Choosing Environmental Policy Instruments: An Introduction

J.R. DeShazo, deshazo@ucla.edu
UCLA, Department of Public Policy

Outline

1. To what level should we reduce pollution?
   socially optimum: cost benefit analysis (CBA)

2. Which policy instruments to use to reduce pollution?
   cost effectiveness analysis (CEA)

3. How to raise funds for resource management and restoration and discourage externalities? (polluter pays principle)
4. Examples from US and World

How much to reduce pollution?

1. Legislatures have chosen a range decision criteria

   -beneficial uses (water quality)

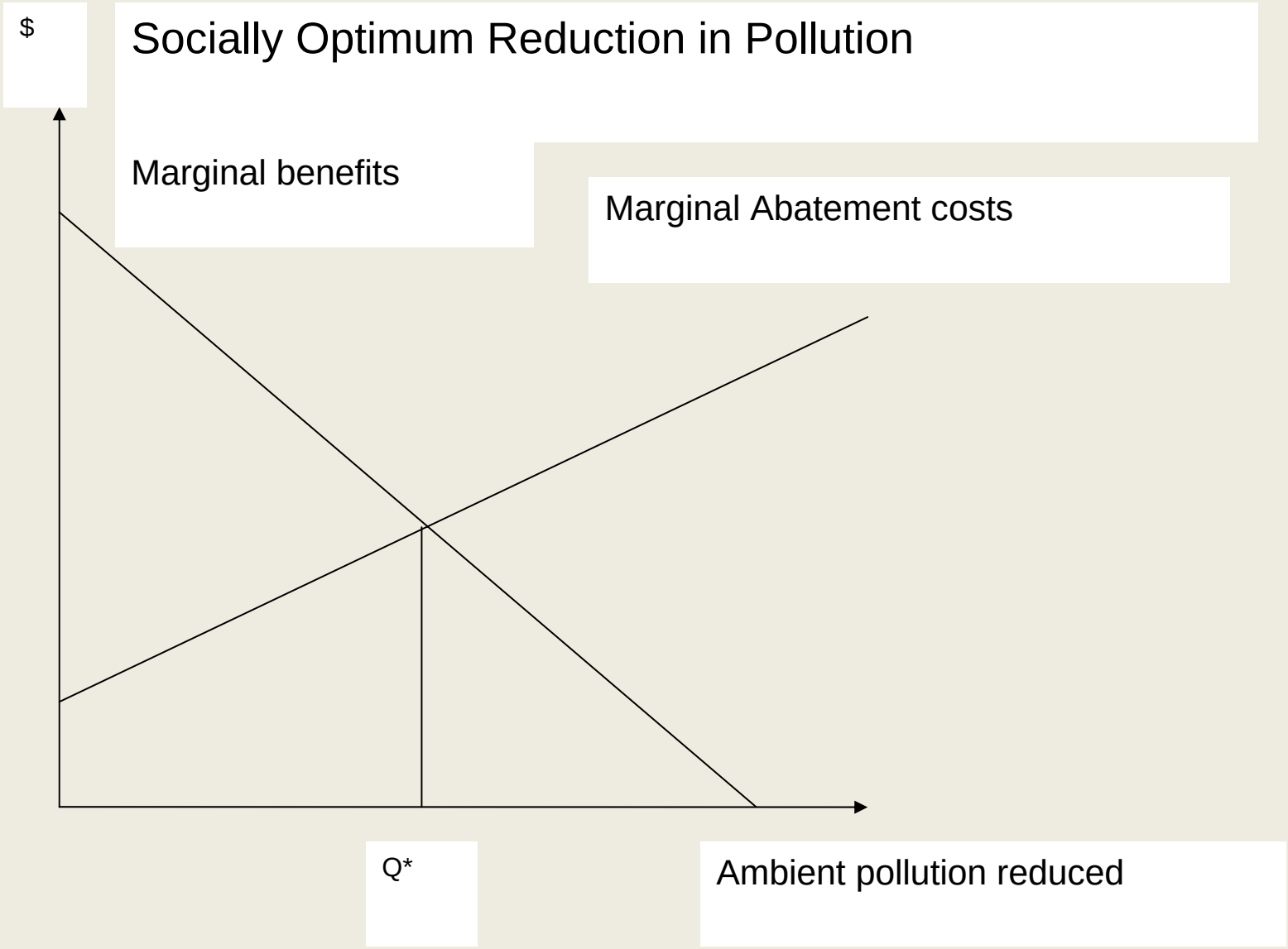
   -no sign. impacts to health (air quality standard)

