


Climate Change Economics

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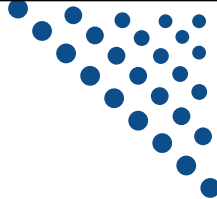
January 10, 2022




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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: 53 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: 585+ members**

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

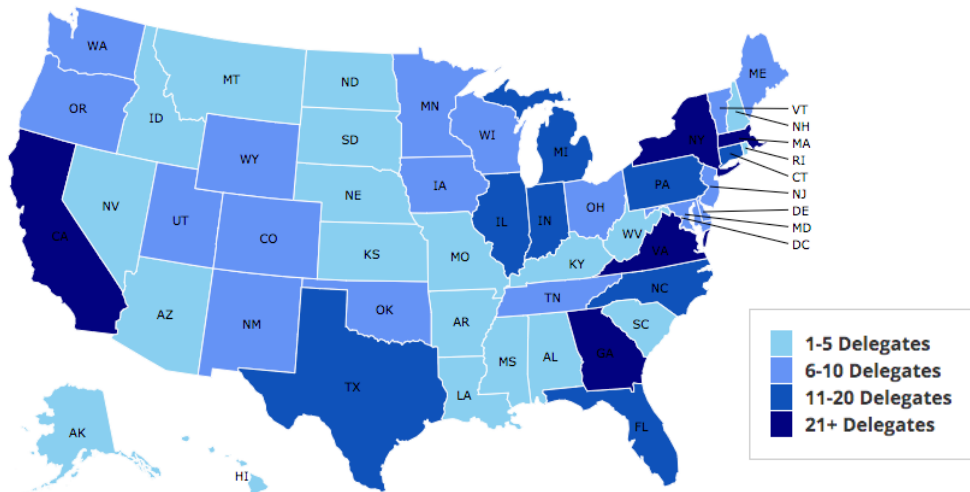
- **Global Partners: 45 Ph.D. Economists**

- 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:**
 - Shana Mcdermott, Trinity University
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- **This slide deck was reviewed by:**
 - Jason Shogren, University of Wyoming
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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).



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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**



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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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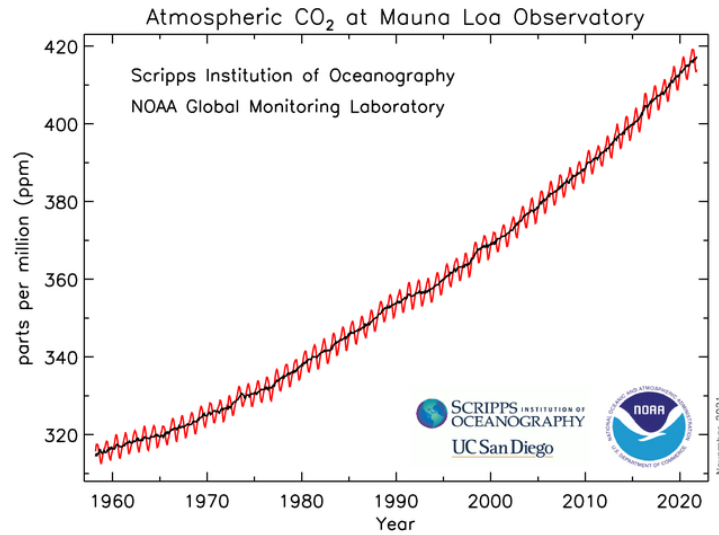


Climate Change Science



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Atmospheric CO₂ Concentrations

