

# Putting a Price on Carbon Emissions

EES 3310/5310

Global Climate Change

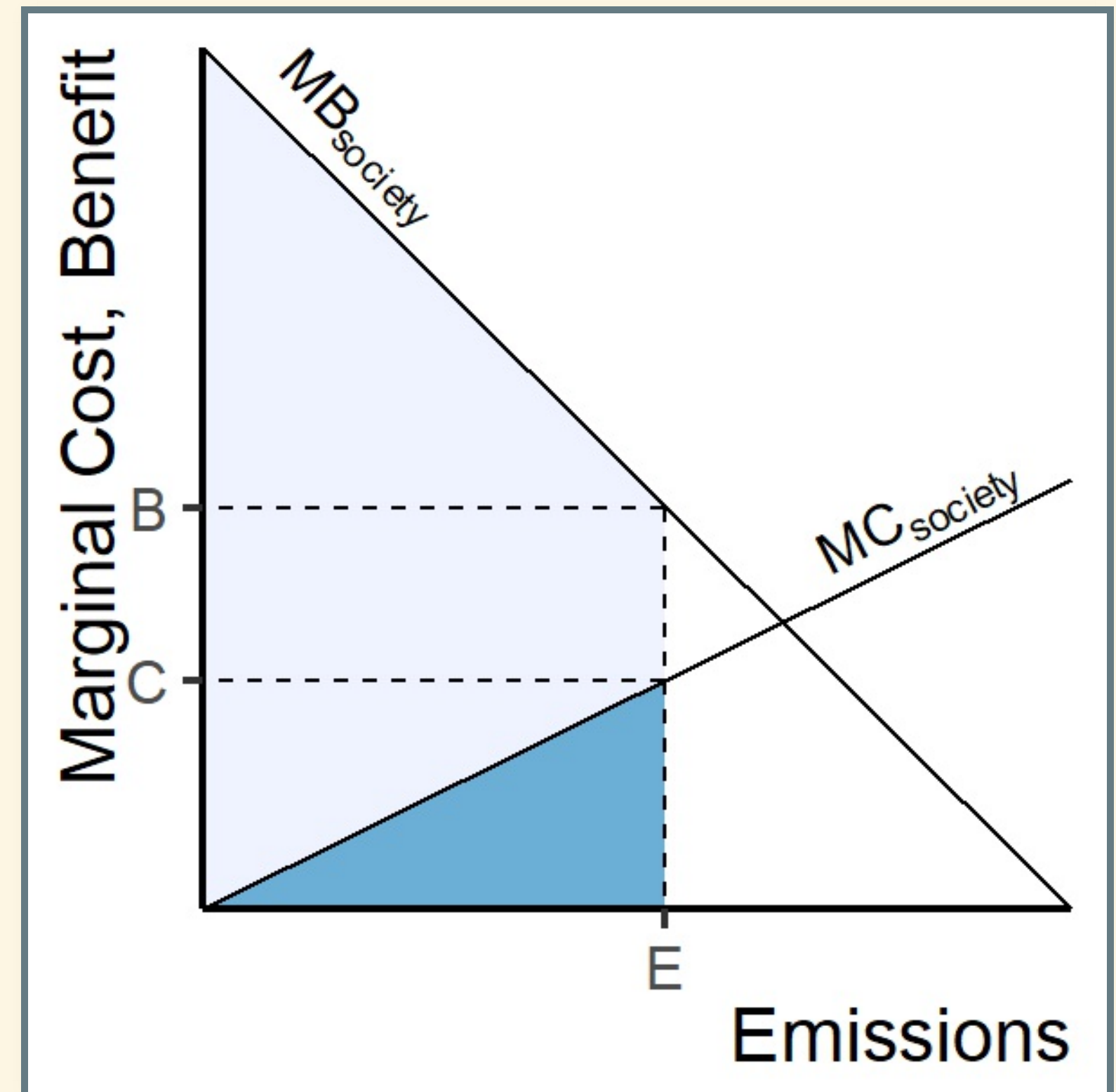
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Class #30: Wednesday, Oct. 31 2018

