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Climate Change Economics

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Whistlestop

June 19, 2019

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.

Who Are We?

- **Honorary Board: 44 members**
  - 2 Fed Chairs: Janet Yellen, Ben Bernanke
  - 6 Chairs Council of Economic Advisers
    - Furman (D), Rosen (R), Bernanke (R), Yellen (D), Tyson (D), Goolsbee (D)
  - 3 Nobel Prize Winners
    - Akerlof, Smith, Maskin
- **Delegates: 364 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: 42 Ph.D. Economists**
  - Aid in slide deck development

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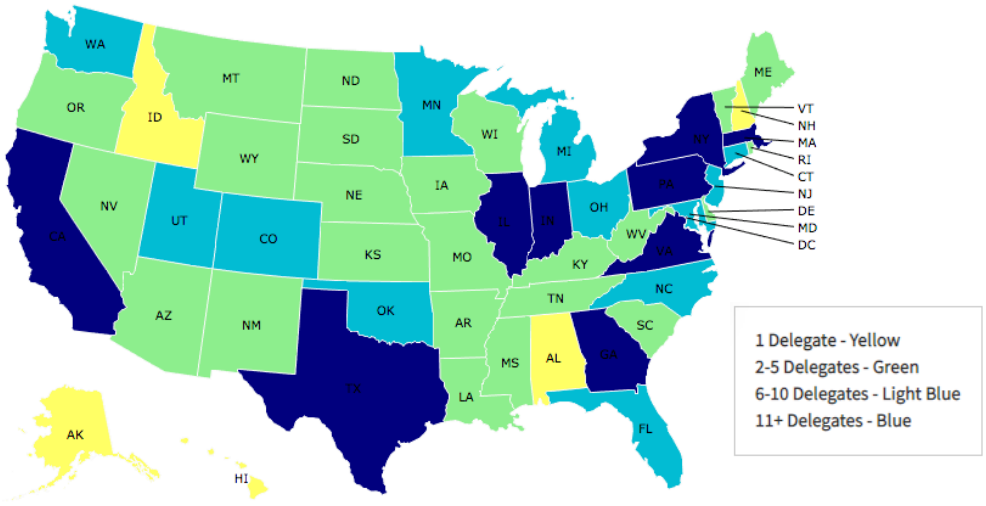
Where Are We?



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- **This slide deck was authored by:**
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  - It is, however, inevitable that the presenter will be asked for and will provide their own views.
  - Such views are those of the presenter and not necessarily those of the National Economic Education Delegation (NEED).

Outline

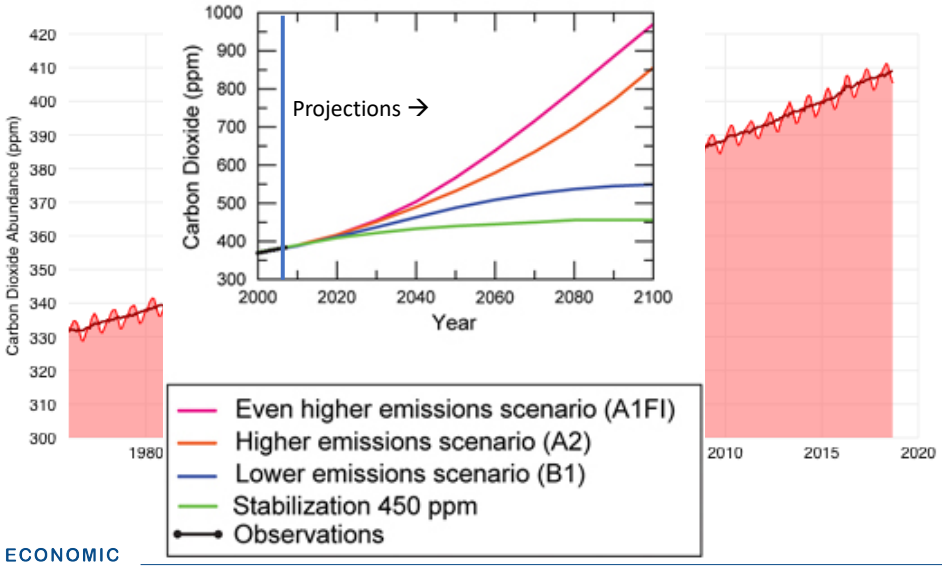
- **Climate change science**
- **Impacts of climate change**
- **Economics of responding to climate change**
- **Addressing the sources of our emissions**
- **Climate change policy**
- **Policy in action**

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.

