


# Climate Change Economics

Jon Haveman, Ph.D.  
*Executive Director*  
*National Economic Education Delegation*

Climate Corps

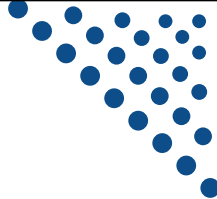
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  - Shana McDermott, Trinity University
  - Sarah Jacobson, Williams College
  - Sharon Shewmake, Western Washington University
- **This slide deck was reviewed by:**
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# Outline

- 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 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.
- ***The “efficient” amount of pollution balances costs & benefits of pollution***



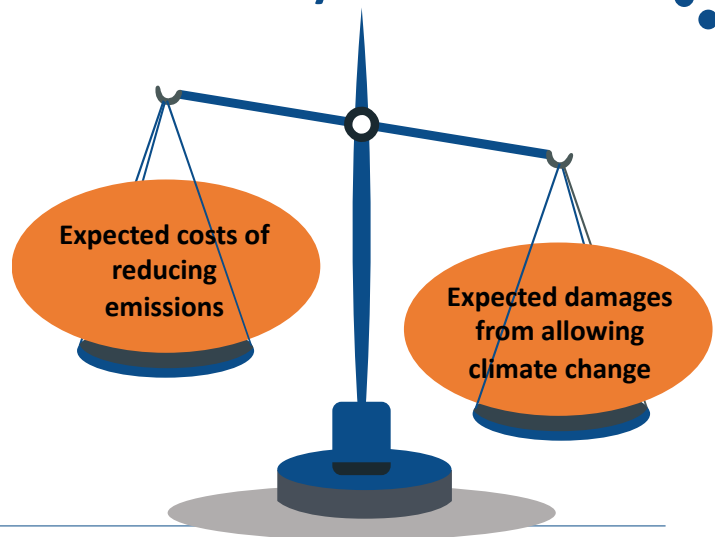
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## How Economists Decide How Much to Fight Climate Change: Cost Benefit Analysis

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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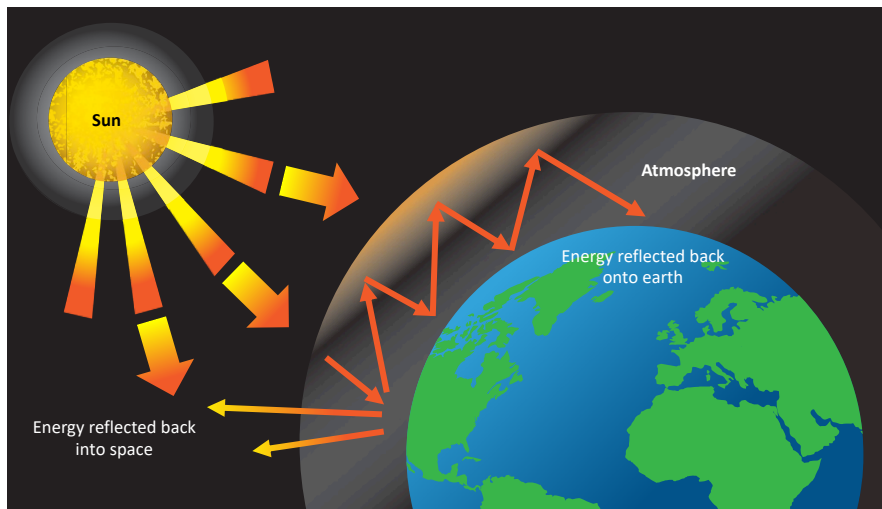
## Climate Change



