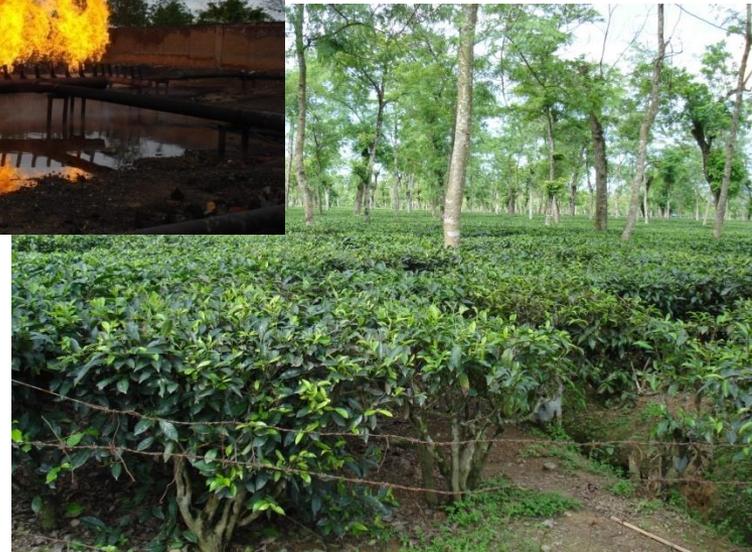


**MANAGEMENT OF THE ENVIRONMENTAL &
SOCIAL IMPACTS OF THE EXTRACTIVE
INDUSTRIES**

**Dr. Devashis Bose,
Associate Professor & Head,
Department Of Economics,
DDR College (Government of Assam),
Chabua (Assam)**

NEGATIVE ENVIRONMENTAL EXTERNALITY



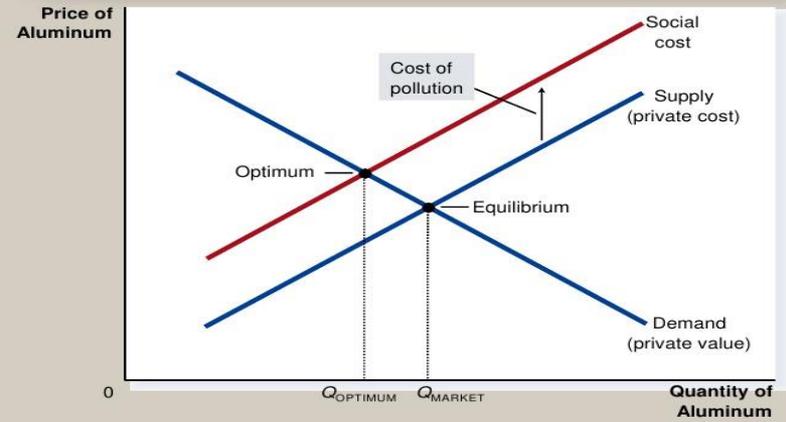
Oil Industry (An Extractive Industry)

- **A major Industry that explores and produces mineral oil and natural gas**
- **Area of the study – OIL Industry in the state of Assam in India**
- **The Environmental implications of exploration and production of mineral oil and natural gas**
 - **Global problems like “enhanced greenhouse effect” to locally increased incidence of respiratory disorders**
 - **Other forms of pollution, those adversely affect the flora, fauna, humans, domesticated animals and all other forms of life**
- **Oil (crude)**
 - **A naturally occurring bituminous liquid found below the surface of the earth**
 - **Major source of energy and core to modern civilization**

SCHEME OF PRESENTATION

- **OIL Industry- The Theory of Environmental Economics**
- **Extractive Industry- Oil Industry & Calculation of Environmental Costs**
- **Pandemic Covid- 19, Oil Industry & Environmental Implications**
- **A Short Film (5 minutes)**

Figure 2 Pollution and the Social Optimum



**OIL INDUSTRY AND THE THEORY OF
COST & AUDIT OF EXTRACTION OF
CRUDE OIL & GAS**

- THE THEORY

OF

ENVIRONMENTAL ECONOMICS

& ENVIRONMENTAL MANAGEMENT

THAT LIES IN THE

BACKDROP

ANALYSIS OF ENVIRONMENTAL EXTERNALITIES

- An economic transaction or activity takes place between two parties/agencies**
- The said transaction or activity leads to loss of welfare to an external party**
- Loss of welfare caused to the external party is Compensated/goes uncompensated**

- Recall: Adam Smith's "invisible hand" of the marketplace leads self-interested buyers and sellers in a market to maximize the total benefit that society can derive from a market.

But market failures can still happen.

EXTERNALITIES AND MARKET INEFFICIENCY

- An *externality* refers to the uncompensated impact of one person's actions on the well-being of a bystander.
- Externalities cause markets to be inefficient, and thus fail to maximize total surplus.

EXTERNALITIES AND MARKET INEFFICIENCY

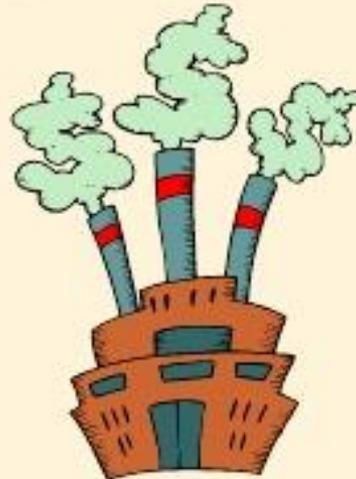
- An externality arises...
 - . . . when a person engages in an activity that influences the well-being of a bystander and yet neither pays nor receives any compensation for that effect.

