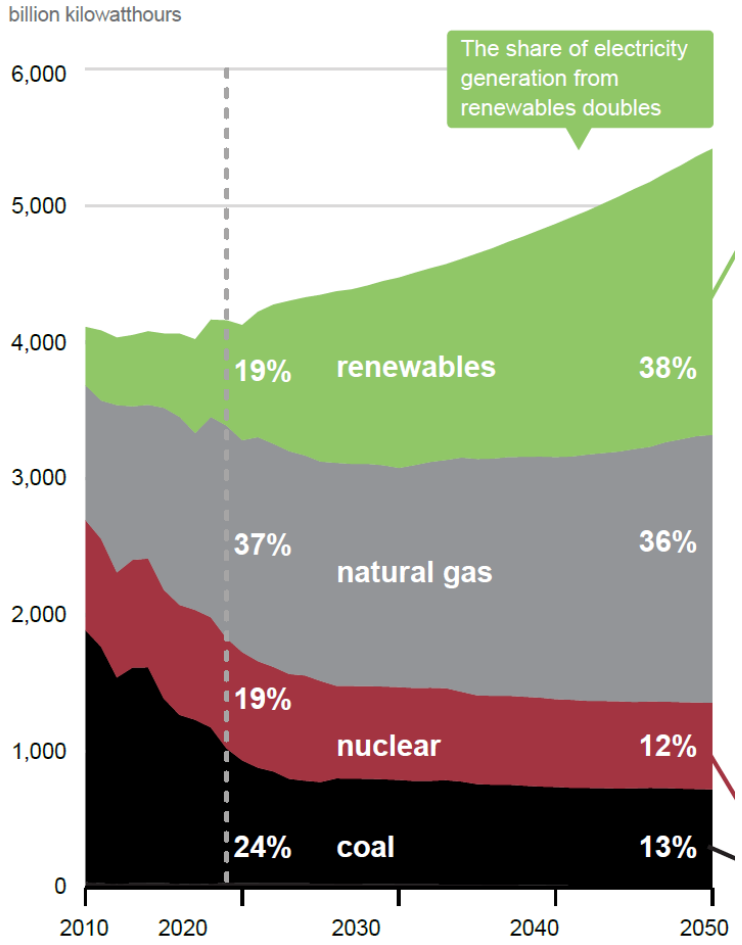
Total Emissions in 2019 = 6,558 Million Metric Tons of CO2 equivalent. Percentages may not add up to 100% due to independent rounding.

What Sectors Will Drive Future US Emissions?