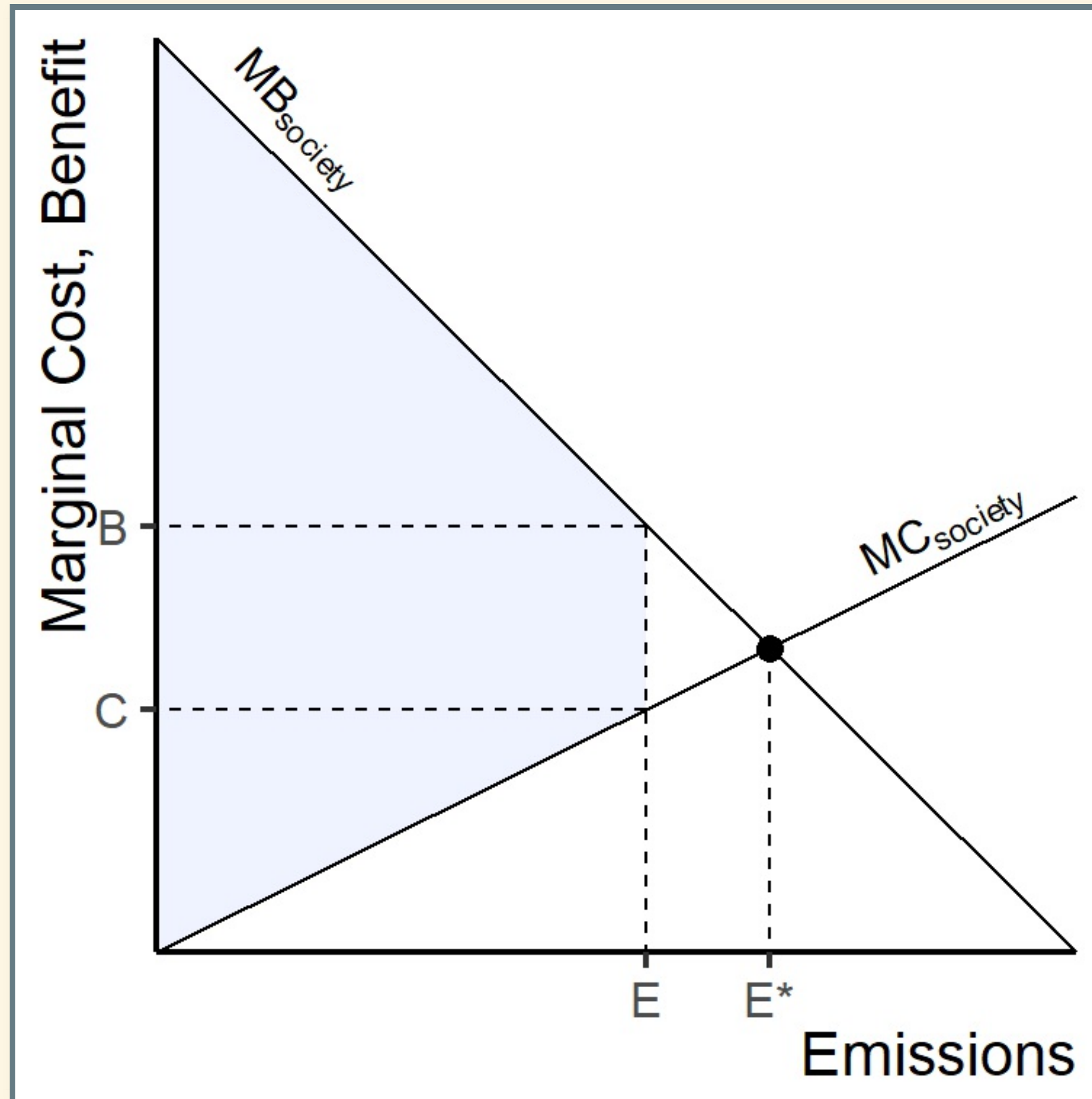


# Review of Costs and Benefits

- Total gross benefit = area under MB
- Total gross cost = area under MC
- **Total net benefit** = gross benefit – gross cost
  - Light gray trapezoid