Climate Change Science

Atmospheric CO_2 Concentrations



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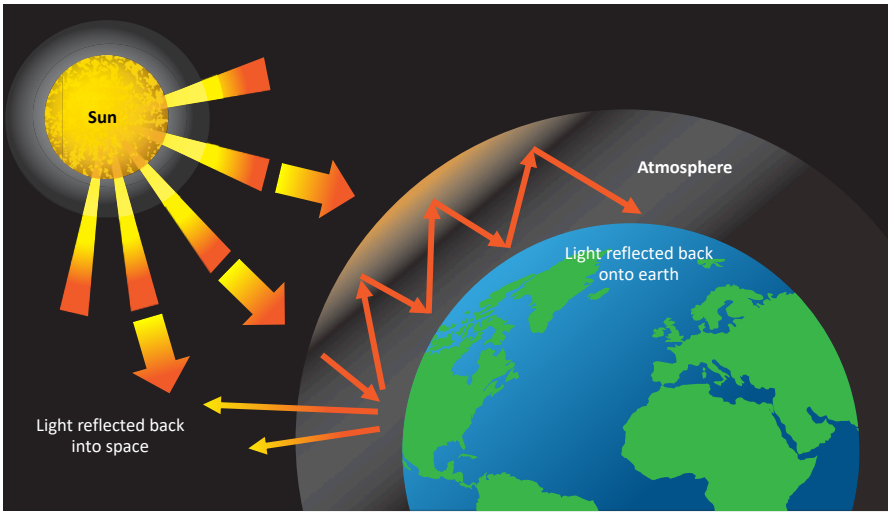
Source: IPCC data distribution center and climate.gov

The Atmospheric Greenhouse Effect



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Uncertainty

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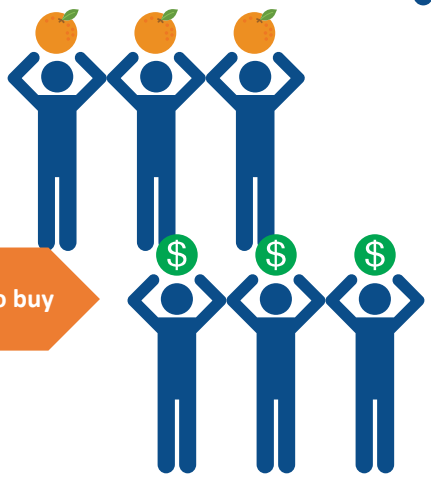
How Much Pollution Does Society Want?

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.

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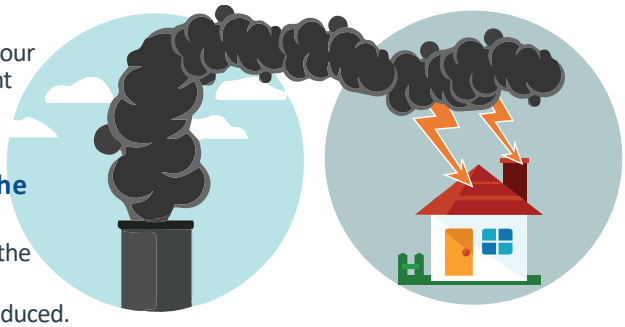
Pollution Imposes Costs Outside the Market

- **Pollution is an EXTERNALITY: a side effect (cost or benefit) that affects someone else when something is bought or sold.**
  - The power company sells you electricity for your house, but the pollution from the power plant affects everyone, not just you!
  - This is a ***market failure.***
- **All of the effects are not always felt by the buyers and sellers.**
  - The price of electricity does not reflect all of the costs—there is too much pollution.
  - Electricity is too cheap. Too much will be produced.
- **There is a cost of electricity above the price paid.**



