Osher Lifelong Learning Institute, Summer 2024

Contemporary Economic Policy Issues

University of Minnesota

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National Economic Education Delegation

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.

Course Outline

- **Contemporary Economic Policy Issues**
  - **Week 2 (6/13): Climate Change Economics (Andrew W. Stevens, University of Wisconsin–Madison)**
  - Week 3 (6/20): Federal Debt and Deficits (Joseph Carolan, Oakland University)
  - Week 4 (6/27): Economics of Immigration (Robert Gitter, Ohio Wesleyan)

Submitting Questions

- **Submit questions in the chat.**
  - I will try to handle them as they come up and/or address them during the Q&A at the end of the presentation
- **We will do a verbal Q&A once the material has been presented.**
- **Slides will be available from the NEED website tonight (https://needelegation.org/delivered_presentations.php).**

Credits and Disclaimer

- **This slide deck was authored by:**
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- **Disclaimer**
  - NEED presentations are designed to be nonpartisan.
  - 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**

But First: What Is Economics?

- **Economics is about making choices under scarcity.**
  - Individuals and firms
- **How do goods and services get allocated among entities in society?**
- **How is value created by trade?**
- **How do "market failures" restrict that value creation?**

Economics Informs Almost Everything

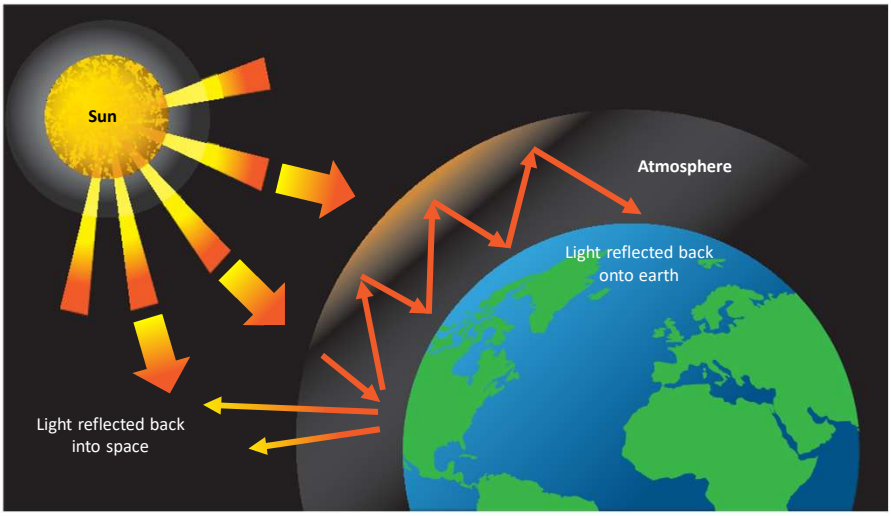
- **Prices**
- **Incentives**
- **Externalities**
- **Cost-Benefit Analysis**
- **Growth**
- **Inflation**
- **Interest Rates**
- **Climate Change**
- **International Trade**
- **Immigration**
- **Housing**
- **Education**
- **Health Care**
- **Gun Control**

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

The Atmospheric Greenhouse Effect



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A Climate Change Ladder

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

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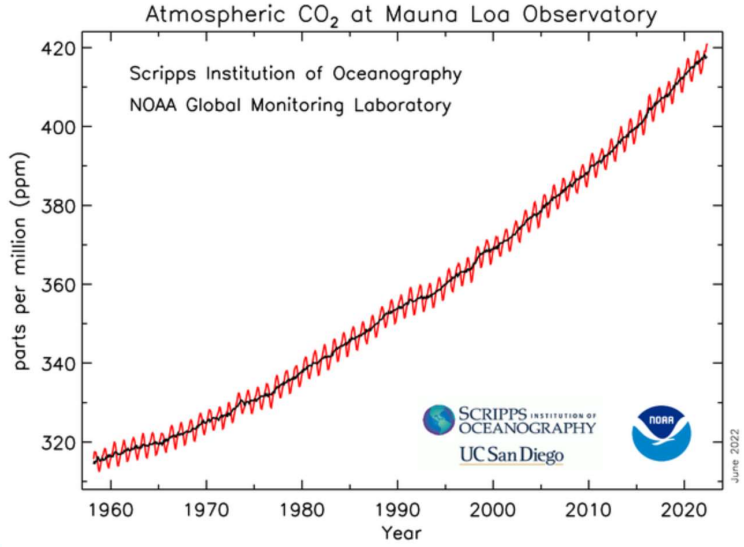
Atmospheric CO_2 Concentrations Up To Now



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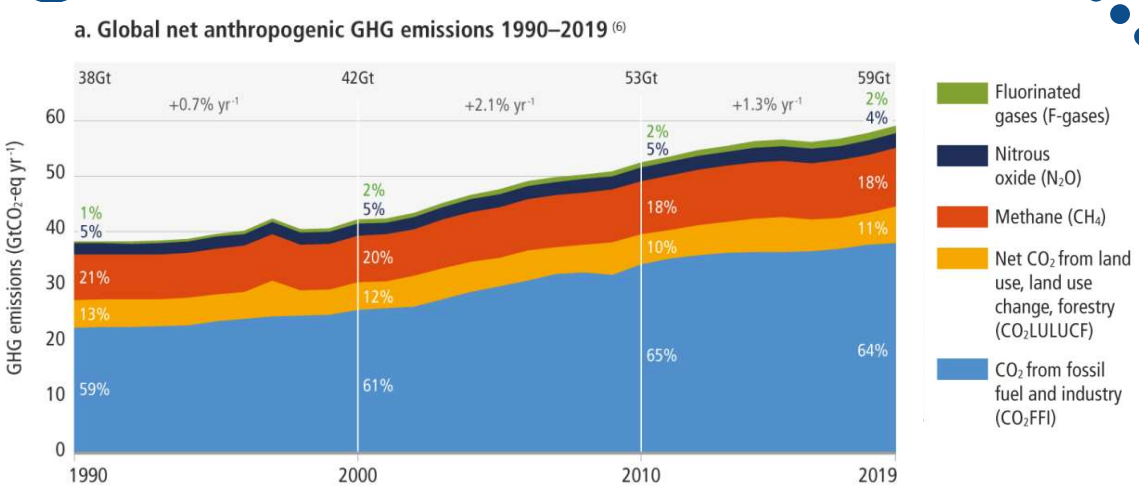
Source: NOAA

Greenhouse Gas Emissions: 1990-2019



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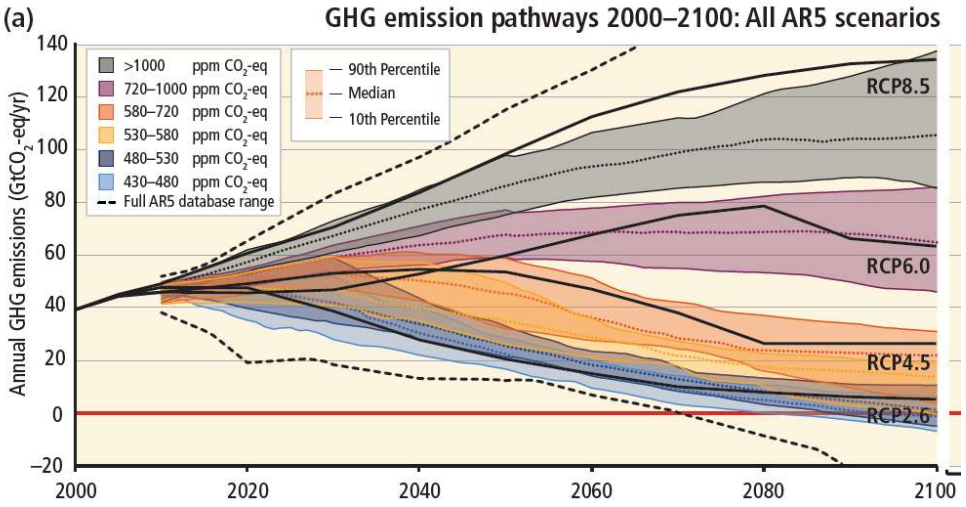
Source: IPCC

Emissions Trajectories into the Future



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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**

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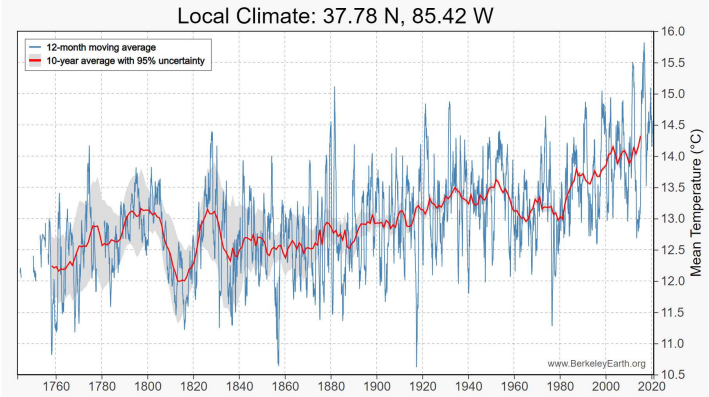
These Changes Are Already Underway

Use http://berkeleyearth.lbl.gov/city-list/ to see the temperature history of a city!