   -cost benefit analysis (drinking water)

2. What would economists choose?

   Socially optimal level: compare benefits to costs

Socially Optimum Reduction in Pollution



Which Policy Instruments to choose?

- **Command and Control**
- a. Technology standards (BAT)/best management practices (BMPs)
- b. Performance Standards
- (1) effluent standards (NPDES)
- (2) ambient standards

- **Economic Incentive Approaches**
- a) tradable permits (water quality trading)
- b) effluent charges (fees or taxes on discharges)
- <u>Secondary</u>
- c) insurance premium (taxes on fuels/chemicals for spills)
- d) User fees (on fuels/equipment needed to enjoy resource)
- e) Deposit-refund system (plastics/cans/glass/etc)

f) Eliminate government subsidy

Criteria for Selecting Pollution Reduction Instruments

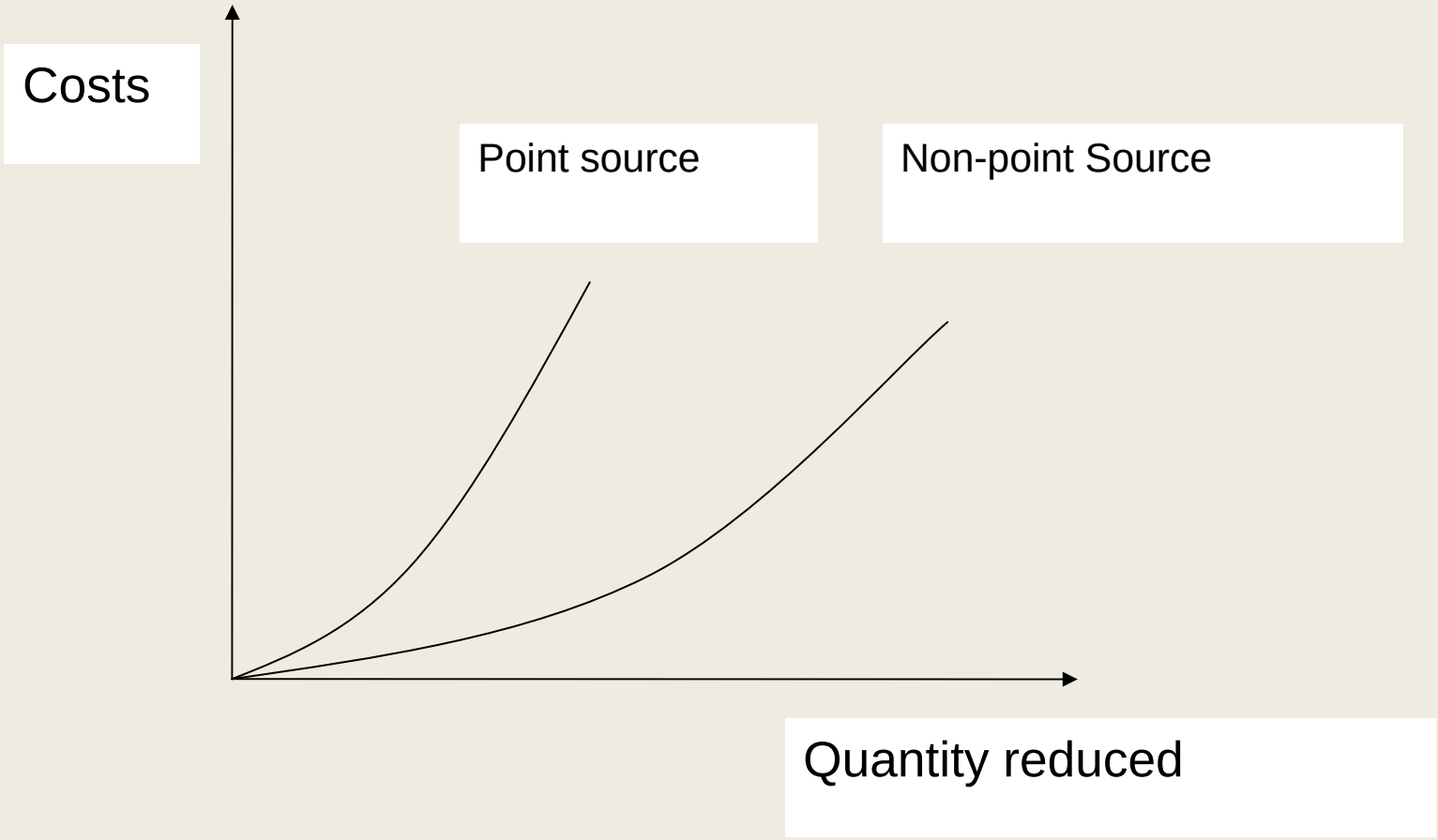
- ***Cost effective (at least)***
- ***Achieve the desired reductions (goals)***
- Is technically and administratively feasible
- Flexible in the face of changing technology, number of emitters and inflation
- Creates incentives for research, development, adoption and diffusion of more advanced pollution control technologies
- Achieves an "acceptable' distribution of costs and benefits of reduction