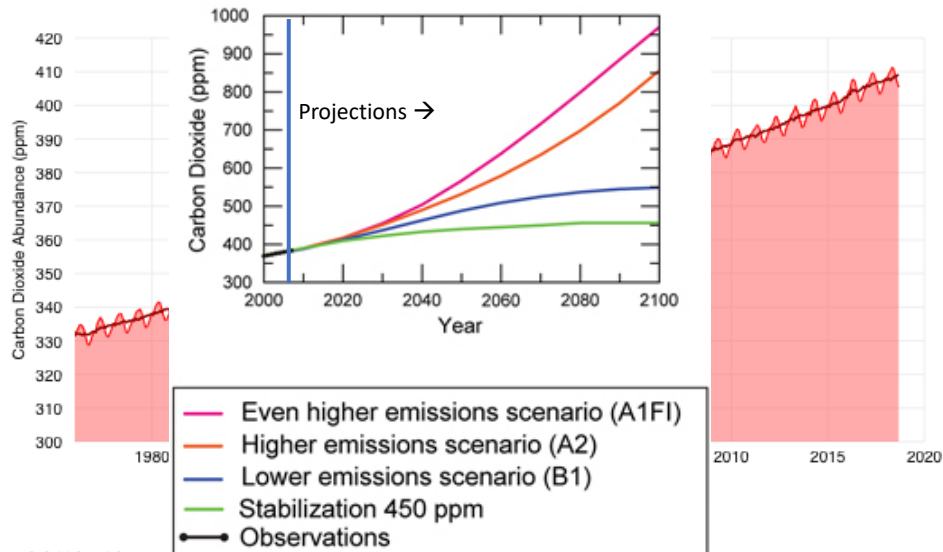


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Source: NOAA

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Atmospheric CO₂ Concentrations

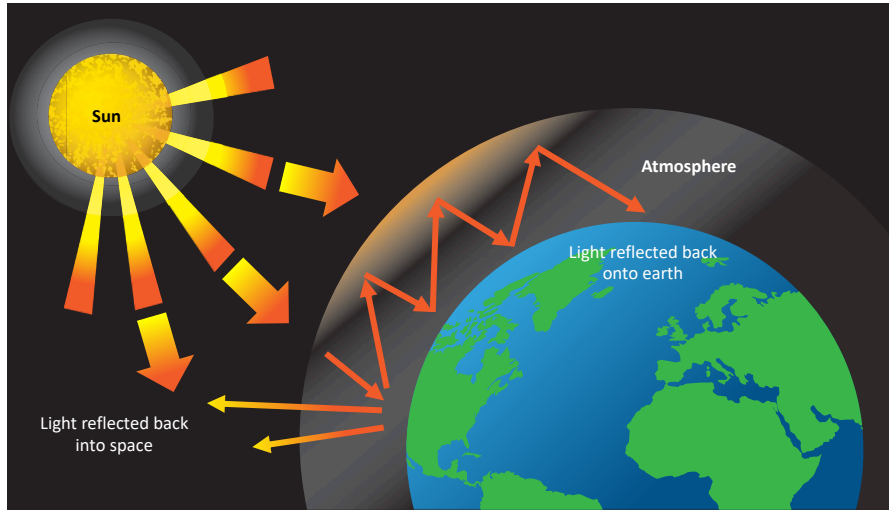


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Source: IPCC data distribution center
and climate.gov

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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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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.

