


Climate Change Economics

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NEED

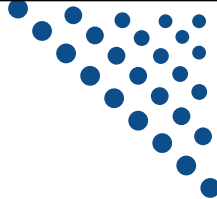
Tiger 21, Vancouver BC
September 15, 2022




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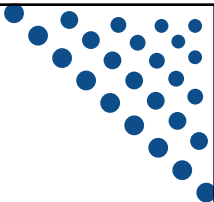
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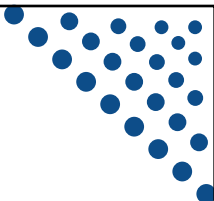
Outline

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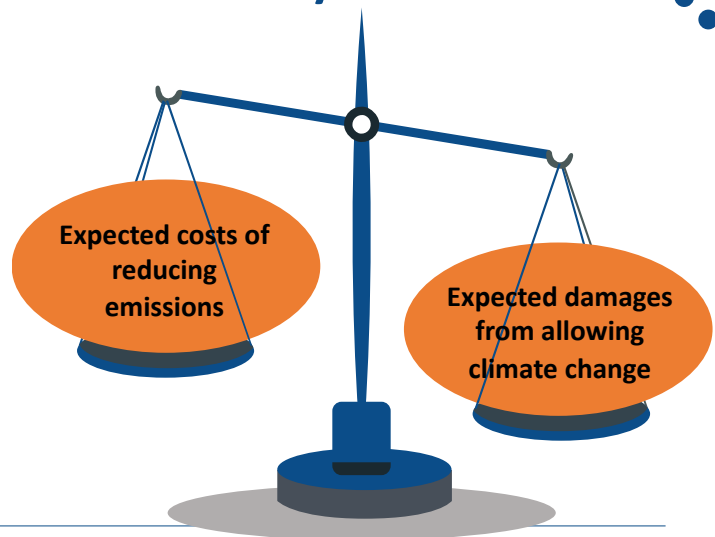
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How Economists Decide How Much to Fight Climate Change: Cost Benefit Analysis

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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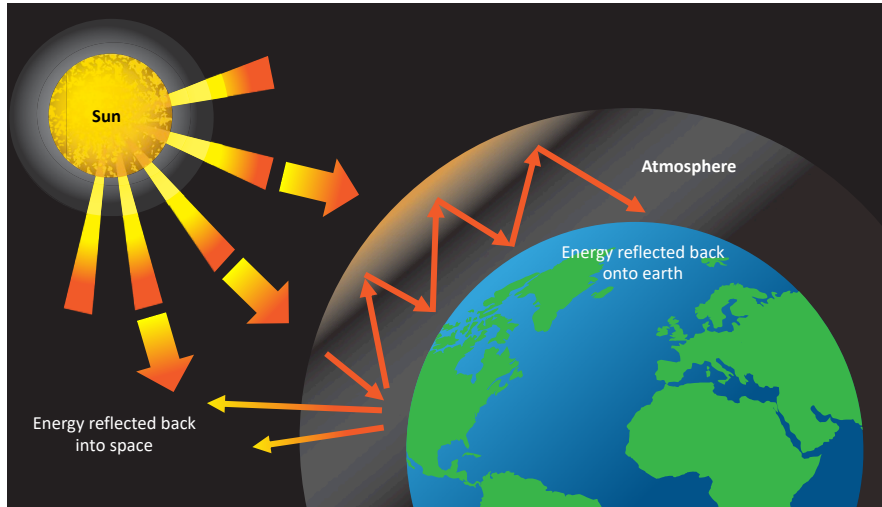
Climate Change



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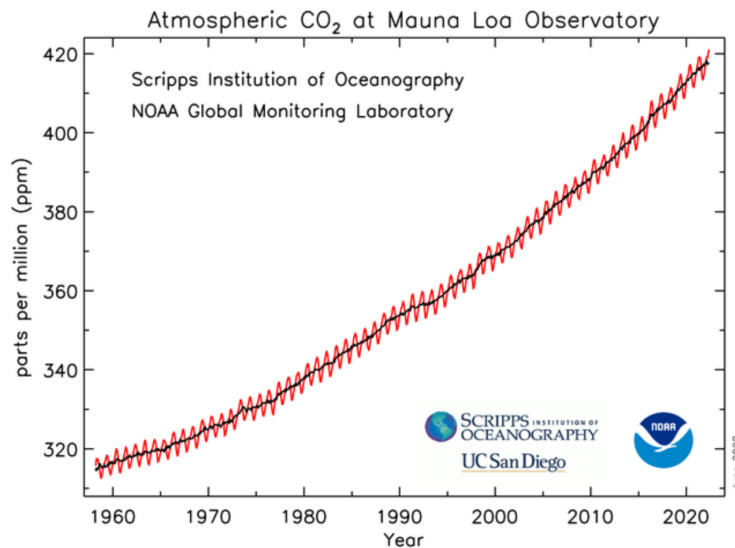
The Atmospheric Greenhouse Effect



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Atmospheric CO₂ Concentrations Up To Now



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Source: NOAA

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What Do Greenhouse Gas Emissions Do to the Planet?