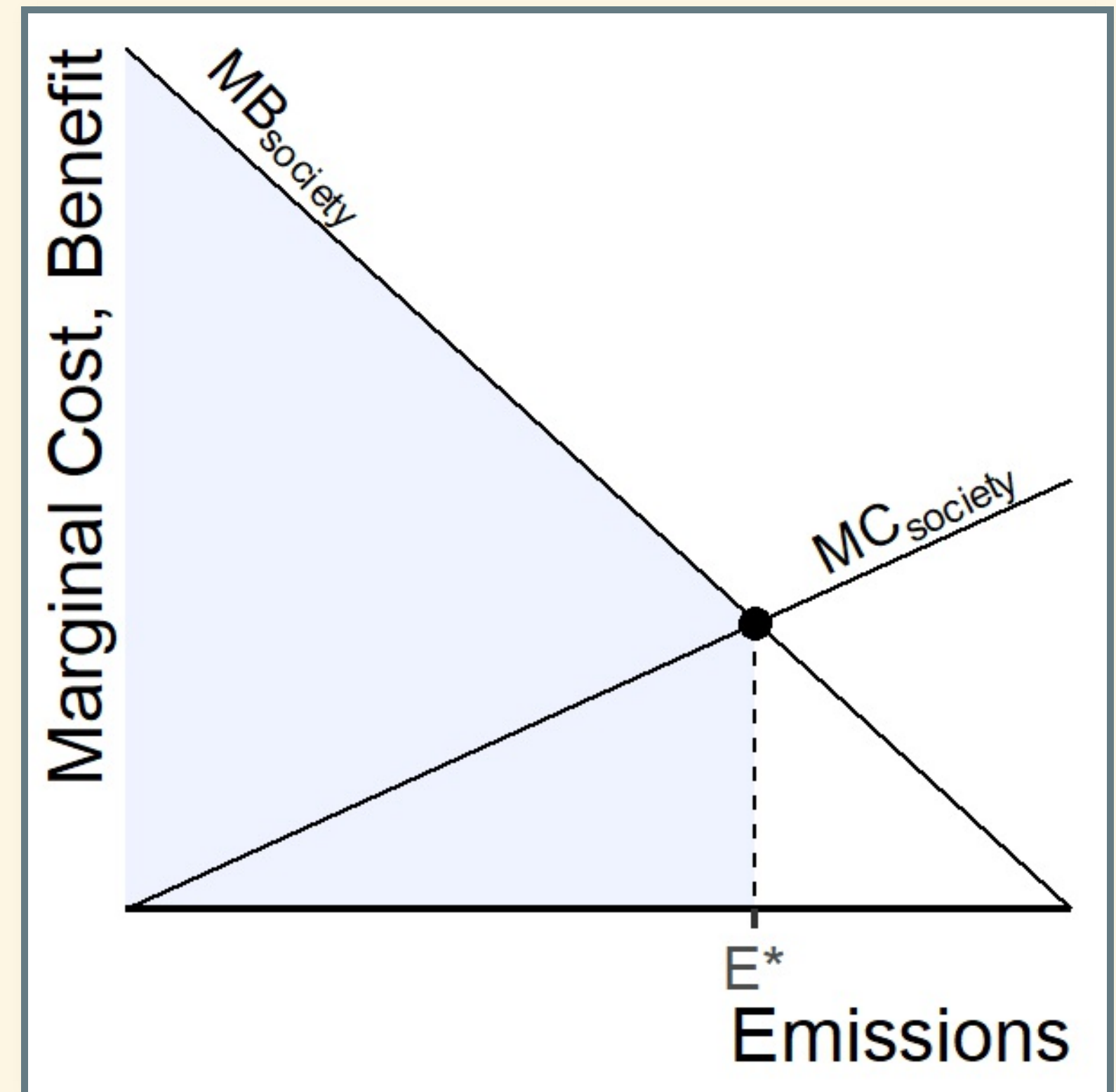


# Total Net Benefit



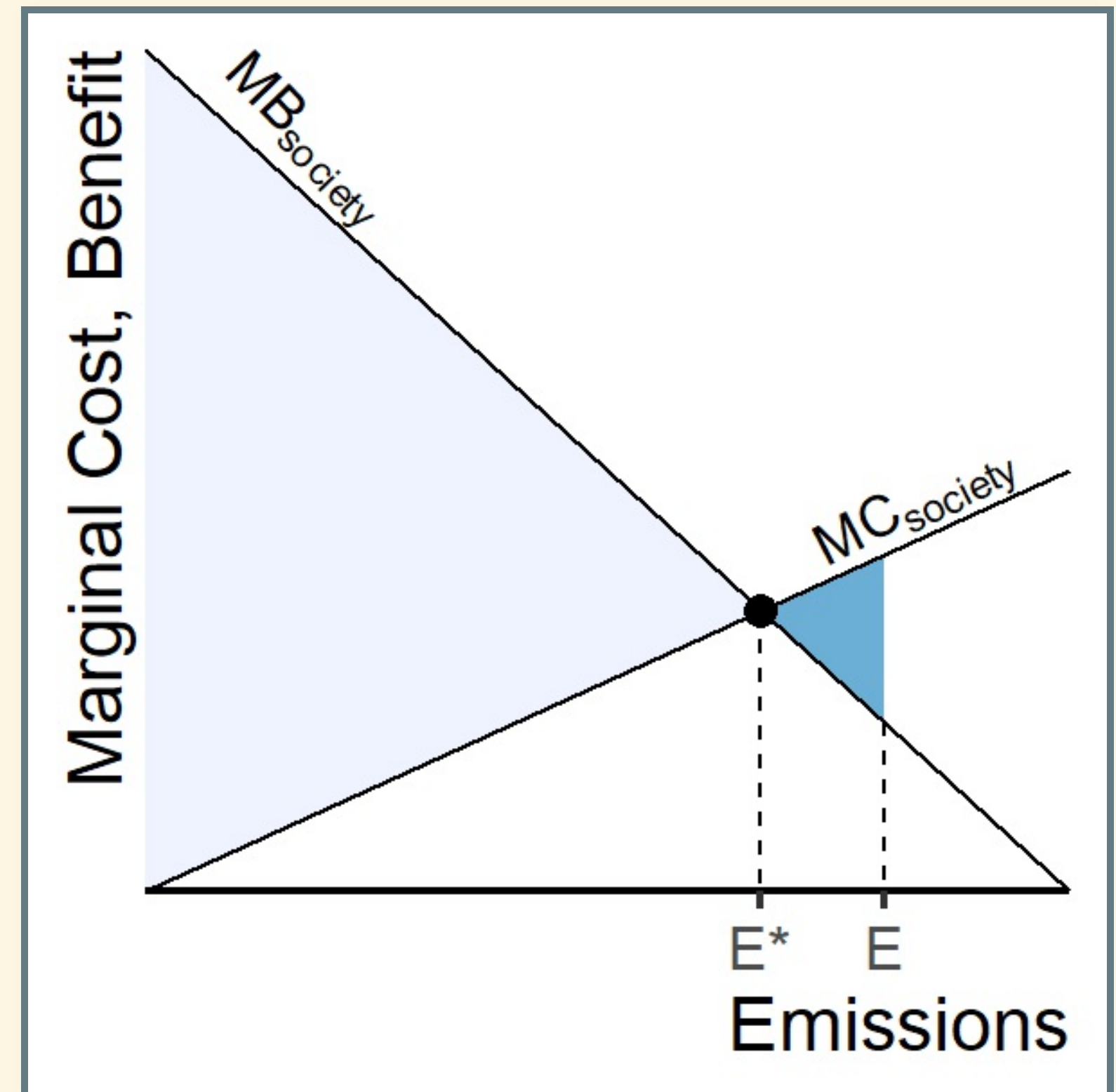
# Optimum Emissions

- Optimum emissions =  $E^*$
- EPA regulations allow  $E^*$  emissions
- Total net benefits are maximized.