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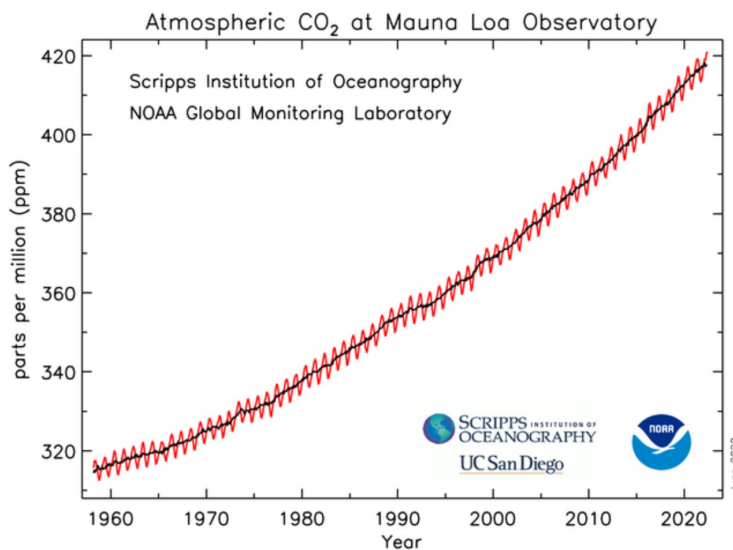
# The Atmospheric Greenhouse Effect



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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?

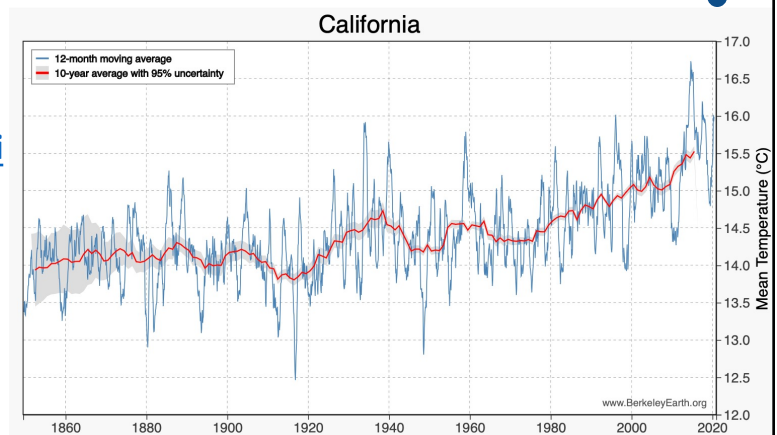
- **Increased temperatures**
  - Sea level rise
  - Storm surges
- **Altered precipitation patterns**
- **More variable weather**
- **More / more powerful storms**
- **Carbon dissolves in ocean**

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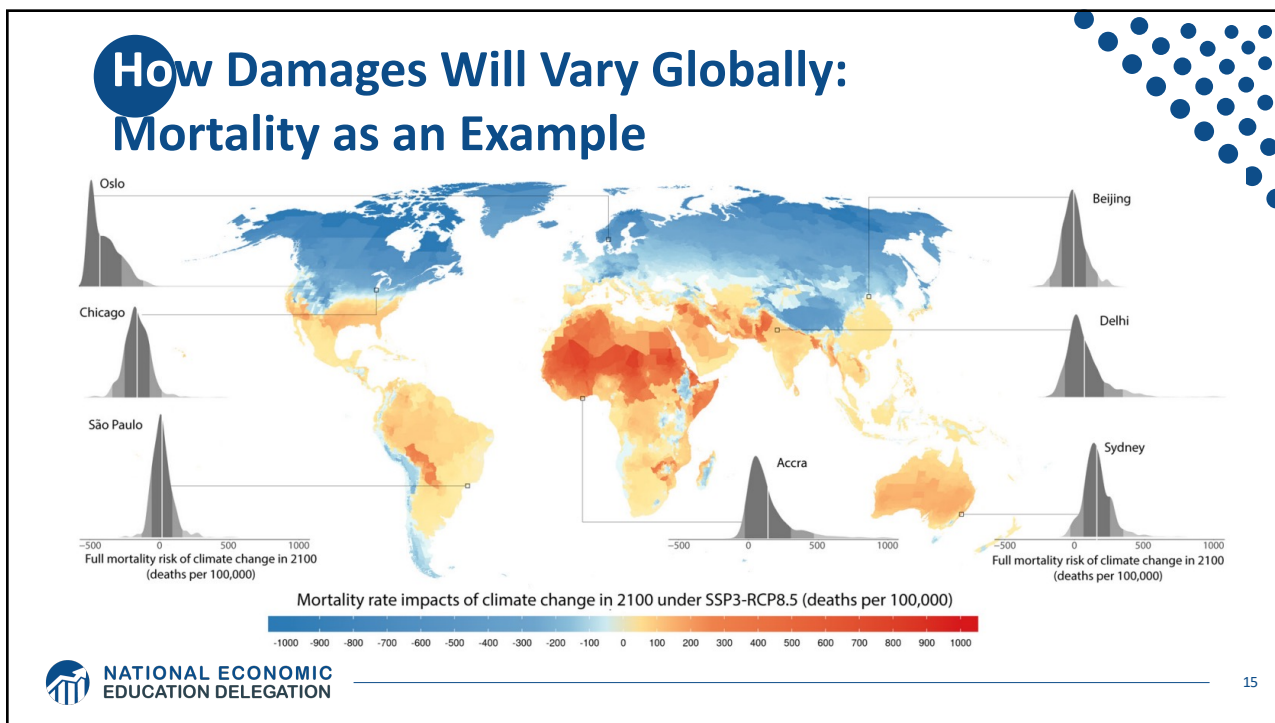
# These Changes Are Already Underway