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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_2.**
  - 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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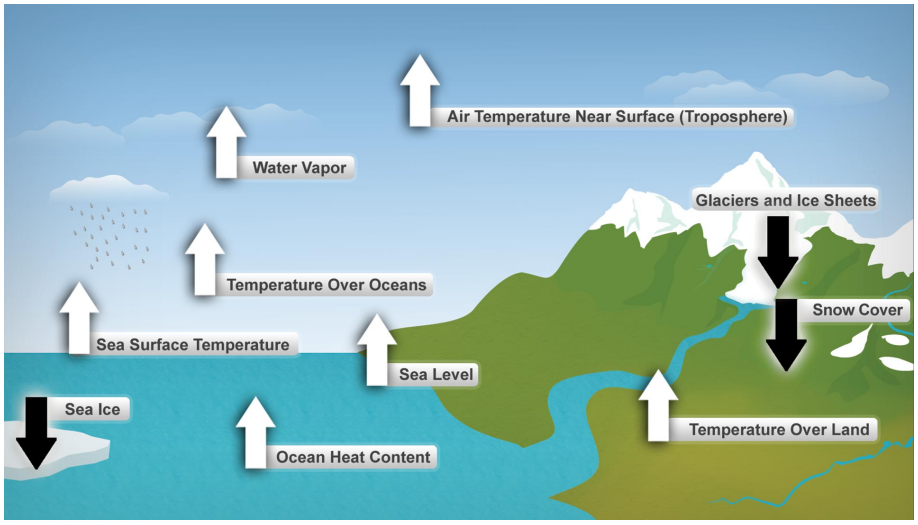
Global Warming Indicators



How These Impacts Affect 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

Economics of Responding to Climate Change

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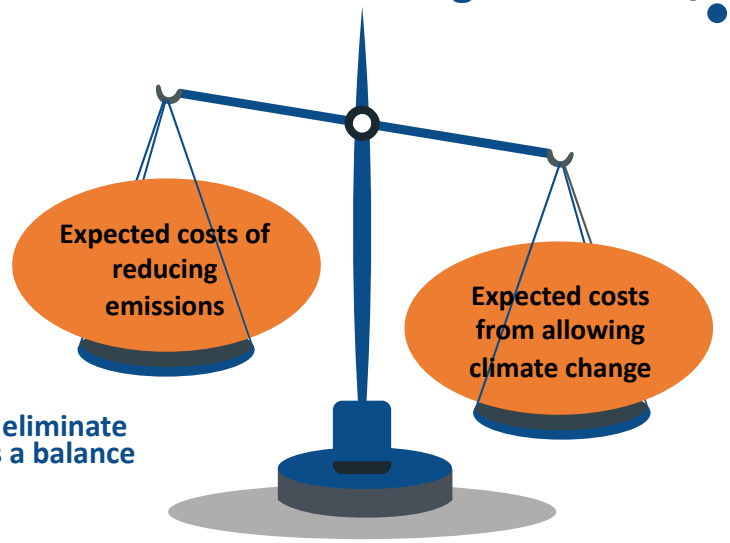
How Economists Decide How Much to Fight Climate Change

- Cost Benefit Analysis
- Weigh:
- This does not necessarily eliminate emissions, but recognizes a balance between economic costs.



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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.**
  - Stern Report estimate: damages could be as high as **20% of worldwide GDP**.
- **Caveats:**
  - Putting a monetary value on priceless things
  - Inequality
  - Uncertainty and risk

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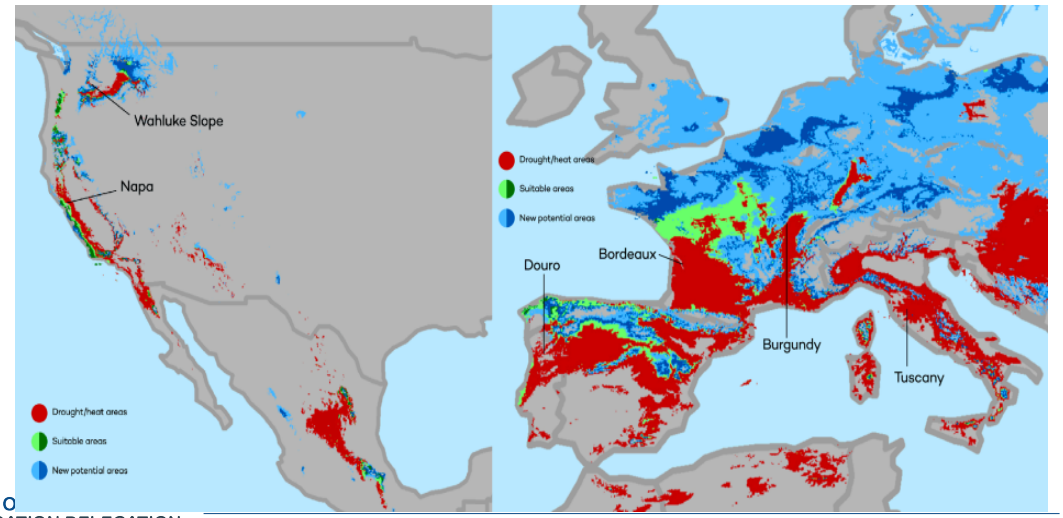
This is What Precisely Wrong Looks Like

