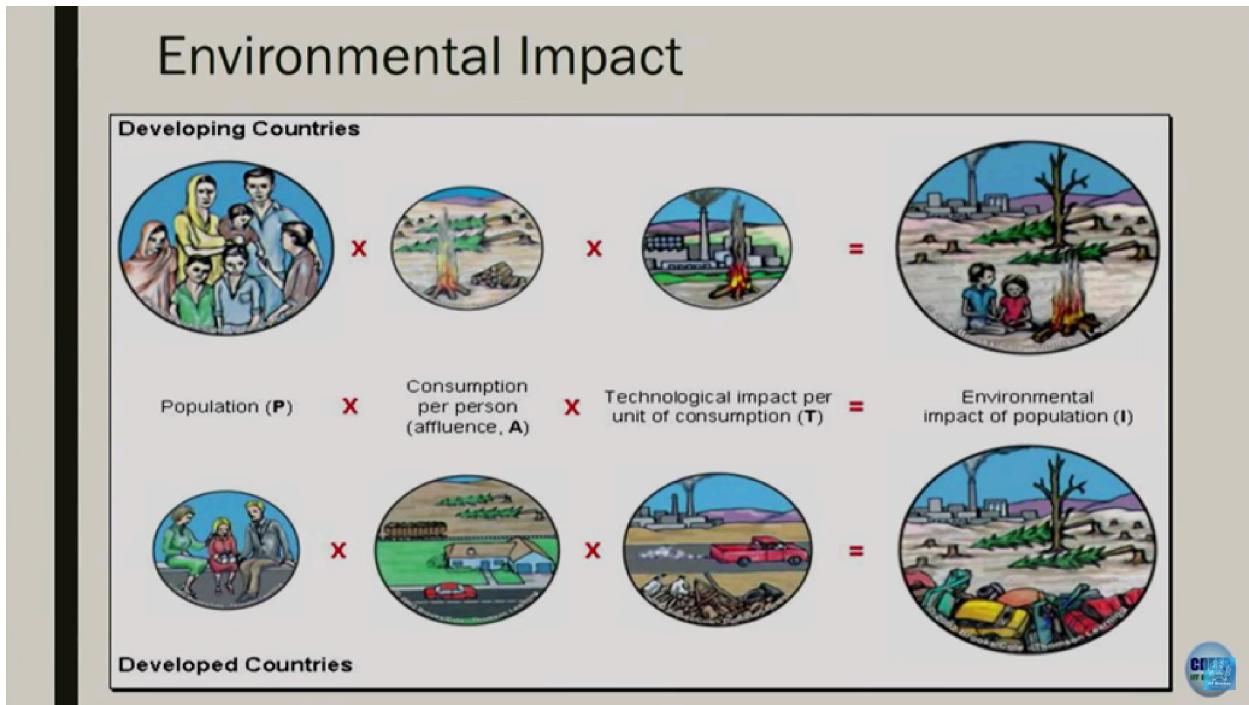


HS200 Notes

Economics:

Pollution = population(P) x unit consumed by each individual, Affluence(A) x Technological impact per unit of consumption (T)



M1 P2

So the Crux of the story is that

- There is a trade-off between the Economy and Environment
- Increasing populations contribute to the accelerated degradation of resources.
- Earth's carrying capacity is limited.
- Growing populations in the LDC have led to land, water, and wood shortages in rural areas and sanitation and water in urban areas.
- Relying solely on economic indicators as a source of well-being is incorrect.
- Trade-offs need to be considered in decision making
- The potential for new technologies, improved environmental governance, and behavioural changes may alleviate the resource strain.

2P1

Market Failure

Market Success (violations lead to Market failures)	Avoiding Market failure
• Complete set of markets with well-defined property rights exist so that assets can be freely traded	<ul style="list-style-type: none">• Complete markets –• Enough markets exist to cover every possible transaction
• Consumers and producers behave competitively by maximizing benefits and minimizing costs	Traders can costlessly create a well-defined property rights system
• Market Prices are known to all consumers and firms	Well-assigned property rights <ul style="list-style-type: none">- Comprehensively assigned (either privately or collectively owned and all entitlements enforced effectively)- Exclusive (benefits accrue to the owner)- Transferable- Secure
• Transaction costs are zero i.e. charging prices does not consume resources	

