Learning Objectives

Identify the need for policy action in dealing with climate change

Identify various policy pathways in response to the global climate change problem

Identify and understand market and non-market based environmental solutions
Climate Change

2017 was the hottest year on record without an El Niño, thanks to global warming

Climate scientists predicted the rapid rise in global surface temperatures that we’re now seeing

Terry P. Hughes, James T. Kerry, Shaun K. Wilson

L.A. lawmakers look to sue big oil companies over climate change — and the costs that stem from it
Why do we need environmental policy?

- TOC problem
- Negative externalities
- Justice
- Rights
- Equity

Source: National Oceanic and Atmospheric Administration
Why global action?

Source: http://www.carbonmap.org/#Emissions
Common but differentiated responsibilities but respective capabilities (CBDR-RC)

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Source: http://www.carbonmap.org/#Emissions
Tragedy of the Commons

Environment is a public good

Source: https://www.youtube.com/watch?v=WYA1y405JW0
Environmental Externalities

Scope of Externalities:

- Localized
- Regional
- Global
Market and non-market solutions

Geo-engineering - Intentionally modify natural systems

Mitigation - Reduce emissions

Climate Change

Adaptation - Limit impacts

Suffer - Business-as-usual
Policy Responses & Economic Analysis

Adaptation
- Afforestation, Open space preservation
- Land use changes, relocation
- Infrastructure protection, Building design
- Flood mitigation
- Emergency Response
- Business Continuity plans
- Community engagement

Mitigation
- Energy efficiency
- Renewable energy
- Combined heat and power
- Sustainable transportation
- Methane capture
- Industrial process improvements
- Building Weatherization
- Water and Energy Conservation
- Protect Sustainable Transportation
- Power System Resilience
- Green Infrastructure

Source: Center for Clean Air Policy

https://globalchange.mit.edu
Cost Benefit Analysis (CBA)

Cost of policy actions to stabilize or reduce CO2 emissions compared to the cost of consequences with the increase of emissions.

Benefits of policy must be equal or greater than the value/cost of projected consequences.

https://globalchange.mit.edu
Determining Valuation

**Stated Preference:** Contingent Valuation

Individuals willingness to pay for a certain good or service (i.e. share the costs of mitigating climate change)

**Revealed Preference:** Hedonic Pricing

Equates the value of non-market goods and services to the difference in price between two marketed products that differ only with regard to the non-market goods and services of interest (i.e. real estate prices that change per climate shifts).
Estimating Costs and Benefits

**Marginal abatement costs**: Cost of reduction of one extra unit of carbon – for various measures such as energy efficiency, shifting to solar and wind power, or avoided deforestation

- Varying effects on GDP

Future costs and benefits evaluated by the use of a **discount rate**.

- How much we should value damages to future people, environment, health, etc?
- Present Value of Cost-Benefit \( X = \frac{X}{(1+r)^n} \)
  - Where \( r \) is the discount rate and \( n \) is the number of years in which we’d receive the benefit

https://globalchange.mit.edu
Social Cost of Carbon

The economic cost of an additional ton of CO2 emissions
- How much future climate mitigation is worth to us today?

- William Nordhaus vs Nicholas Stern
- Differences:
  - Discount Rates
  - Uncertainty
  - Economic costs of action to mitigate climate change

Issues with CBA

Spatial and temporal scales
- Discounting

“Value of Statistical Life”

Uncertainty
- Damage estimates for rising frequencies and intensities of weather extremes
- Resulted in use of “integrated assessment models”

Figure by Anthony Fratto. Data Courtesy of NOAA National Centers for Environmental Information

https://globalchange.mit.edu
Cost Effectiveness Analysis (CEA)

Accepts a goal as given by society and uses economic techniques to determine the most efficient way to reach that goal

- i.e. target based
- Considers the outputs produced by a project (not measured in monetary terms)

IPCC: - “Like other target-based approaches, CEA often turns into an implicit CBA, especially if even the minimum costs turn out to be too high and beyond the ability to pay of the society. The target is iteratively revised until an acceptable solution is found.”
Economic Policy Options

GHG Emissions are a negative side-effect of economically valuable activities.

Coase Theorem: externalities are potentially correctable through the market if property rights are clearly assigned and there are low transaction costs.

Remedying externalities can be thought of as two separate problems:
1. What should be done?
2. Who should pay for it?

Market has yet to rectify GHG emissions due to difficulty in assigning responsibility.

If the Coase Theorem cannot hold, external quantity regulation is needed.
Command and Control

Setting a standard of performance or quantity for GHG emissions or demanding a specific technology

**Requirements**: Production function for each firm

**Examples**: EPA Clean Power Plan, Renewable Fuels and Portfolio Standards

**Incentives & Advantages**: Allows firms to conceal costs and there is no marginal incentive to abate

**Risks, Costs, and Drawbacks**: Inefficient production and a lack of innovation. Requires separate rules for each plant and monitoring output
Pigouvian Taxation

Taxing emissions to the point where desired emissions level are achieved (i.e. emitters pay for the social cost of emissions).

**Requirements**: Calculating the marginal social cost of emissions

**Examples**: U.K., Ireland, Australia, Chile, Sweden

**Incentives & Advantages**: Easy to implement, transparent, and minimizes GHG emissions

**Risks, Costs, and Drawbacks**: May over/under-predict the quantity of GHG emissions and monitoring output
Cap and Trade

Emissions are capped at the desired level and a set number of permits are required for emitting carbon dioxide. Firms can trade permits with one another to emit more.

**Requirements:** Calculating optimal quantity of GHG emissions

**Examples:** SO2 permits (Clean Air Act Amendments of 1990), Regional Greenhouse Gas Initiative, European Union Emissions Trading System

**Incentives & Advantages:** efficiency/ease in setting levels, minimizes the externality

**Risks, Costs, and Drawbacks:** May over/under-predict the revenue, monitoring output, requiring bureaucratic structure to operate the permit market.
Carbon Tax (1) vs. Cap and Trade (2)

Summary

Climate change is a pressing policy issue.

Global action is required to effectively manage climate change.

Policy responses are assessed through cost-benefit and cost-effectiveness analysis.

Economic options in addressing GHG emissions are categorized by command-and-control, pigouvian taxation, and cap-and-trade.
Thank you.

Questions?
Sources

https://www.theguardian.com/environment/climate-consensus-97-percent/2018/jan/02/2017-was-the-hottest-year-on-record-without-an-el-nino-thanks-to-global-warming

https://www.nature.com/articles/nature24672

Extra Slides
Climate Change and Public Policy

Source: http://www.carbonmap.org/#Emissions
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