


# Climate Change Economics

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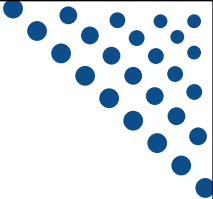
**Michael Bremer and Lynn Sieben Cocktail Party**  
May 29, 2020




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## National Economic Education Delegation

- **Vision**
  - One day, the public discussion of policy issues will be grounded in an accurate perception of the underlying economic principles and data.
- **Mission**
  - NEED unites the skills and knowledge of a vast network of professional economists to promote understanding of the economics of policy issues in the United States.
- **NEED Presentations**
  - Are **nonpartisan** and intended to reflect the consensus of the economics profession.






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# Who Are We?

## • Honorary Board: 48 members

- 2 Fed Chairs: Janet Yellen, Ben Bernanke
- 6 Chairs Council of Economic Advisers
  - o Furman (D), Rosen (R), Bernanke (R), Yellen (D), Tyson (D), Goolsbee (D)
- 3 Nobel Prize Winners
  - o Akerlof, Smith, Maskin

## • Delegates: 500+ members

- At all levels of academia and some in government service
- All have a Ph.D. in economics
- Crowdsource slide decks
- Give presentations

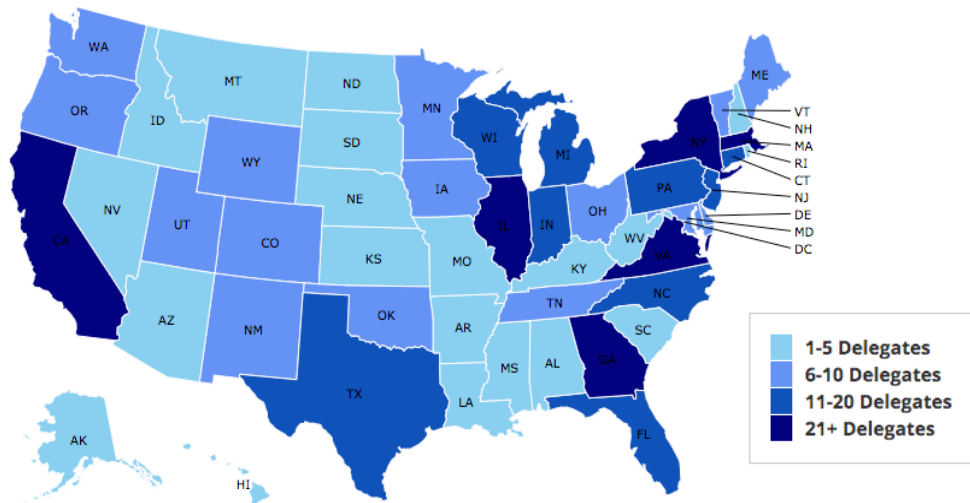
## • Global Partners: 45 Ph.D. Economists

- Aid in slide deck development



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# Where Are We?



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## Credits and Disclaimer

- **This slide deck was authored by:**
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## Outline

- Externalities
- Economics of responding to climate change
- Addressing the sources of our emissions
- Climate change policy
- Policy in action



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## How Can Economists Contribute to Thinking about Climate Change?

- By assessing behavioral reactions to climate change.
- By measuring the damage and estimating the economic costs of fighting climate change.
- By designing smart policies that minimize costs.
  - Balance economic growth with GHG emission mitigation.

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## Externalities – Pricing Things Right

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## How Much Pollution Does Society Want?

### Analogy: How Many Oranges Does Society Want?

- People grow and sell oranges for a price that at least covers costs (*supply*).
- People will not pay more for them than what they consider to be their value (*demand*).
- Prices let *supply* and *demand* balance out. The price settles where:

# of oranges people want to sell = # of oranges people want to buy

- This is the “right” number of oranges for society.
- Prices reflect scarcity and the social value of the resource.



## Electricity Is Different From Oranges

- Many sources of electricity generate pollution.
- **Pollution is an EXTERNALITY:**
  - a side effect (cost or benefit) that affects someone else when something is bought or sold.
  - This is a *market failure*.
- **The price of electricity does not reflect all of the costs.**
  - Electricity is too cheap.
  - There is too much pollution.



## Social Cost of Carbon

- Cost above price paid.
- The expected cost of damages from each unit of greenhouse gas emissions.
- Current EPA estimate: ~\$40 per metric ton of CO<sub>2</sub>.
  - About \$123/car per year.
  - \$26 Billion for all vehicles in the US.
- Social cost of carbon will increase over time.



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## Externalities

- An externality occurs when market activity affects people outside of a market.
  - Market activity SPILLS OVER onto others.
  - A **negative externality** occurs when a **cost** spills over.
  - A **positive externality** occurs when a **benefit** spills over.



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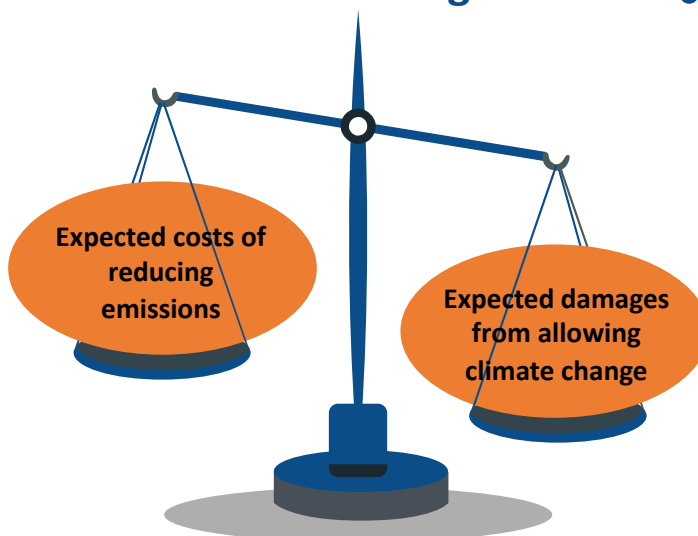
# Economics of Responding to Climate Change



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## How Economists Decide How Much to Fight Climate Change

- Cost Benefit Analysis
- Weigh:



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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.
  - Costs amount 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.**
- **Caveats:**
  - Putting a monetary value on priceless things
  - Inequality
  - Uncertainty and risk



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“It is better to be roughly right than precisely wrong.”

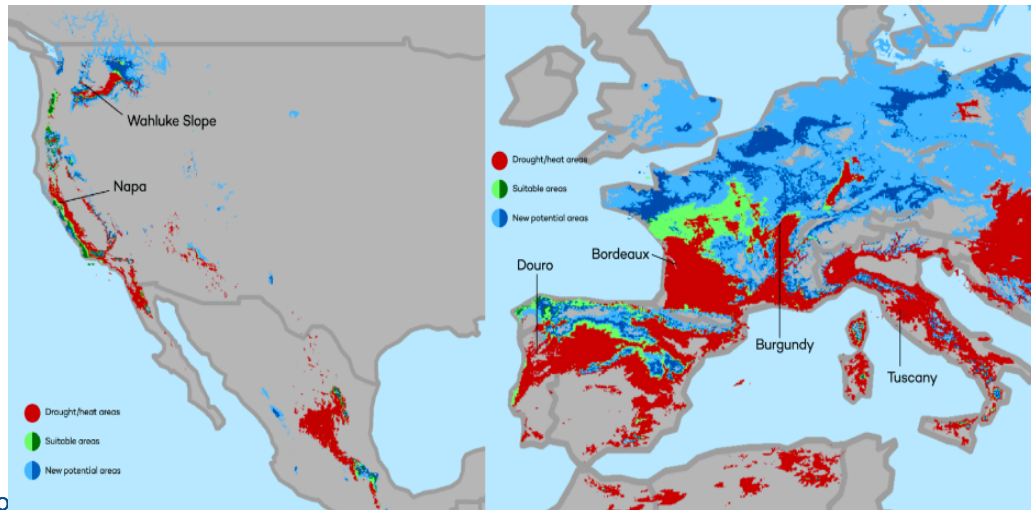
- John Maynard Keynes

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## This is What Precisely Wrong Looks Like

The changing map of the world's wine-growing regions.