Environment being a Public good

- Pure public good (consumption is non-rival and non-excludable)
- Non- Exclusion
- Non-rival goods (marginal social cost of supply to an additional individual is zero, Markets fail because firms cannot profit, the incentive to free-ride, prisoner's dilemma)
- Rival Goods (overexploitation, Tragedy of Commons e.g. fishing grounds)

Non rival goods

Free rival goods: Can benefit without paying for it

Prisoner's dilemma (Individual rationality diverges from group rationality)

- Two suspects, who are guilty of a specific crime are taken into custody and placed in different cells).
- However, there is no adequate evidence to convict them at a trial.
- The district attorney points out to each prisoner that each has two alternatives:
- to confess to the crime the police are sure they have done, or not to confess.
- If they both do not confess – they will get minor punishment;
- if they both confess they will be prosecuted but will be given less than severe sentence
- but if one confesses and the other does not, then the confessor will receive lenient treatment for turning state's evidence whereas the latter will get severe punishment



Other reasons why Markets Fail

- Non-Convexities
- Asymmetric Information
- Moral Hazard (Incentive Problem)
- Adverse Selection) (cannot identify the type or character)
- Externalities

WHAT IS EXTERNALITY?

Externalities are unintended (and uncompensated) side effects of one person's or firm's activities on another.

Examples:

- 1) Health effect of smoke emissions from vehicles
- 2) Health effect of smoke emissions from Thermal power plant
- 3) Health effect of discharging untreated effluent factory

WHY THESE SIDE EFFECTS?

- Interdependence in production or consumption.
- The utility of individual i depends not only on his consumption but also on the consumption of another individual:
- $U_i = U_i(X_i, X_j)$ & $P_i = P_i(X_i, X_j)$
- NOTE
- These damages are unintentional *per se*, as they are typically challenging to avoid.
- This interdependence must also be a non-market dependence to qualify as an externality.

EXAMPLES

Press Esc to exit full screen



- 1) Congestion caused by a vehicle on other drivers - -
unintentional and difficult to avoid.
- 2) Air Pollution caused by power plants - unintentional and
difficult to avoid
- 3) If many people are in queue to buy water or medicine,
→ this may lead to ↑ in price.
Can this be Called as EXTERNALITY? – **No**

Why Because it is perpetuated through market
mechanisms. Hence not an external effect.

WHEN EXTERNALITY ARISES?



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Two Types of COSTS:

- 1) Private Costs
- 2) Social Costs

Ex. - w.r.t. Vehicular Air pollution in Delhi/Chennai

Private Costs - Cost of Owning a vehicle, Fuel (petrol/diesel/LPG), maintenance cost etc.

Social Costs - Effect of pollutant on other people, my vehicle causing congestion for others + Private costs.

When SOCIAL COSTS > Private Costs

⇒ Negative Externality

OTHER EXAMPLES OF EXTERNALITY?



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Examples of Negative Externality

- Pollution of Ganges or Yamuna by upstream activities
- Transboundary Pollution
- Soil Erosion caused by excessive and type of agriculture
- Floods caused by Deforestation
- Garbage (NIMBY)
- Use of pesticides in agriculture – affecting downstream water bodies

Positive Externalities:

When Social Benefit > Private Benefit

Examples of Positive Externality

- 1) R&D by a firm for Cancer / COVID vaccine]
- 2) New filters for cars to reduce emissions
- 3) Forestation in hilly regions affecting water supply in the plains.

TYPES OF EXTERNALITY

Two Types:

- 1) Positive and Negative
- 2) Depletable and Non-depletable
 - Manure from a cow is depletable.
 - Because if one person takes it, the other cannot.
 - Vehicular air pollution or Odour from Solid waste are non-depletable



PROLOGUE

Climate change • Climate change refers to long-term shifts in temperatures and...

Hazardous Wastes

Copy link

- **TRIC**
 - **Toxic**
 - Contains one or more of 39 toxic, carcinogenic, mutagenic, or teratogenic compounds
 - **Reactive** or explosive
 - **Ignitable** or catches fire easily
 - **Corrosive** to metal containers

Climate change · Climate change refers to long-term shifts in temperatures and...