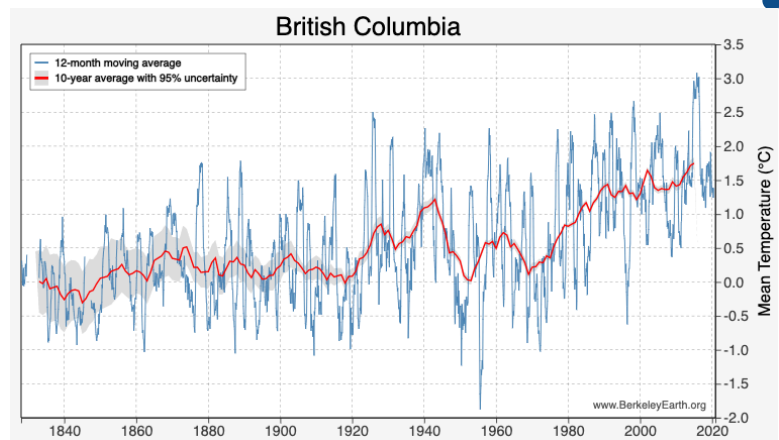
- **Increased temperatures**
 - Sea level rise
 - Storm surges
- **Altered precipitation patterns**
- **More variable weather**
- **More / more powerful storms**
- **Carbon dissolves in ocean**

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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's British Columbia.



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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 CO₂ (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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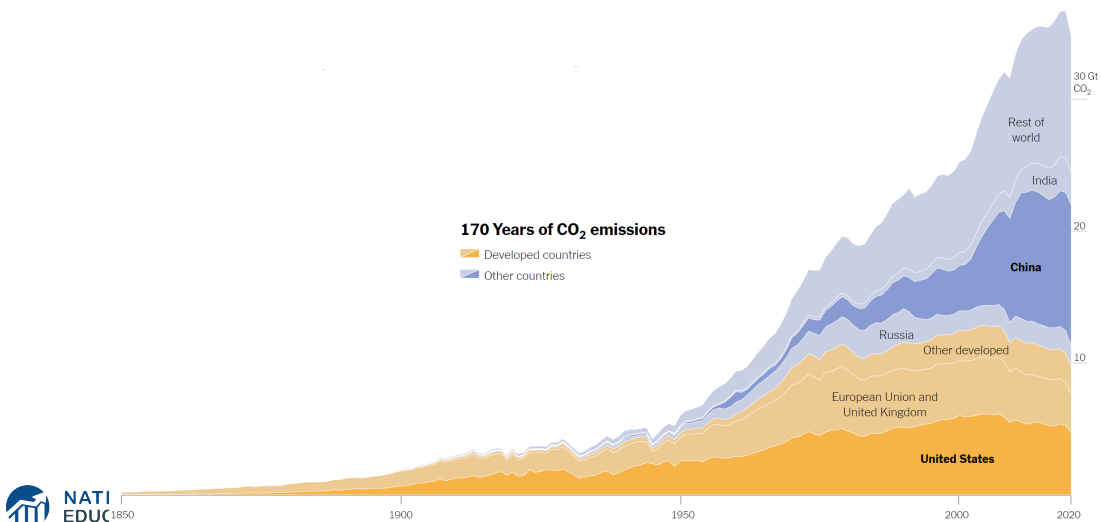
Global Net Emissions Are What We Care About

- **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 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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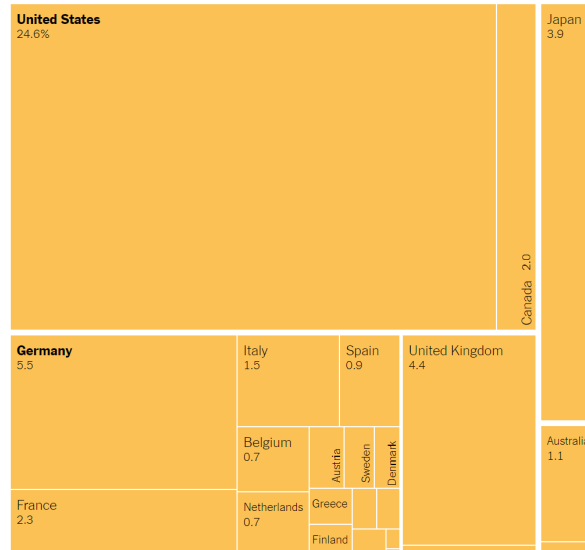
Sources of the Global Flow of Emissions



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Sources of the Global Stock of Emissions