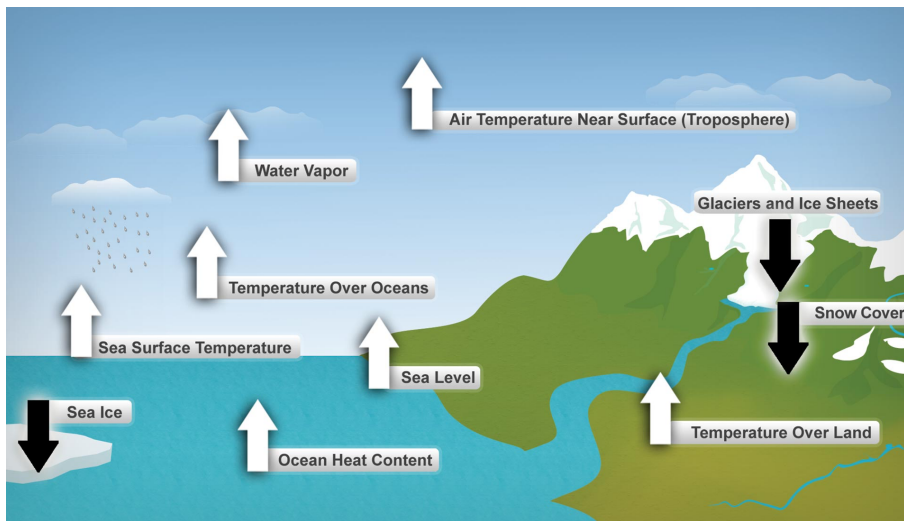


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Impacts of Climate Change

Global Warming Indicators

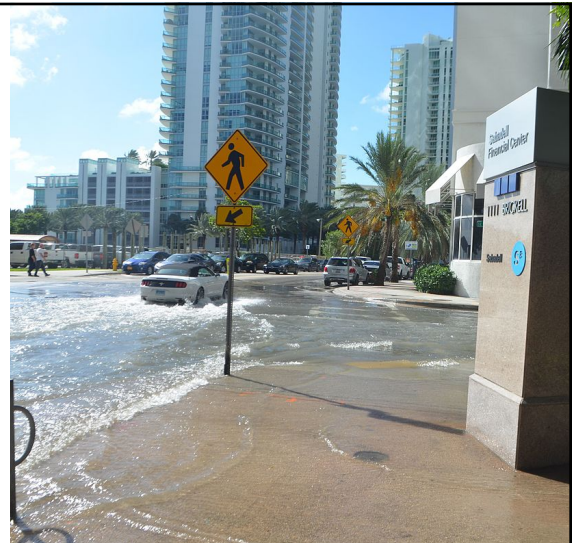


How These Impacts Affect Humans

- 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

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



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

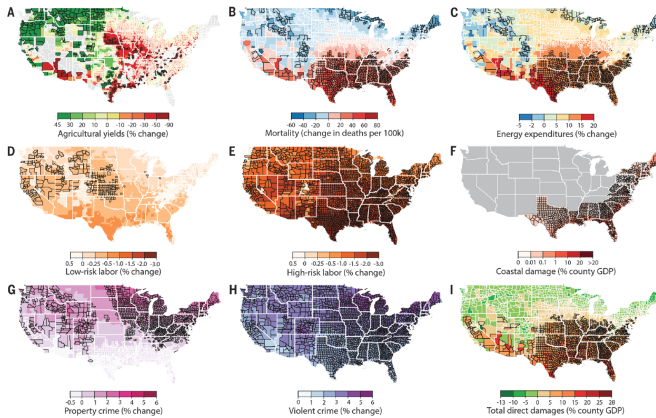


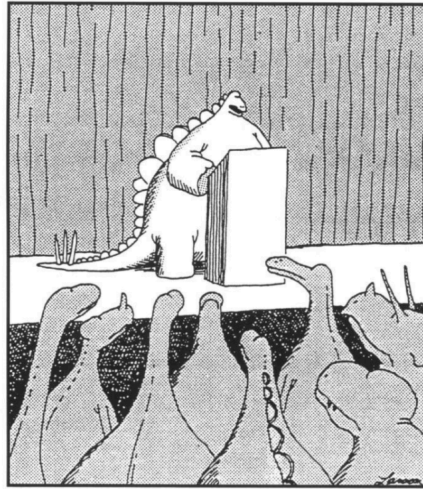
Fig. 2. Spatial distributions of projected damages. County-level median values for average 2080 to 2099 RCP8.5 impacts. Impacts are changes relative to counterfactual "no additional climate change" trajectories. Color indicates magnitude of impact in median projection; outline color indicates level of agreement across projections (thin white outline, inner 66% of projections disagree in sign; no outline, $\geq 83\%$ of projections agree in sign; black outline, $\geq 95\%$ 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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Adaptation Reduces Damages

- Human *adaptations* are costly actions that can reduce damages from climate change.
- The **net cost to society** is the **cost of adaptation** plus the **cost of the remaining damages**.
- People will take some actions on their own, up to the point where they find it worthwhile.
- Some responses require government involvement: large-scale actions or actions with shared benefits.
- Adaptation is already underway.

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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."

Economics of Responding to Climate Change

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, 4th report:**
 - 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 2021, Part 1 of 6th Report:**
 - “Unless there are immediate, rapid, and large-scale reductions in greenhouse gas emissions, limiting warming to 1.5°C will be beyond reach.” Ko Barrett, NOAA & IPCC Vice-Chair

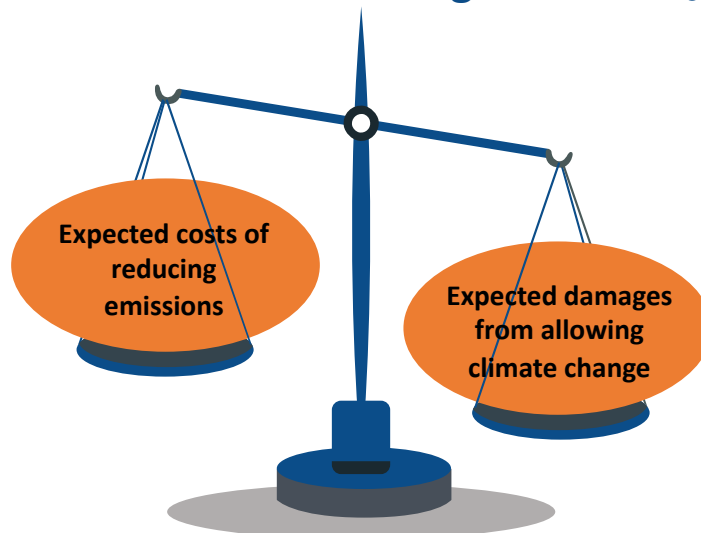


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How Economists Decide How Much to Fight Climate Change