EXTERNALITIES AND MARKET INEFFICIENCY

- When the impact on the bystander is adverse, the externality is called a negative externality.
- When the impact on the bystander is beneficial, the externality is called a positive externality.

EXTERNALITIES AND MARKET INEFFICIENCY

- Negative Externalities
 - Automobile exhaust
 - Cigarette smoking
 - Barking dogs (loud pets)
 - Loud stereos in an apartment building



Environment- A
Public Good

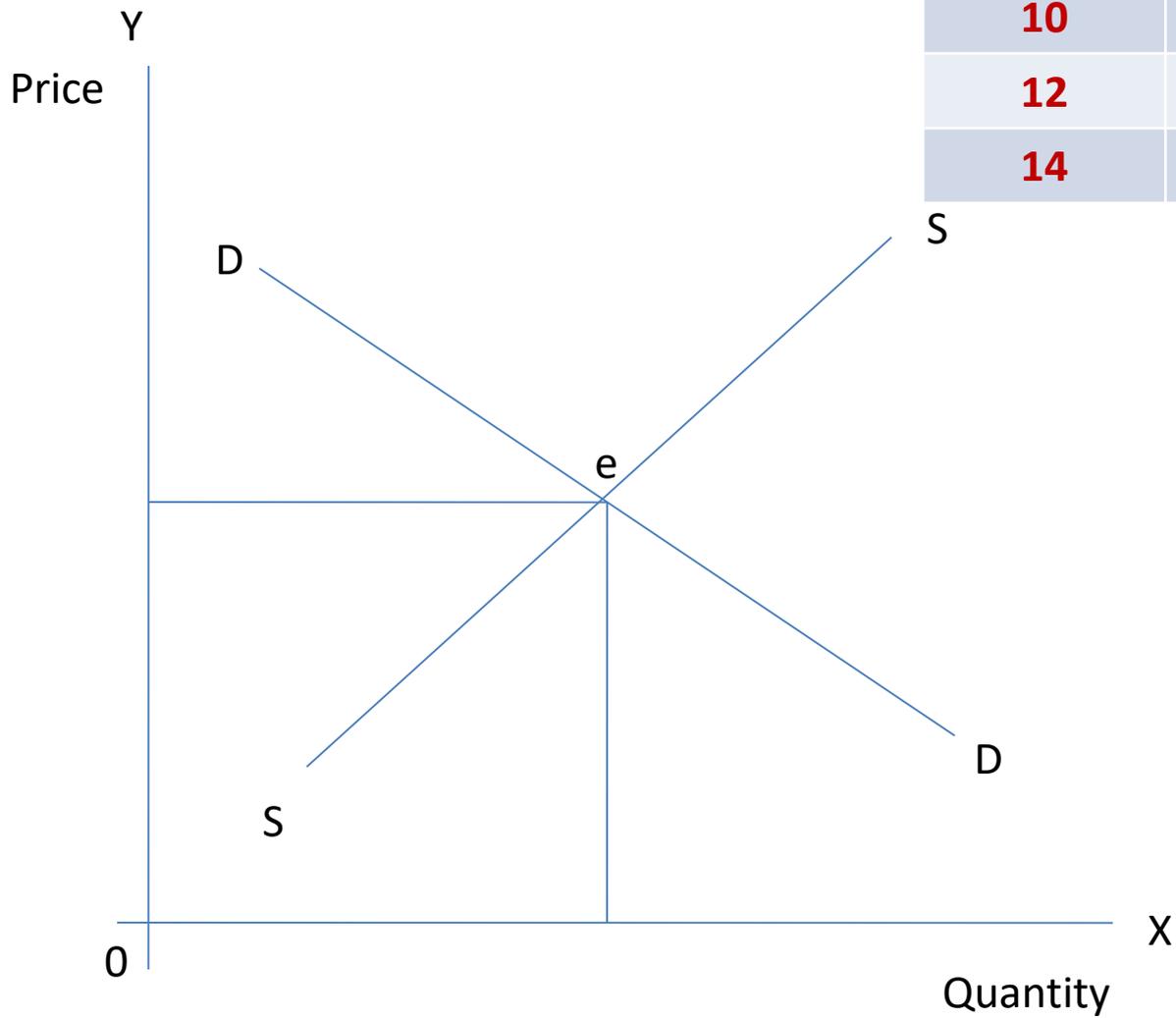


OR SAY.....FLARING OF GAS in OIL INSTALLATIONS
Or
EXTRACTION OF CRUDE OIL!