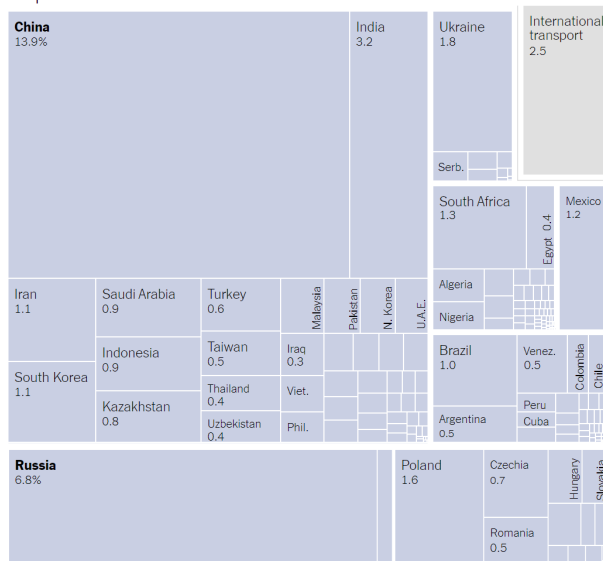
23 rich, developed countries are responsible for half of all historical CO₂ emissions.



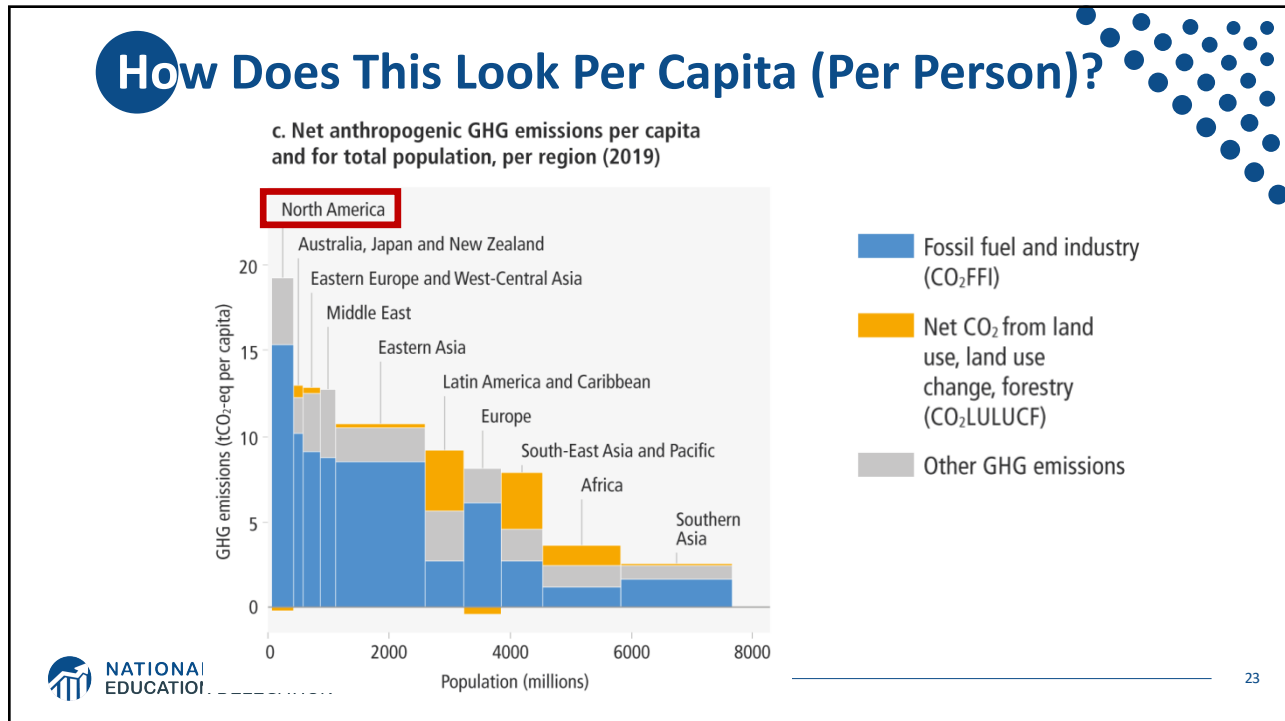
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Sources of the Global Stock of Emissions