- **Cost Benefit Analysis**
- **Weigh:**



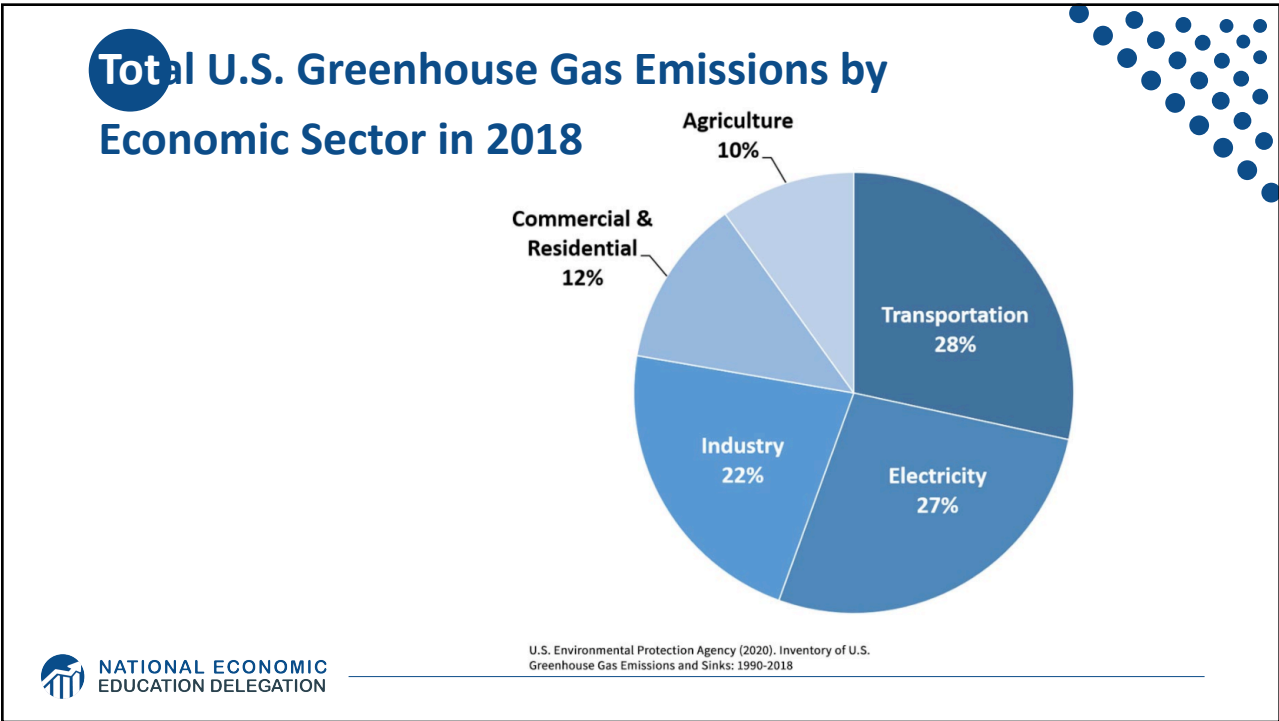
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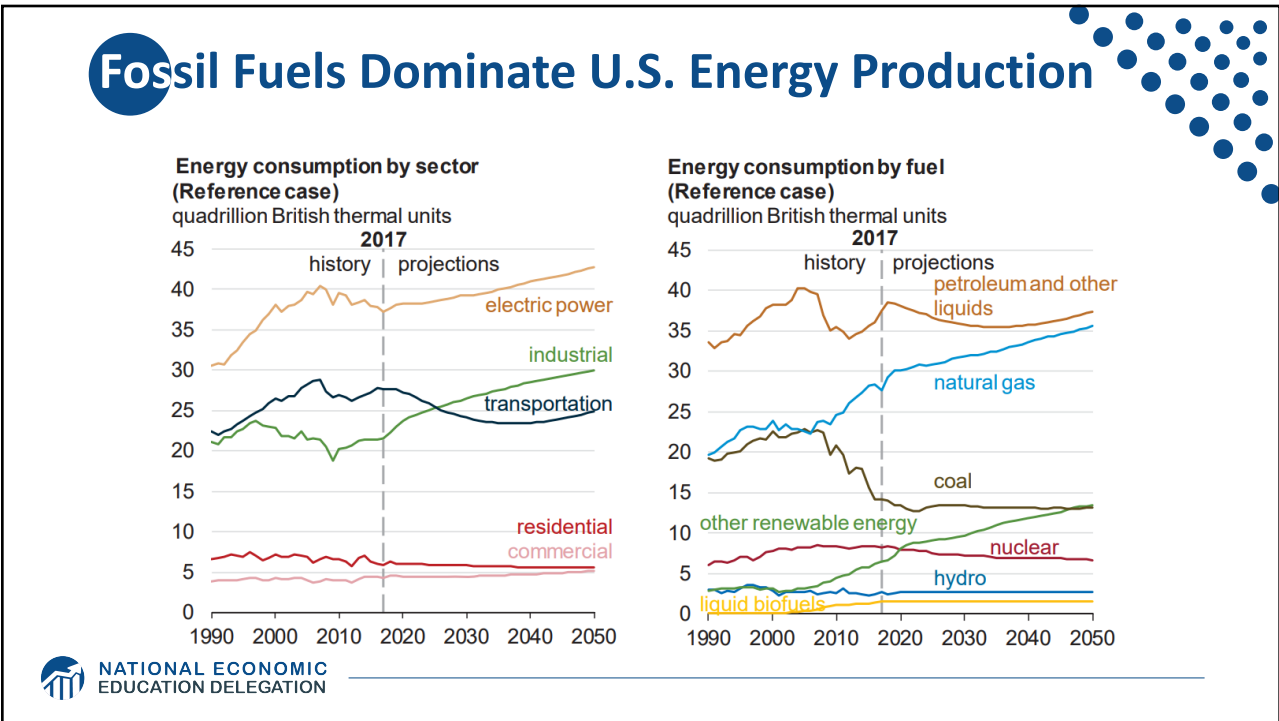
Economic Growth and Climate Change Action Are Compatible