Here's Louisville, KY.



Data Table | Download Image

Climate Stripes

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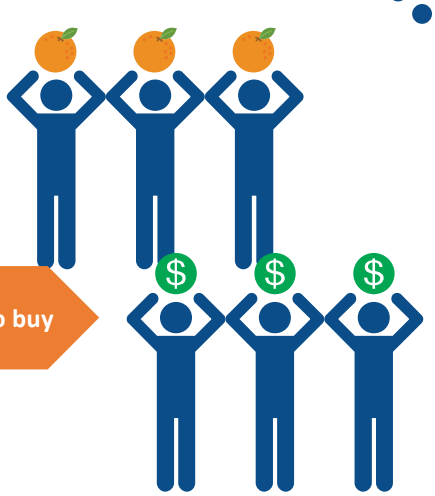
How Much Pollution Does Society Want? Analogy: How Many Oranges Does Society Want?

- 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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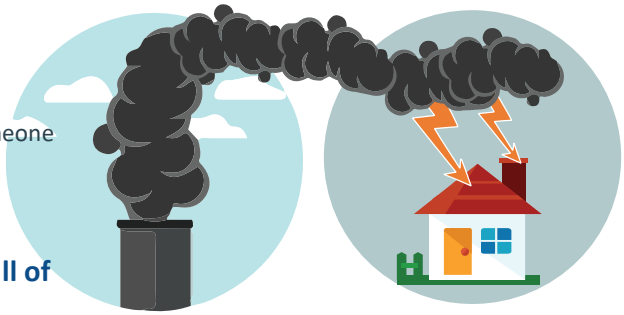
Electricity Is Different From Oranges

- **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.



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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: ~$51 per metric ton of CO_2.**
  - About $157/car per year.
  - $32 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.

Examples of Externalities

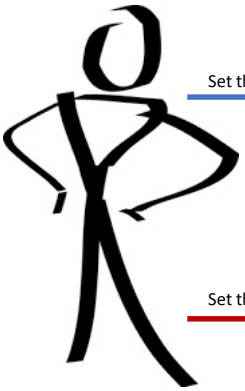
- **Negative Externalities:**
  - Heating your house
  - Smoking
  - Getting a dog
  - Pig farming
- **Positive Externalities**
  - Education
  - Growing apples
  - Getting a vaccination
  - Basic scientific research

Addressing a Negative Externality

$.14/Kwh

Social cost = $.02/Kwh

$.16/Kwh



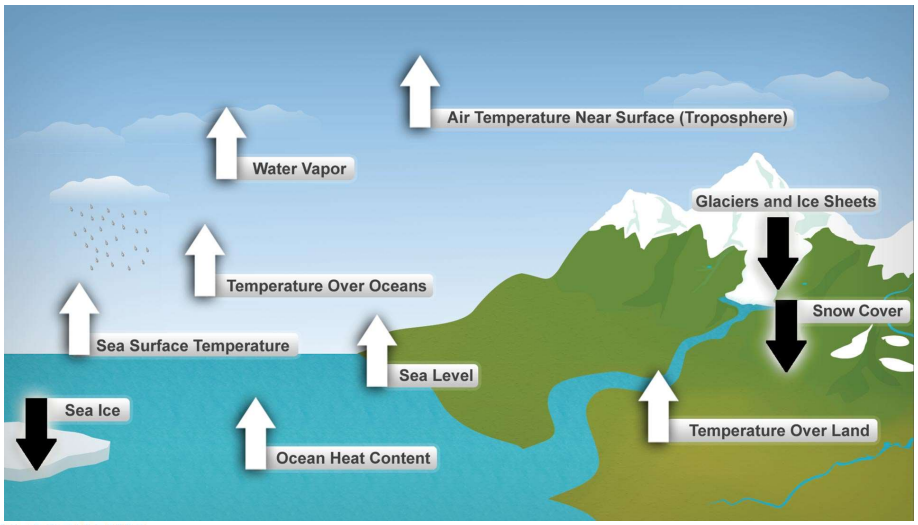
Set thermostat to: 68 degrees

Set thermostat to: 65 degrees

The social cost of $.02/Kwh has been INTERNALIZED.

Impacts of Climate Change

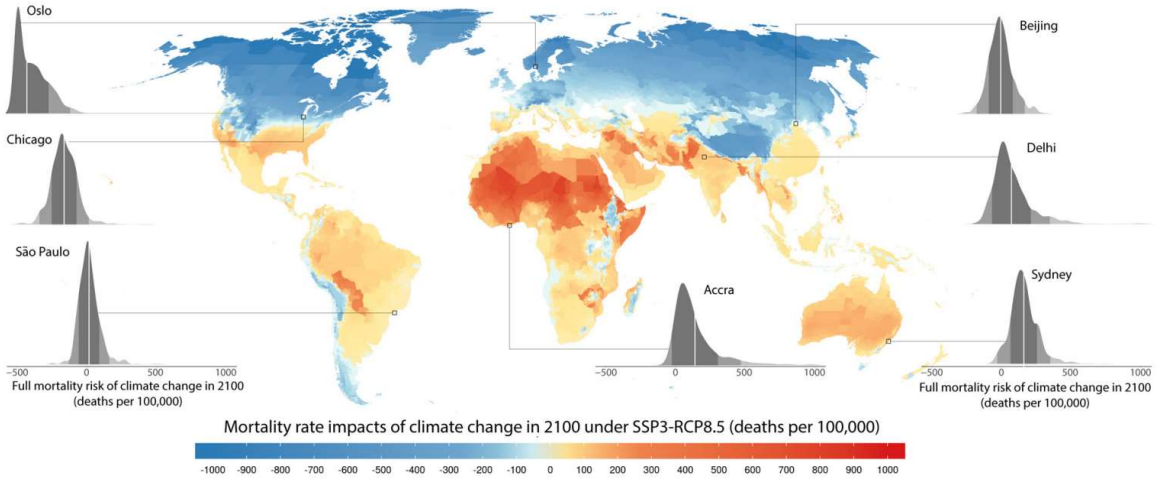
Global Warming Indicators



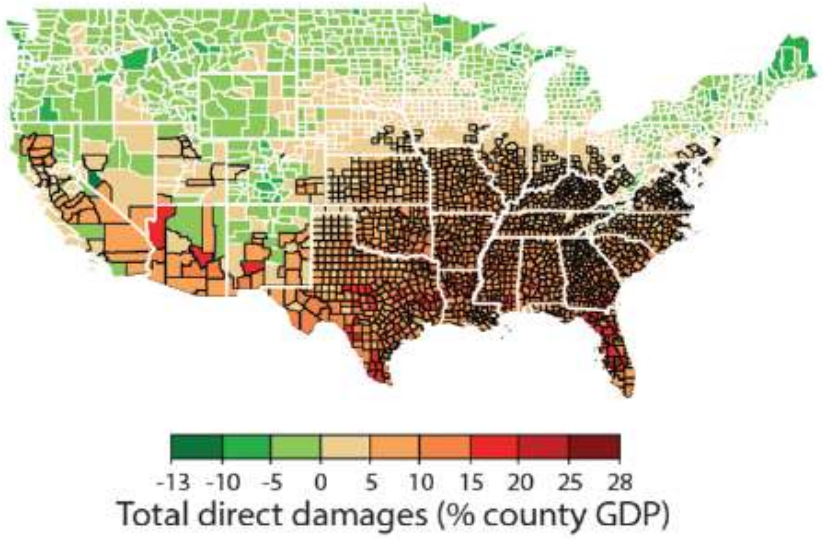
How These Impacts Affect Humans

- 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

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.