Cost Effectiveness Criteria

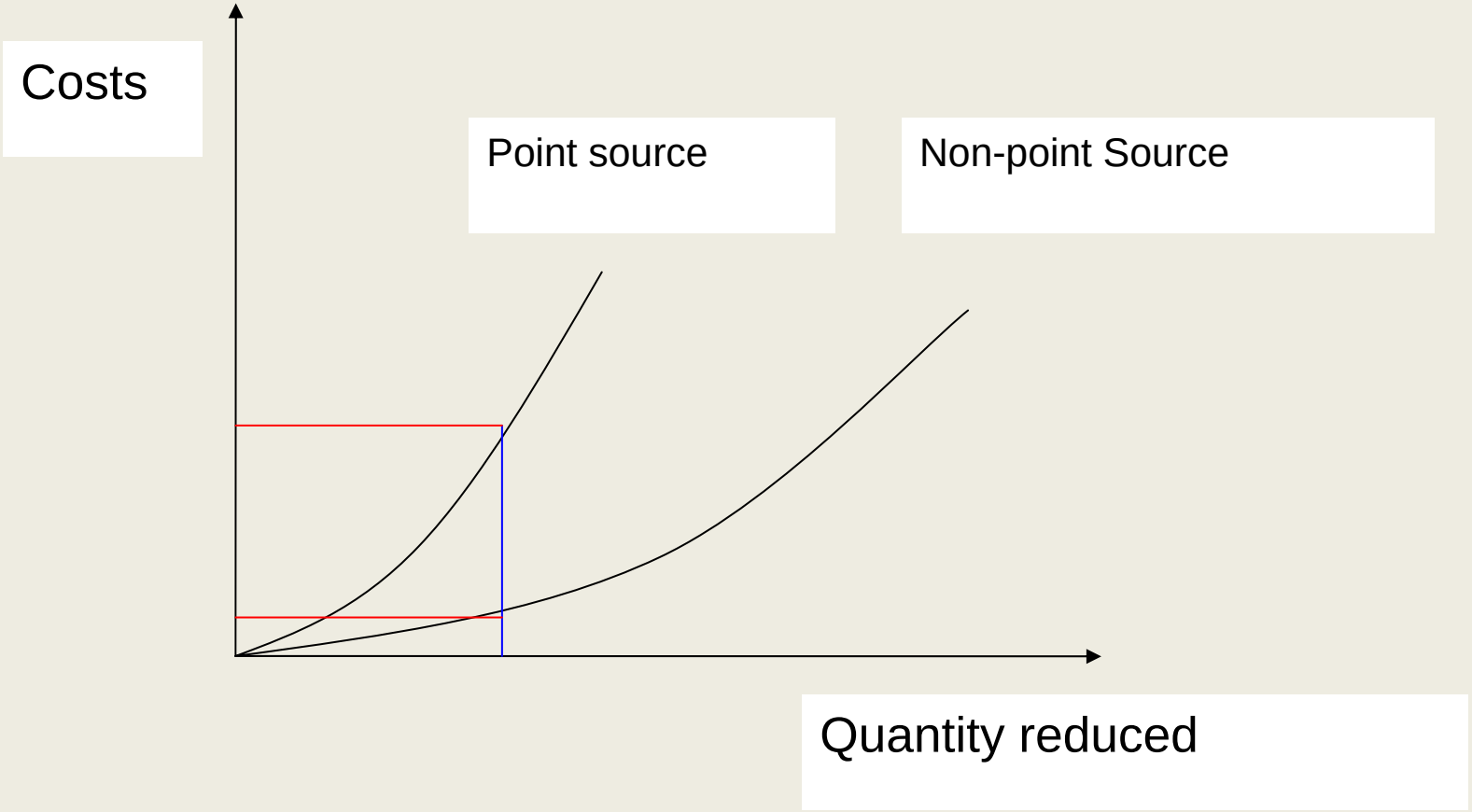
- Does not ask what is the most efficient level of pollution.
- ***Assumes or is given*** a reduction in pollution and asks
- Which of several ways of achieving that reduction minimizes the cost to society?
- Policies A B C D