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



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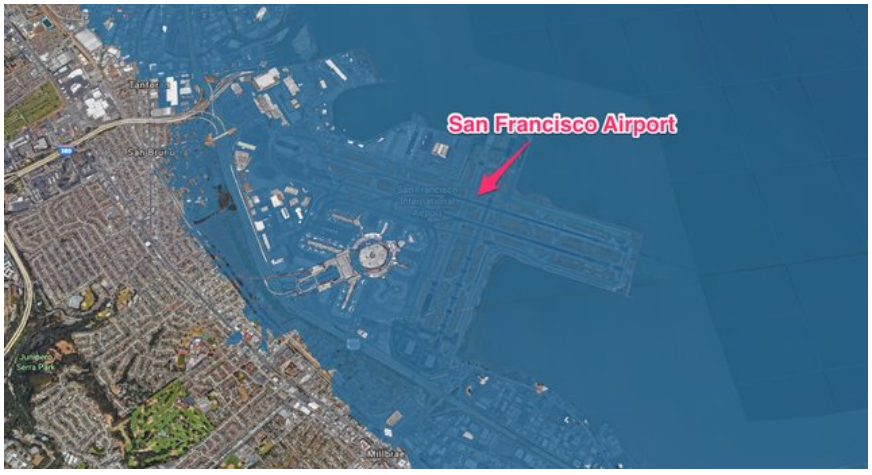

This is What Precisely Wrong Looks Like

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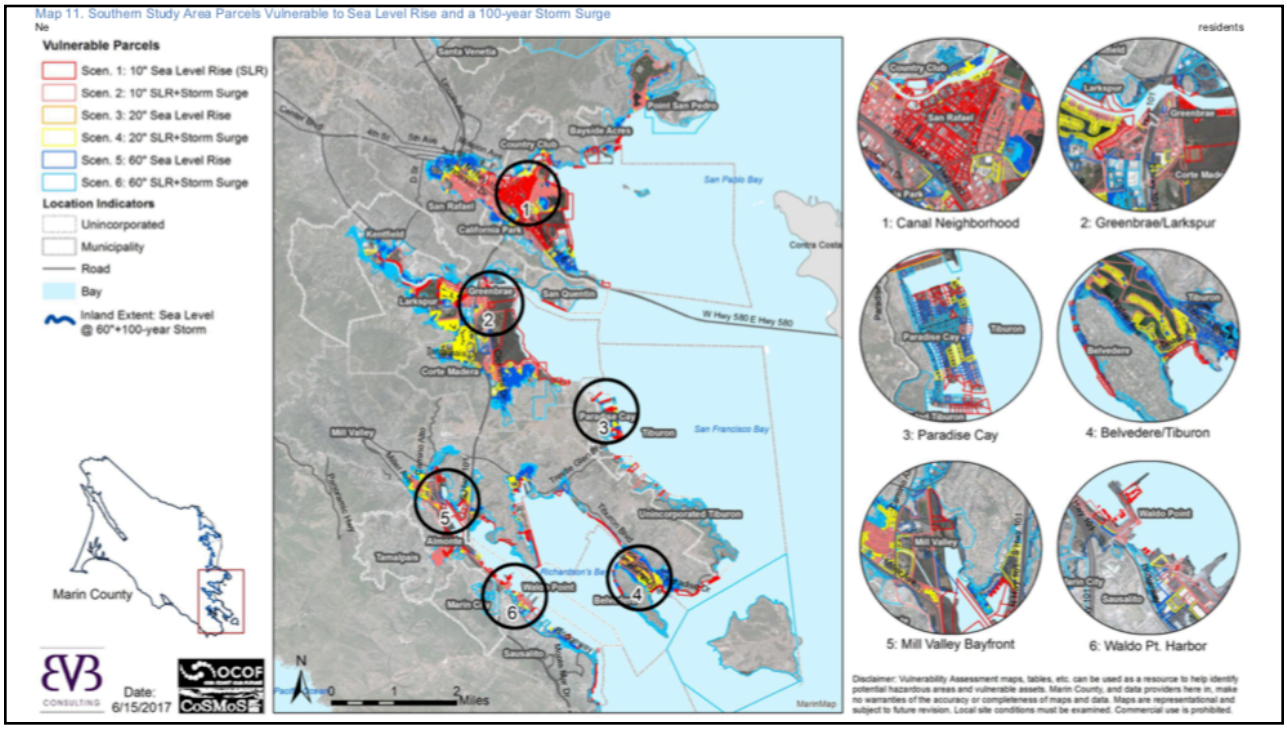