"Criteria" Air Pollutants

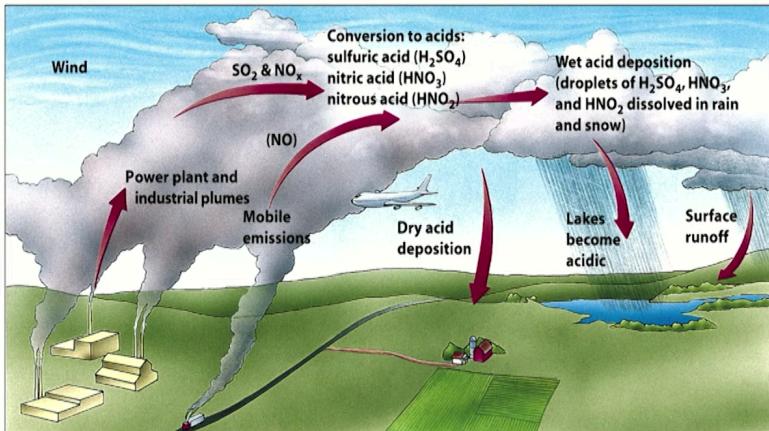
1. Carbon monoxide (CO)
2. Nitrogen Dioxide (NO₂)
3. Sulfur Dioxide (SO₂)
4. Suspended Particulate Matter (SPM)
5. Ozone (O₃)
6. Lead
7. Hydrocarbons

Climate change · Climate change refers to long-term shifts in temperatures and...

Health effects of air pollutants

Pollutant	Health effect
Sulfur Dioxide and Particulate material	Irritate respiratory tract and impairment of lungs to exchange gases
Nitrogen Dioxides	Causes airway restriction
Carbon monoxide	Binds with iron in blood hemoglobin Causes headache, fatigue, drowsiness, death
Ozone	Causes burning eyes, coughing, and chest discomfort

How Acid Deposition Develops



- Respiratory diseases
- Toxic metal leaching into drinking water
- Decreased atmospheric visibility
- Damage to structures, especially containing limestone
- Decreased productivity and profitability of fisheries, forests, and farms

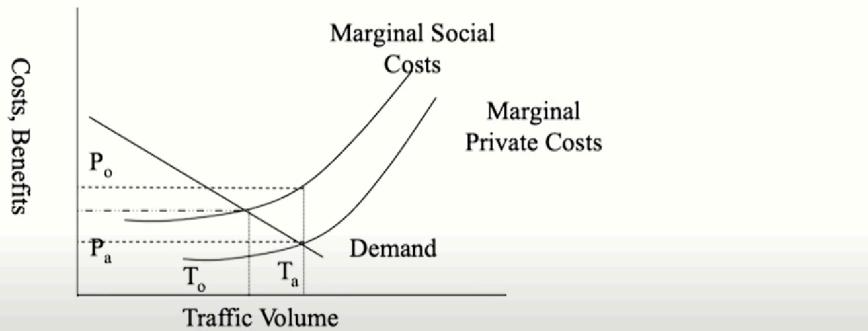
Diseases transmitted through contaminated drinking water

Organism type	Diseases
Bacteria	Typhoid fever, Cholera, Bacterial Dysentery, Enteritis
Viruses	Infectious Hepatitis
Parasitic Protozoa	Amoebic Dysentery Giardiasis
Parasitic worms	Schistosomiasis

Groundwater Pollution

- Out-of-sight pollution
- Low risk ecological problem
- High risk health problem
- Cannot get rid of degradable waste
 - Low flow rates
 - Few bacteria
 - Cold temperatures

Economics of Vehicular Pollution Control – Externality Diagram



Economic Instruments	CAC or Regulations	Economic or Market Based Instruments		Involving Participation
		Using Markets	Creating Markets	
	1) Standards MINAS, Product and Process standards	<ul style="list-style-type: none"> • <i>Charge Systems</i> – • effluent charges; • user charges; • product charges; • administrative charges; • impact fees 	1) Property rights / decentralisation	1) Voluntary agreements
	2) Bans	<ul style="list-style-type: none"> • 2) <i>Fiscal Instruments or Environmental Taxes</i> – • pollution taxes; • input taxes; • aid in installing new technology; • subsidies for environmental R&D 	2) Tradeable permits / rights	2) Public participation
	3) Permits/ quotas/license	<ul style="list-style-type: none"> • 3) <i>Financial Instruments</i> – • financial subsidies; • soft loans and grants 	3) International offset systems	3) Information disclosure
		4) <i>Deposit-refund systems and environmental performance bonds</i>	4) Liability insurance legislation	4) Two-tier monitoring 

SELECTION OF POLICY INSTRUMENT

Number of criteria -

- Static Cost Efficiency
- Dynamic Cost Efficiency
- Goal Fulfillment
- Administrative Costs
- Barriers to Entry
- Polluter Pays Principle
- Politics of Implementation (Acceptability)