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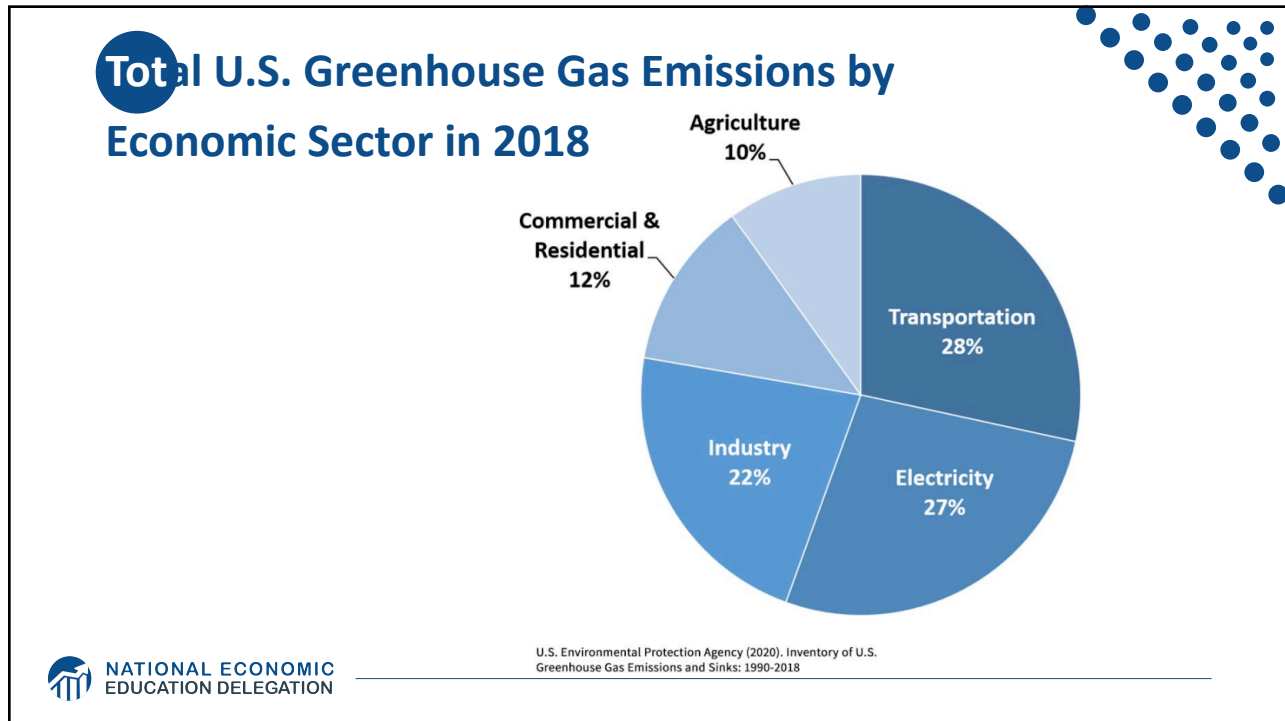
## Economic Growth and Climate Change Action Are Compatible

- Abating greenhouse gas emissions is costly...  
... but climate change damages are even more costly.
- Economic growth comes with consequences that we have to deal with, including climate consequences.
- Economies with environmental regulations can still be dynamic.
- Goal: design policies that reach climate goals at the least possible cost.

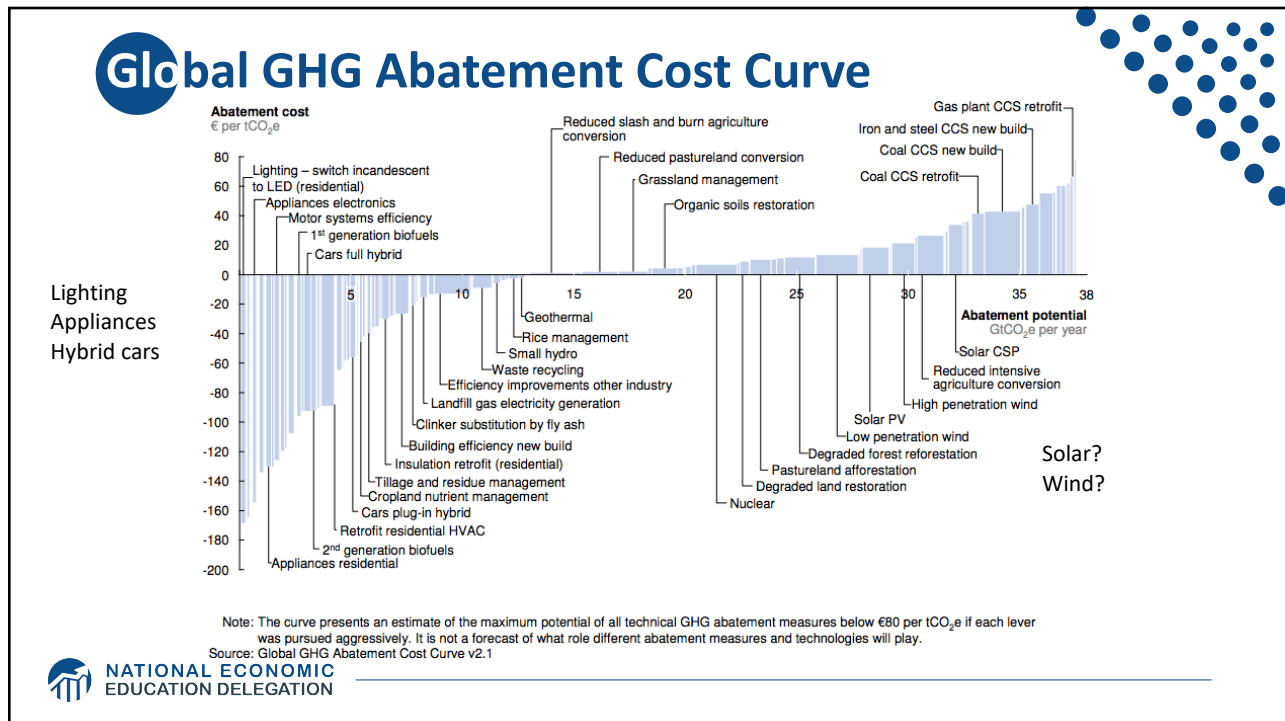


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# Climate Change Policy



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## Policies That Reduce Emissions: Directly

- **Regulation**

- Emissions standards or limits
  - E.g., CAFE standards

- **Market-oriented policies**

- Putting a price on emissions
  - Subsidizing green energy (*e.g.*, feed-in tariffs)
  - Tax or cap & trade



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## How Does Cap and Trade Work?