- All achieve a reduction of 100 units, but which imposes the lowest aggregate costs on society?

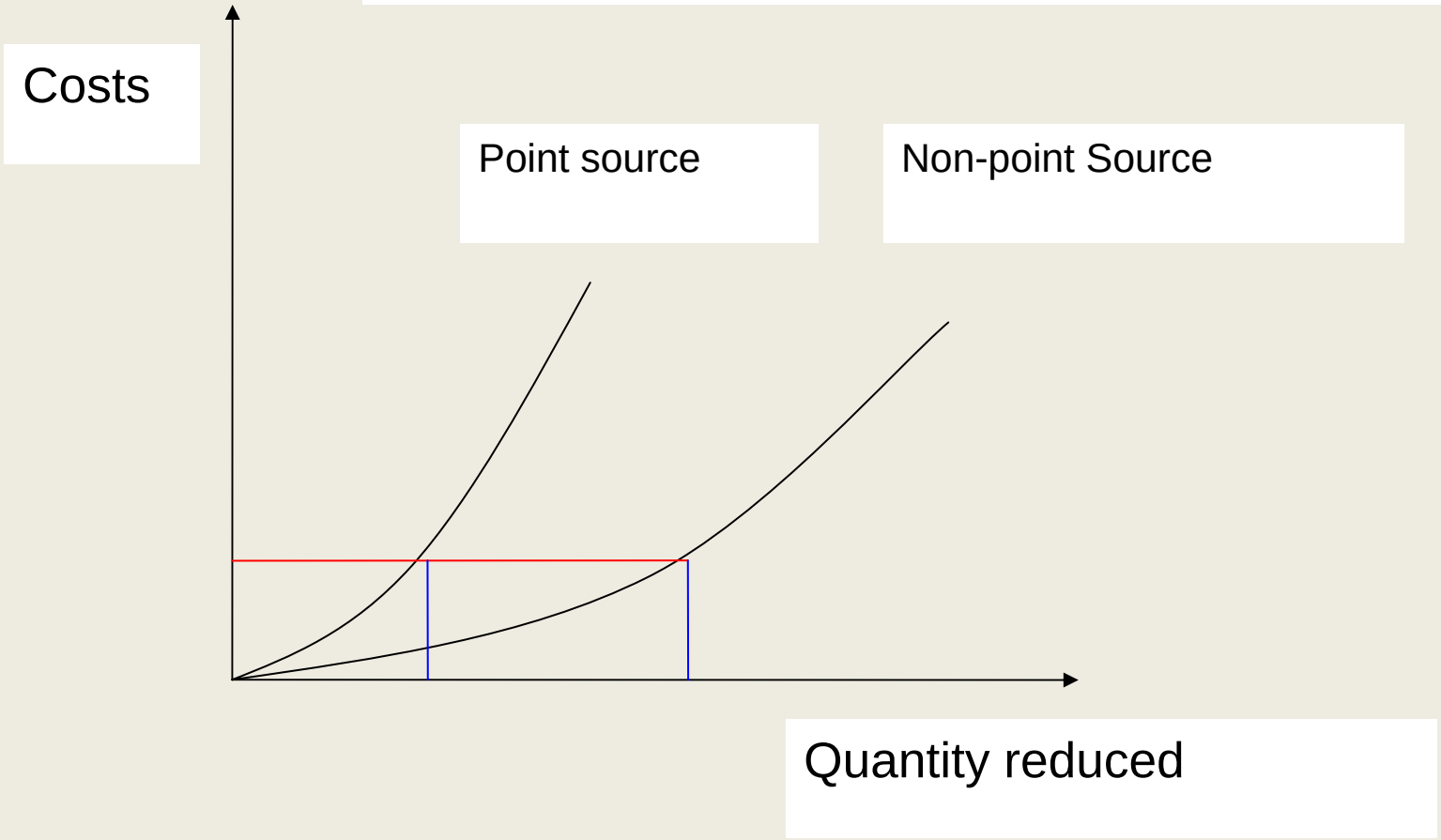
Difference in Marginal Abatement Costs



Equal allocation of quantity of pollution burden



Cost Effective Allocation of Pollution Reduction Burden



Which policy instruments achieve a cost effective allocation of the burden?

- Taxes/effluent fees
- Tradable permits systems (cap and trade)
- 2001 EPA estimate of saving for TMDL program from cost effective approaches $900 million

Advantages of Market Instruments

- Allows polluters reductions at lowest possible costs. (Firms & localities like them better.)
- Enables regulator to negotiate lower overall pollution (Environmentalist like them.)
- Creates an *ongoing* incentive for polluters to reduce pollution on *their own*.
- Incentives for polluters to innovate and seek out less polluting processes.

Disadvantages of Market Instrument

- Not applicable to all environmental problems
  - properties of the pollutant (e.g., hot spots)
- New skill set for regulators: expertise must be acquired
- Initial design of policies is subject to political manipulation (which is also true for the standards)