- **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.**

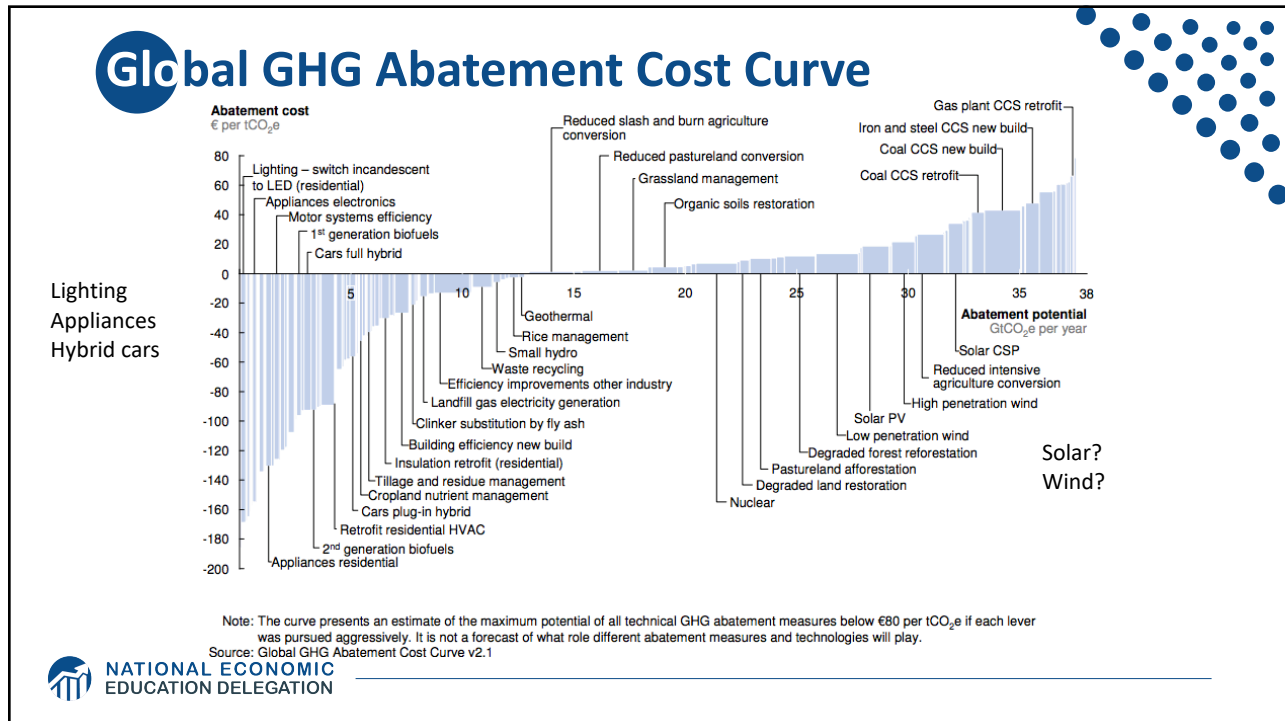
Addressing the Sources of Our Emissions