EXTERNALITIES AND MARKET INEFFICIENCY

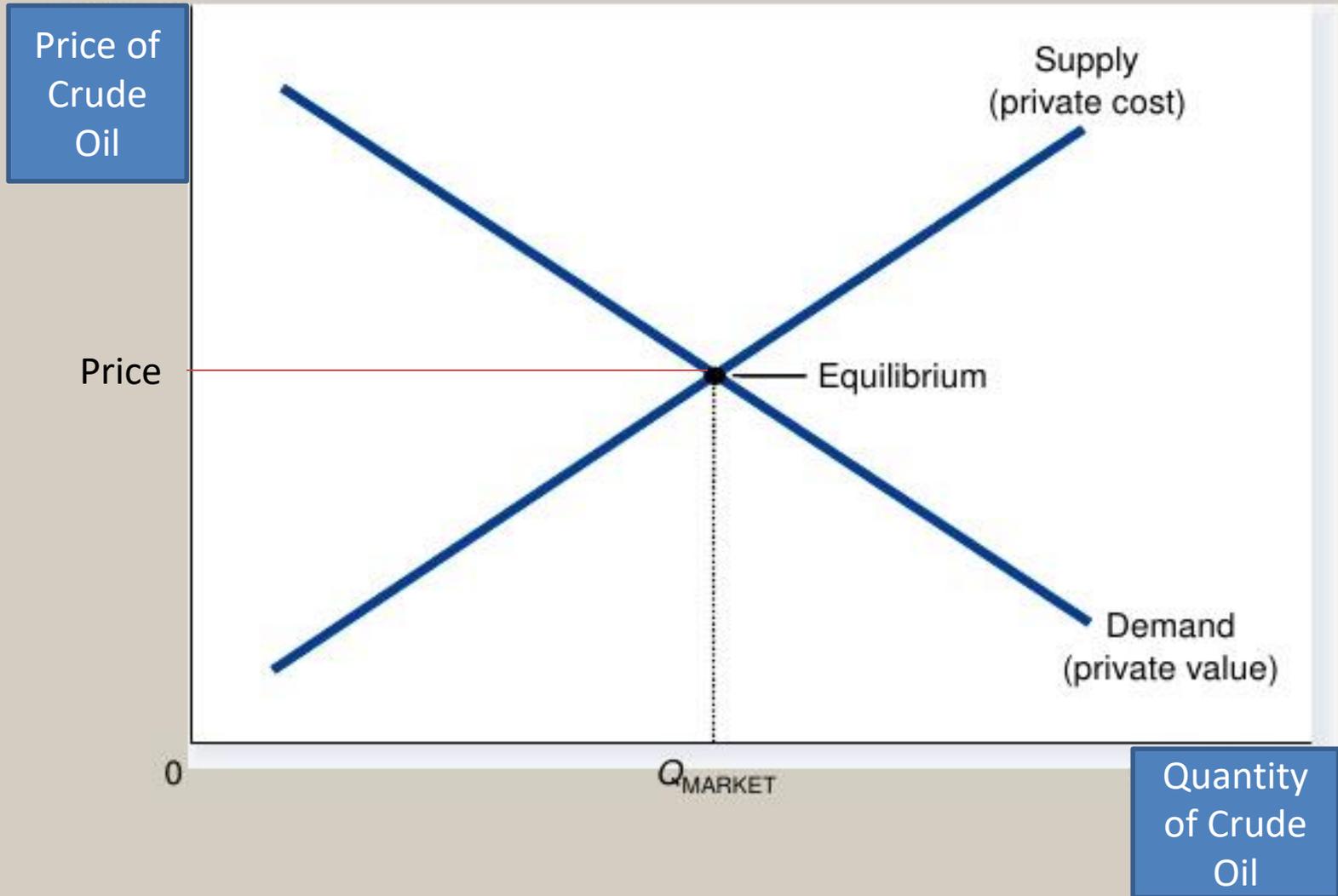
- Positive Externalities
 - Immunizations
 - Restored historic buildings
 - Research into new technologies