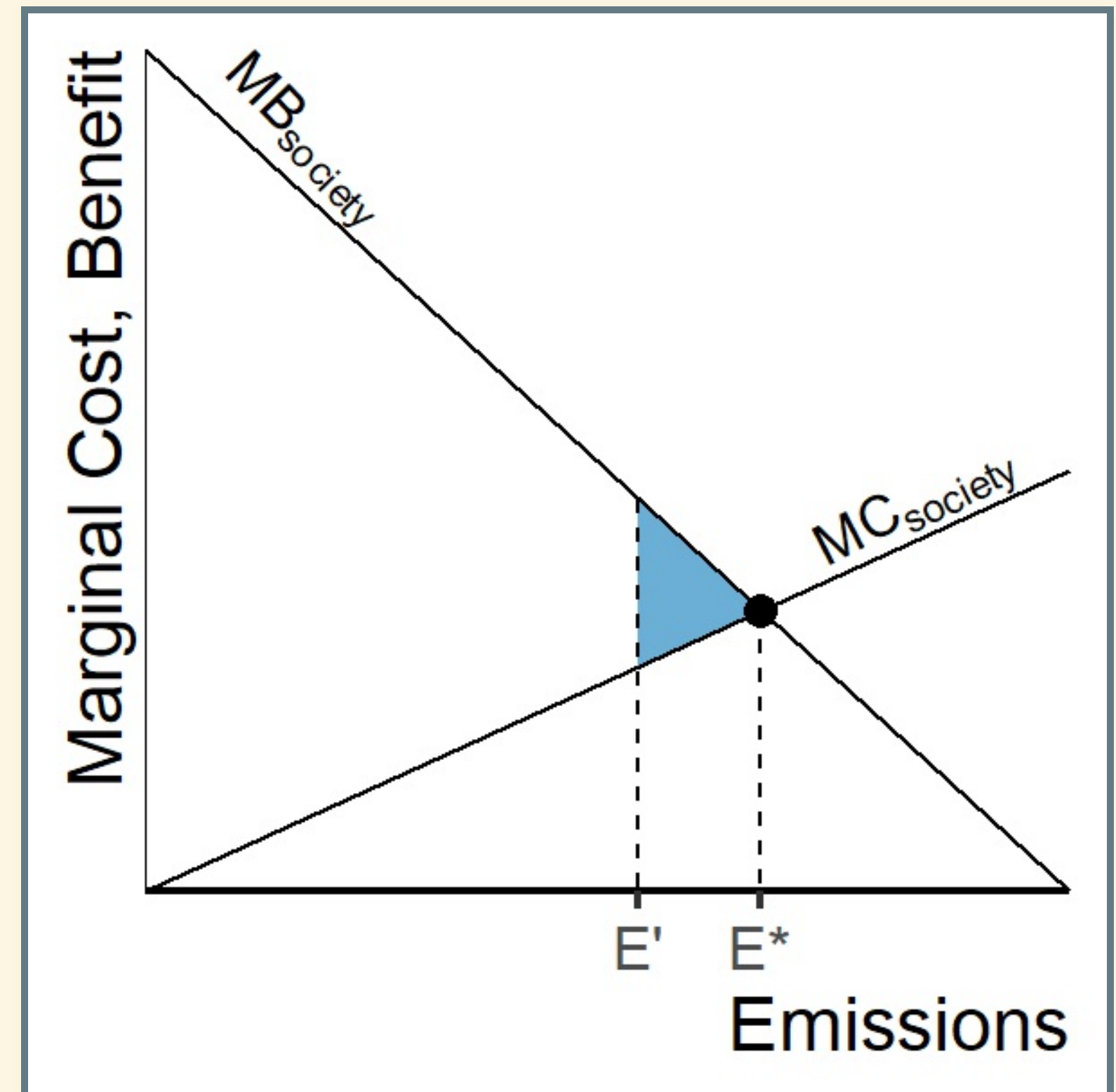
# Deadweight Losses

- Optimum emissions =  $E^*$
- EPA regulations allow  $E'$  emissions
- Deadweight Loss (dark blue triangle) = difference between **actual net benefit** and **optimum net benefit**