US Electricity Sources



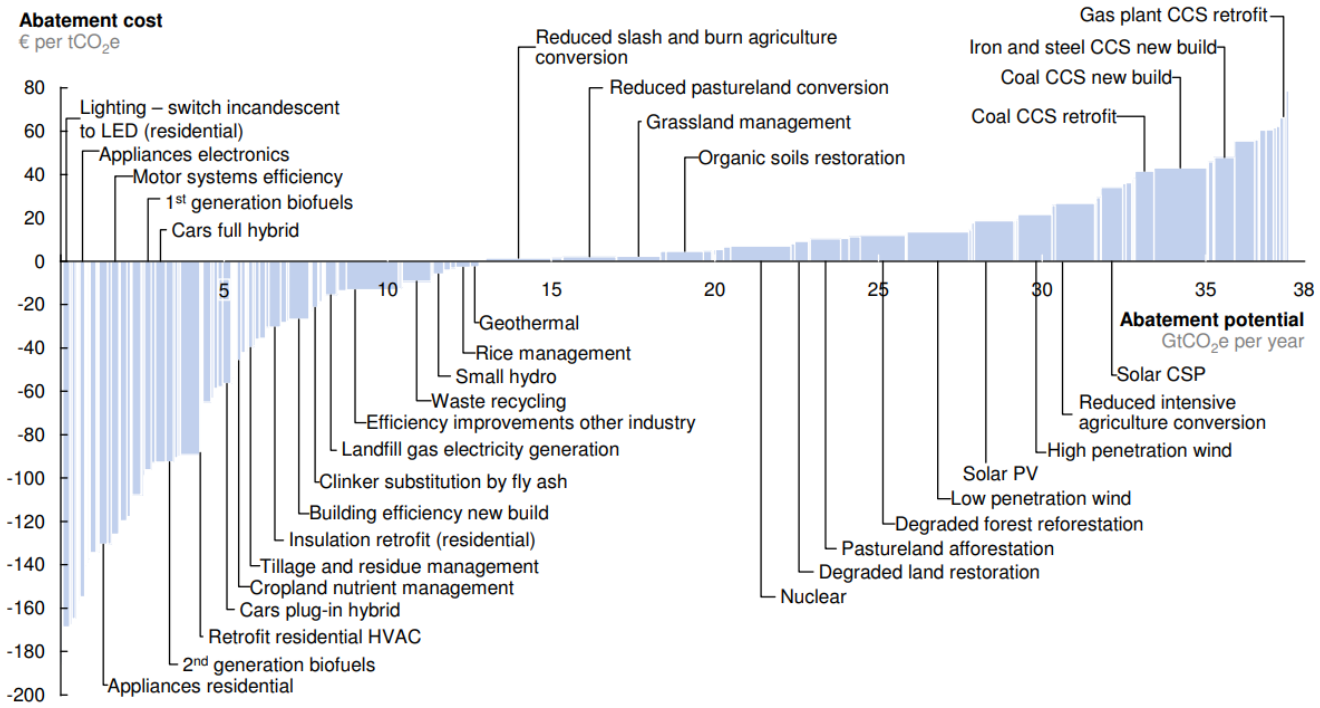
Which Emissions Should We Cut?

- **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!

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

But Are Costs So Easy 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 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

Climate Change Policy

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?