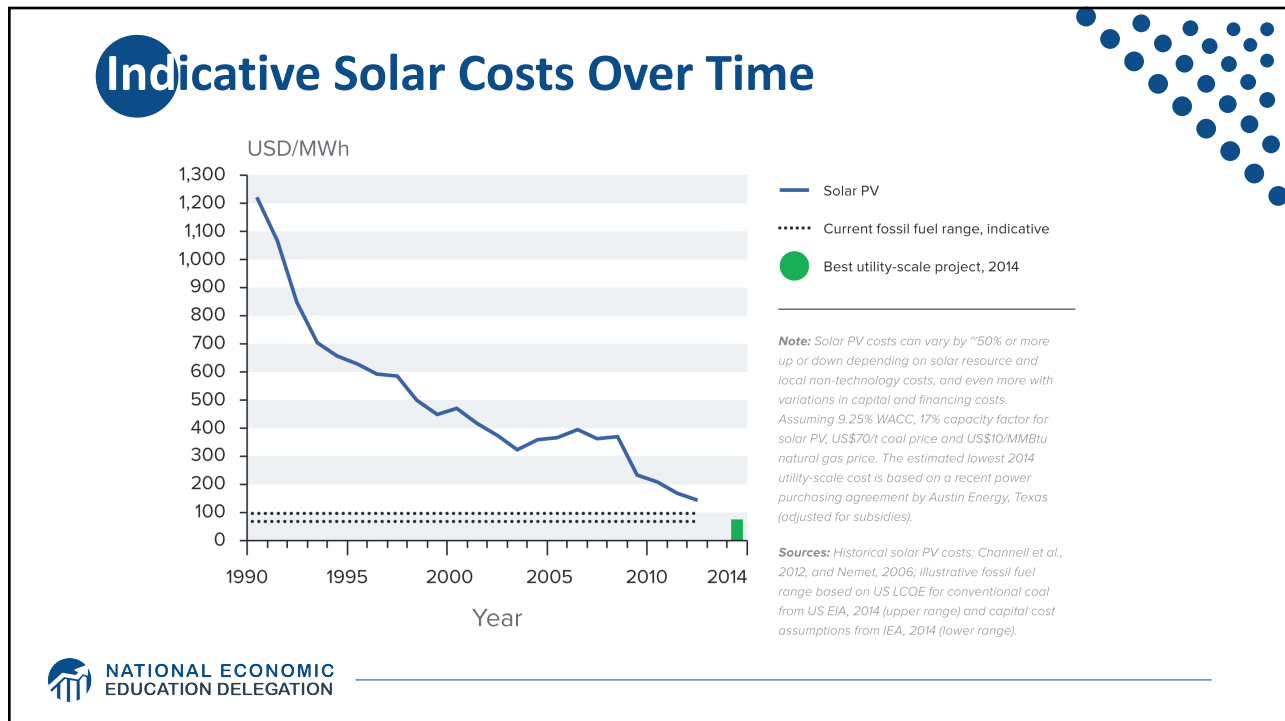
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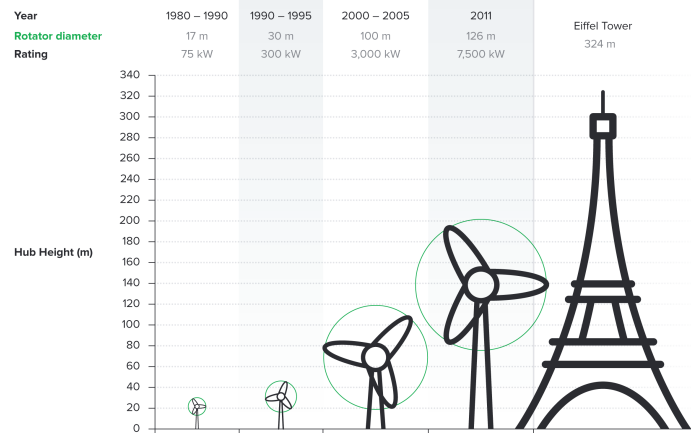