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# Regulation



# Regulation

- **Command and Control**
- **Market-Based Regulation**
  - Put a price on externalities
  - Let the market decide best balance between costs and benefits of pollution
  - *Pigovian tax*:
    - Tax equal to social cost
    - Directly compensate people hurt by pollution
    - Or rebate other taxes: indirect compensation
    - Or invest in socially beneficial projects
      - Clean energy
      - Infrastructure to adapt to climate change
      - Compensate out-of-work coal miners



# Nordhaus on Pigovian Taxes

- Taxes on something makes people do less of it
- We want people to work, don't want them to pollute
- But we tax working and don't tax polluting
- Revenue-neutral carbon tax:
  - Raise tax on CO<sub>2</sub>, cut payroll taxes

# Details

- People don't like paying taxes
- *Invisible taxes*
  - Charge tax when fossil fuels are taken out of the ground or imported into US
  - Fossil fuel producer pays tax, passes cost on to consumers
- Taxes → higher prices → less consumption
- Higher fuel prices:
  - Incentive to buy energy-efficient products
  - Incentive to invent, produce, market efficient products
  - Clean energy becomes more competitive

# Simplicity of Carbon Prices

- **Command and Control:**
  - Government has to assess emissions & costs for all kinds of technology
- **Green consumers:**
  - To reduce carbon footprint, research and calculate emissions embedded in products & services
- **Pricing carbon:**
  - Simple calculation: tax carbon content of fuels
  - Consumers receive simple price signal:
    - Shop for lowest price to reduce carbon footprint

# Difficulties

- Setting the correct tax rate is hard
  - Social cost of carbon is uncertain
  - Social cost depends on total emissions now & in the future
    - Set tax to marginal cost based on total emissions to date
    - Tax rises over time

# Difficulties

- People are not always rational consumers
  - Both as individuals and as organizations
- Often don't notice small changes in price
- Often don't recognize opportunities to save through efficiency & conservation
- Importance of calling people's attention to places they could cut emissions and save money

# Difficulties

- *Offshoring*
  - If US sets carbon tax, India does not, companies will shift production from US to India
  - Big problem unless carbon tax is applied to all countries