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

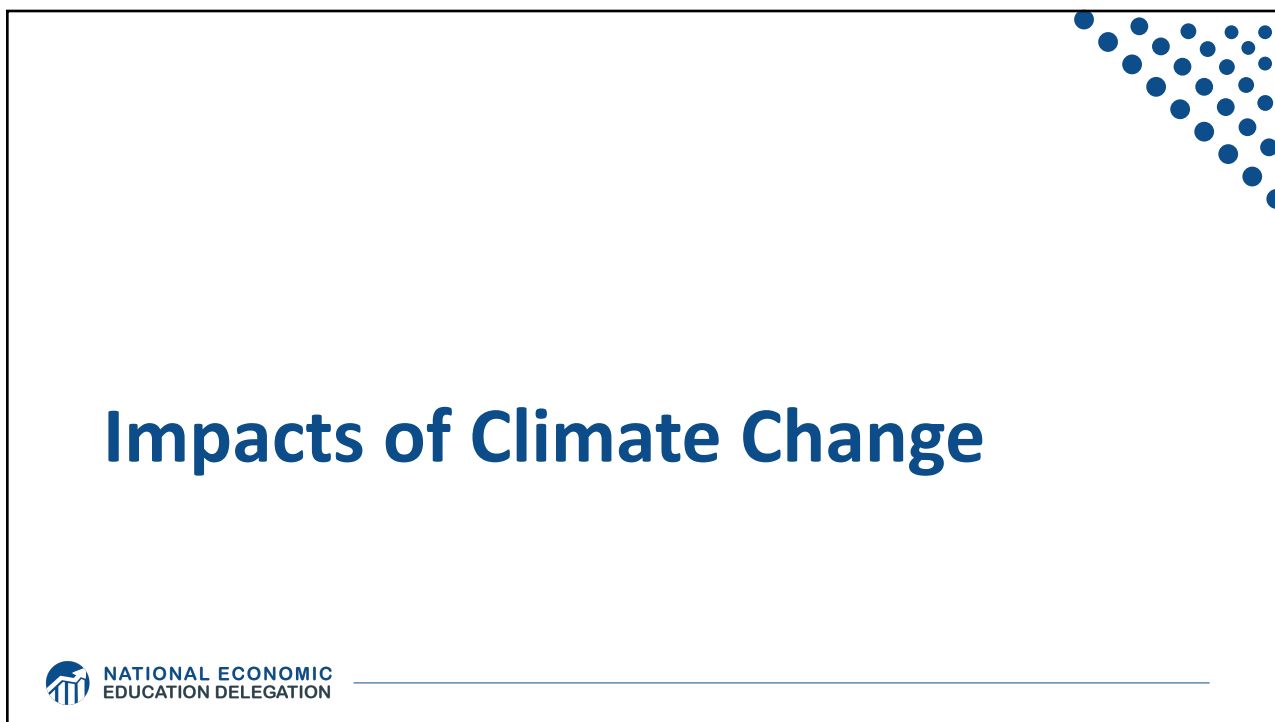
Here is California.