- **Activities to be covered are determined.**
- **Acceptable emissions levels are indicated.**
- **“Permits” that allow acceptable emissions levels are issued.**
  - How?
    - According to historical emissions?
    - Evenly across emitters?
    - Sold at some price?
- **A “market” is developed.**
- **Those desiring to emit will have to buy sufficient permits to accommodate their emissions.**
- **Those wishing to abate will offer their permits on the “market”.**
  - The price of a permit indicates:
    - The benefit of eliminating further emissions.
    - The cost of emitting.
- **Gov’t agency determines equality of permits in possession and emissions.**



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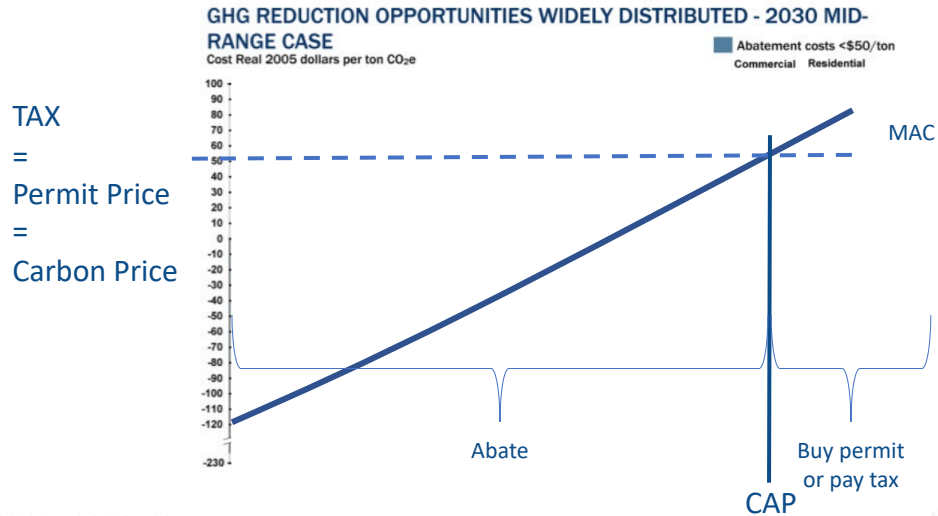
## How Does a Carbon Tax Work?

- **Activities to be covered are determined.**
- **The price of emissions is determined.**
  - Presumably some relation to the social cost of polluting.
- **Emissions are measured.**
- **Taxes are determined.**
- **Q: What to do with the tax revenue?**



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## Putting a Price on Carbon



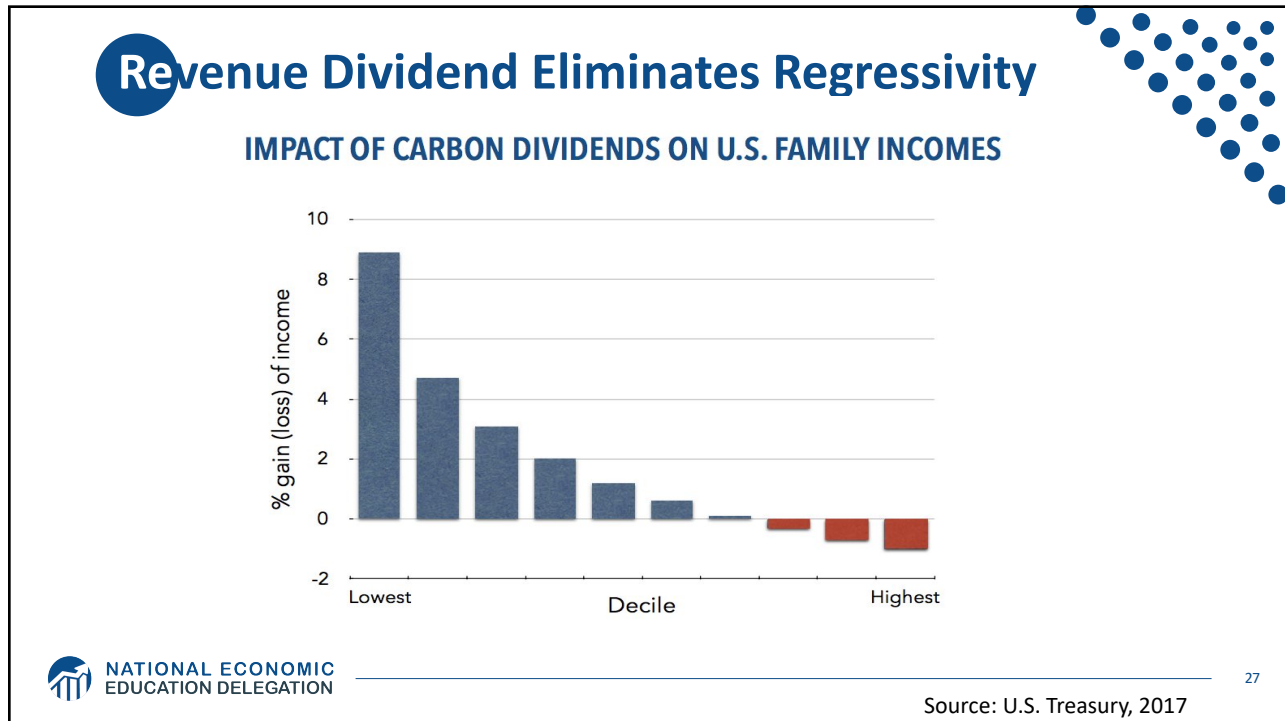
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## Carbon Prices: the Good and Bad

- **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.
  - It is necessary to monitor emissions.
  - Potentially regressive
    - Costs may weigh more heavily on low-income households.



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## 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 3) Predictability	1) Susceptible to lobbying. 2) Only generates revenue if government sells permits. 3) Cap can be changed by regulator. 4) Less certainty over future. 5) Regulations reduce efficacy of Cap & Trade

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## One Other 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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## Thoughts on Regulation vs Market-Oriented

- **Equity.**
  - Both types of policies are regressive.
    - Cap and Trade and a Carbon Tax can offset the regressivity.
    - Regulations do not.
- **Efficiency.**
  - Market-oriented policies tend to achieve emissions reduction at much lower cost.
    - Example: CAFÉ Standards vs Carbon Tax
      - Tax is significantly more efficient.
      - Why?



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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.



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## Policies That Reduce Emissions: INDIRECTLY

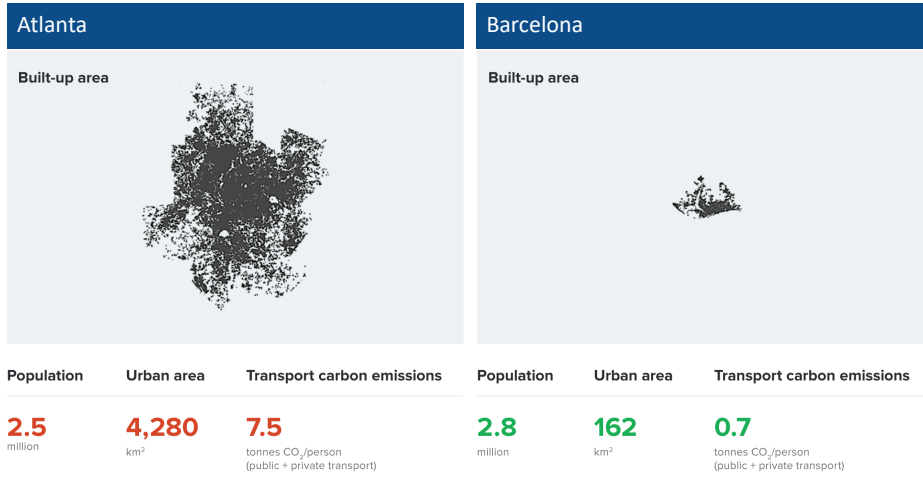
- **Subsidizing R&D**
- **Grid / infrastructure**
- **Energy efficiency mandates and subsidies**
- **Mandating renewable energy (e.g., renewable portfolio standards)**
- **Land use policies**



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## Atlanta and Barcelona Have Similar Populations but Very Different Carbon Productivity