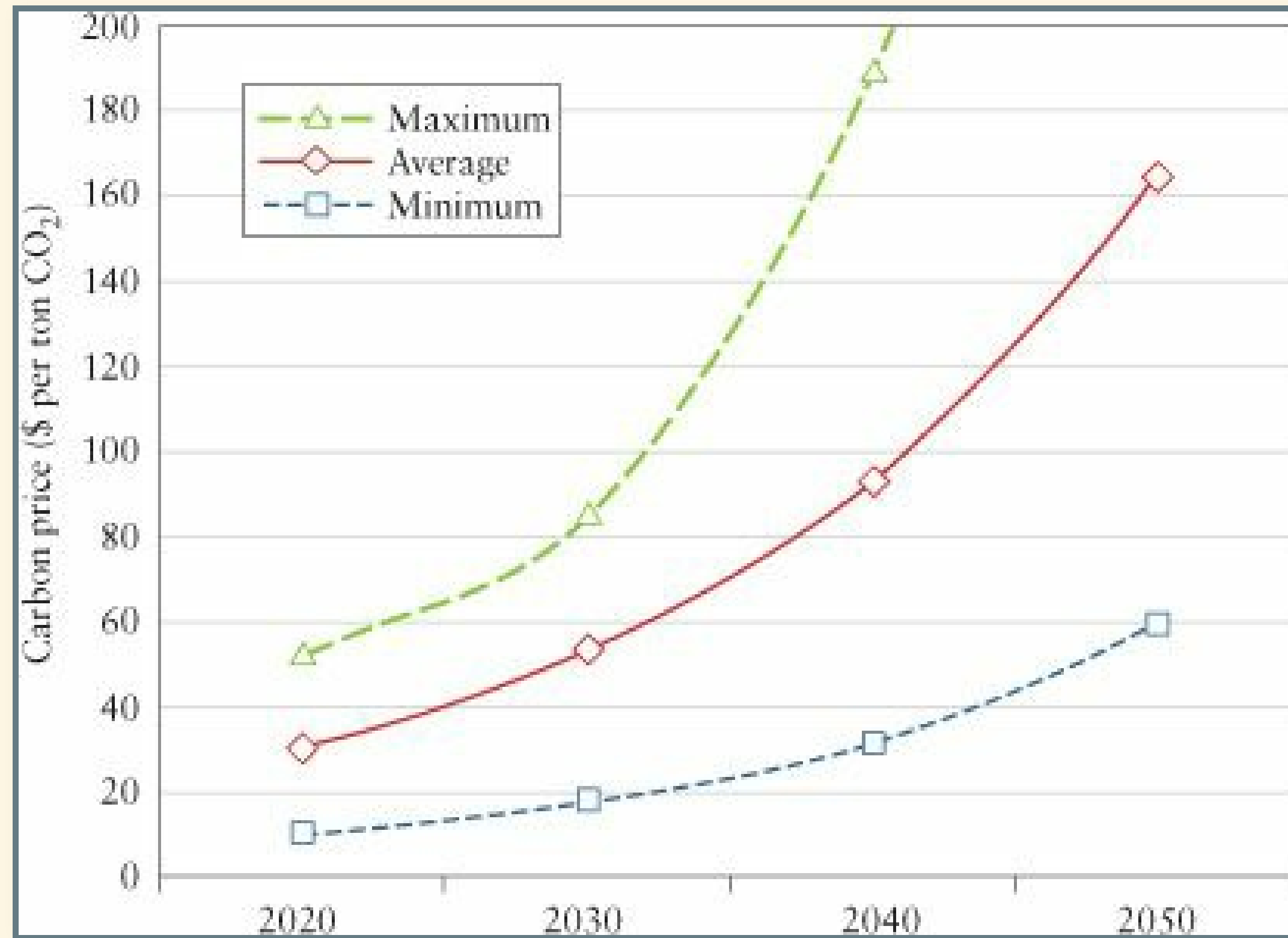
# Difficulties

- Lack of control:
  - Actual emissions depend on both *price* **and** *consumer demand*
    - If regulators underestimate demand, emissions and warming will be greater than goal
    - But if social cost is correct, this may mean benefits of energy consumption exceed damage from warming



# Carbon Taxes

# Example tax calculations



Tax necessary to stabilize at 2.5°C warming

# Impact of \$25/ton tax

Item	Price increase
Coal	134%
Electricity	31%
Natural gas	30%
Gasoline & petroleum products	11%

# Impact of \$25/ton tax on Household Spending

Item	Tons CO <sub>2</sub>	Cost of tax	Spending increase
Annual electricity for one home	9.34	\$230.00	19.0%
Economy-class international flight	4.68	\$120.00	8.0%
Annual phone & internet	0.01	\$0.36	0.0%
Annual total consumption for one household	30.00	\$740.00	0.9%

# Impact of \$25/ton tax on National Economy

Year	Tax rate (\$/ton)	Emissions (billion ton)	Revenue (\$ billion)	Revenue (% GDP)
2010	\$0	6.30	\$0	0.00%
2015	\$25	5.90	\$147	0.96%
2020	\$30	5.50	\$168	0.97%
2025	\$42	5.40	\$225	1.14%
2030	\$53	5.20	\$277	1.25%

**Discuss**