- Taxes and fees are difficult to pass and adjust politically

Examples of Economic Incentive Approaches (US & World)

- a) tradable permits (water quality trading/TMDLs)
- b) effluent charges (fees or taxes on discharges)
- c) insurance premium (taxes on fuels/chemicals for spills)
- d) User fees (on fuels/equipment needed to enjoy resource)

STATE POLICIES AND PROGRAMS

State	Name	Pollutant	Potential Types of Trading
MD	Maryland Nutrient Trading Policy	Nitrogen and Phosphorus	PS-PS, PS-NPS, and NPS-NPS
MI	Michigan Water-Quality Trading Rules	Nitrogen, Phosphorus, potentially sediments	PS-PS, PS-NPS, and NPS-NPS
PA	Pennsylvania Multi-media Trading Registry	Multiple (nutrients, habitat, etc.)	PS-PS, PS-NPS, and NPS-NPS
VA	Virginia Nutrient Trading Program	Nitrogen and Phosphorus	PS-PS and PS-NPS
WV	West Virginia Trading Framework	Multiple (could potentially include nutrients, metals, or cross-pollutant trading for dissolved oxygen)	PS-NPS and NPS-NPS
WI	Wisconsin Nutrient Trading Rules	Phosphorus	PS-PS, PS-NPS, and NPS-NPS

Source: Breetz, H. et al. (2004) “Water Quality Trading and Offset Initiatives in the U.S.: A Comprehensive Survey” Dartmouth College, Hanover, NH.