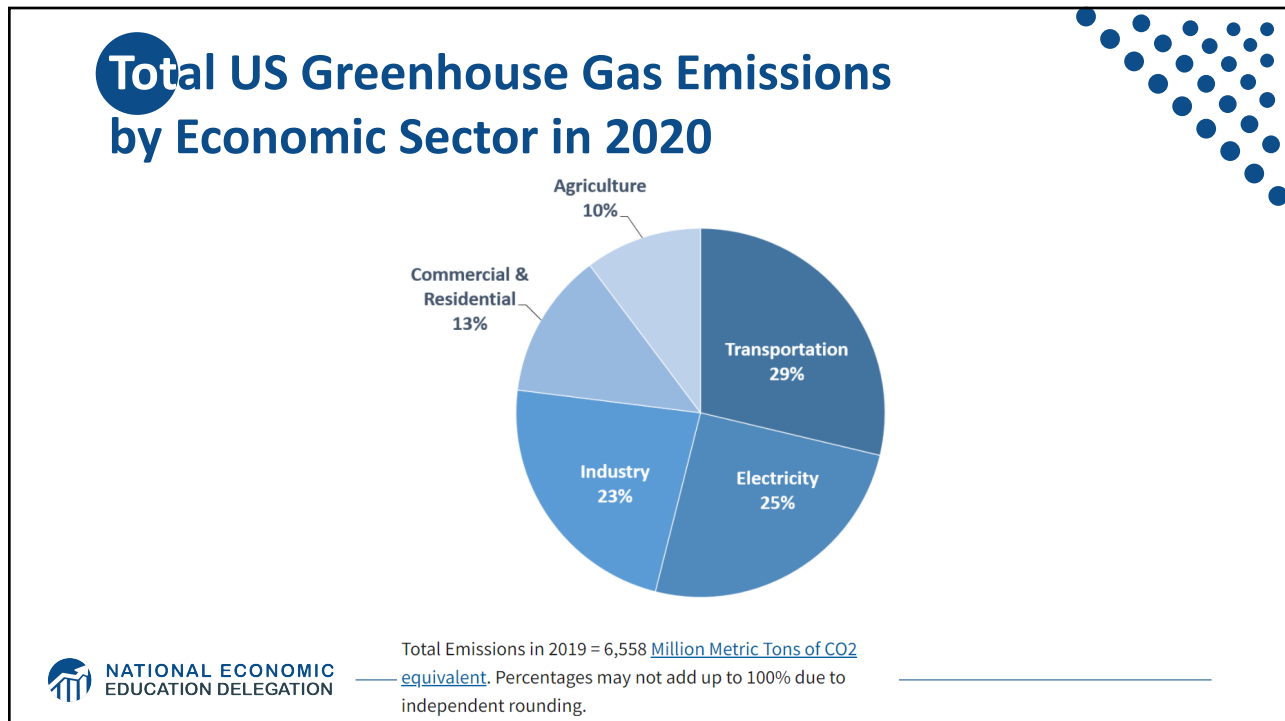
More than 150 countries are responsible for the other half.



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Which Emissions Should We Cut?

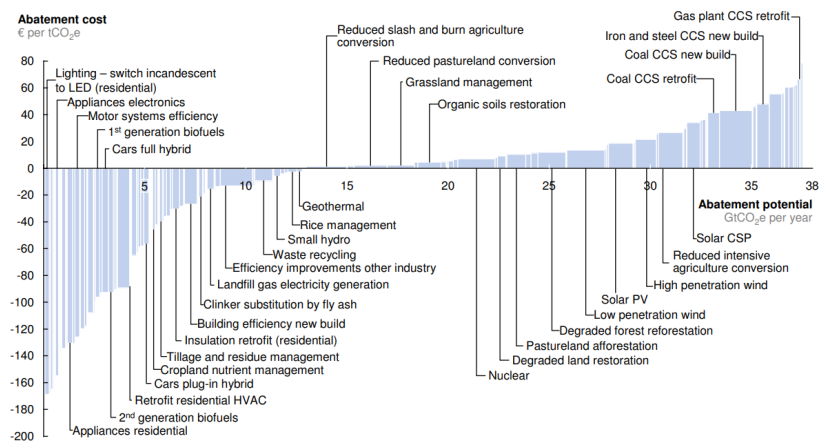
- List all possible ways to reduce emissions
- Figure out how much each can reduce in total
- Figure out how much each costs per unit of emissions reduced
- Line them up in order: cheapest to costliest (“marginal abatement cost curve”)
 - → Tackle first the cheapest ones!



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



Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €80 per tCO₂e 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

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:
 - 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.