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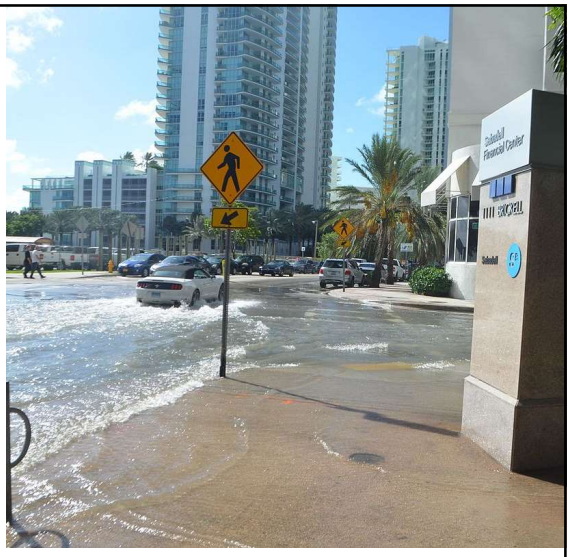
Real Estate Markets

- Sea level rise
- Wildfire risk
- Extreme weather events
  - Hurricanes
  - Extreme rainfall
  - Drought
- Water supplies, electricity reliability
- Residential markets affected
- Turnover leading indicator



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Individual-Level Adaptation

- **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.

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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**
- **Supporting low-income and vulnerable populations**
- **Moving residents of a town**

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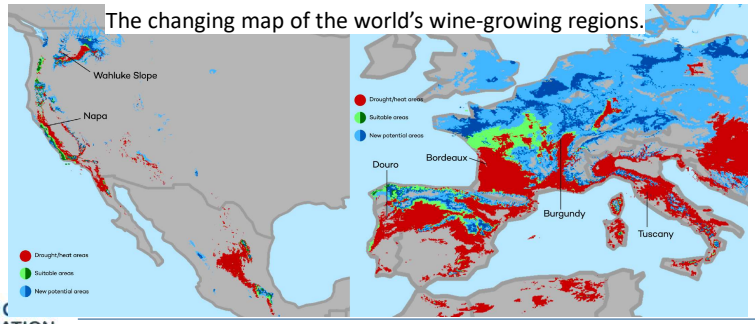
Market-Based Adaptation

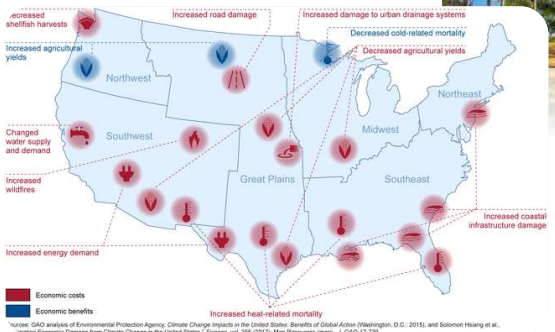
- **Prices and costs influence behavior.**
  - Where to live.
  - Where/when/what to plant.
- **Avoid barriers to market adjustment.**
  - Trade barriers, immigration restrictions, federal flood insurance, agricultural subsidies, and zoning regulations.

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



Most Vulnerable People and Places

- **Tropical areas**
- **Low-lying coastal areas**
- **Low-income people**



Projected Effects Vary Across the U.S. but Are Estimated at 1.2% of GDP per 1C Increase

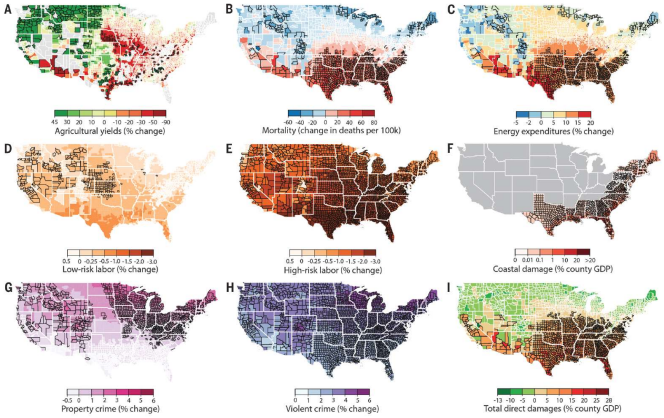


Fig. 2. Spatial distributions of projected damages. County-level median values for average 2080 to 2099 RCP8.5 impacts. Impacts are changes relative to counterfactual "no additional climate change" trajectories. Color indicates magnitude of impact in median projection; outline color indicates level of agreement across projections (thin white outline, inner 66% of projections disagree in sign; no outline, ≥83% of projections agree in sign; black outline, ≥95% agree in sign; thick white outline, state borders; maps without outlines shown in fig. S2). Negative damages indicate economic gains. (**A**) Percent change in yields, area-weighted average for maize, wheat, soybeans, and cotton. (**B**) Change in all-cause mortality rates, across all age groups. (**C**) Change in electricity demand. (**D**) Change in labor supply of full-time-equivalent workers for low-risk jobs where workers are minimally exposed to outdoor temperature. (**E**) Same as (D), except for high-risk jobs where workers are heavily exposed to outdoor temperatures. (**F**) Change in damages from coastal storms. (**G**) Change in property-crime rates. (**H**) Change in violent-crime rates. (**I**) Median total direct economic damage across all sectors [(A) to (H)].

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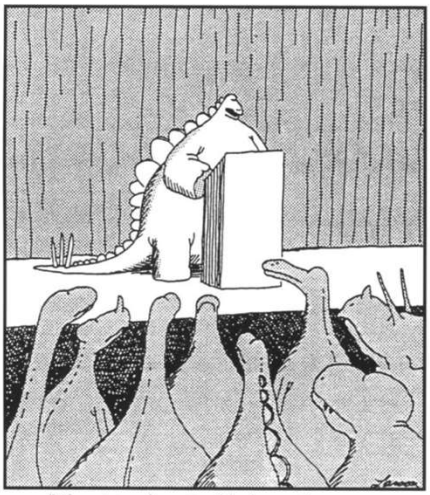

"The picture's pretty bleak, gentlemen. … The world's climates are changing, the mammals are taking over, and we all have a brain about the size of a walnut."

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Economics of Responding to Climate Change

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International Climate Policy Goals

- **Intergovernmental Panel on Climate Change (IPCC)**
  - Global effort to fight climate change
  - Reports on consensus of climate science, including economics
- **IPCC report in 2007:**
  - Recommended goal: < 2 degrees C (3.6 degrees F)
  - Industrialized countries should reduce GHG emissions between 25% and 40% below 1990 levels by 2020.
- **2016 Paris Agreement:**
  - Basic goal of 2 degrees C: requires 40-70% GHG reduction 2010 → 2050
  - Reach goal of 1.5 degrees C: requires 70-95% GHG reduction 2010 → 2050
- **IPCC report in 2018:**
  - Temperature has already increased by 1.0 degrees C - Recommended: < 1.5 C

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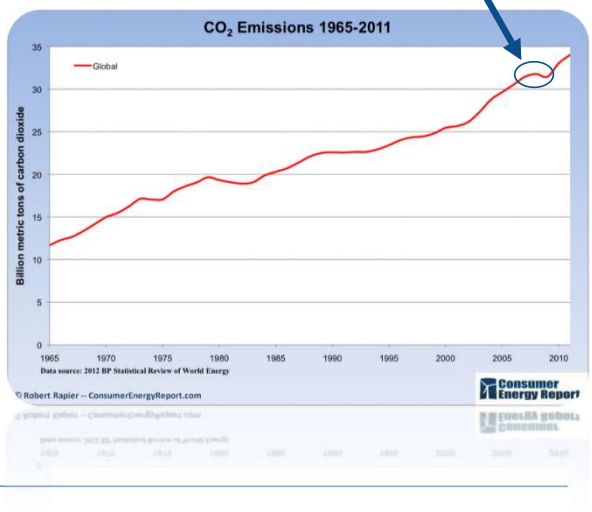
Recent Progress on Climate Goals

- **IPCC's Fifth Assessment Report (2014)**
  - Goals from previous report (2007) were met!
  - … but mainly because of the Great Recession…
  - … which is not the preferred method of reducing emissions.