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Source: New Climate Economy Report, 2014

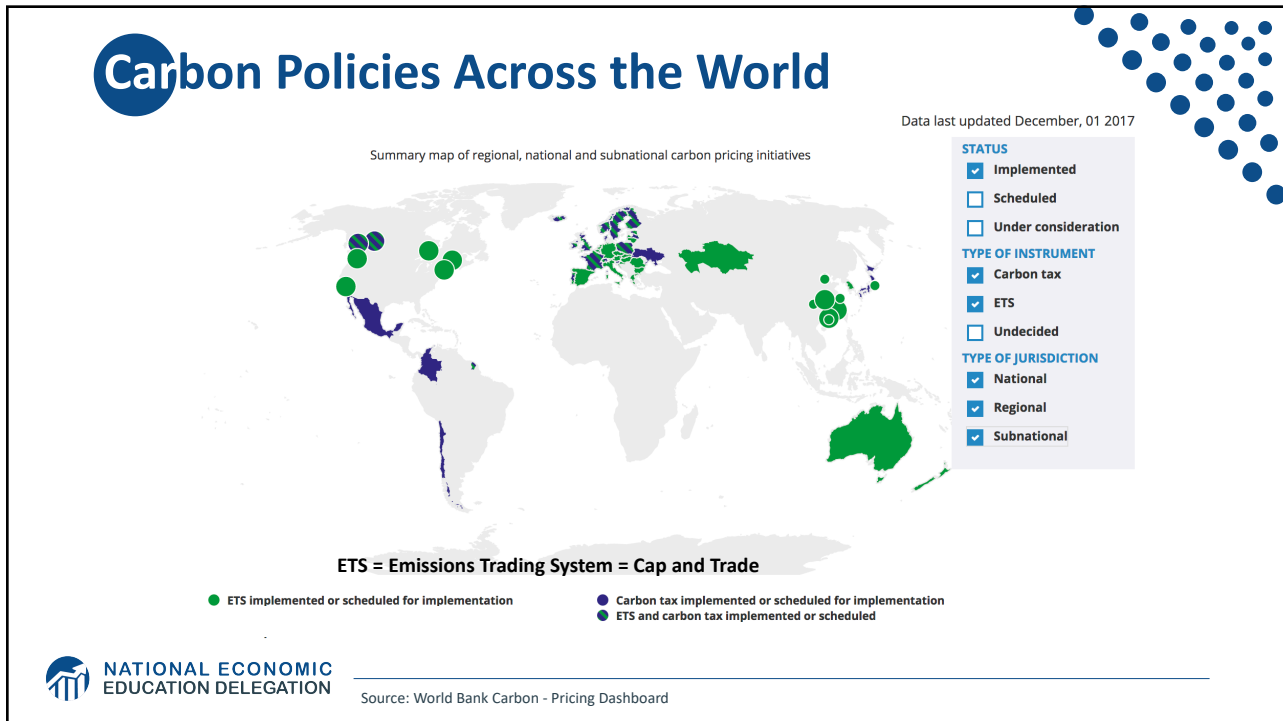
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## Climate Change Policy in Action