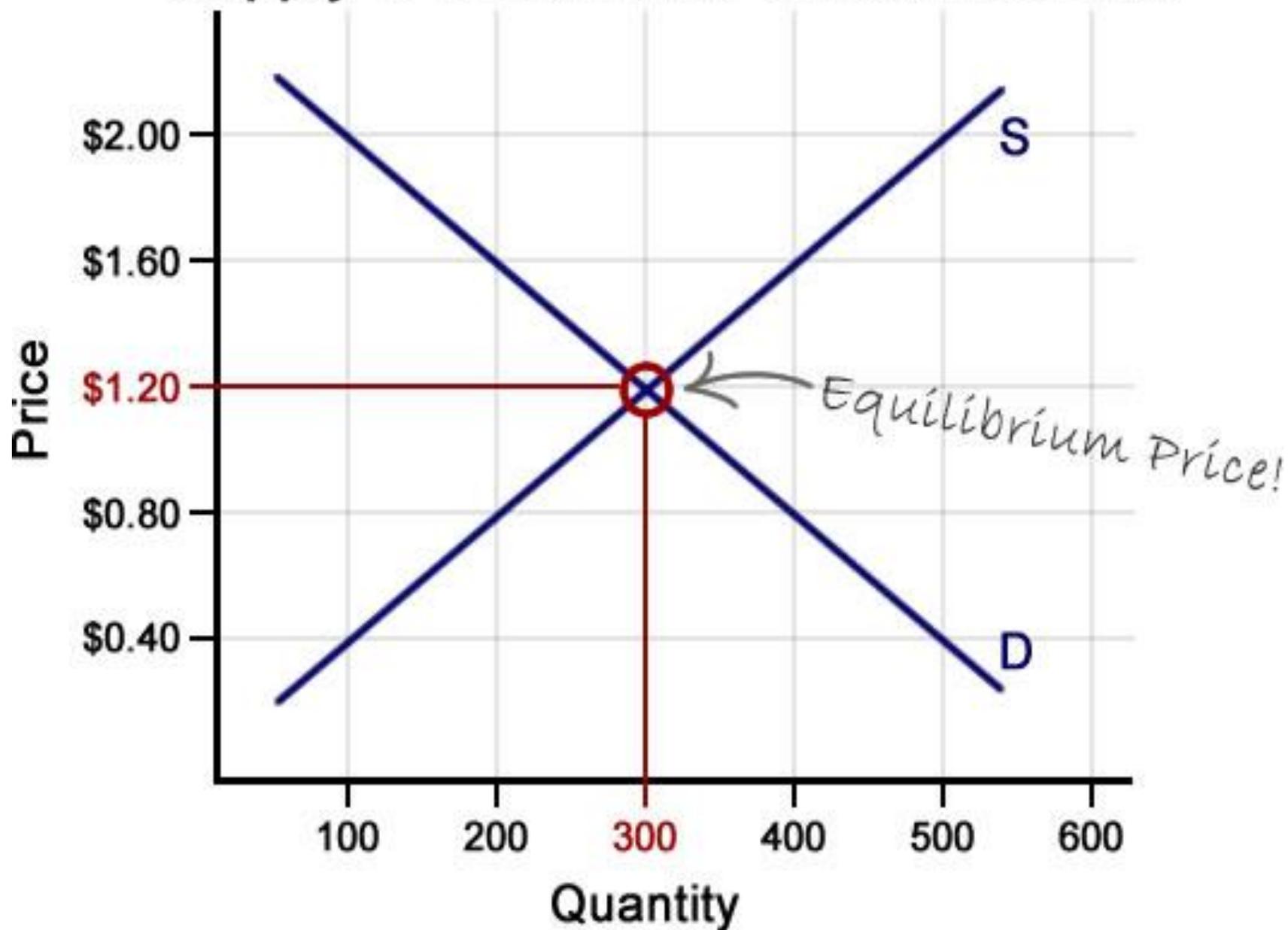


Price of x (in \$)	Qty. dmd. (in units)	Qty. supld (in units)
10	100	60
12	80	80
14	60	100