TRADING INITIATIVES

State	Name	Pollutant	Potential Types of Trading (Point or Nonpoint Sources)
CA	Grassland Area Farmers	Selenium	NPS-NPS
CA	San Francisco Bay	Mercury	Not determined
CO	Bear Creek	Phosphorus	PS-PS
CO	Boulder Creek	Nitrogen	PS-NPS
CO	Chatfield Reservoir	Phosphorus	PS-PS and PS-NPS
CO	Cherry Creek	Phosphorus	PS-NPS
CO	Clear Creek	Heavy metals (e.g. Arsenic, Copper)	PS-NPS
CO	Lake Dillon	Phosphorus	PS-NPS and NPS-NPS
CO	Lower Colorado River	Selenium, possibly habitat	PS-PS, PS-NPS, and NPS-NPS
CT	Long Island Sound	Nitrogen	PS/PS
FL	Tampa Bay	Nitrogen	No trading actually occurs
ID	Lower Boise River	Phosphorus	PS-NPS
IL	Illinois Pretreatment Trading Program	Multiple (indirect discharges)	PS-PS
IL	Piasa Creek Watershed Project	Sediment	PS-NPS

Source: Breetz, H. et al. (2004) “Water Quality Trading and Offset Initiatives in the U.S.: A Comprehensive Survey” Dartmouth College, Hanover, NH.

TRADING INITIATIVES cont'd

State	Name	Pollutant	Potential Types of Trading (Point or Nonpoint Sources)
MA	Acton WWTP	Phosphorus	PS-NPS
MA	Charles River	Water flow	PS-NPS
MA	Edgarton WWTP	Nitrogen	PS-NPS
MA	Falmouth WWTP	Nitrogen	PS-NPS
MA	Massachusetts Estuaries Project	Nitrogen	PS-NPS
MA	Specialty Minerals, Inc.	Temperature	PS-NPS
MA	Wayland Business Center	Phosphorus	PS-NPS
MI	Kalamazoo River	Phosphorus	PS-NPS
MN	Minnesota River	Phosphorus	PS-PS
MN	Rahr Malting Co.	Phosphorus, nitrogen, 5-day carbonaceous biochemical oxygen demand (CBOD-5), and sediment	PS-NPS
MN	Southern Minnesota Beet Sugar Cooperative	Phosphorus	PS-NPS
NV	Truckee River	Nitrogen, Phosphorus, or Total Dissolved Solids (TDS)	PS-PS and PS-NPS

Source: Breetz, H. et al. (2004) "Water Quality Trading and Offset Initiatives in the U.S.: A Comprehensive Survey" Dartmouth College, Hanover, NH.

TRADING INITIATIVES cont'd

State	Name	Pollutant	Potential Types of Trading
NJ	Passaic Valley Sewerage Commission Pretreatment Trading	Heavy metals (Cadmium, Copper, Lead, Mercury, Nickel, and Zinc)	PS-PS
NY	New York City Watershed	Phosphorus	PS-PS and PS-NPS
NC	Neuse River Basin	Nitrogen	PS-NPS
NC	Tar-Pamlico Basin	Nitrogen and Phosphorus	PS-NPS
OH	Clermont County	Nitrogen, Phosphorus, or Total Dissolved Solids (TDS)	PS-NPS
OH	Great Miami River Watershed Trading Pilot Program	Nitrogen and Phosphorus	PS-NPS
PA	Conestoga River	Nitrogen and Phosphorus	PS-NPS
PA	Pennsylvania Water-based Trading Simulations	Simulations include: CBOD, phosphorus, nitrogen, suspended solids, ammonia, acid and metals	PS-PS, PS-NPS, and NPS-NPS
VA	Blue Plains	Nitrogen	PS-PS
VA	Henry County	Total Dissolved Solids (TDS)	PS-PS
WI	Fox-Wolf Basin	Phosphorus	PS-PS and PS-NPS
WI	Red Cedar River	Phosphorus	PS-NPS
WI	Rock River	Phosphorus	PS-PS and PS-NPS
Regional	Chesapeake Bay	Nitrogen and Phosphorus	PS-PS and PS-NPS