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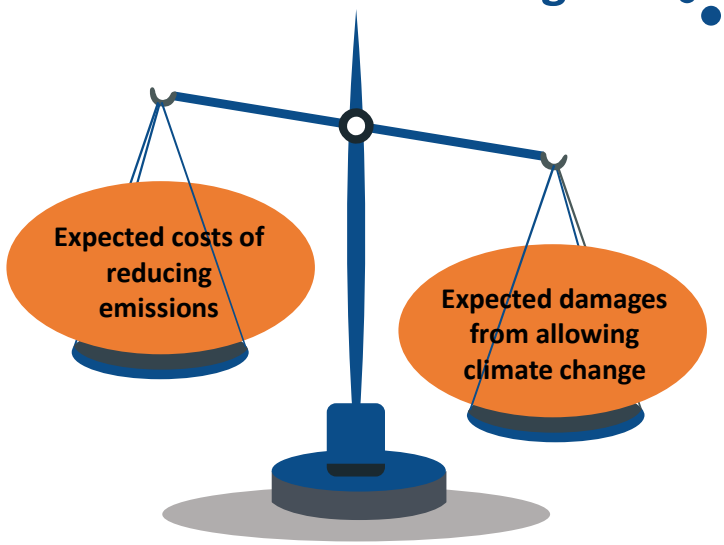
How Economists Decide How Much to Fight Climate Change

- **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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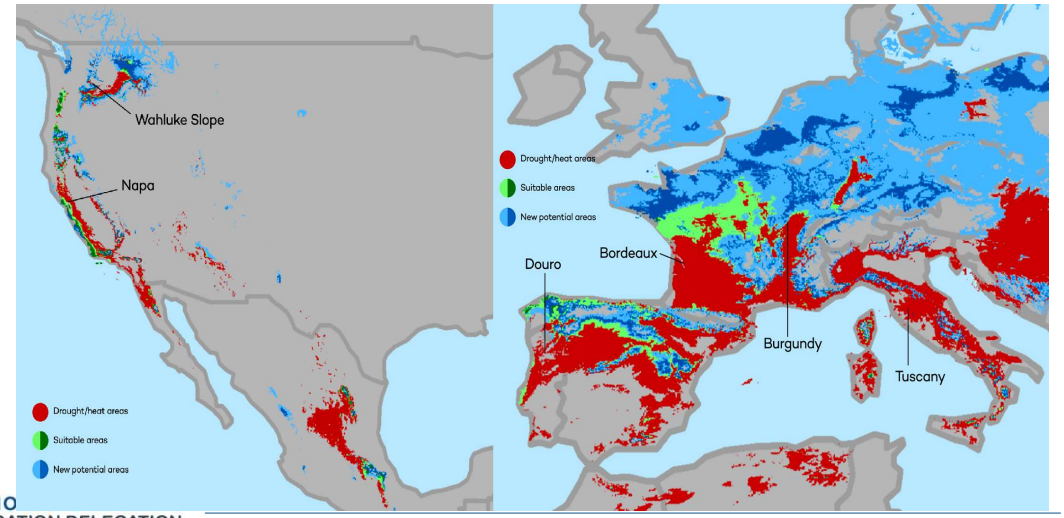
This is What Precisely Wrong Looks Like

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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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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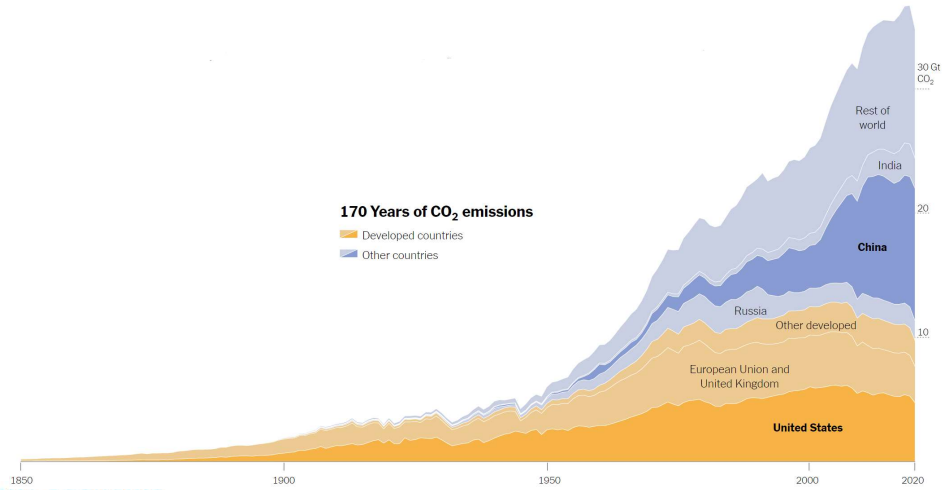
Sources of the Global Flow of Emissions



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Sources of the Global Stock of Emissions

23 rich, developed countries are responsible for half of all historical CO_2 emissions.

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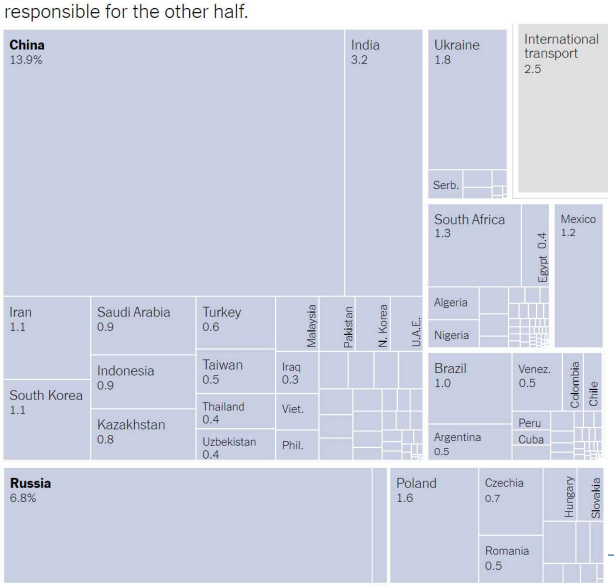
Sources of the Global Stock of Emissions

More than 150 countries are responsible for the other half.



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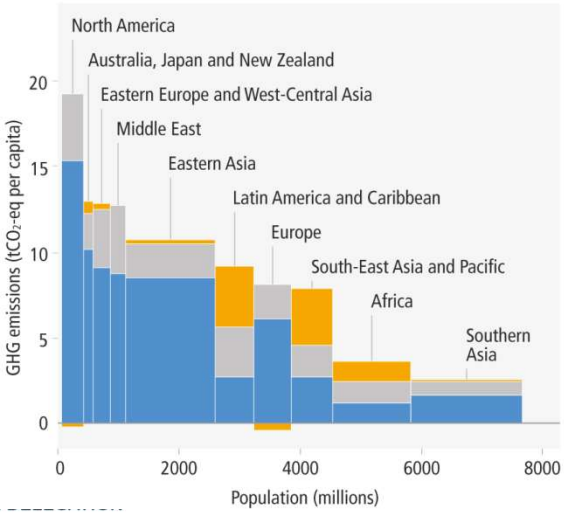
How Does This Look Per Capita (Per Person)?

c. Net anthropogenic GHG emissions per capita and for total population, per region (2019)



Fossil fuel and industry (CO_2FFI)

Net CO_2 from land use, land use change, forestry (CO_2LULUCF)

Other GHG emissions

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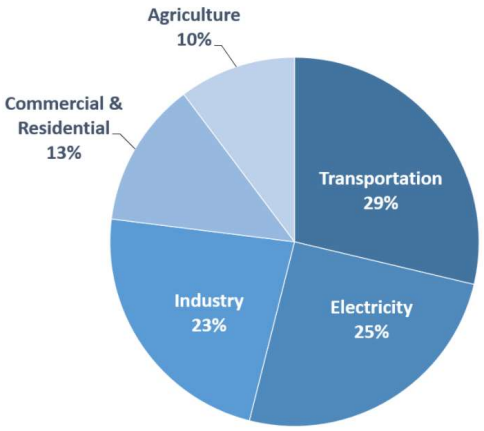
Total US Greenhouse Gas Emissions by Economic Sector in 2020



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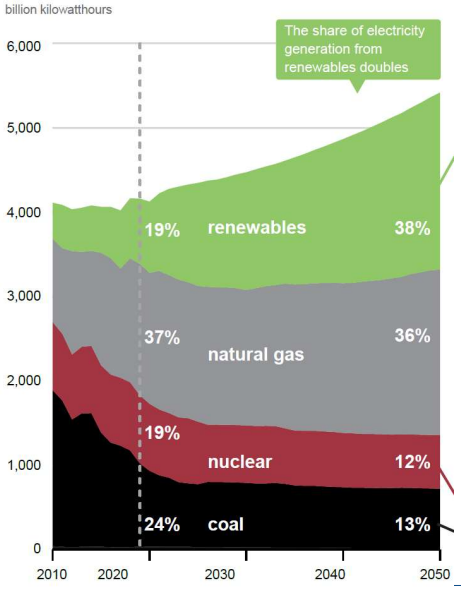
Total Emissions in 2019 = 6,558 Million Metric Tons of CO2 equivalent. Percentages may not add up to 100% due to independent rounding.