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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<sub>2</sub> (but estimates vary a lot!)
  - About \$230/car per year.
  - \$42 Billion for all vehicles in the US.
- Social cost of carbon will increase over time.



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# Reducing Emissions



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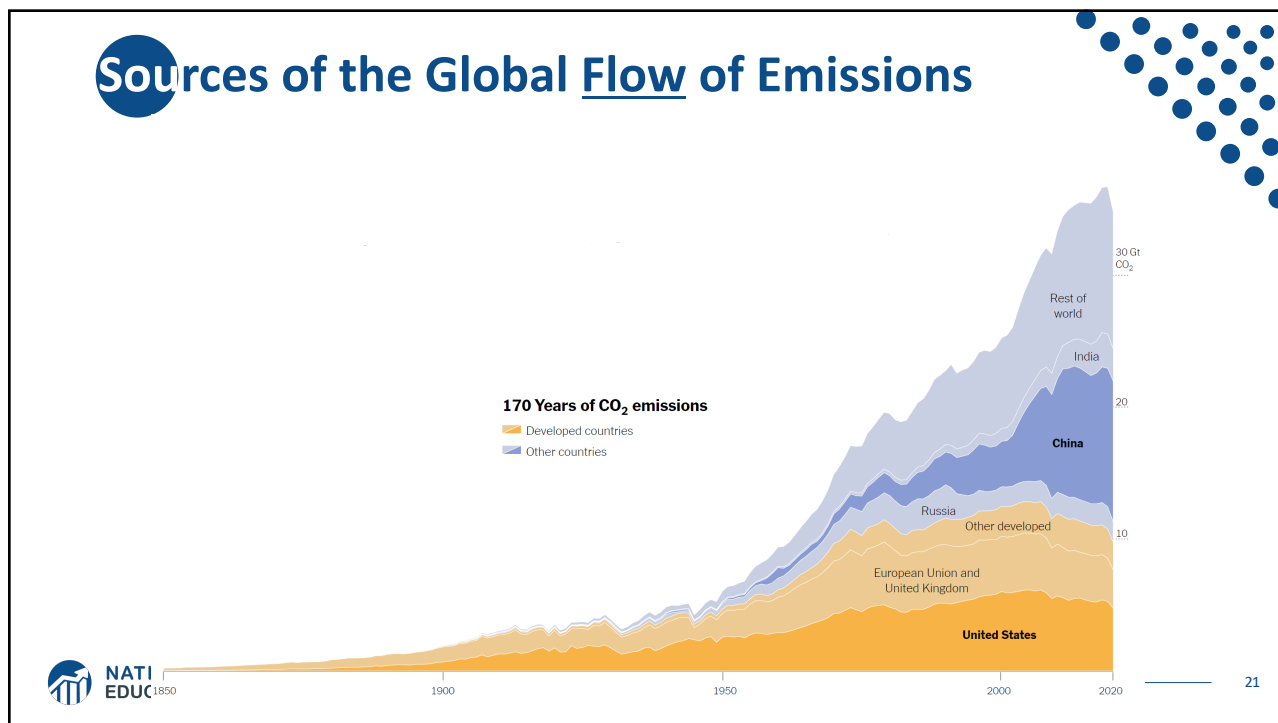
## **Global Net Emissions** Are What We Care About