Economic Growth and Climate Change Action Are Compatible

- 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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Addressing the Sources of Our Emissions

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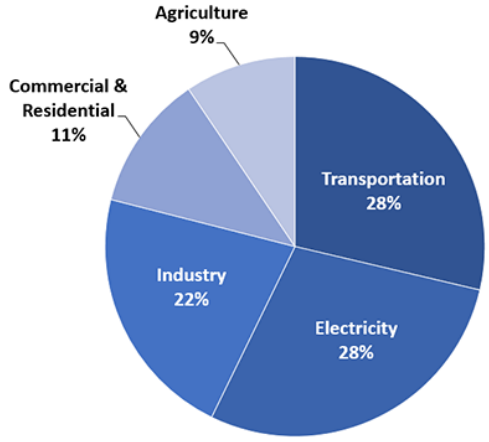
Total U.S. Greenhouse Gas Emissions by Economic Sector in 2016



U.S. Environmental Protection Agency (2018). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016

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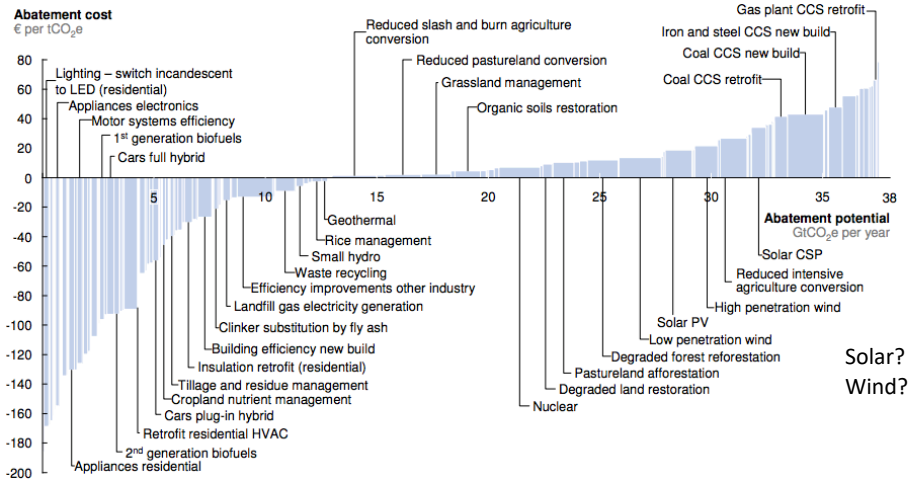
Global GHG Abatement Cost Curve

Lighting
Appliances
Hybrid cars



Solar?
Wind?

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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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?