U.S. Electricity Sources



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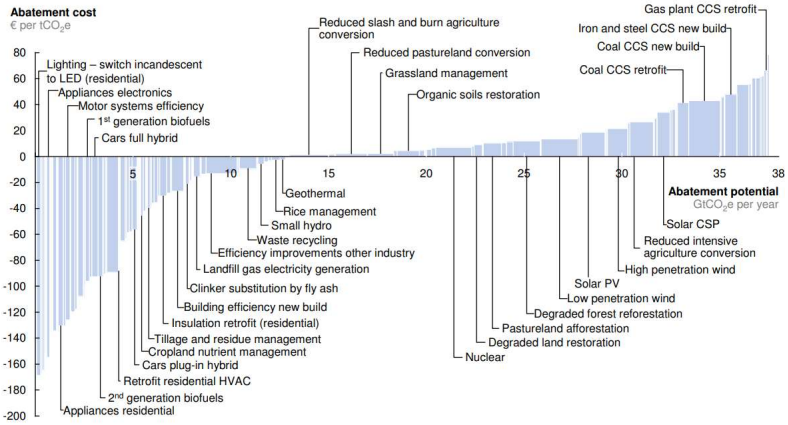
Which Emissions Should We Cut?

- 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

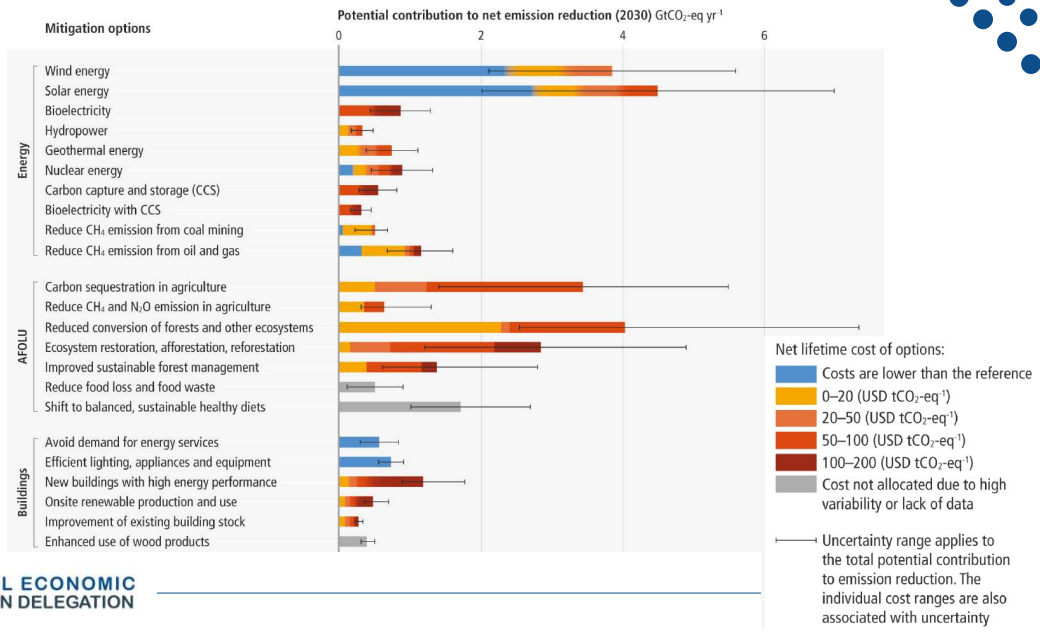
(Don't trust these numbers, this is just to show the idea)

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 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

Newer Estimated Abatement Cost Curve



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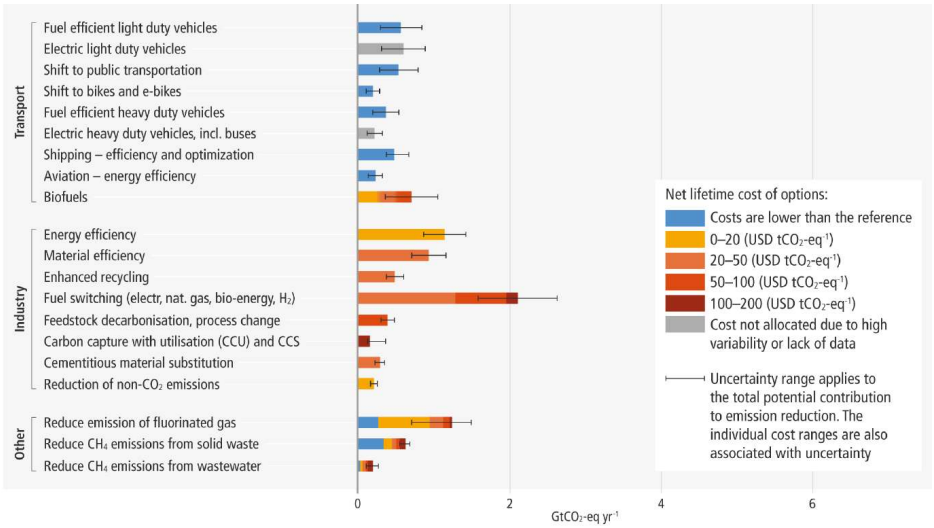
Newer Estimated Abatement Cost Curve



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Costs and Barriers Can Be Difficult 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

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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

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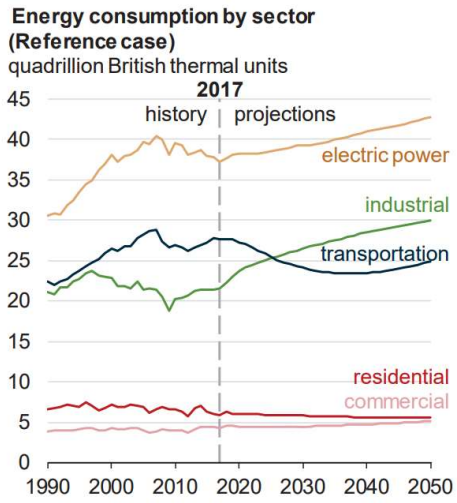
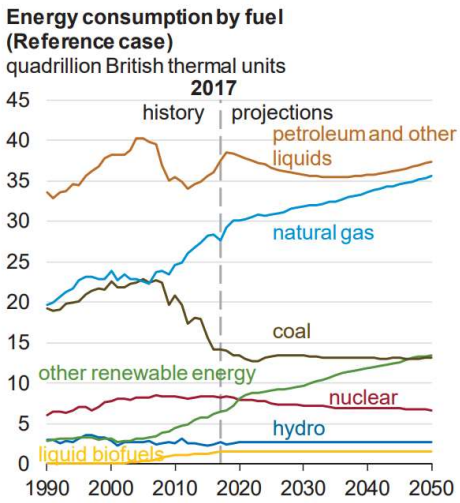
Fossil Fuels Dominate U.S. Energy Production





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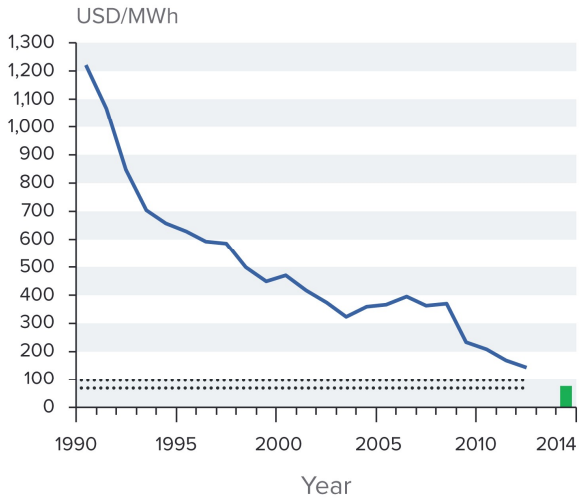
Indicative Solar Costs Over Time



Solar PV

Current fossil fuel range, indicative

Best utility-scale project, 2014

Note: *Solar PV costs can vary by ~50% or more up or down depending on solar resource and local non-technology costs, and even more with variations in capital and financing costs. Assuming 9.25% WACC, 17% capacity factor for solar PV, US$70/t coal price and US$10/MMBtu natural gas price. The estimated lowest 2014 utility-scale cost is based on a recent power purchasing agreement by Austin Energy, Texas (adjusted for subsidies).*

Sources: *Historical solar PV costs: Channell et al., 2012, and Nemet, 2006; illustrative fossil fuel range based on US LCOE for conventional coal from US EIA, 2014 (upper range) and capital cost assumptions from IEA, 2014 (lower range).*

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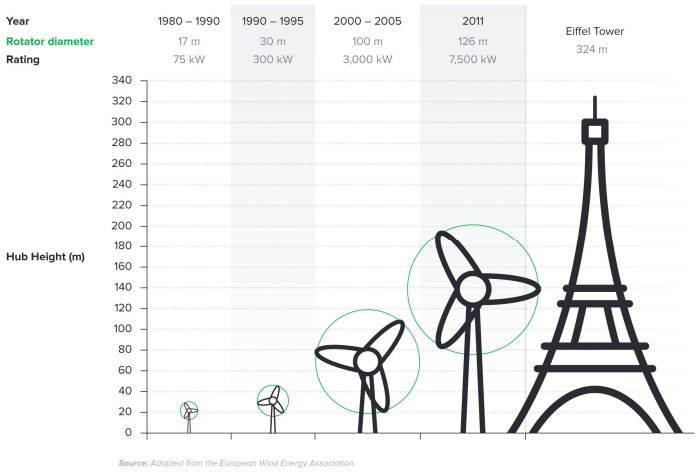
Wind Turbines Have 100 Times More Power Generation Capabilities Than 30 Years Ago



Source: Adapted from the European Wind Energy Association.