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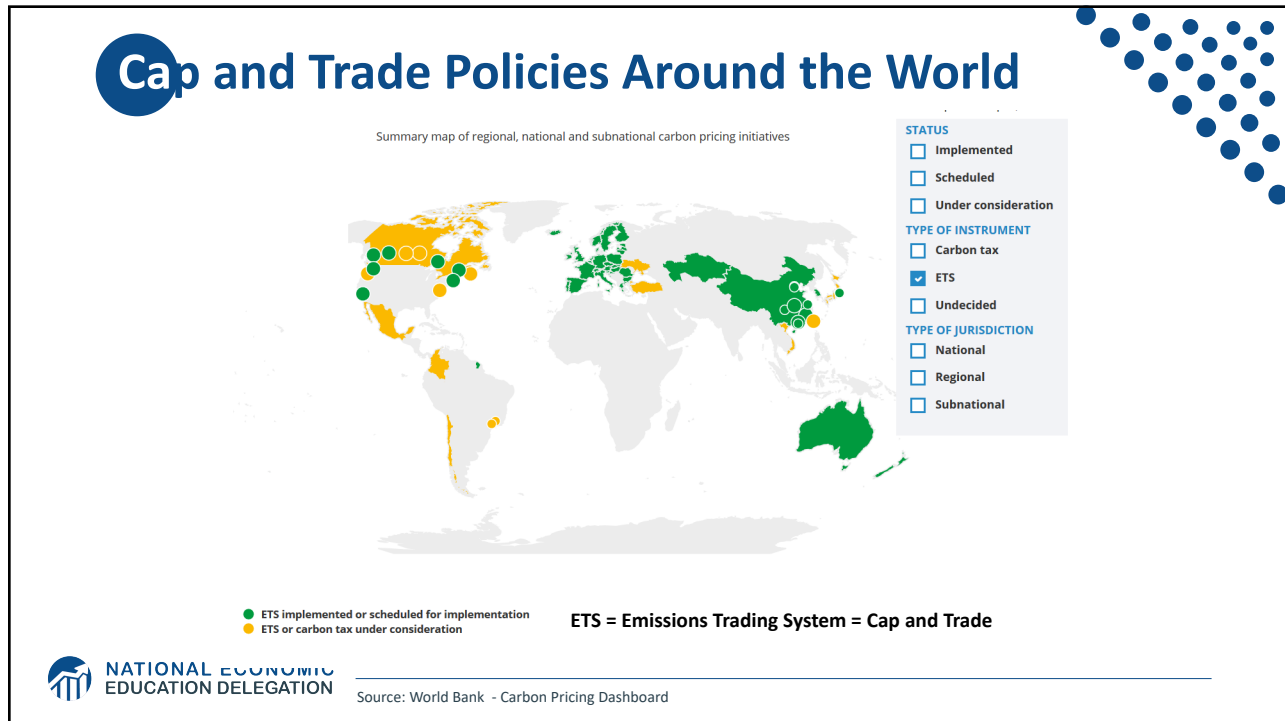
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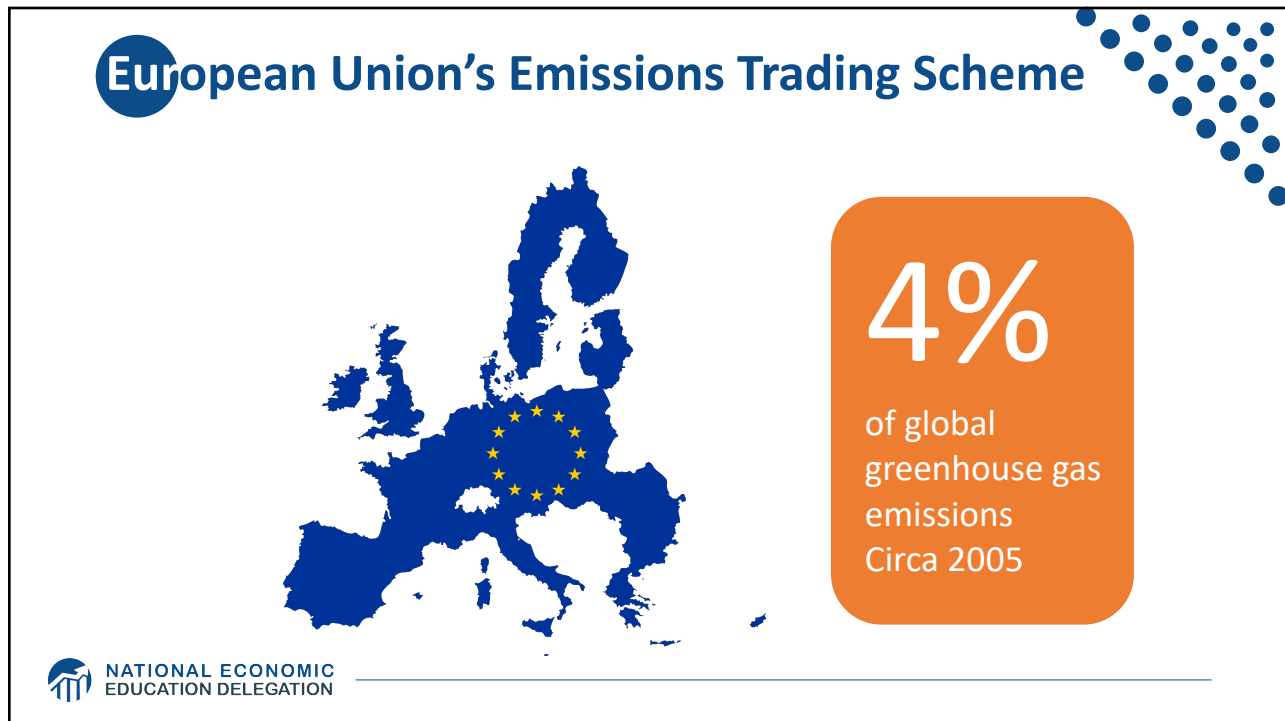
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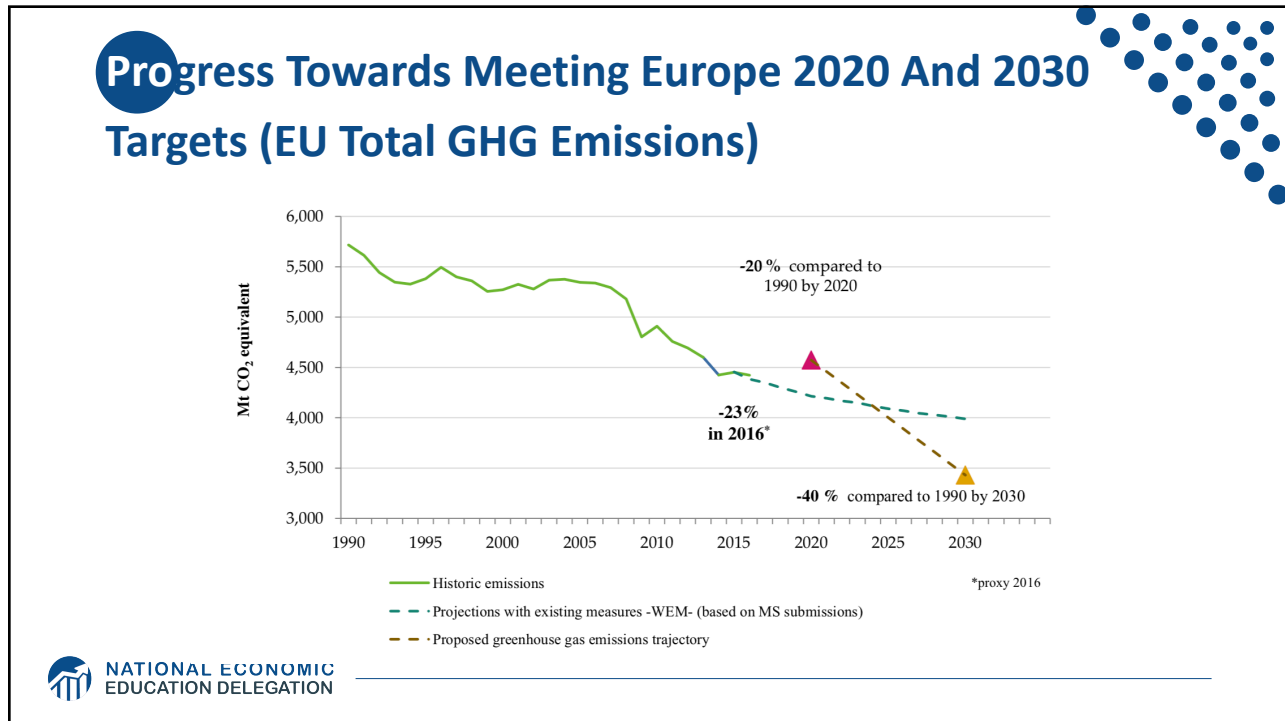
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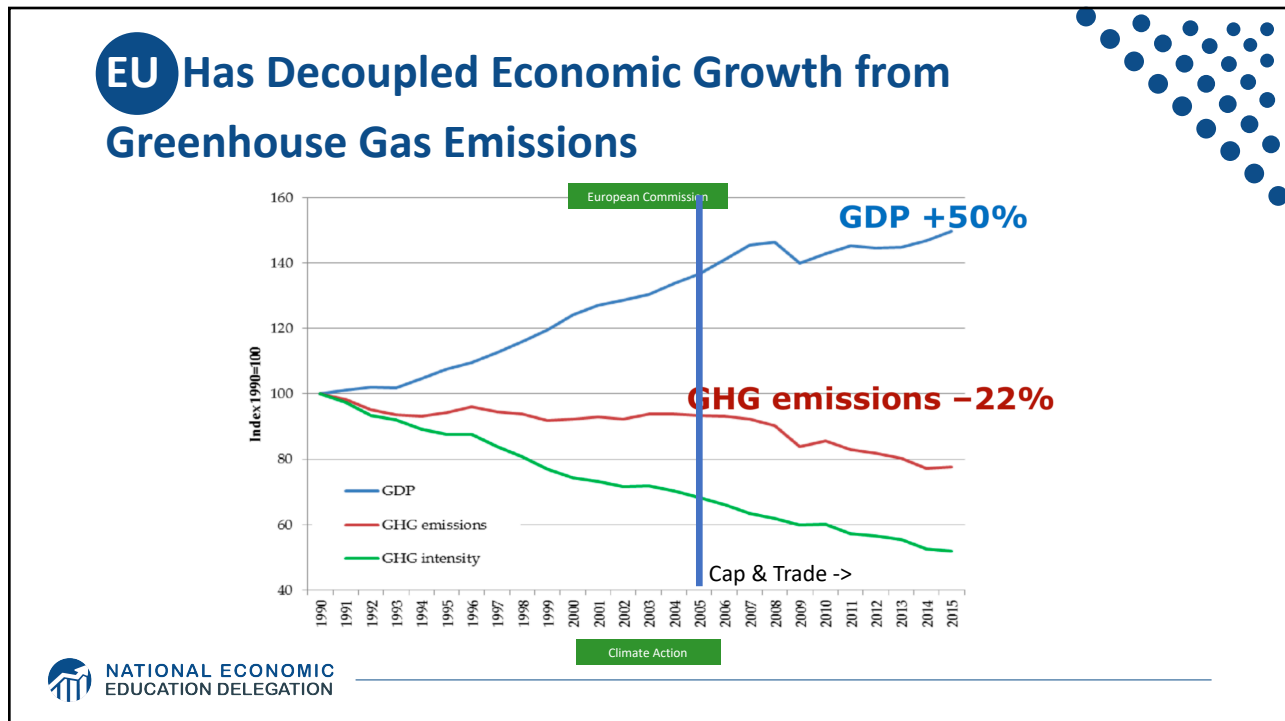
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## California's Cap and Trade System: 2012+



0.7%


of global greenhouse gas emissions




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## California's System Is Flexible