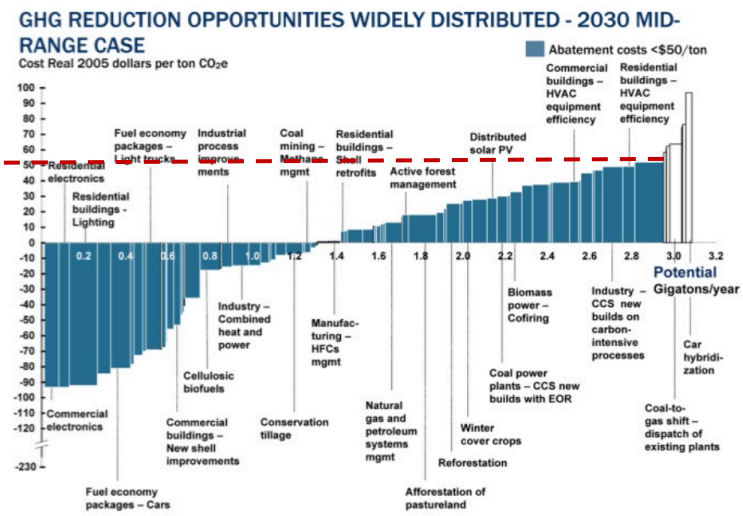
- **Activities to be covered are determined.**
- **Acceptable emissions levels are indicated.**
- **"Permits" that allow acceptable emissions levels are distributed.**
  - How?
    - According to historical emissions?
    - Evenly across emitters?
    - Sold at some price?
- **A "market" is developed.**
- **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 cost of emitting.
    - The cost of eliminating further emissions.
- **Agency determines equality of permits in possession and emissions.**

How Does a Carbon Tax Work?

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

Putting a Price on Carbon

Suppose a Social Cost Of Carbon of $50



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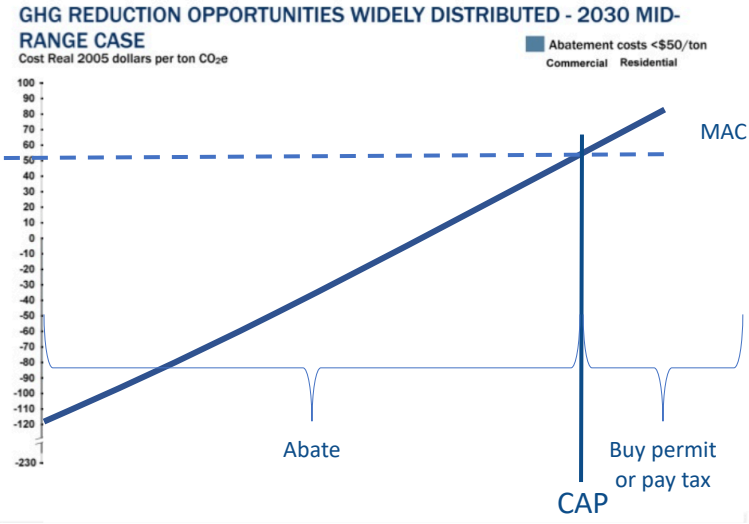
Putting a Price on Carbon

TAX
=
Permit Price
=
Carbon Price



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Carbon Prices: the Good and Bad

- **Good:**
  - Provide price signal to lower emissions.
  - They yield low-cost reductions in emissions.
- **Bad:**
  - Firms might leave to flee regulation.
  - It is necessary to monitor emissions.
  - Regressive
    - Costs weigh more heavily on low-income people.

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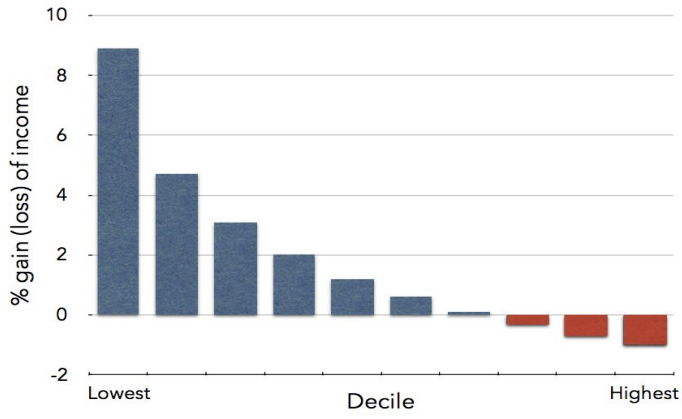
Revenue Dividend Eliminates Regressivity

IMPACT OF CARBON DIVIDENDS ON U.S. FAMILY INCOMES



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Source: U.S. Treasury, 2017

Carbon Tax and Cap & Trade: the Differences

	Carbon Tax	Cap & Trade

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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	Always generates revenue May require legislation to change	May be more susceptible to lobbying Only generates revenue if government sells permits Cap can be changed by regulator

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Cap and Trade: Additional Concerns

- **Inconsistency with other Policies**
  - E.g., renewable mandates
- **Uncertainty over price**
  - Business has a preference for certainty.
    - Higher prices of energy may be preferable to uncertainty.