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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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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.

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.

How Does a Carbon Tax Work?

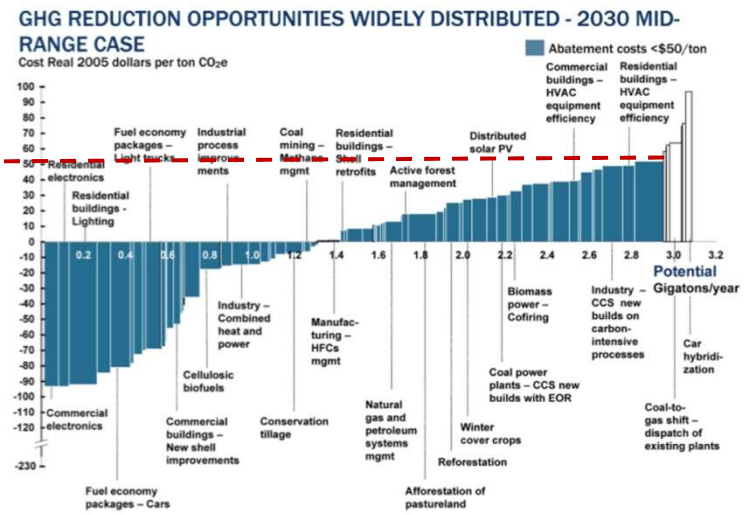
- **Choose activities to be covered (e.g., electricity sector, all emitters, etc.).**
- **Set tax level.**
  - Optimally, it represents the social cost of polluting.
- **Polluters must pay a tax for every unit emitted.**
  - Polluters with **low** abatement costs will **abate** to avoid the tax
  - Polluters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



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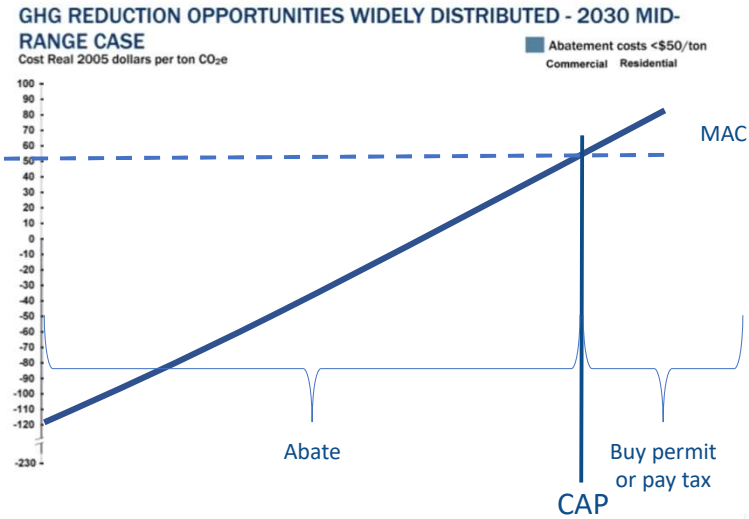
Putting a Price on Carbon

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.
  - 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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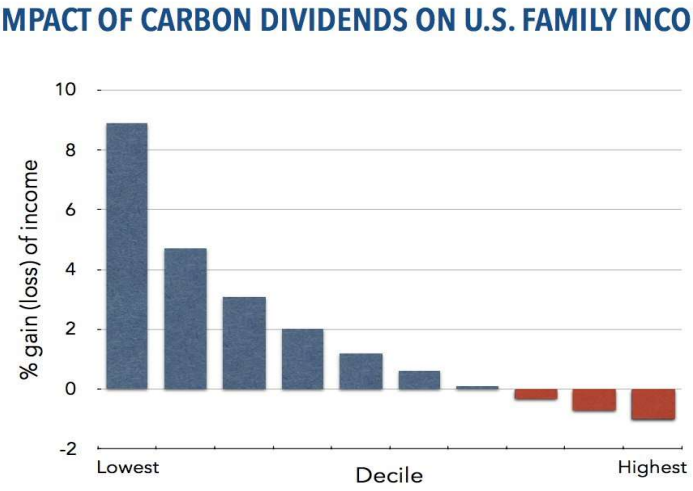
Revenue Dividend Eliminates Regressivity



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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	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.

Implications of a $50/ton Price on Carbon

- **A doubling of the price of coal-fired electricity.**
  - Makes solar, wind, and nuclear much more attractive from a cost perspective.
- **Add $230/year to the cost of driving a gasoline-powered car.**
  - Makes walking, biking, carpooling, public transportation much more attractive.
- **Add $1/year to the cost of banking services.**
- **The current average price of carbon emissions is just $2.**
  - This…has virtually no effect.

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

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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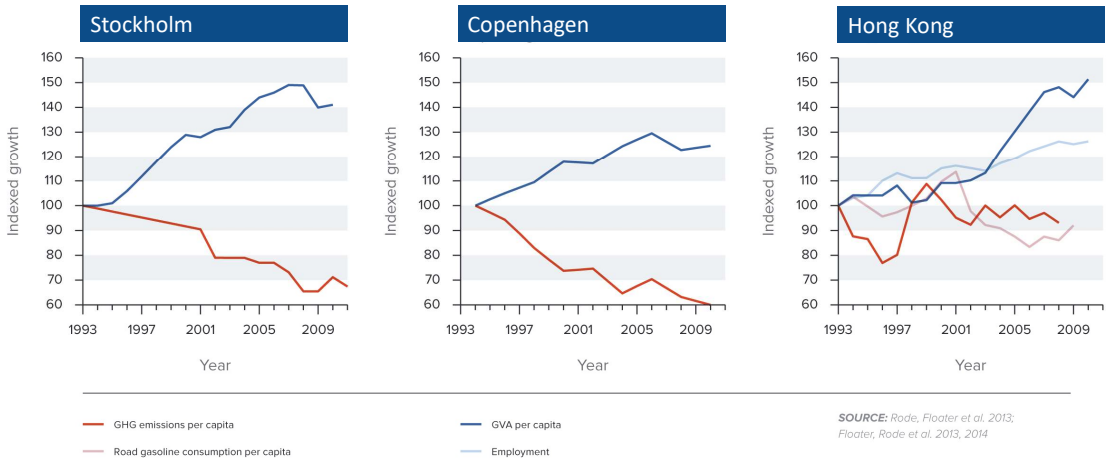
Source: New Climate Economy Report, 2014

Compact and Connected Urban Pathways Can Go Hand-in-hand with Economic Growth



SOURCE: *Rode, Floater et al. 2013; Floater, Rode et al. 2013, 2014*

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Climate Change Policy in Action

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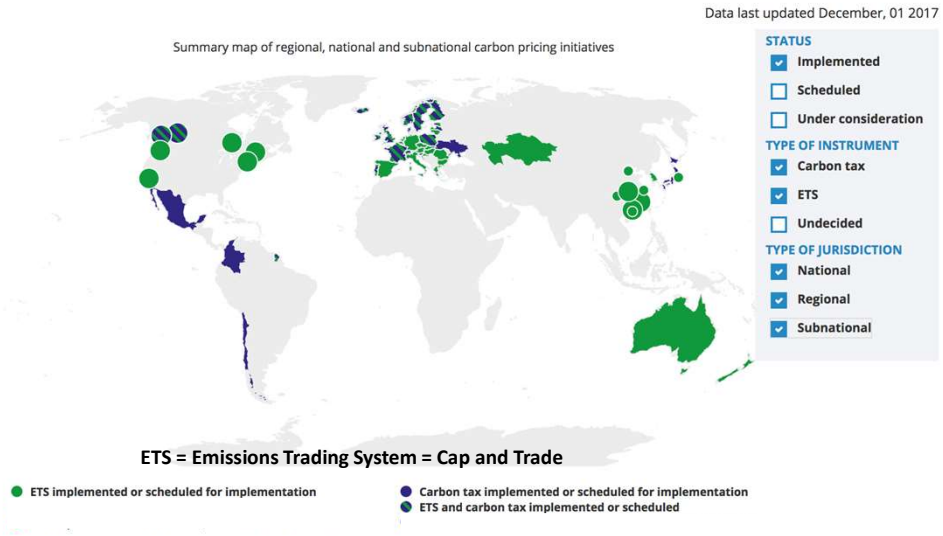
Carbon Policies Across the World