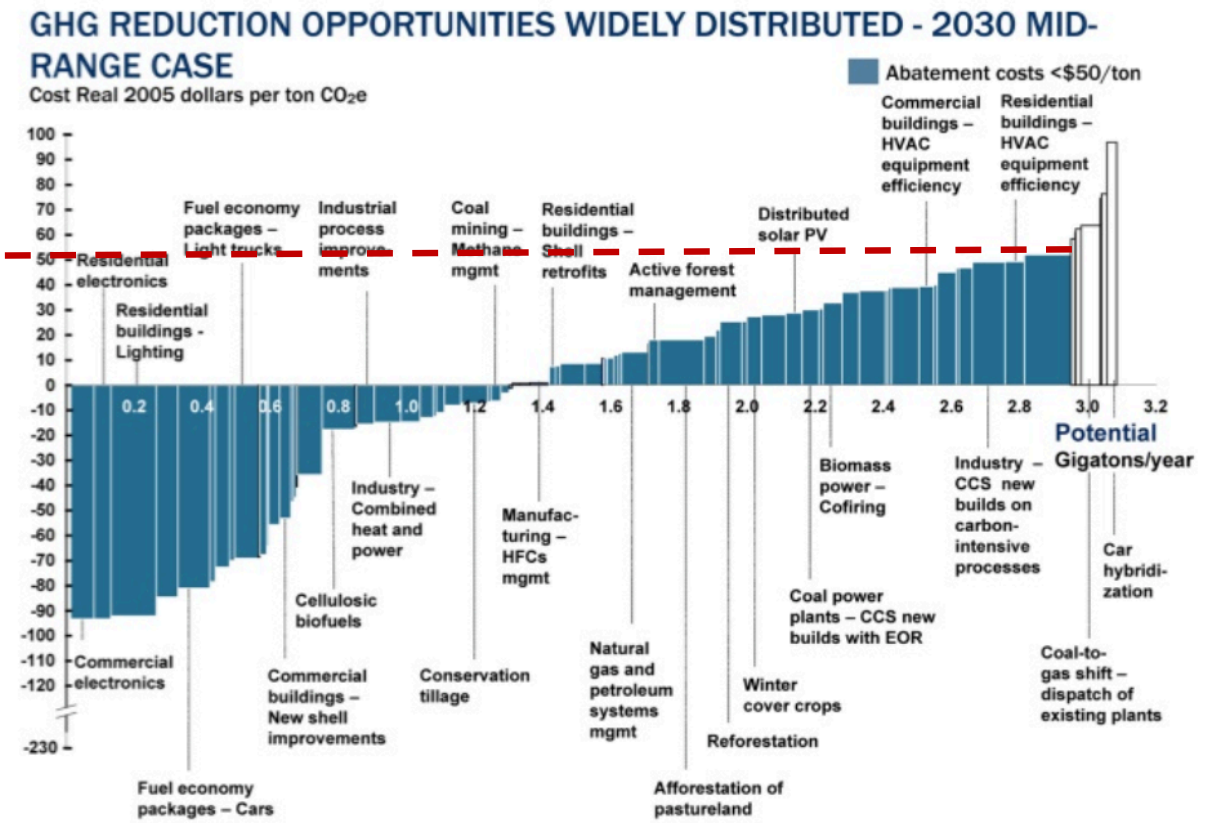
- **Choose activities to be covered (e.g., electricity sector, all emitters, etc.).**
- **Set tax level.**
  - Optimally, it represents the social cost of polluting.
- **Polluters must pay a tax for every unit emitted.**
  - Polluters with **low** abatement costs will **abate** to avoid the tax
  - Polluters 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**