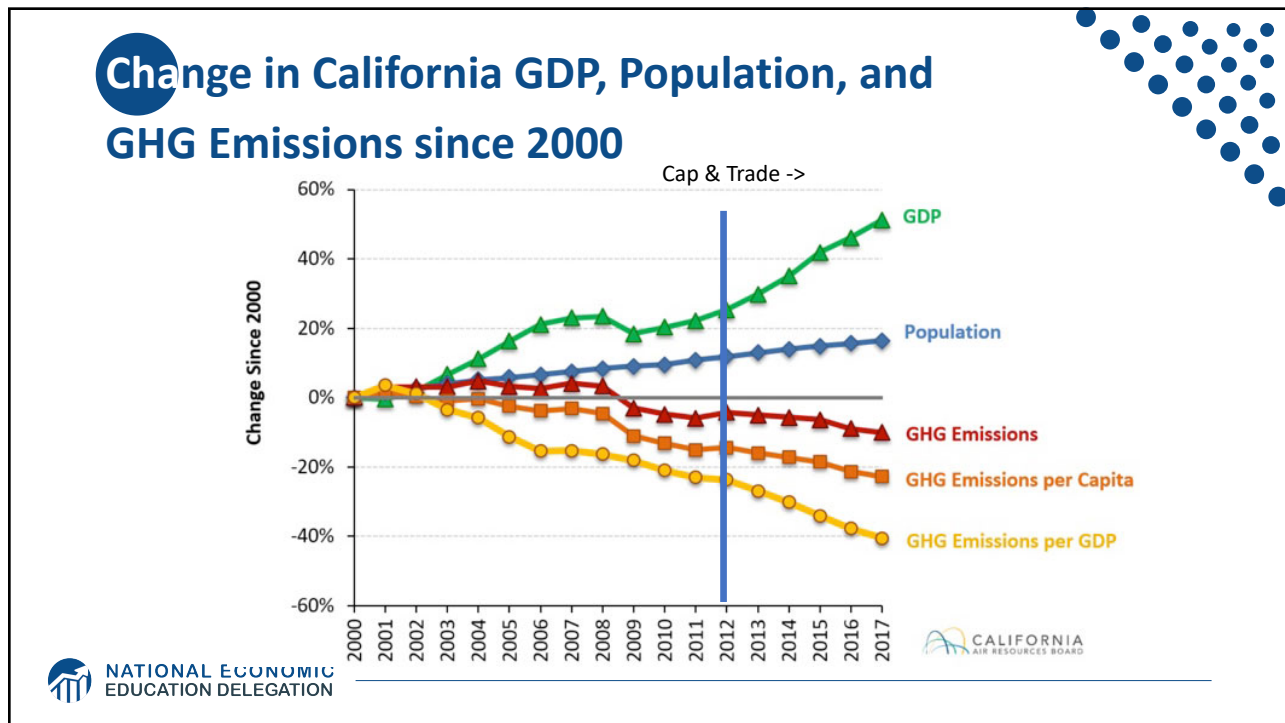


- **California's goals:**
  - Reduce emissions to 1990 levels by 2020
  - An 80% reduction in emissions from 1990 levels by 2030
- **California's Tools:**
  - Cap and Trade
  - Renewable Portfolio Standard
  - Clean Cars Program
  - Low Carbon Fuel Standard



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## RGGI: the Regional Greenhouse Gas Initiative

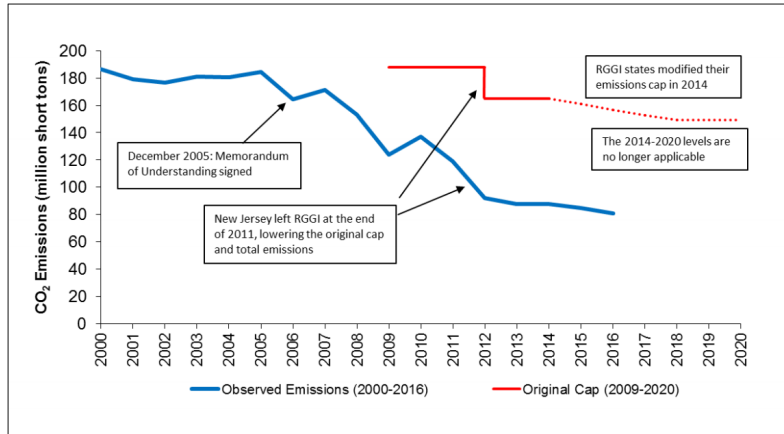
- **Participants: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont**
  - 7% of US emissions
- **Covers power plants**
- **First implemented in 2009**
- **Caused emissions reduction of 24% below what they would have been**

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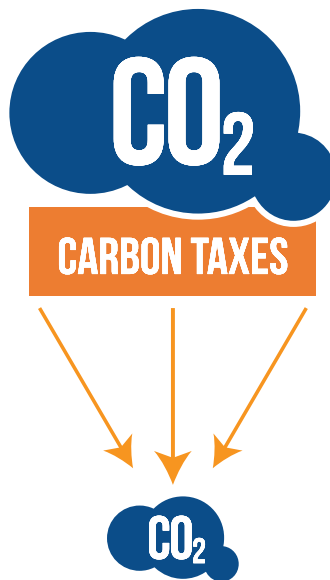
# RGGI's Effect on Emissions

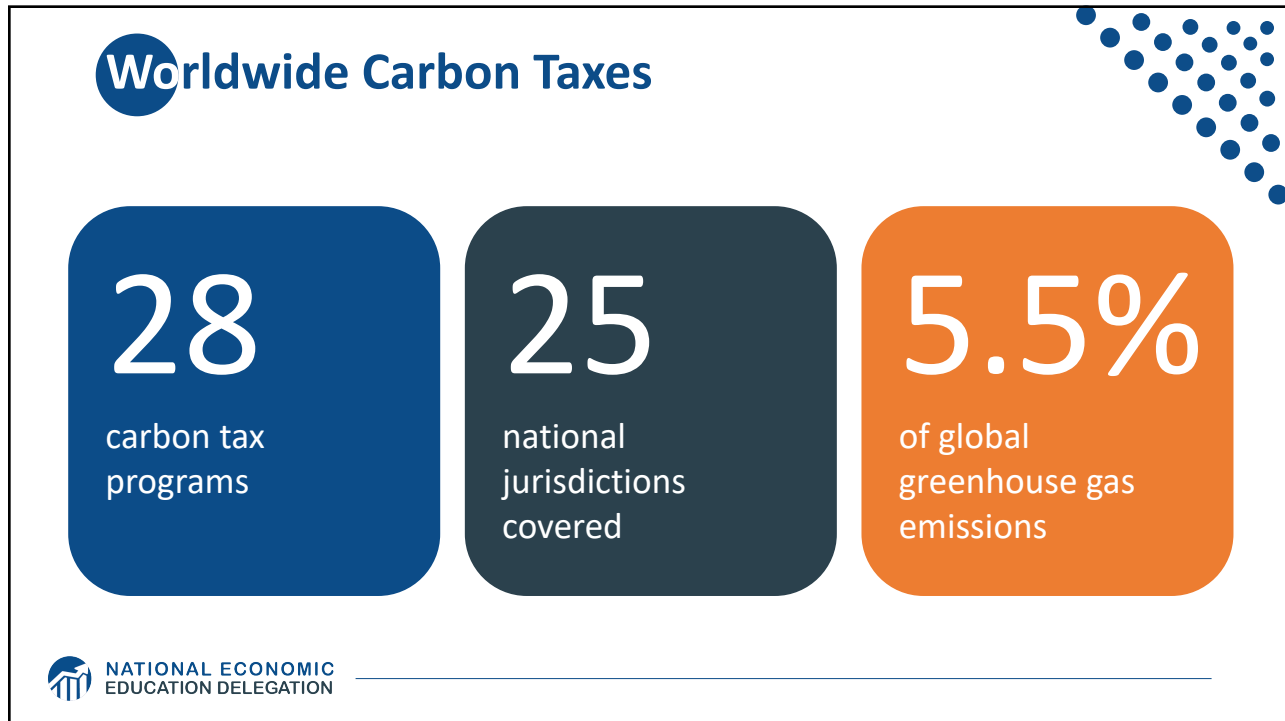
Figure I. Observed Emissions Compared to the Original Emissions Cap