Policy Instrument Selection Matrix

Criteria	CAC Regulation	MBI	
		Tax or charge	Tradable Emission Permits
<i>Static cost efficiency</i>	No – neither static nor	Yes (specially)	Yes – if market not too thin
<i>Dynamic cost efficiency</i>	No – Perverse incentives	Yes	Yes – Depends
<i>Goal fulfillment</i>	(No) may be at firm level but not aggregate level	No – optimal tax level unknown. Inflation may be problem	Yes – The regulator can be fairly certain of reaching target
<i>Administrative</i>	Best – control	Depends	Hard to administer with
<i>Barrier to entry</i>	Standards for	Neutral	Can be used by established
<i>Polluter Pays</i>	Yes	Yes	Yes (if auctioned)
<i>Politics of implementation</i>	Risk for rent-seeking behaviour	Risk of opposition if not refunded	Neutral (at least if grandfathered)

CAC = Command Based Control

U.S. Market for SO₂ Allowances

- Sulfur dioxide (SO₂) is a primary product of coal-burning power plants.
- SO₂ pollution lowers the pH scale of rainfall, leading to the problem commonly known as acid rain.
 - Increased acidity of lakes and rivers.
 - Slower growth, injury or death of forests.
 - Visibility impairment.
- SO₂ can impair respiratory function and is linked to various respiratory ailments.

	Policy Instrument	Natural Resource Management (Water, fisheries, agriculture, forestry, minerals & biodiversity)	Pollution Control (Air, water, solid waste & hazardous waste)
7	Deposit-refund schemes	Reforestation deposits or performance bonds in forestry	Waste management, used vehicles, vehicle inspection
8	Refunded emission payments		NOx abatement in Sweden
9	Creation of property rights	Private national parks, property rights and deforestation	
10	Common property resources	CPR management	
11	Legal mechanisms, liability	Liability bonds for mining or hazardous waste	
12	Voluntary agreements	Forest Products	Toxic Chemicals
13	Information provision, labels	Labelling of food, forest products	PROPER and other labelling schemes
14	International treaties	International treaties for protection of Ozone layer, seas, climate etc.	



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The Source of Global Warming

- is the observed warming over the last 50-100 years due to natural climate variability, human influence, or both?
- “.... natural forcing alone is unlikely to explain the recent observed global warming or the observed changes in vertical temperatures structure of the atmosphere.”
- “In light of new evidence and considering the remaining uncertainties, most of the observed warming over the last 50 years is likely due to increased GHG concentrations.”

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The Main **Greenhouse Gases**

Greenhouse gases	Chemical formula	Pre-industrial concentration (ppbv)	Concentration in 1994 (ppbv)	Atmospheric lifetime (years)*	Anthropogenic sources	Global warming potential (GWP)**
Carbon dioxide	CO ₂	278,000	358,000	Variable	Fossil-fuel combustion Land-use conversion Cement production	1
Methane	CH ₄	700	1,721	12.2+-3	Fossil fuels Rice paddies Waste dumps Livestock	21***
Nitrous oxide	N ₂ O	275	311	120	Fertilizer Industrial processes Combustion	310
CFC-12	CCl ₂ F ₂	0	0.503	102	Liquid coolants Foams	6,200-7,100****
HCFC-22	CHClF ₂	0	0.105	12.1	Liquid coolants	1,300-1,400****
Perfluoro-methane	CF ₄	0	0.070	50,000	Production of aluminum	6,500
Sulfur hexa-fluoride	SF ₆	0	0.032	3,200	Dielectric fluid	23,900

Policies to address climate change

- Domestic policy instruments to enable individual nations to achieve their specific targets/goals
- International policy instruments to allocate responsibility among nations
 - Main criteria
 - Cost effectiveness (Minimum aggregate costs)
 - Dynamic incentives for technology innovation and diffusion
 - Adaptability to economic and social changes
 - Distributional equity
 - Institutional (political and administrative) feasibility

How to combat?

- Green house gas emission reduction - a collective target
- Collective responsibility
- Bilateral or multilateral policy
- Voluntary agreement leads to free riding and emission leakages
- Kyoto Protocol – an agreement made under UNFCCC
- Countries that ratify agreed to reduce the emissions below a target level or engage in emissions trading if they maintain or increase the green house gases
- Objective: Stabilization of the greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system