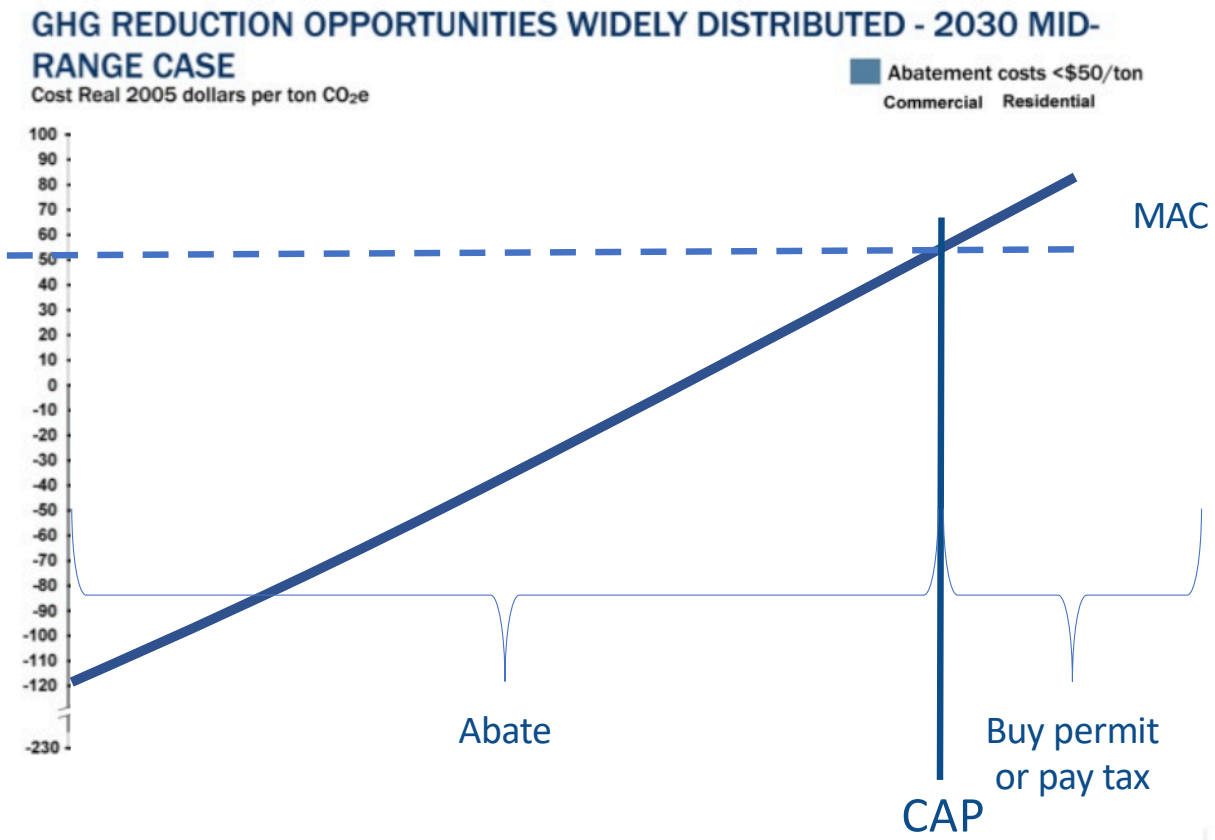
Putting a Price on Carbon

Suppose a Social Cost Of Carbon of $50



Putting a Price on Carbon

TAX
=
Permit Price
=
Carbon Price



Carbon Prices: the Good and Bad

- **Good:**
  - Provide price signal to lower emissions.
  - They yield low-cost reductions in emissions.
  - They spur innovation in clean technologies.
- **Bad:**
  - Firms might leave to flee regulation.
  - Emissions must be monitored.
  - Potentially regressive (low-income families bear disproportionate burden)
    - Probably true of other regulations, too.
    - New research shows it may not be regressive at all, though!