Source: Breetz, H. et al. (2004) "Water Quality Trading and Offset Initiatives in the U.S.: A Comprehensive Survey" Dartmouth College, Hanover, NH.

EFFLUENT FEES

Regulated Substance	Country	Rate	Use of Revenues
BOD load	Bulgaria	$0.11/kg	National environmental fund (70%); polluter's municipality (30%)
	Colombia	Río Negro basin only, rate n.a.	Wastewater treatment plants (50%); industrial clean technology equipment (30%); research, administration (20%)
	Estonia[2]	BOD_5 $77/ton permitted; $386/ton above	Estonian Environmental Funds national (50%); county (50%)
	Lithuania[3]	BOD_7 $75/ton	Municipal environmental funds (70%); General budget (30%)
	Malaysia	BOD from palm oil industry; current rates n.a.	n.a.
	Philippines	BOD in Laguna de Bay watershed, rates n.a.	Water quality management, monitoring & enforcement (80%); local government budgets (20%)
	Poland[4]	BOD_5 $172 to $1,722/ton, depending on source	National, regional and municipal environmental funds
	South Korea[12]	n.a.	n.a.

Source: Stavins, R. (2001) "Experience with Market-Based Environmental Policy Instruments" in: Maler, K. and Vincent, J., eds. *The Handbook of Environmental Economics*. Amsterdam: North-Holland/Elsevier Science.

EFFLUENT FEES cont'd

Regulated Substance	Country	Rate	Use of Revenues
TSS	Bulgaria[7]	$0.04/kg	National environmental fund (70%); polluter's municipality (30%)
	Colombia	Río Negro basin only, rate n.a.	Wastewater treatment plants (50%); industrial clean technology equipment (30%); research, administration (20%)
	Estonia[2]	$39/ton permitted; $386/ton above	Estonian Environmental Funds national (50%); county (50%)
	Lithuania[3]	$15/ton	Municipal environmental funds (70%); General budget (30%)
	Poland[4]	$74/ton	National, regional and municipal environmental funds
	South Korea[12]	n.a.	n.a.

Source: Stavins, R. (2001) "Experience with Market-Based Environmental Policy Instruments" in: Maler, K. and Vincent, J., eds. *The Handbook of Environmental Economics*. Amsterdam: North-Holland/Elsevier Science.

EFFLUENT FEES cont'd

Regulated Substance	Country	Rate	Use of Revenues
Combined industrial water emissions	China	Varies with pollutants.	Grants, low-interest pollution control loans (80%); local monitoring and administration (20%)
	France[13]	Varies by river basin	Water pollution control
	Germany[14]	$42 per "pollution unit"	Water quality management
	Latvia[11]	$1.65 to $27,600/ton, depending on effluent hazard class	National, regional and local general budgets
	Netherlands	Varies by flow and load	Water quality policy
	Slovakia[6]	Varies by effluent load and quantity (not quality) of receiving waters	Slovak Environmental Fund

Source: Stavins, R. (2001) "Experience with Market-Based Environmental Policy Instruments" in: Maler, K. and Vincent, J., eds. *The Handbook of Environmental Economics*. Amsterdam: North-Holland/Elsevier Science.