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Source: World Bank Carbon - Pricing Dashboard

Cap and Trade

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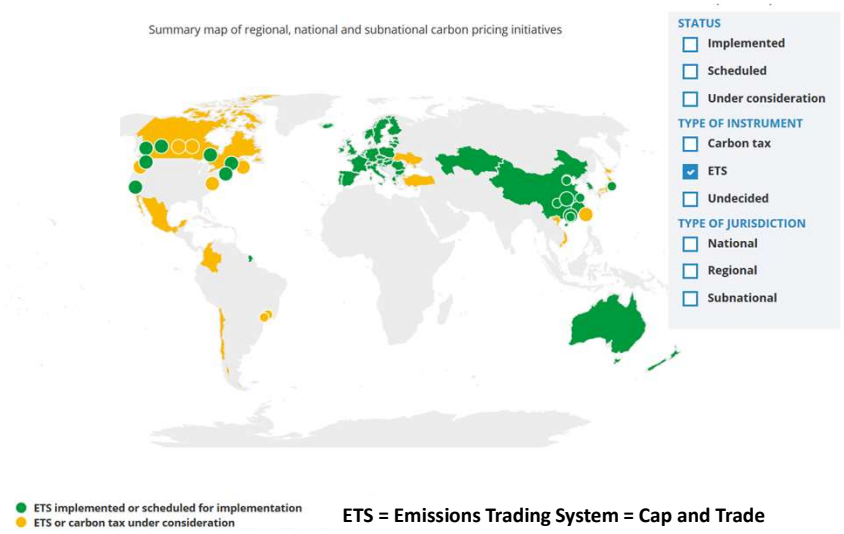
Cap and Trade Policies Around the World



ETS = Emissions Trading System = Cap and Trade

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Source: World Bank - Carbon Pricing Dashboard

European Union's Emissions Trading Scheme

4%

of global greenhouse gas emissions Circa 2005

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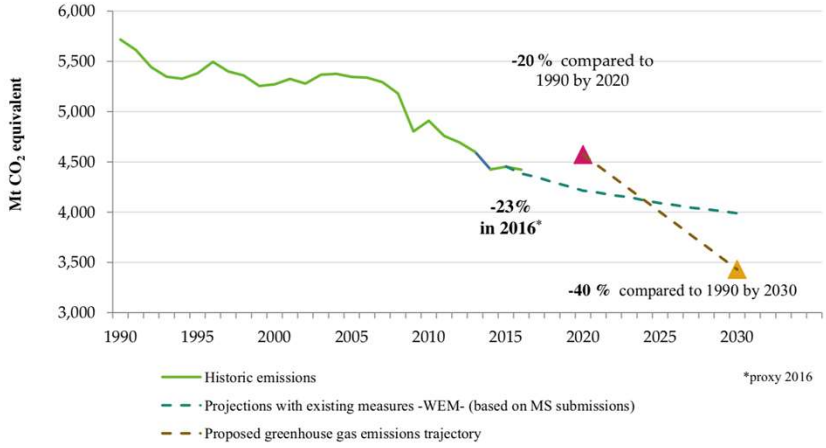
Progress Towards Meeting Europe 2020 And 2030 Targets (EU Total GHG Emissions)



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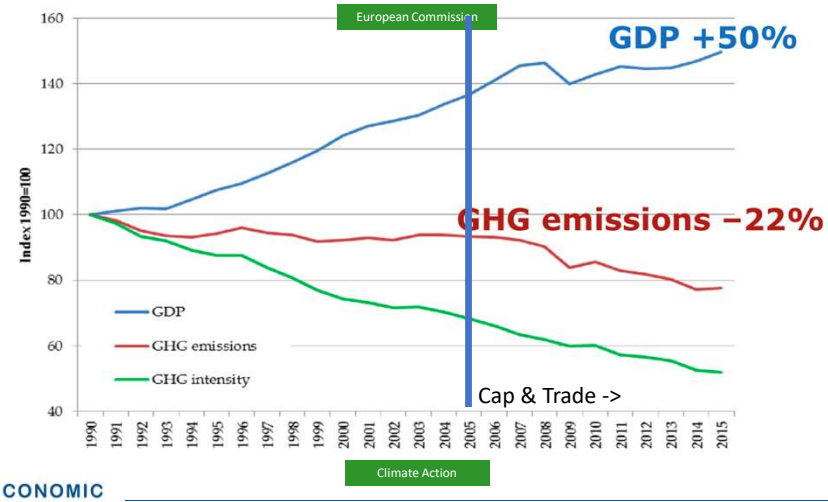
EU Has Decoupled Economic Growth from Greenhouse Gas Emissions



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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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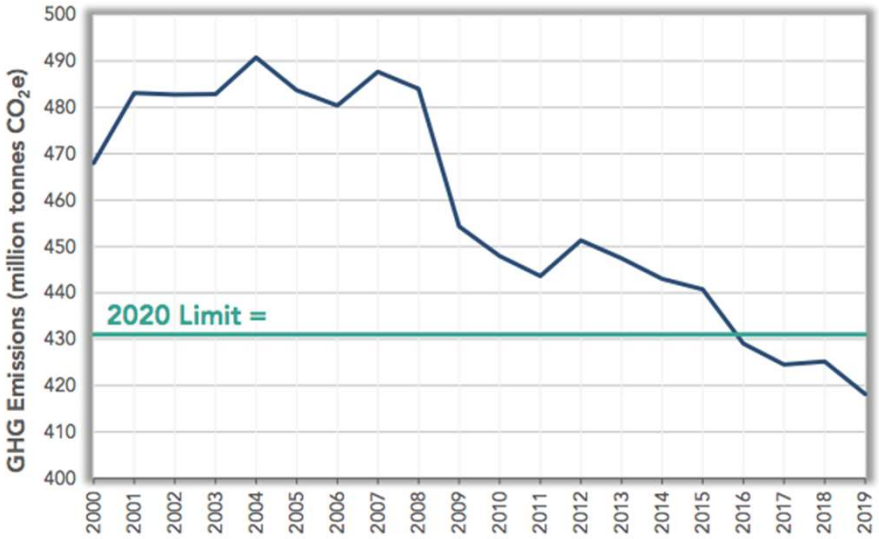
CA Relative to Goals: How Are We Doing?



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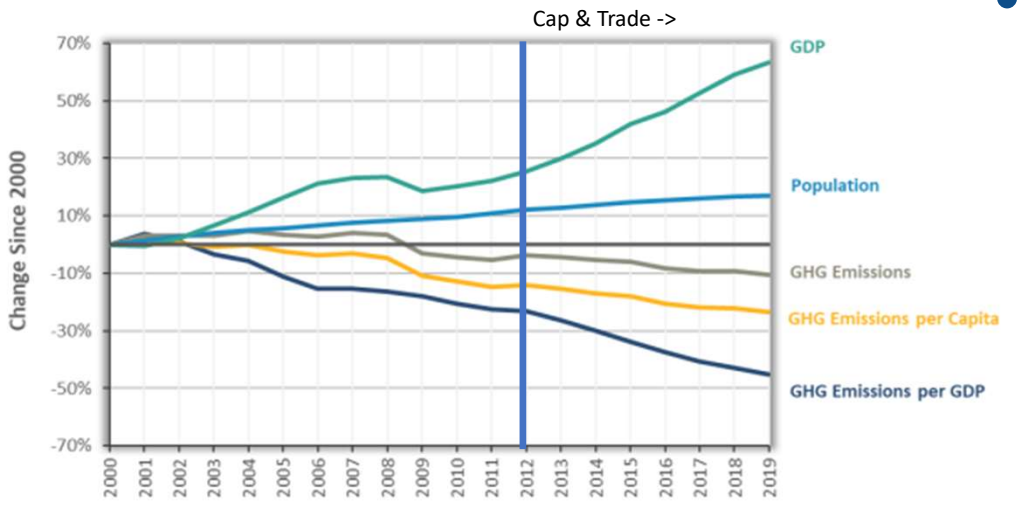
Change in California GDP, Population, and GHG Emissions since 2000



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Source: CA Air Resources Board

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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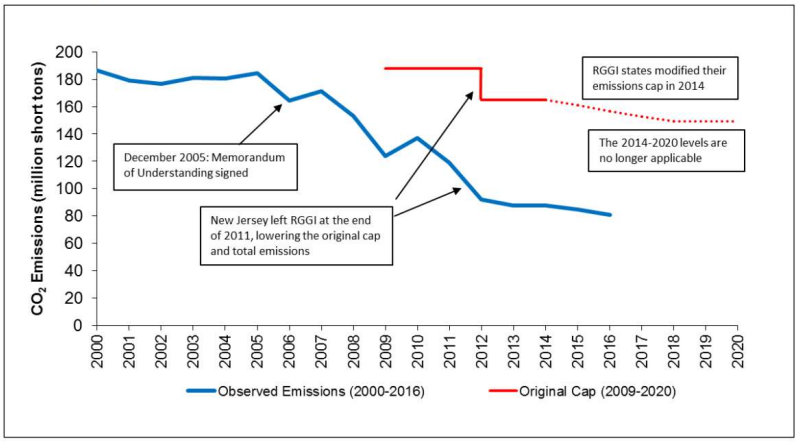
RGGI's Effect on Emissions

Figure 1. 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.