Carbon Tax and Cap & Trade: the Differences

	Carbon Tax	Cap & Trade
Carbon Price	Certain	Uncertain
Emissions	Uncertain	Certain
Ease of Implementation	May be easier to implement	
Additional concerns	1) Always generates revenue 2) May require legislation to change tax level 3) Predictability	1) Susceptible to lobbying 2) Only generates revenue if government sells permits 3) Regulator can change cap 4) Less certainty over future costs 5) Some other regulations become ineffective w/ a cap

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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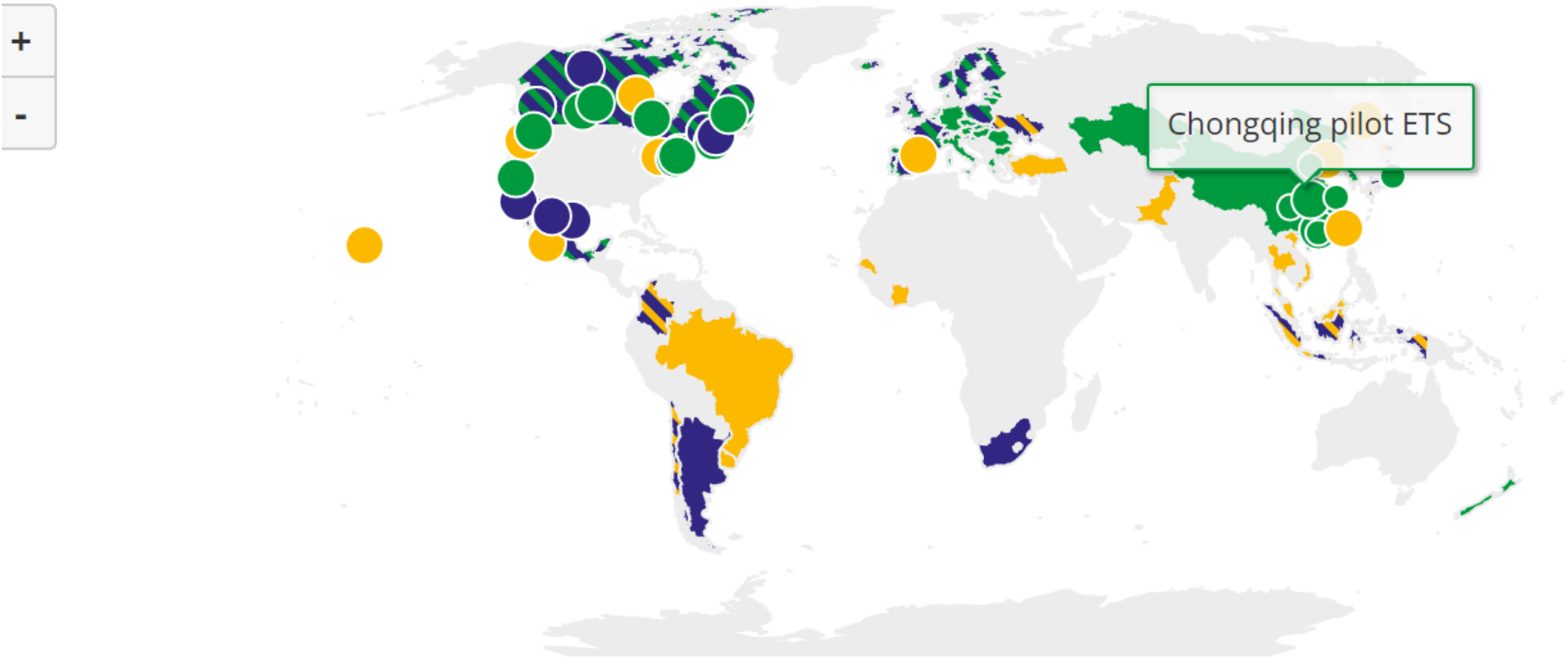
Incentive-Based Climate Policies Right Now