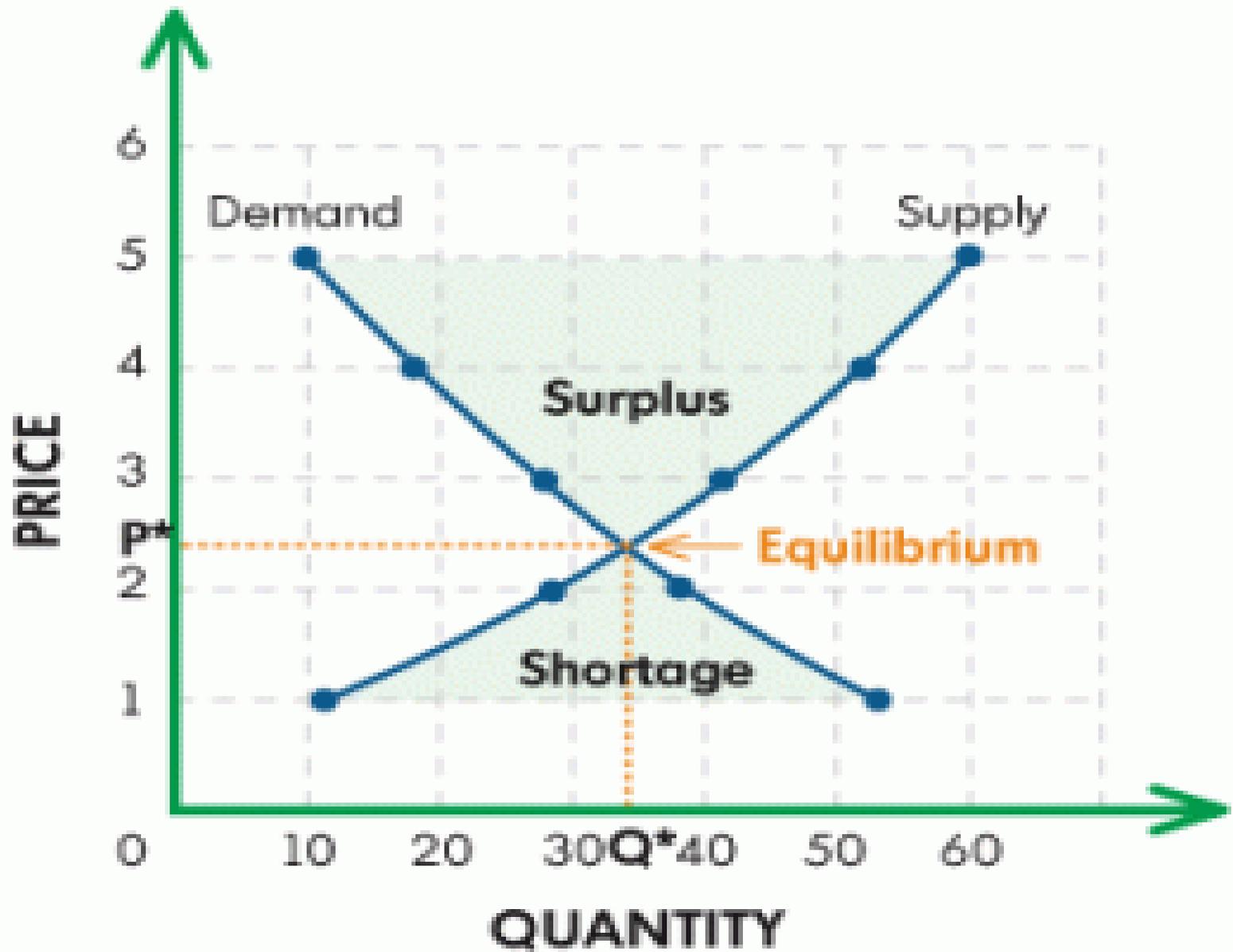
Market for Crude Oil



Supply & Demand for Chocolate Bars



Supply and Demand

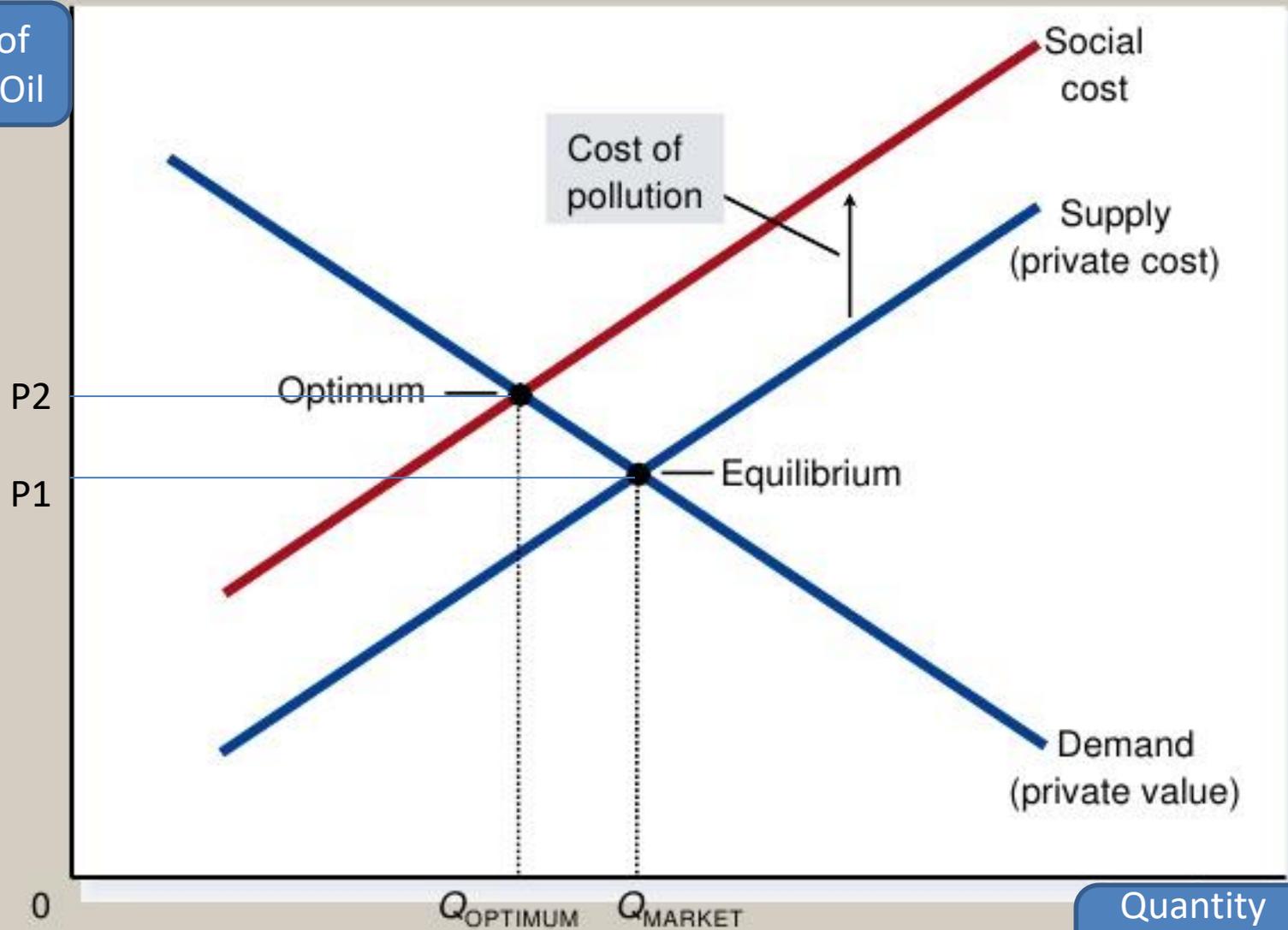


EXTERNALITIES AND MARKET INEFFICIENCY

- Negative externalities lead markets to produce a larger quantity than is socially desirable.
- Positive externalities lead markets to produce a smaller quantity than is socially desirable.

Figure 2 Pollution and the Social Optimum

Price of Crude Oil



Quantity of Crude Oil

Markets and Pollution

-
- Total costs of making a product include a seller's internal private costs and the external costs of pollution paid by society.
 - A supply curve based on all costs of making a product lies higher than one based only on sellers' internal private costs.
 - The higher supply curve crosses the demand curve at a lower quantity and a higher price than the lower supply curve.
 - When sellers' costs include only private costs, too much is produced and price is too low.
 - This lowers utility, and violates rights, and justice.

Negative Externalities

- The intersection of the demand curve and the social-cost curve determines the optimal output level.
 - The socially optimal output level *is less than* the market equilibrium quantity.

Negative Externalities

- *Internalizing an externality* involves altering incentives so that people take account of the external effects of their actions.

Internalization of the Costs of Pollution

- Absorption of external costs by the producer, who then takes them into account when determining the price of goods.
 - But this process leads to environmental injustice because the external costs of pollution are borne largely by those who do not enjoy a net benefit from the activity that produces the pollution.