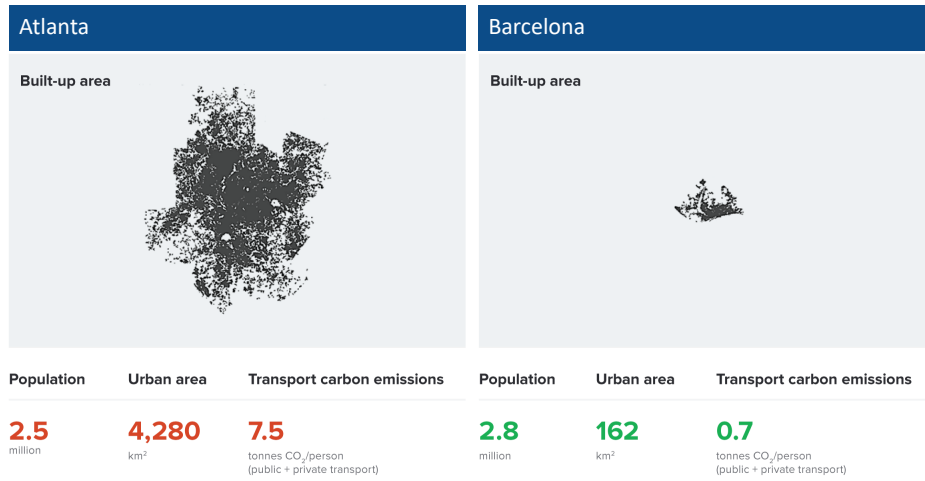


Examples of Other Policies that Reduce Emissions

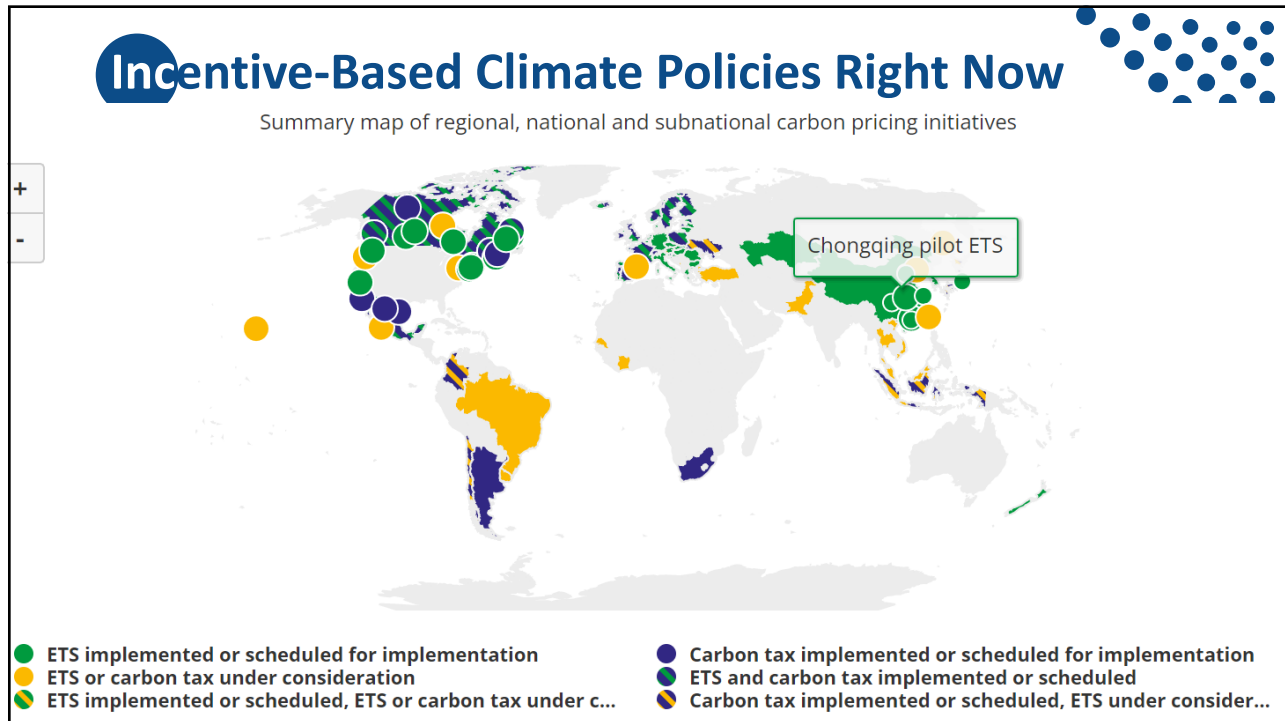
- **Research and development subsidies**
- **Renewable energy mandates (e.g., renewable portfolio standards)**
- **Energy efficiency mandates and subsidies (e.g. CAFE fuel economy standards)**
- **Grid / infrastructure improvements**
- **Public transportation**
- **Land use / zoning policies**