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...

British Columbia's Carbon Tax Since 2008

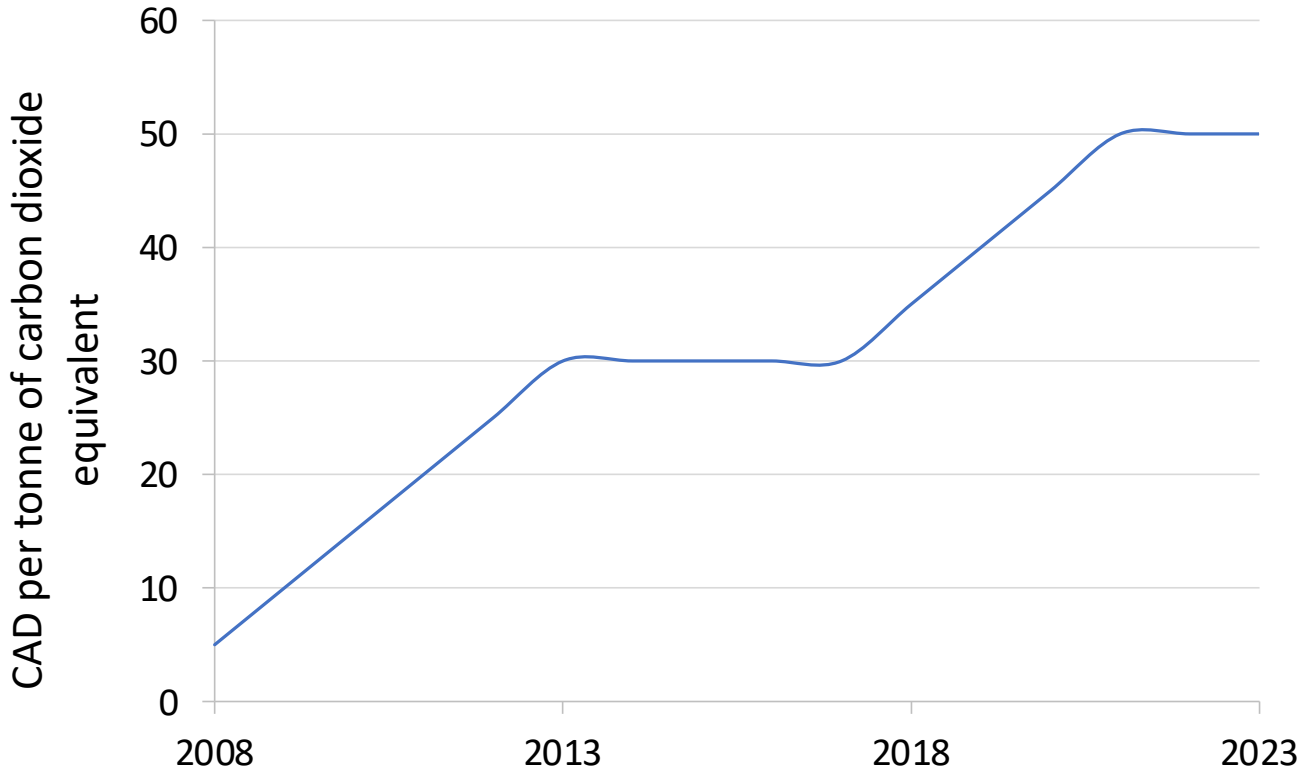
0.1%

of global greenhouse gas emissions

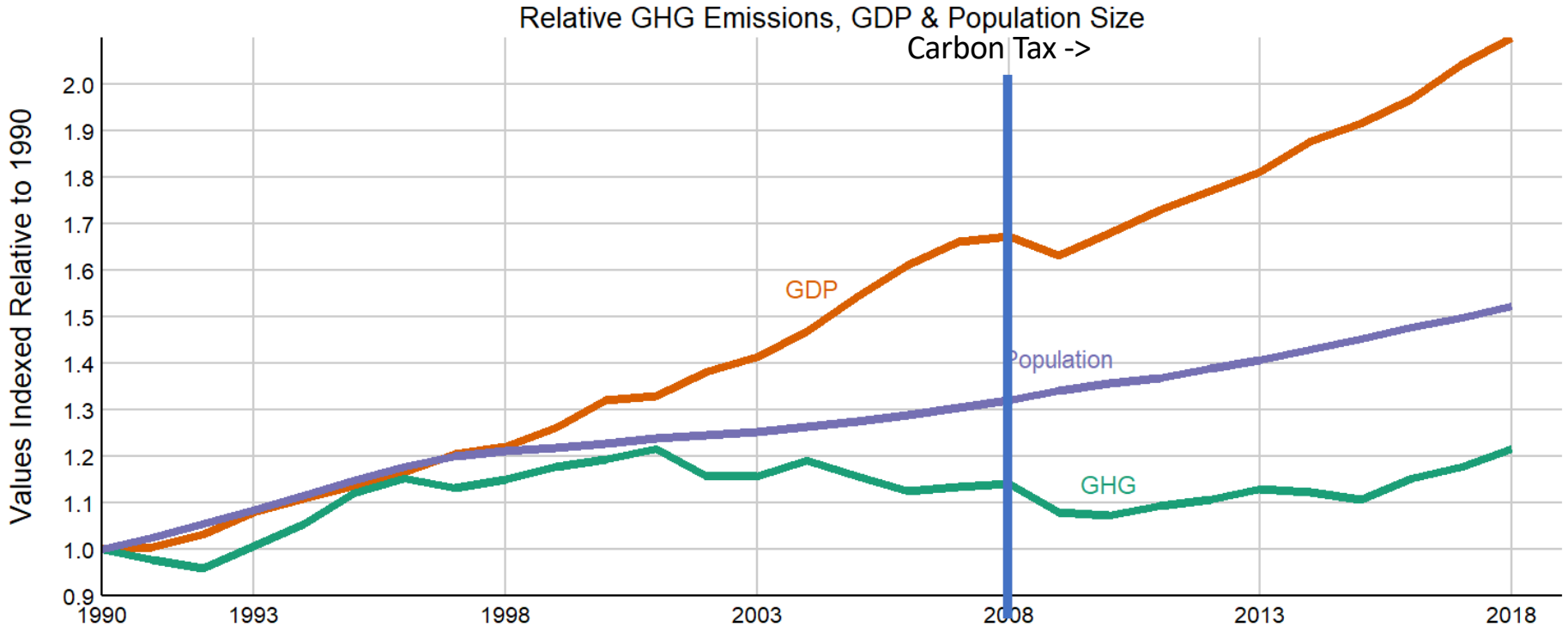
“Tax the pollution we do not want, and return the money for what we do want — money in people’s pockets, jobs and investment.”