Negative Externalities

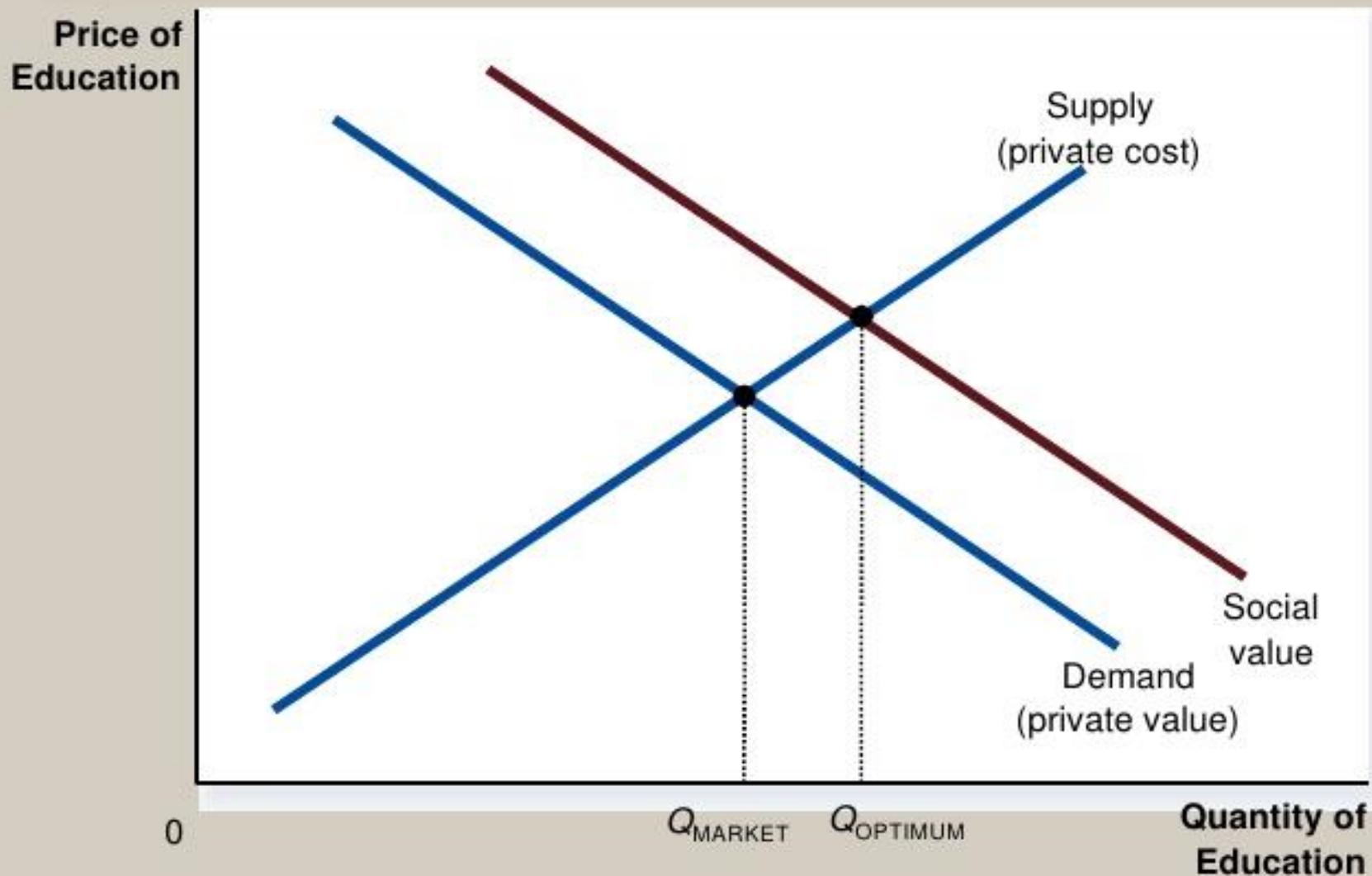
- Achieving the Socially Optimal Output
- The government can internalize an externality by imposing a tax on the producer to reduce the equilibrium quantity to the socially desirable quantity.

Positive Externalities

- When an externality *benefits* the bystanders, a positive externality exists.
 - The social value of the good exceeds the private value.

Social Value or
Cost/Private Value or
Cost

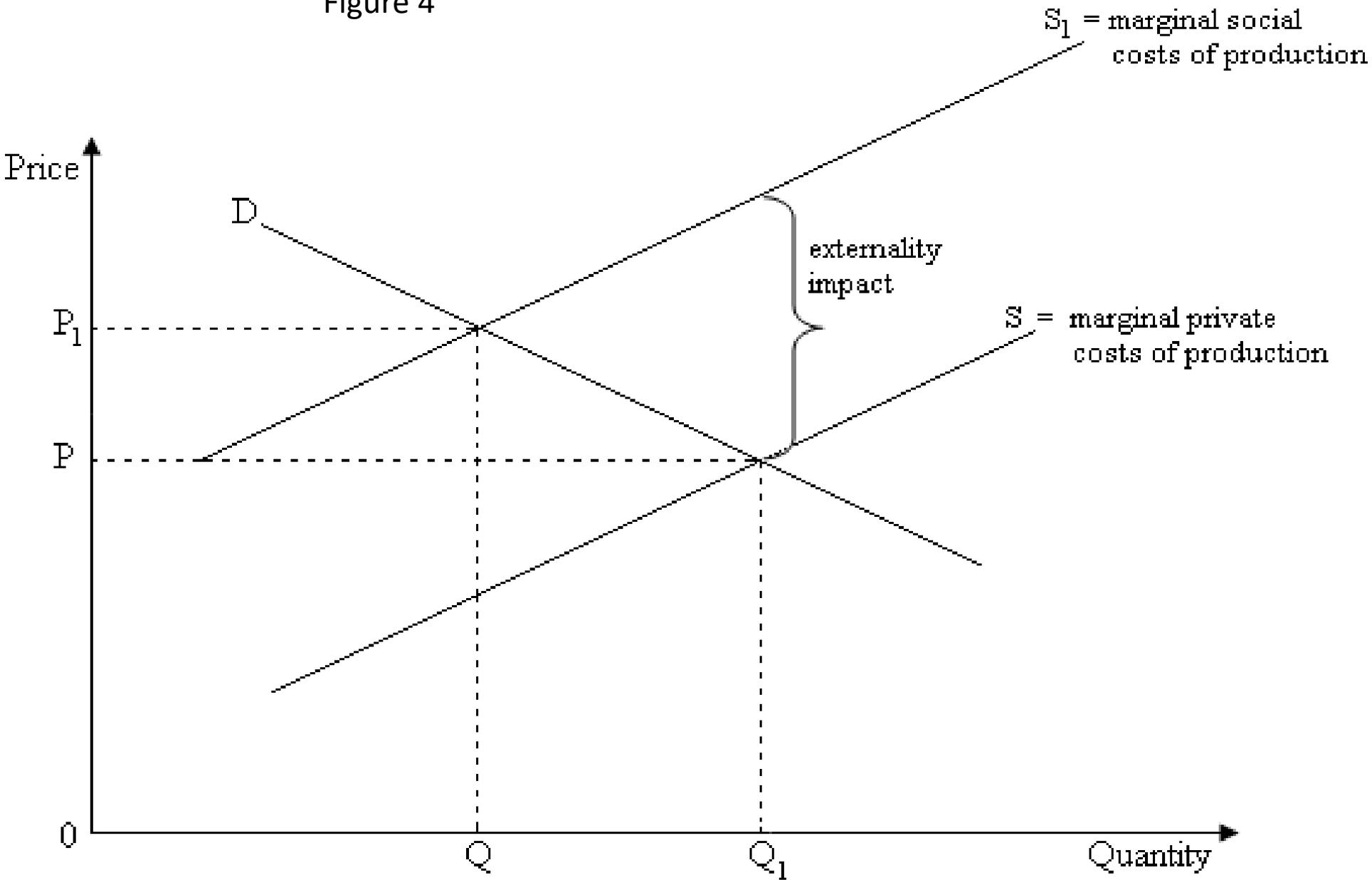
Figure 3 Education and the Social Optimum