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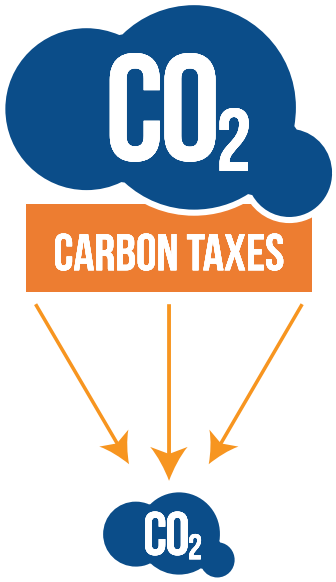
Carbon Tax



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Worldwide Carbon Taxes

28
carbon tax programs

25
national jurisdictions covered

5.5%
of global greenhouse gas emissions

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British Columbia's Carbon Tax Policy

0.1%

of global greenhouse gas emissions

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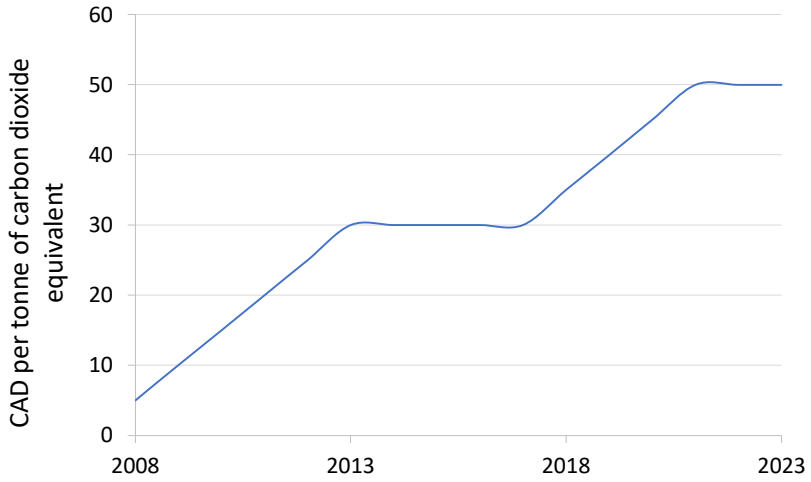
> **"Tax the pollution we do not want, and return the money for what we do want — money in people's pockets, jobs and investment."**
>
> - B.C. Government - Carbon Tax Brochure

British Columbia's Tax on Carbon



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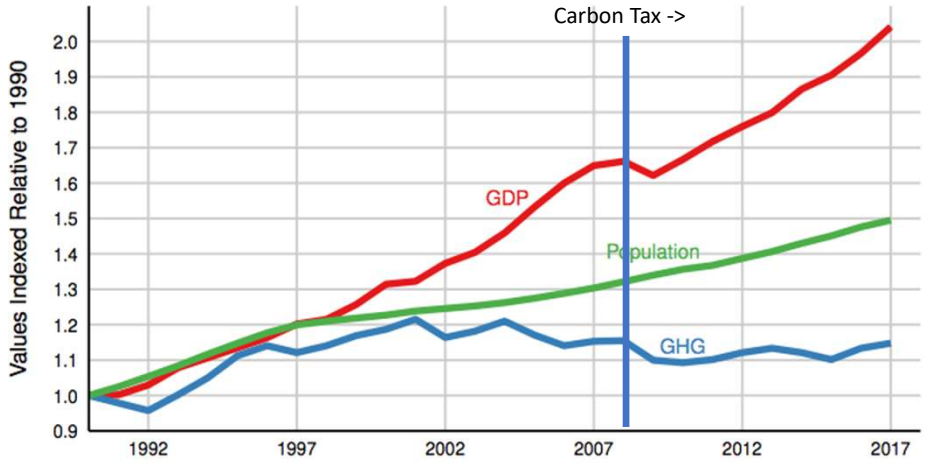
Relative Greenhouse Gas Emissions, GDP & Population Size: British Columbia



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Sweden's Carbon Tax Policy

Oldest Carbon Tax

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Sweden's Carbon Tax Policy

Started in 1991

Currently at $140/ton

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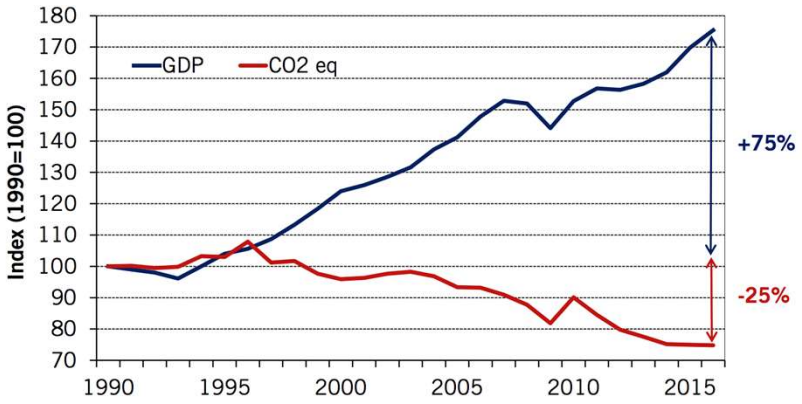
Real GDP and Domestic CO_2eq Emissions[1] In Sweden, 1990-2016



[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

- 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 celsius.
  - *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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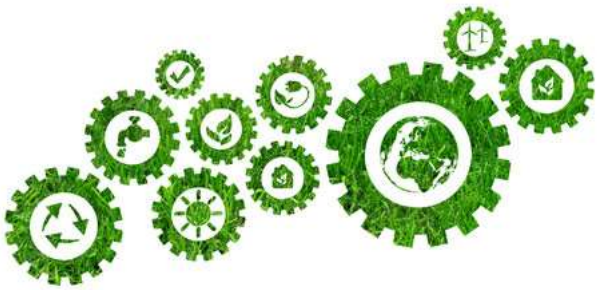
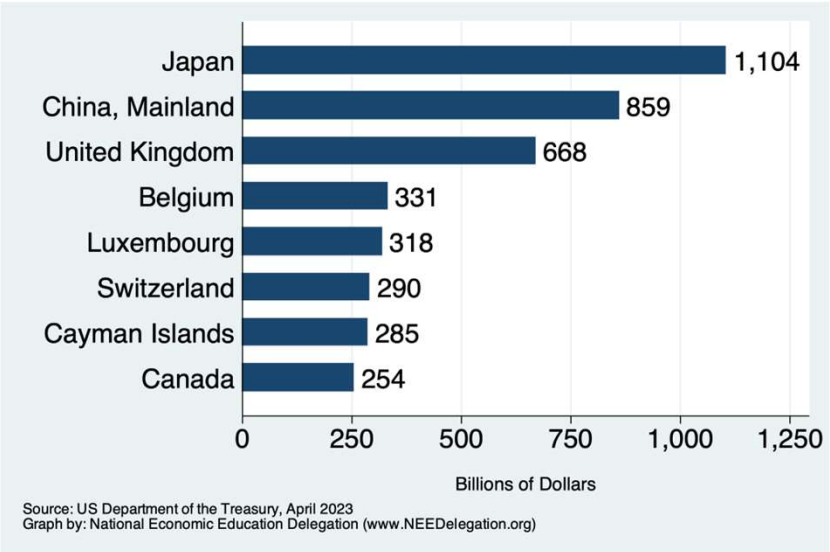


> **“Economic policies will be central to accomplishing the goals we choose.”**
>
> - Harris and Roach (2007)

Next week: Who Holds US Debt?



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https://ticdata.treasury.gov/Publish/mfh.txt

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Thank you!

Any Questions?

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