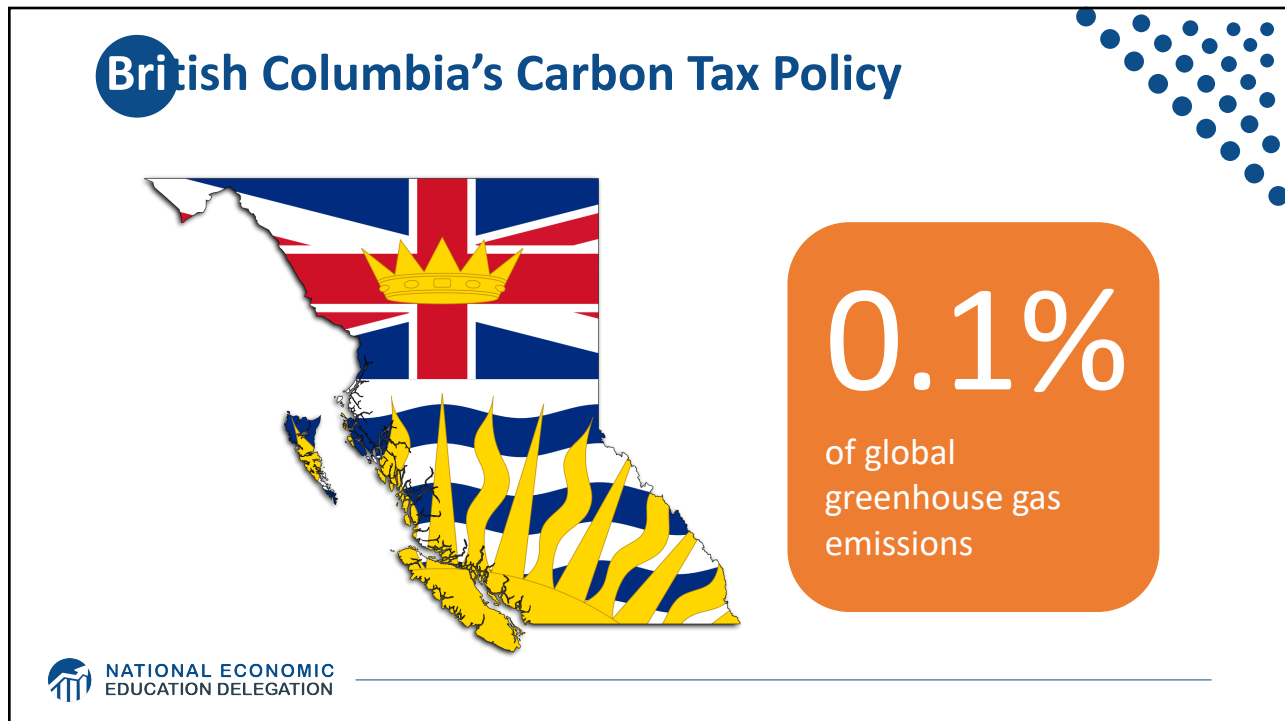
Source: Prepared by CRS; observed state emission data (2000-2016) provided by RGGI at <http://www.rggi.org>.