EFFLUENT FEES cont'd

Regulated Substance	Country	Rate	Use of Revenues
Nitrogen and Phosphorous	Denmark	N $3.10/kg; P $17.30/kg discharged to surface waters	General budget
	Estonia[2]	N $65/ton permitted; $320/ton above P $115/ton permitted; $580/ton above discharged to surface water, ground water or soil	Estonian Environmental Funds national (50%); county (50%)
	Lithuania[3]	N $75/ton; P $260/ton	Municipal environmental funds (70%); General budget (30%)

Source: Stavins, R. (2001) "Experience with Market-Based Environmental Policy Instruments" in: Maler, K. and Vincent, J., eds. *The Handbook of Environmental Economics*. Amsterdam: North-Holland/Elsevier Science.

An Assessment of Policy Control Instruments w.r.t. to Various Criteria

Criteria	***Tech. Standards BMP/BAT***	***Performance effluent Standards***	***Pollution Taxes***	***Tradable Permits (with cap)***
Achieves Q* over time	No	No (but true of ambient standards)	No	Yes
Cost Effective	No	No	Yes	Yes
Incentives: R&D & Adoption	None	Moderate	High	High

How to raise revenues and signal social costs are present?

a) effluent charges (fees or taxes on discharges)

b) insurance premium (taxes on fuels/chemicals for spills)

c) User fees (on fuels/equipment needed to enjoy resource)

Types of Policy Instruments

- **Command and Control**
- a. Technology standards (BAT)/best management practices (BMPs)
- b. Performance Standards
- (1) effluent standards (NPDES)
- (2) ambient standards

- **Economic Incentive Approaches**
- a) tradable permits (water quality trading)

INSURANCE PREMIUM TAXES (U.S.)

Item/Action Taxed	First Enacted/Modified	Rate	Use of Revenues
Chemical production	1980/1986	$.22 to $4.88/ton	Superfund (CERCLA)
Petroleum production	1980/1986	$.097/barrel crude	
Corporate income	1986	0.12%[2]	
Petroleum and petroleum products	1989/1990	$.05/barrel	Oil Spill Liability Trust Fund
Petroleum-based fuels, except propane	1986/1990 (expired 1995)	$.001/gal	Leaking Underground Storage Trust Fund

Source: Stavins, R. (2001) "Experience with Market-Based Environmental Policy Instruments" in: Maler, K. and Vincent, J., eds. *The Handbook of Environmental Economics*. Amsterdam: North-Holland/Elsevier Science.

FEDERAL USER CHARGES (U.S.)

Item Taxed	First Enacted/Modified	Rate	Use of Revenues
Noncommercial motorboat fuels	1932-1992	$.183/gal	Aquatic Resource Trust Fund
Inland waterways fuels	1978/1993	$.233/gal	Inland Waterways Trust Fund
Non-highway recreational fuels and small-engine motor fuels	1932/1993	$.183/gal gasoline $.243/gal diesel	National Recreational Trails Trust Fund and Wetlands Account of Aquatic Resources Trust Fund
Sport fishing equipment	1917/1984	10% (except 3% for outboard motors)	Sport Fishing Restoration Account of Aquatic Resources Trust Fund
Bows and arrows	1972/1984	11%	Federal Aid to Wildlife Program
Firearms and ammunition	1918/1969	10%	

Source: Stavins, R. (1998) “Market-Based Environmental Polices” in: Portney, P. and Stavins, R., eds. *Public Polices for Environmental Protection*.

Review

1. To what level should we reduce pollution?
   socially optimum: cost benefit analysis (CBA)

2. Which policy instruments to use to reduce pollution?
   cost effectiveness analysis (CEA)

3. How to raise funds for resource management and restoration and discourage externalities? (polluter pays principle)
4. Examples from US and World

Degree of Self-adjustment of Pollution Policies

- <u>Changes in external conditions:</u>
  - **Number of polluting sources**
    - (-) Effluent standards, technical Standards, taxes
    - (+)Permits, Ambient standards
  - **Inflation**
    - (-) Taxes
    - (+) Permits, standards
  - **Technological progress** (decline in pollution & abatement cost)
    - (- -) Performance & Technology standards (little costs savings)
    - (+) Permits (both cost savings but no pollution reduction)
    - (+ +) Taxes (cost savings and pollution reduction)