- **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

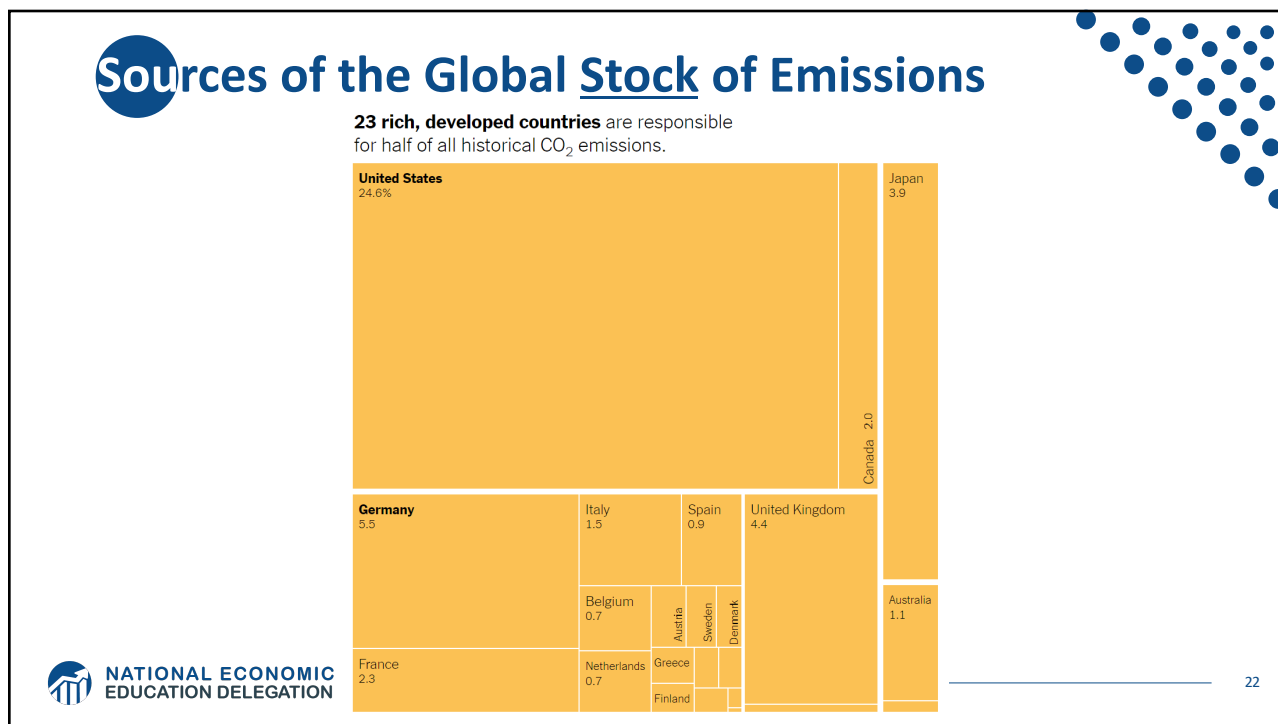


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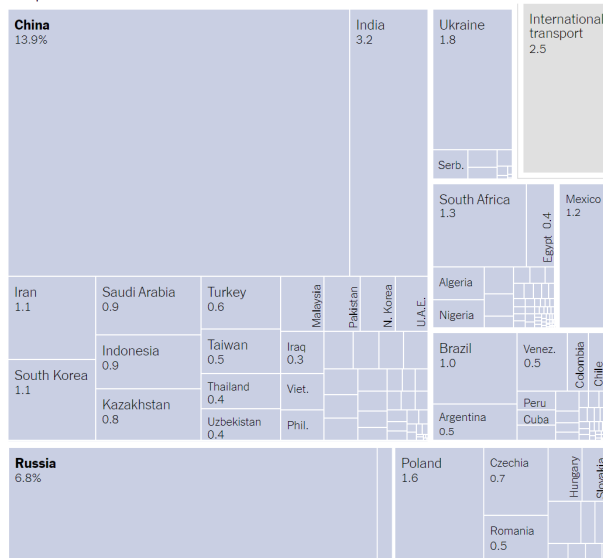
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# Sources of the Global Stock of Emissions