Positive Externalities

- The intersection of the supply curve and the social-value curve determines the optimal output level.
 - The optimal output level is more than the equilibrium quantity.
 - The market produces a smaller quantity than is socially desirable.
 - The social value of the good exceeds the private value of the good.

Figure 4



“The best things in life are free. . . .”

- When a good does not have a price attached to it, private markets cannot ensure that the good is produced and consumed in the proper amounts.

“The best things in life are free. . . .”

- Free goods provide a special challenge for economic analysis.
- Most goods in our economy are allocated in markets...

THE DIFFERENT KINDS OF GOODS

- When thinking about the various goods in the economy, it is useful to group them according to two characteristics:
 - *Is the good excludable?*
 - *Is the good rival?*

THE DIFFERENT KINDS OF GOODS

- **Excludability**
 - *Excludability* refers to the property of a good whereby a person can be prevented from using it.
- **Rivalry**
 - *Rivalry* refers to the property of a good whereby one person's use diminishes other people's use.

What are Public Goods?

Public goods cause market failure due to the problem of **missing markets** – the main characteristics of public goods are as follows:

- 1. Non-excludability:** Benefits derived from **pure public goods** cannot be confined solely to those who have paid for it. Non-payers can enjoy the benefits of consumption at no financial cost to themselves – economists call this the **'free-rider' problem**
- 2. Non-rival consumption:** Each party's enjoyment of the good or service does not diminish others' enjoyment – in other words the marginal cost of supplying a public good to an extra person is zero. If a public good is supplied to one person, it is available to all.
- 3. Non-rejectable:** The **collective supply** of a pure public good for all means that it cannot be rejected by people, an example is a national nuclear defence system or major flood defence projects.

The nature of public goods is that it is hard to protect property rights

Characteristics of Public Goods

Pure public goods are **non-excludable** and **non-rival** in consumption

Public goods are also known as **collective consumption goods**

Why healthcare is NOT a public good

Healthcare has the characteristics of a private good because it is rival and excludable in consumption



Sanitation infrastructure



Flood defence / tidal barrage



Crime control for a community



Reduced risk of disease from vaccinations



Freely available knowledge e.g. online learning



Public service broadcasting

THE DIFFERENT KINDS OF GOODS

- Four Types of Goods
 - Private Goods
 - Public Goods
 - Common Resources
 - Natural Monopolies

THE DIFFERENT KINDS OF GOODS

- **Private Goods**
 - Are both excludable and rival.
- **Public Goods**
 - Are neither excludable nor rival.
- **Common Resources**
 - Are rival but not excludable.
- **Natural Monopolies**
 - Are excludable but not rival.

Figure 1 Four Types of Goods

		Rival?	
		Yes	No
Excludable?	Yes	<p>Private Goods</p> <ul style="list-style-type: none">• Ice-cream cones• Clothing• Congested toll roads	<p>Natural Monopolies</p> <ul style="list-style-type: none">• Fire protection• Cable TV• Uncongested toll roads
	No	<p>Common Resources</p> <ul style="list-style-type: none">• Fish in the ocean• The environment• Congested nontoll roads	<p>Public Goods</p> <ul style="list-style-type: none">• Tornado siren• National defense• Uncongested nontoll roads

PUBLIC GOODS

- A *free-rider* is a person who receives the benefit of a good but avoids paying for it.

The Free-Rider Problem

- Since people cannot be excluded from enjoying the benefits of a public good, individuals may withhold paying for the good hoping that others will pay for it.
- The free-rider problem prevents private markets from supplying public goods.