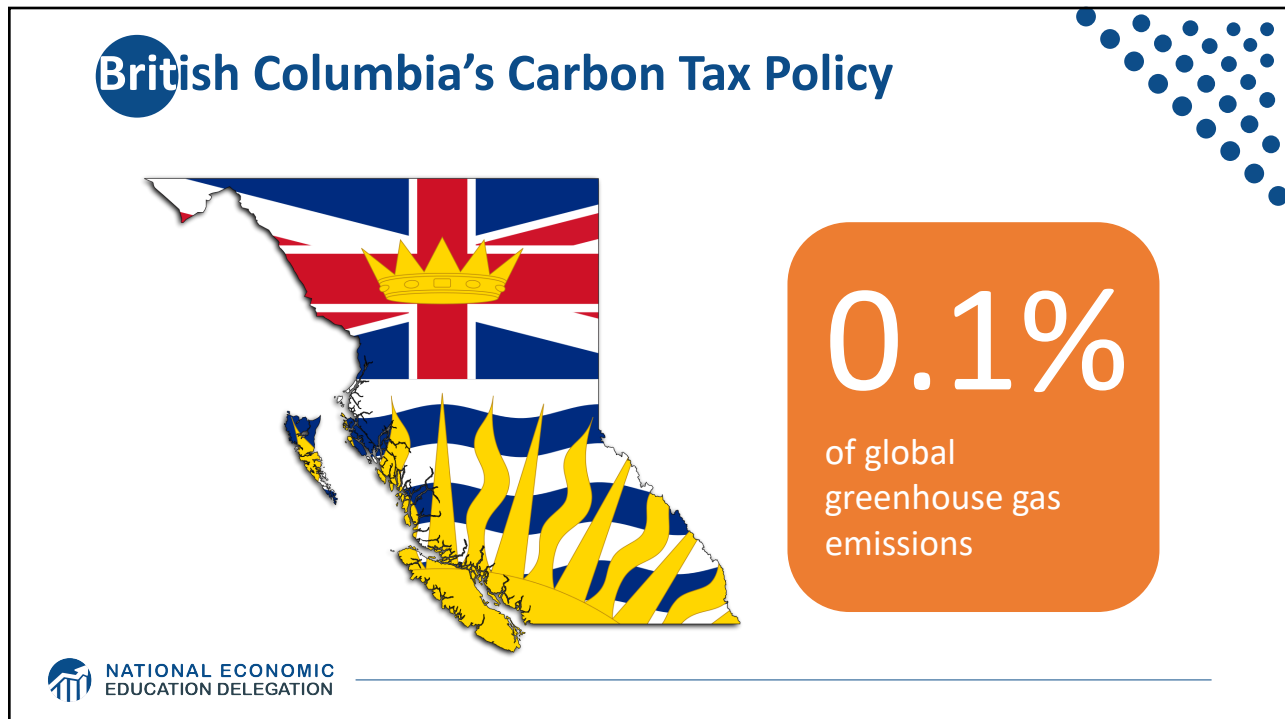
Atlanta and Barcelona Have Similar Populations but Very Different Carbon Productivity