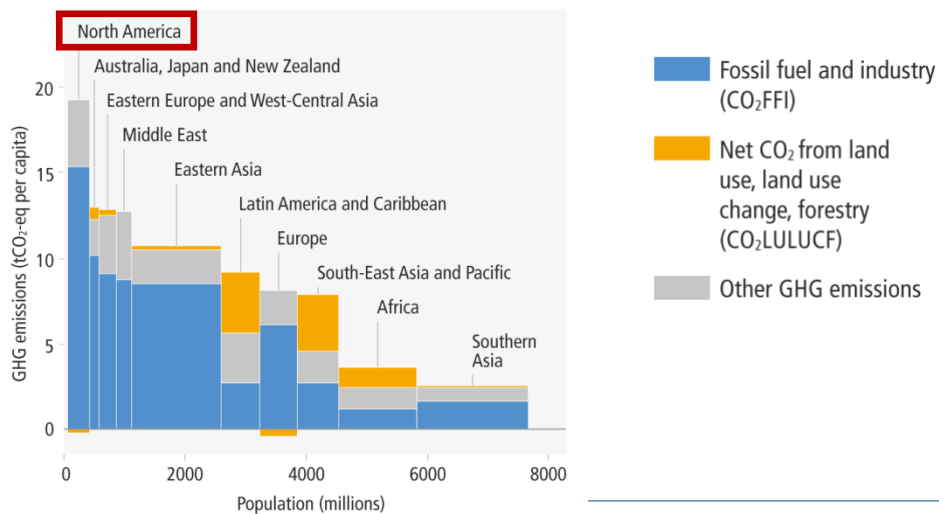
More than 150 countries are responsible for the other half.



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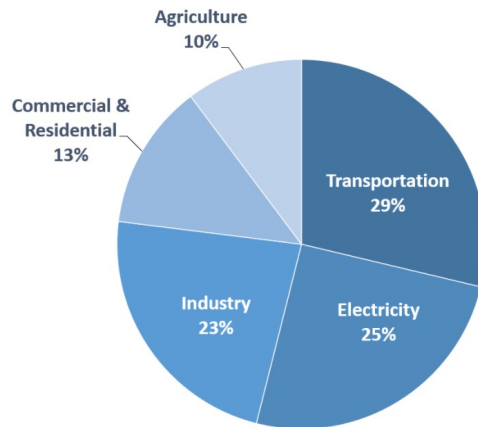
# How Does This Look Per Capita (Per Person)?

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 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!

”Marginal Abatement Cost Curve”



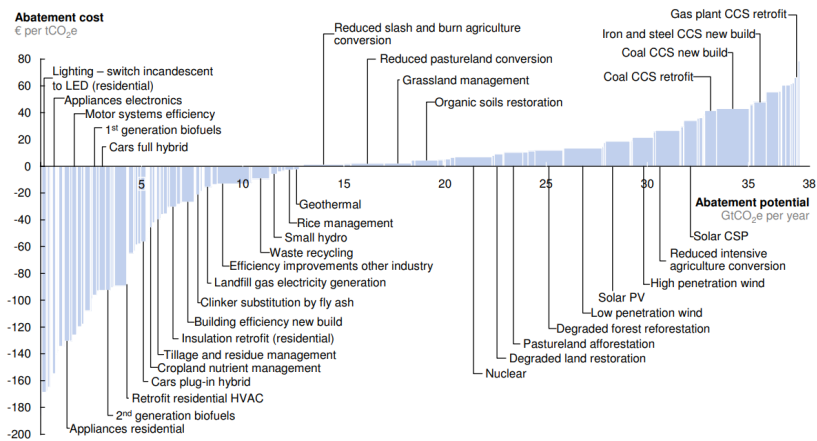
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# Example Abatement Cost Curve

(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 €30 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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# 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.



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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**



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## One Thing: Cap and Trade vs. Carbon Tax

- **Emissions regulations and Cap and Trade can work at cross purposes.**
  - Regulations that lower emissions from big polluters...
    - Lower the demand for permits
    - Lowers the price of permits
    - Reduces incentives for other industries to cut emissions
- **Regulations can undermine the effectiveness of Cap and Trade.**
- **The same is not true of a carbon tax.**
  - Though regulations might cut tax revenue, revenue is not the goal of the carbon tax.