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**

Challenges with Renewable Energy

- **It's intermittent - only produced if there is sun or wind.**
- **Energy is needed all day and night, with peak times.**
- **Limited w/o storage.**
  - Creative storage options are under development

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Atlanta and Barcelona Have Similar Populations but Very Different Carbon Productivity

Atlanta			Barcelona		
Built-up area			Built-up area		
Population	Urban area	Transport carbon emissions	Population	Urban area	Transport carbon emissions
2.5 million	4,280 km²	7.5 tonnes CO_2/person (public + private transport)	2.8 million	162 km²	0.7 tonnes CO_2/person (public + private transport)

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Source: New Climate Economy Report, 2014

Land Use: Restoration Is Possible

South Korea restored its forest cover from 35% to 64% of the country's total area

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Climate Change Policy in Action

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California's Cap and Trade System: 2012+

0.7%

of global greenhouse gas emissions

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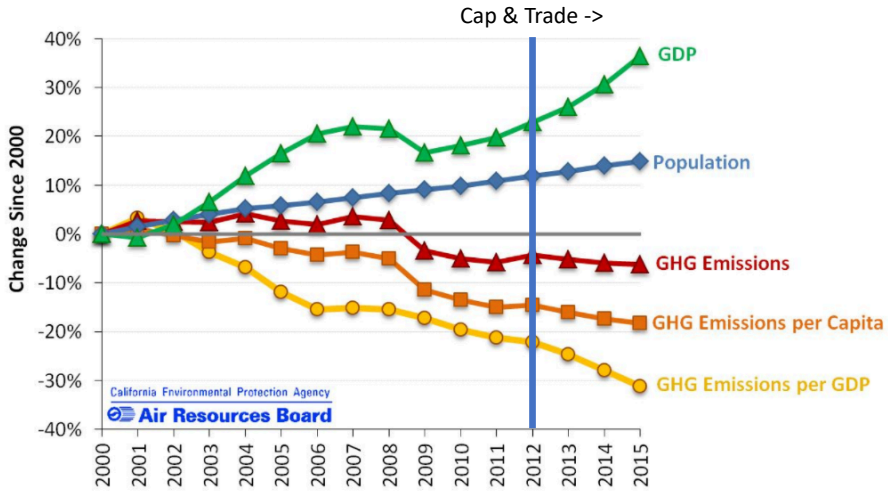
Change in California GDP, Population, and GHG Emissions since 2000



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Worldwide Carbon Taxes

26
carbon tax programs

24
national jurisdictions covered

5.3%
of global greenhouse gas emissions

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Sweden's Carbon Tax Policy

Oldest Carbon Tax: 1991

$140/ton

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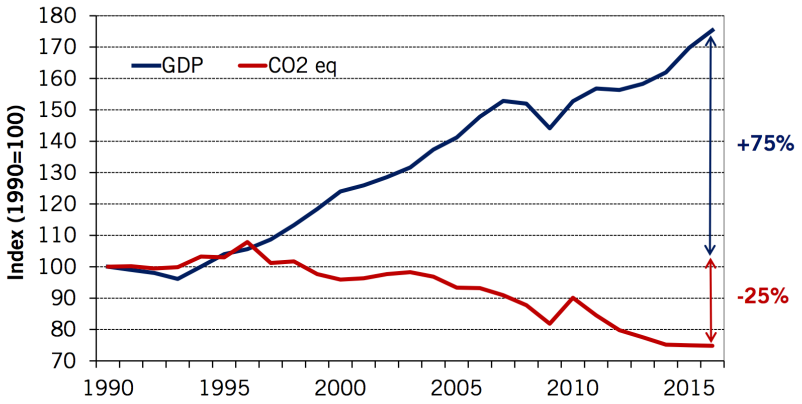
Real GDP and Domestic CO_2eq Emissions[1] In Sweden, 1990-2016



[1] In accordance with Sweden's National Inventory Report, submitted under the UNFCC and the Kyoto Protocol. CO_2 = approx. 80 % of total CO_2eq 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

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Summary

- 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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