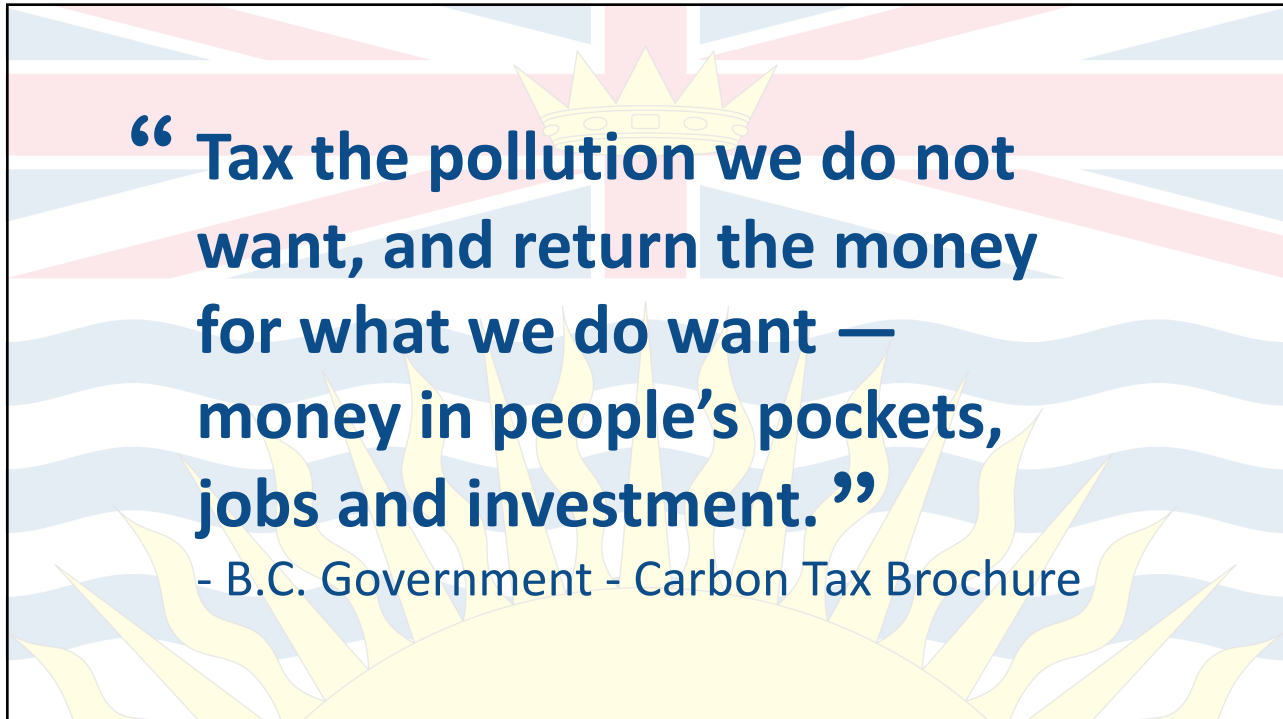
Climate Change Policy in Action



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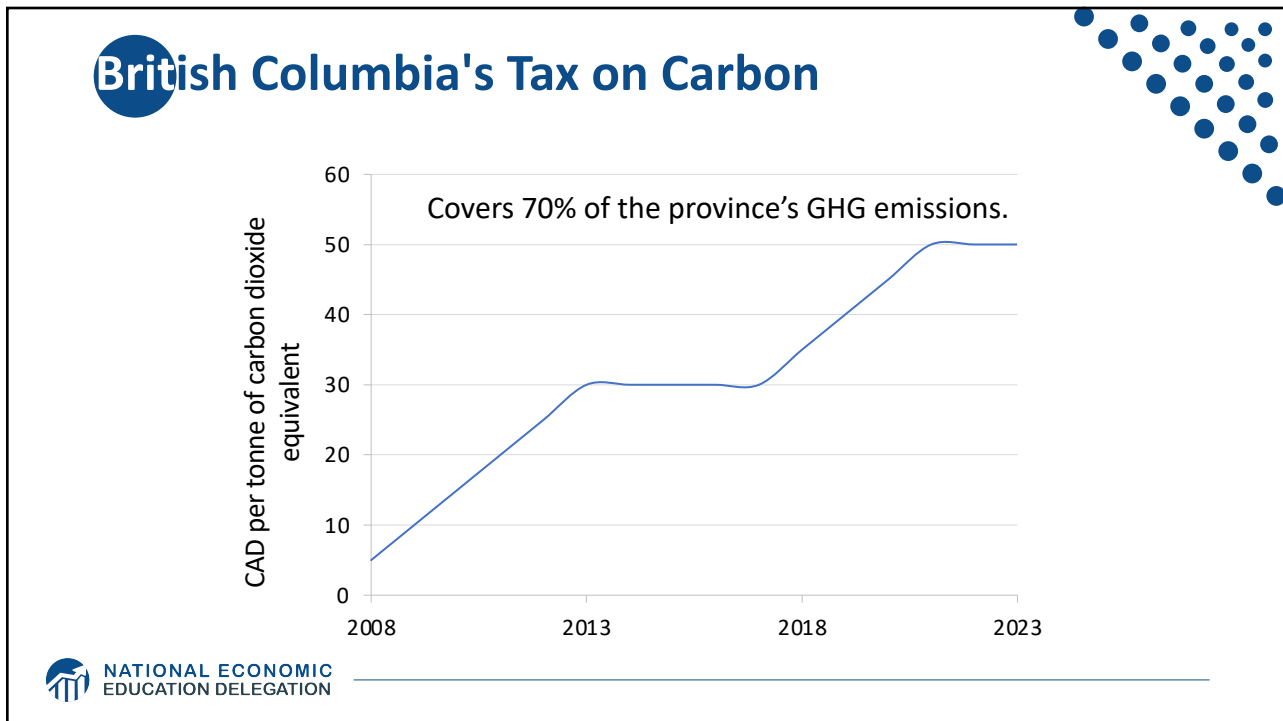


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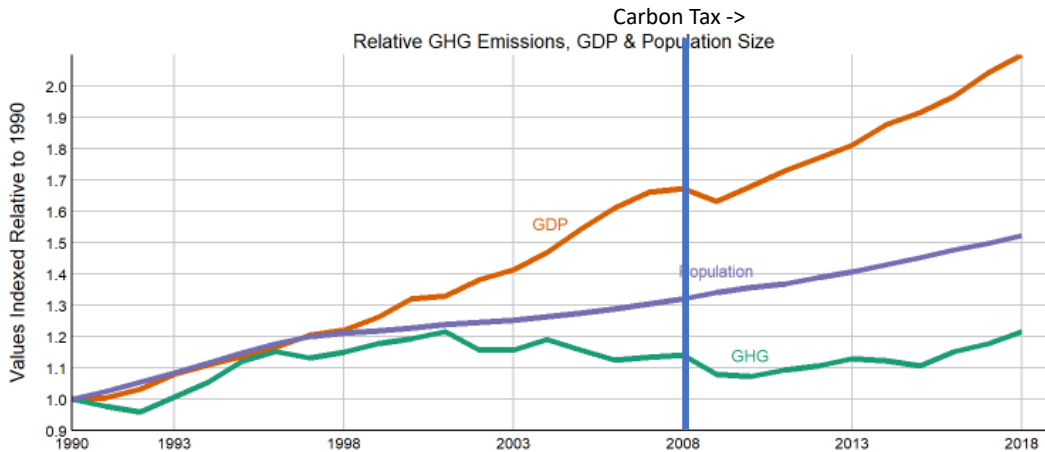
“ Tax the pollution we do not want, and return the money for what we do want — money in people’s pockets, jobs and investment. ”
- B.C. Government - Carbon Tax Brochure