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## 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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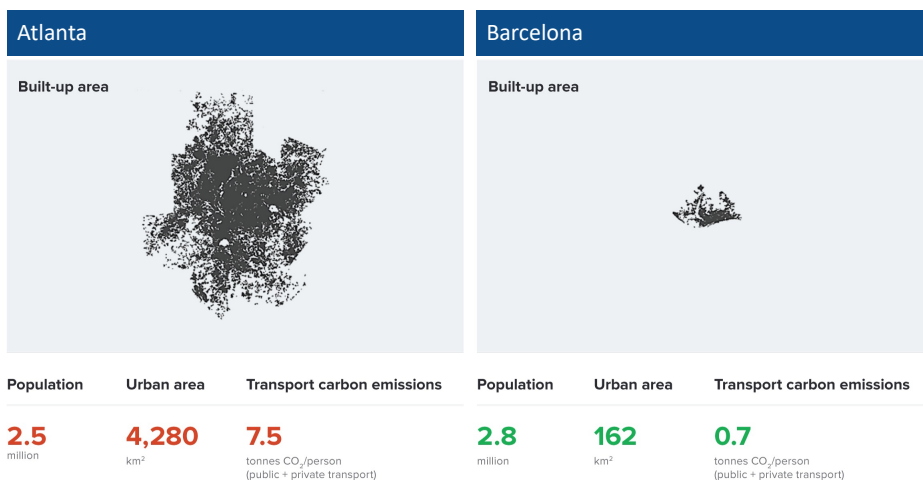
## Examples of Other Policies that Reduce Emissions

- Research and development subsidies
- Renewable energy mandates (e.g., renewable portfolio standards)
- 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



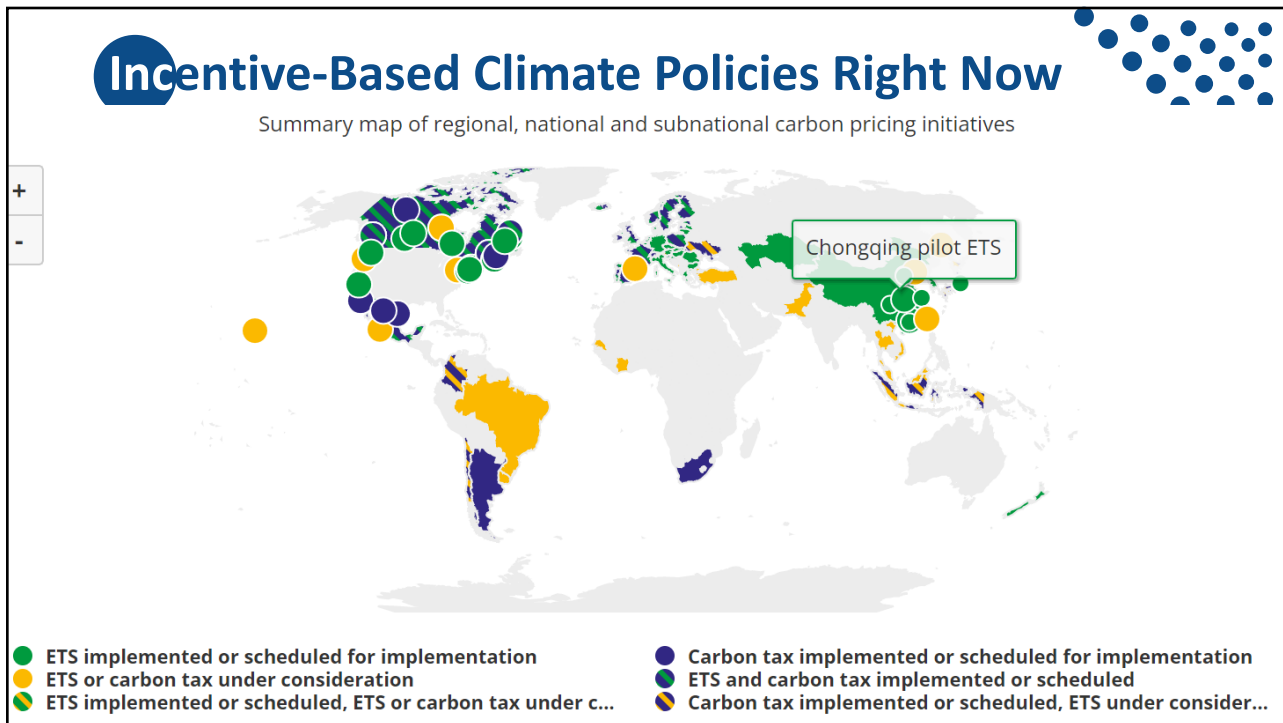
Source: New Climate Economy Report, 2014