# Carbon Tax



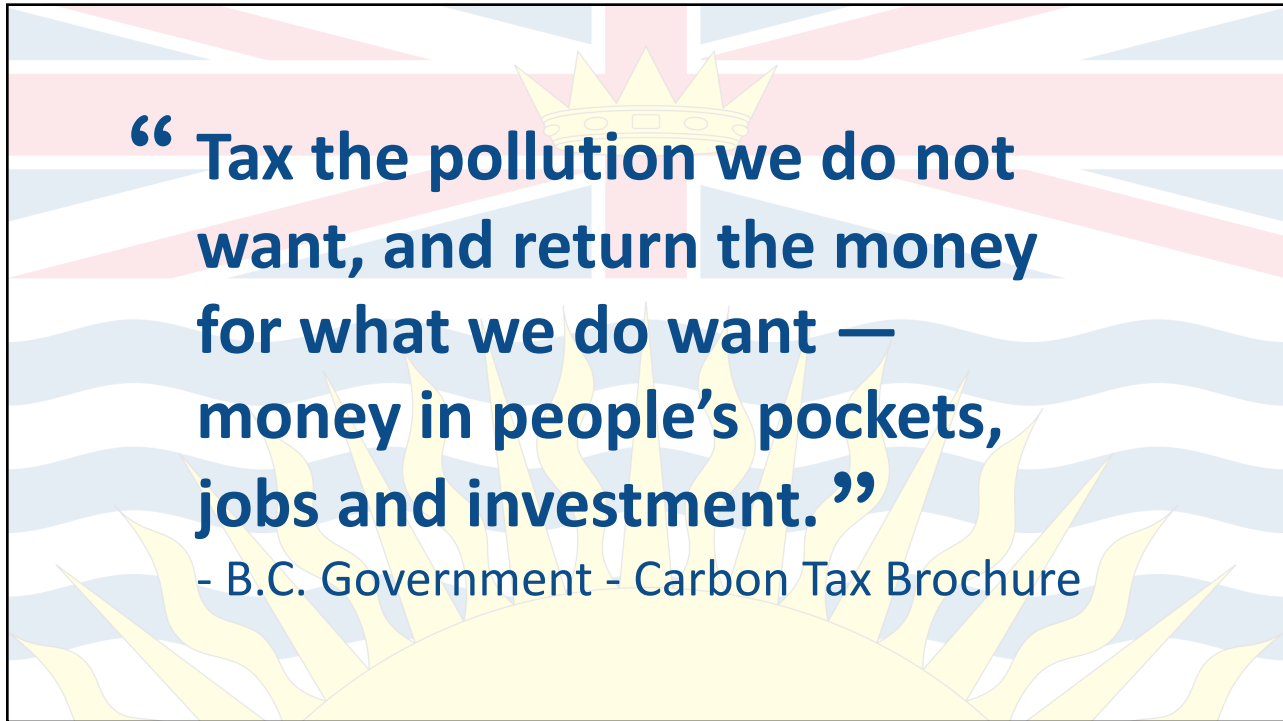


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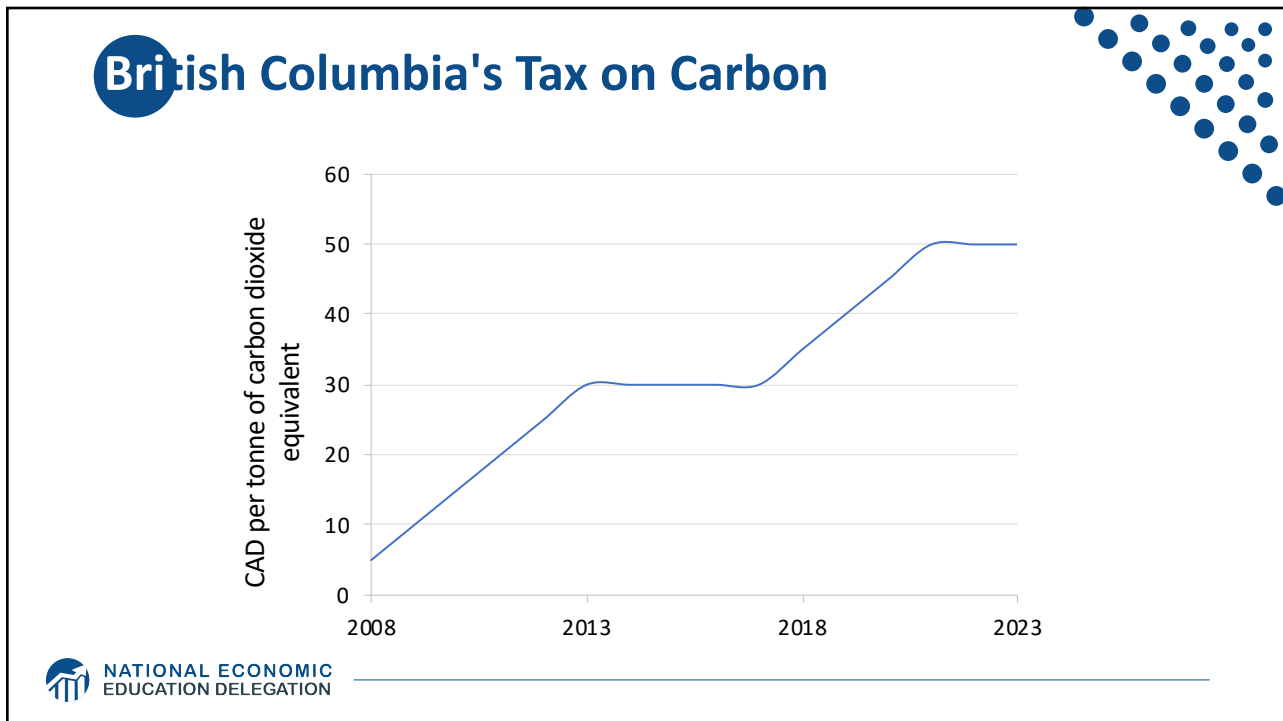


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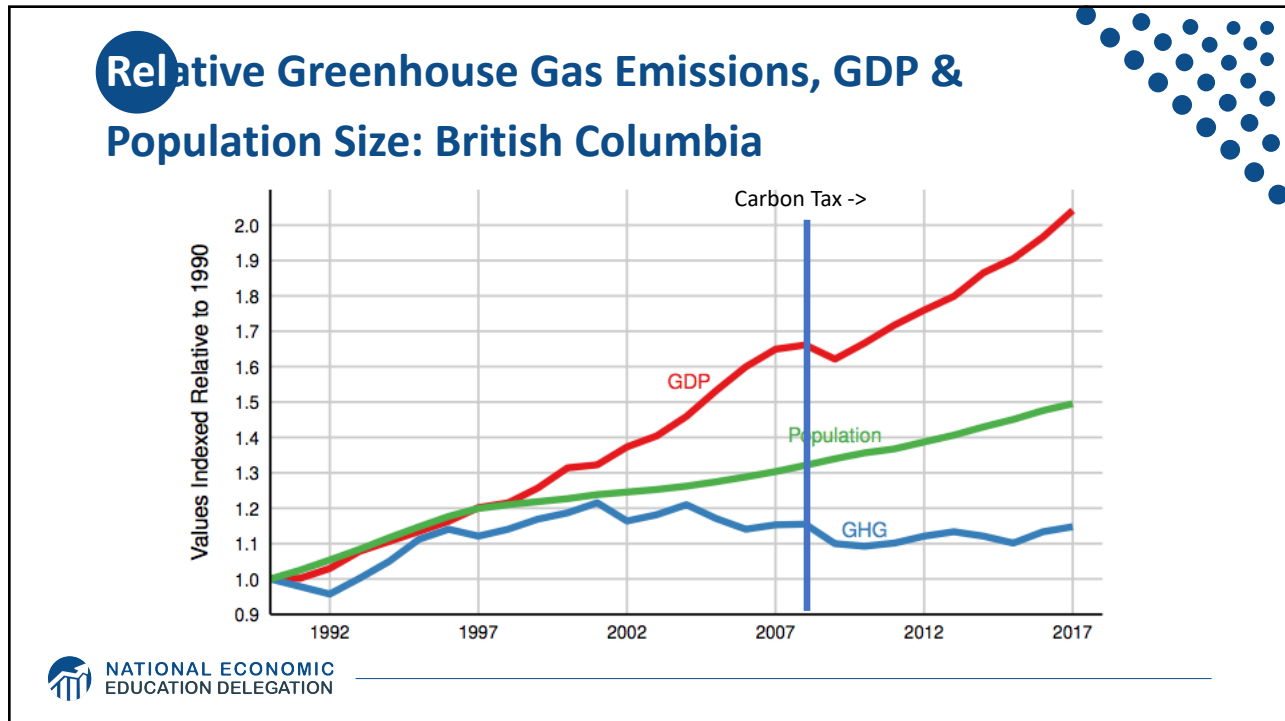




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## Sweden's Carbon Tax Policy



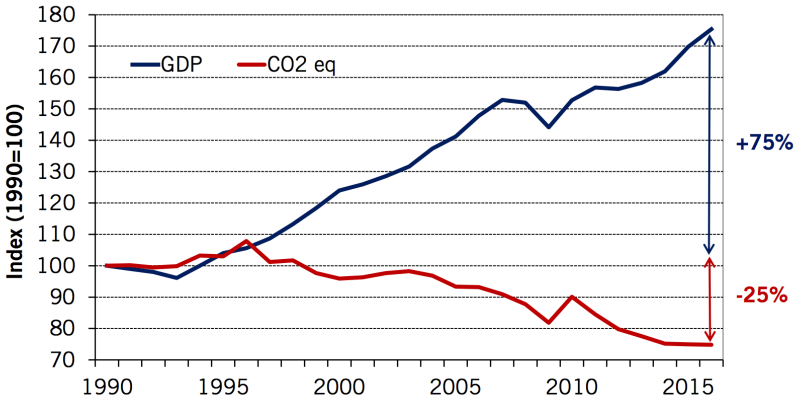
# Started in 1991

Currently at \$140/ton

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## Real GDP and Domestic CO<sub>2</sub>eq Emissions<sup>1</sup> In Sweden, 1990-2016



Year	Real GDP (Index 1990=100)	Domestic CO <sub>2</sub> eq Emissions (Index 1990=100)
1990	100	100
1995	105	100
2000	125	95
2005	145	90
2010	160	80
2016	175	75

<sup>1</sup> In accordance with Sweden's National Inventory Report, submitted under the UNFCCC and the Kyoto Protocol. CO<sub>2</sub> = approx. 80 % of total CO<sub>2</sub>eq emissions. Preliminary data for 2016.
 Sources: Swedish Environmental Protection Agency, Statistics Sweden

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## U.S. Carbon Tax Plans

- Climate Leadership Council
- Citizens Climate Lobby
- States and municipalities:  
Washington state, Oregon,  
Washington, DC



**“ Economic policies will be  
central to accomplishing  
the goals we choose.”**

- Harris and Roach (2007)

## Summary

- Climate change is real, is caused by human actions, and has impacts we're already feeling.
- We need to reduce emissions to balance the costs of action against the costs of inaction.
- Scientists and the IPCC recommend that we work to keep warming below 1.5 degrees celcius.

- *Economists believe that this goal is well worth the costs!*



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## Summary – *continued*

- There are many ways to reduce emissions.
- Economics-inspired policies can help us do this at the lowest cost.
- Taxes and cap and trade are proven effective tools to fight climate change!
- Other tools may also be necessary.



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**Thank you!**

# Any Questions?

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