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Wind Turbines Have 100 Times More Power Generation Capabilities Than 30 Years Ago



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

- **Regulation**

- Emissions standards or limits
 - E.g., CAFE standards (CAFE: Corporate Average Fuel Economy)

- **Market-oriented policies**

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



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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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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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California's System Is Flexible

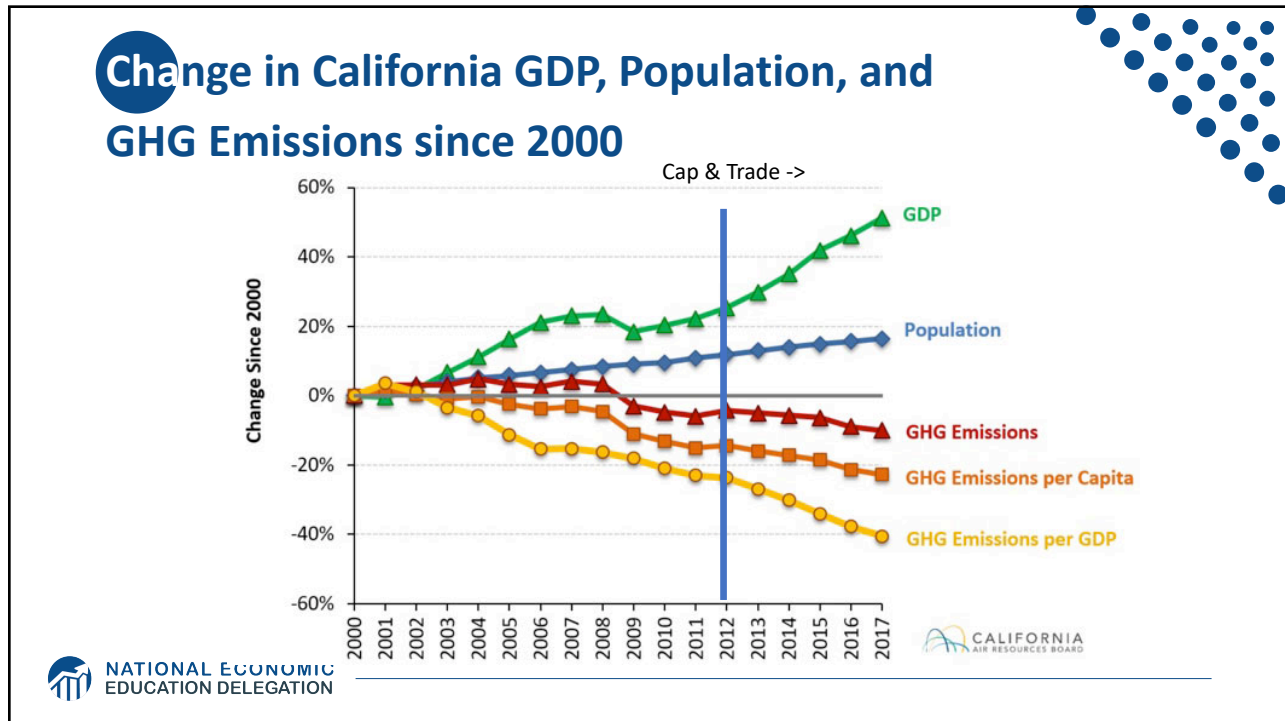


- **California's goals:**
 - Reduce emissions to 1990 levels by 2020
 - An 80% reduction in emissions from 1990 levels by 2030
- **California's Tools:**
 - Cap and Trade
 - Renewable Portfolio Standard
 - Clean Cars Program
 - Low Carbon Fuel Standard



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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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Thank you!

Any Questions?

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