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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



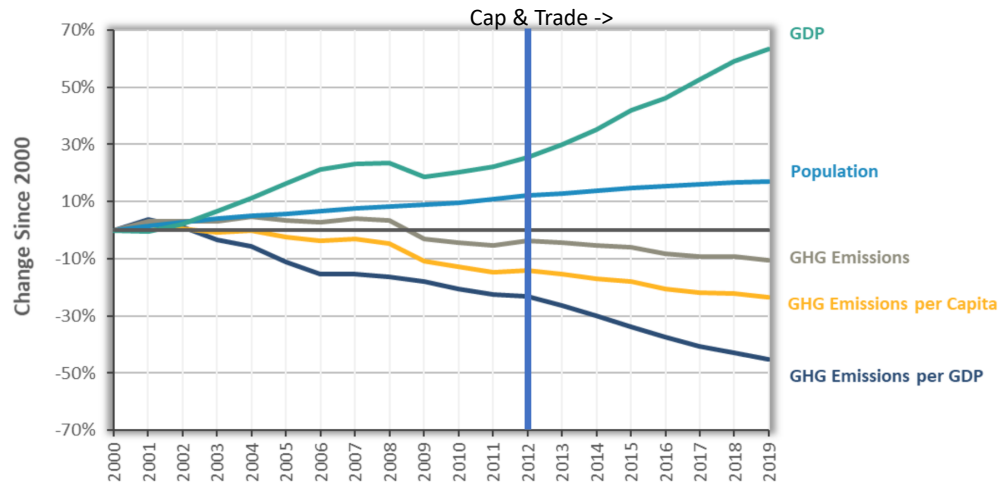
- **California's goals:**
  - Reduce emissions to 1990 levels by 2020
  - An 80% reduction in emissions from 1990 levels by 2030
- **California's Tools:**
  - Cap and Trade
  - Renewable Portfolio Standard
  - Clean Cars Program
  - Low Carbon Fuel Standard



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## 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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**Thank you!**

# Any Questions?

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

Jon Haveman, Ph.D.

Jon@NEEDelegation.org

Contact NEED: [info@NEEDelegation.org](mailto:info@NEEDelegation.org)

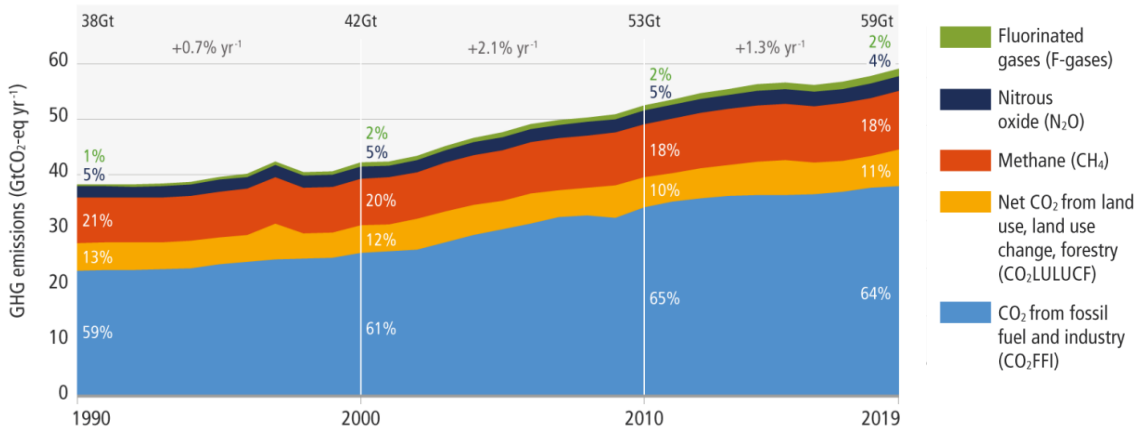
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# Greenhouse Gas Emissions 1990-2019

a. Global net anthropogenic GHG emissions 1990–2019 <sup>(6)</sup>



Source: IPCC