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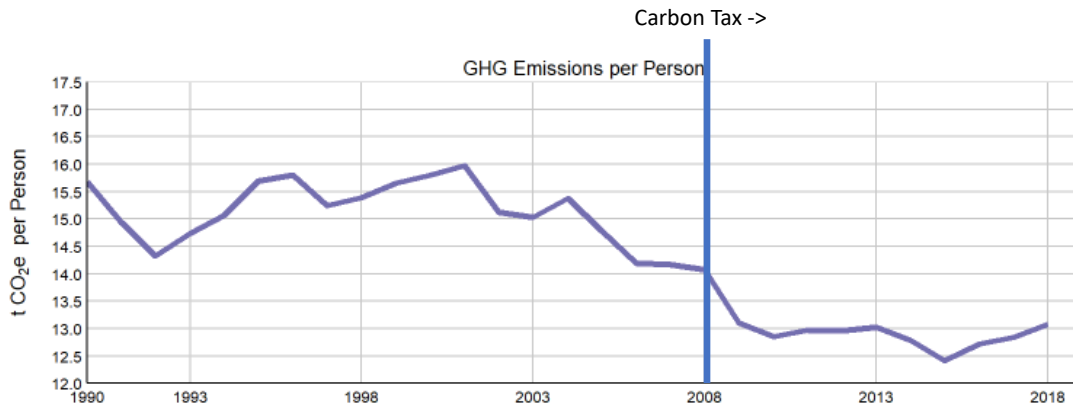
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Relative Greenhouse Gas Emissions, GDP & Population Size: British Columbia



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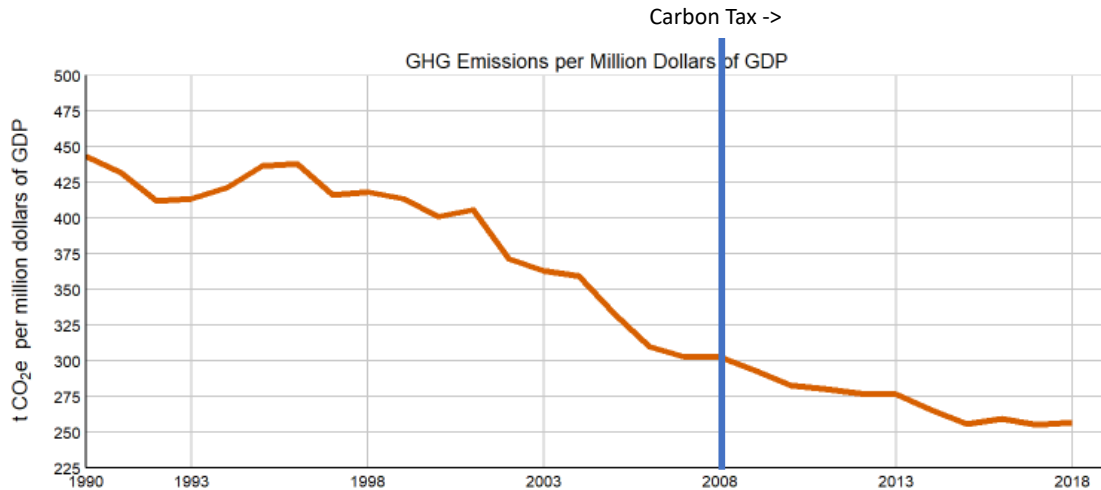
Was it the Carbon Tax? Maybe!



* To compare to per capita emissions from other jurisdictions, the afforestation and deforestation emissions included in the B.C. inventory were removed for this calculation, as these emission sources are not tracked everywhere. More details on these emissions are available below.

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Was it the Carbon Tax? Maybe Not...



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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

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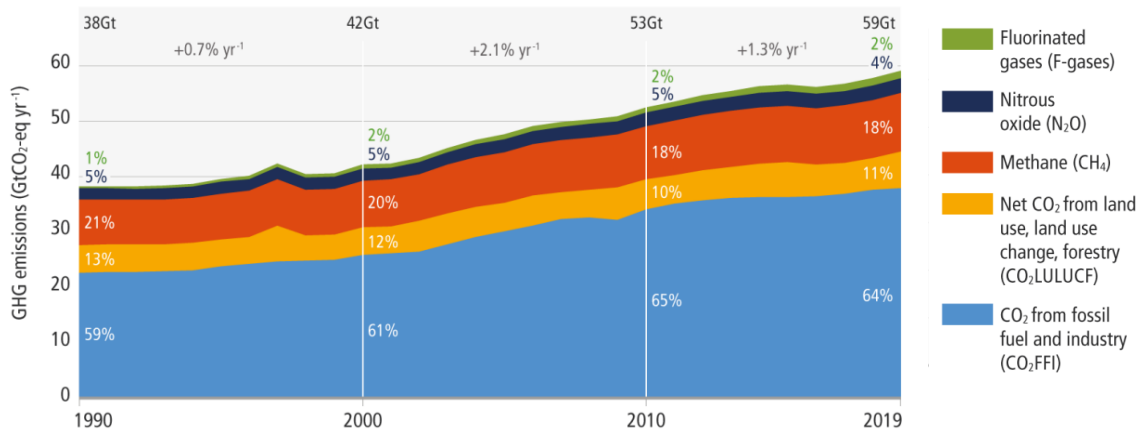
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Greenhouse Gas Emissions 1990-2019

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



Source: IPCC