- B.C. Government - Carbon Tax Brochure

British Columbia's Tax on Carbon



Relative Greenhouse Gas Emissions, GDP & Population Size: British Columbia



California's Cap and Trade System Since 2012

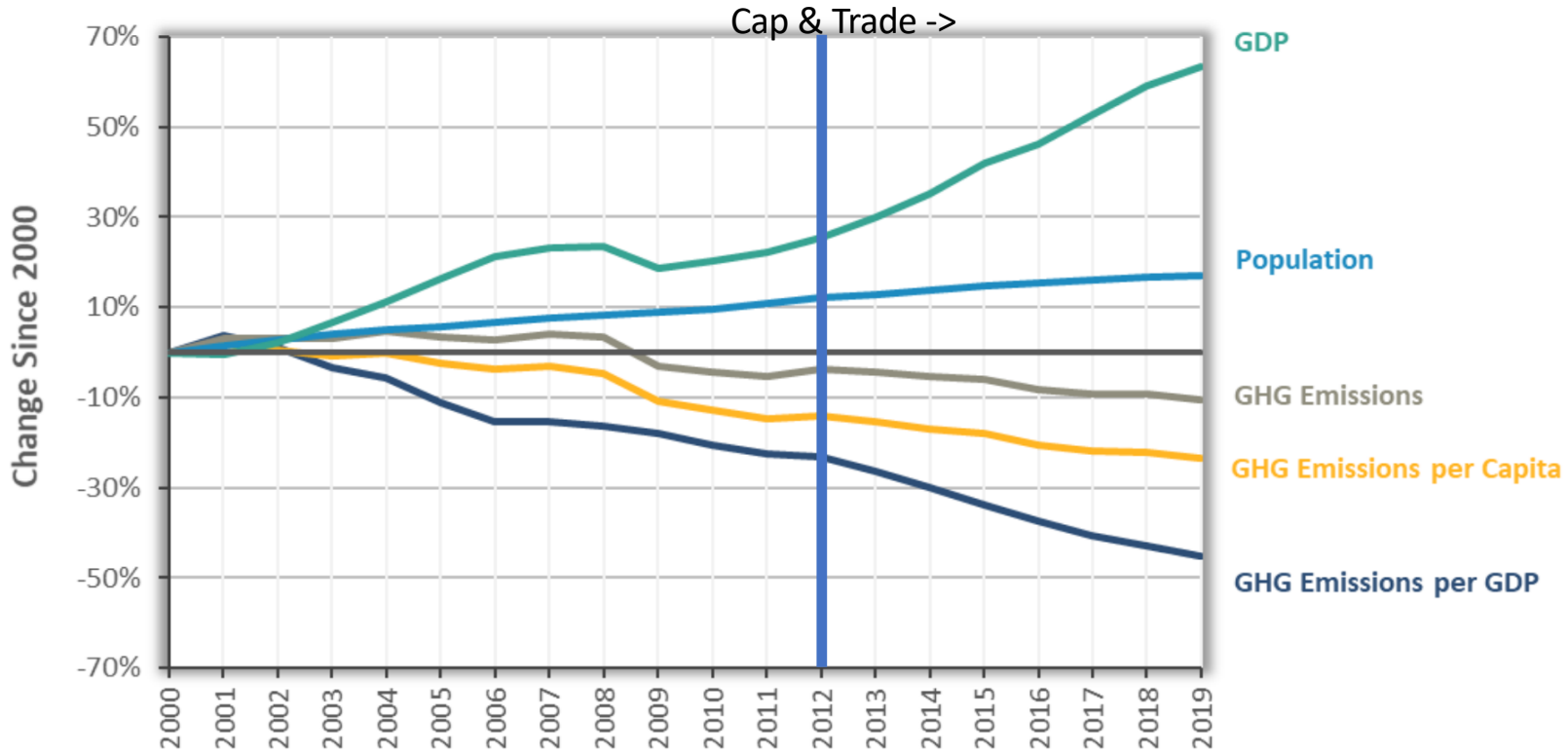
0.7%

of global greenhouse gas emissions

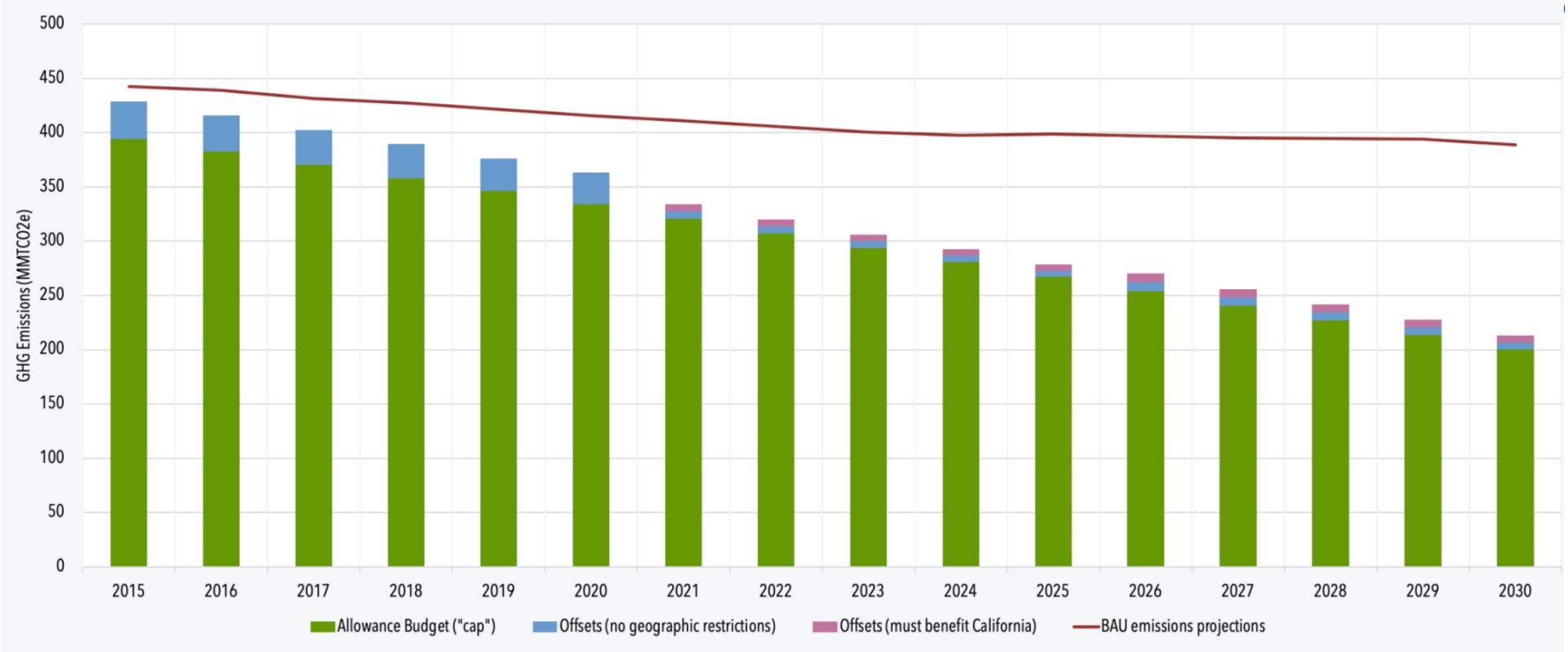
California's AB32: Global Warming Solutions

- **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

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



Projected trends in California's emissions



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.**

Course Outline: New Course Next Week

- **Contemporary Economic Policy**
  - Week 1 (2/28): US Economy & Coronavirus Economics
  - Week 2 (3/7): The Black-White Wealth Gap
  - Week 3 (3/14): Healthcare Economics
  - Week 4 (3/21): The Federal Debt

Thank you!

Questions?

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