Public Goods, Market Failure and Free-Riders

With public goods, private sector markets may fail to supply **in part or in whole** the optimum quantity of public goods

- Pure public goods are not normally provided by the private sector because they would be unable to supply them for a profit.
- It is up to the government to decide what output of public goods / funding of public goods is appropriate for society.
- To do this, it must estimate the **net social benefits** from making public goods available.
- **The Free-Rider Problem**
 - Because public goods are non-excludable it is difficult to charge people for benefitting once a product is available
 - The **free rider problem** leads to under-provision of a good and thus causes market failure

The Changing Nature of Public Goods

Advances in technology are causing a blurring of the distinction between public and private goods. Here are some examples.

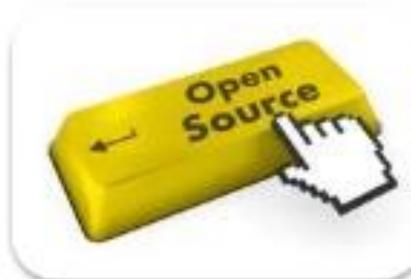
- In some cases, **encryption** allows suppliers to exclude non-payers – although the product remains non-rival
- Technological progress reduces the cost of smart-metering used in road pricing – this makes roads more of a private (excludable) good
- The open source / creative commons movement has made much information public good in nature



Encryption devices



Smart Electronic Road Pricing



Open Source Software



Live Streaming of Events

Excludability and Rivalry – Different Goods & Services

Totally non-rival in consumption

Encrypted digital broadcasting

Private Parks

Analogue broadcasting

Common Land

National defence systems

Public Firework Displays

Toll Bridges

Totally rival in consumption

Sports Tickets to a Major Event

Vaccinations for the general population

Totally excludable

Totally non-excludable

Public Bads

- A **public bad** has negative effects (externalities) on people and their communities leading to a significant **loss of social welfare**
- Examples of public bads:
 1. Spread of infectious diseases such as [Covid 19](#)
 2. Unauthorized / illegal surveillance by the state
 3. Modern slavery / human trafficking
 4. Environmental threats to the global commons
 5. Gender and other forms of discrimination in labour markets
 6. Disposal of household and commercial waste
 7. Web viruses / denial of service attacks
 8. High rates of global inequalities of income and wealth
 9. Endemic corruption within organisations and societies
 10. Externalities from banking crises / financial mismanagement

Key Point: Arguments about whether market activity lead to public bads almost inevitably involves making **normative statements** that carry **value judgements**

Tragedy of the Commons

- The *Tragedy of the Commons* is a parable that illustrates why common resources get used more than is desirable from the standpoint of society as a whole.
 - Common resources tend to be used excessively when individuals are not charged for their usage.
 - This is similar to a *negative externality*.

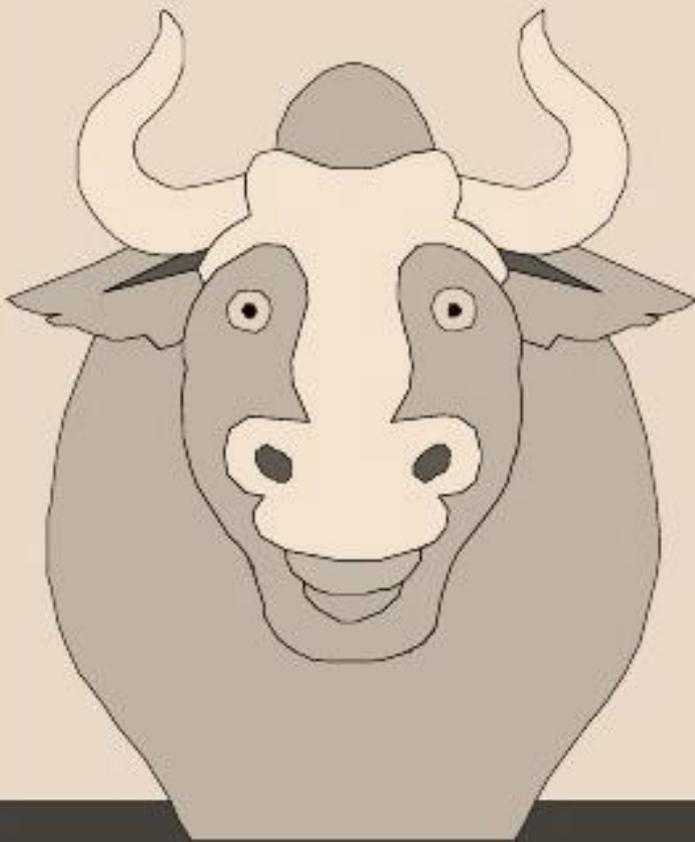
The Tragedy of the Commons

- The pursuit of individual self-interest is often not good for social efficiency leading to the long term depletion of resources
- Consider the example of a stock of common grazing land used by all livestock farmers in a small village.
- Each farmer keeps adding more livestock to graze on the Commons, because the marginal cost of doing so is zero.
- But because the commonly own resource is then over-used the result is a depletion of the soil, lower productivity and thus a fall in the market value of the resource for all users.
- The resource may become irretrievably damaged.
- The contribution of each agent is minute, but summed over all agents, these actions cause long term damage

Key Point: The Tragedy of the Commons is caused mainly by the **lack of property rights** meaning that a government / community cannot protect the resource

CASE STUDY: Why Isn't the Cow Extinct?

- Will the market protect me?



**Private
Ownership and
the Profit
Motive!**

CONCLUSION: THE IMPORTANCE OF PROPERTY RIGHTS

- The market fails to allocate resources efficiently when property rights are not well-established (i.e. some item of value does not have an owner with the legal authority to control it).

*Fresh Air, the beautiful oceans,
the snow clad mountains. . .
The ENVIRONMENT*

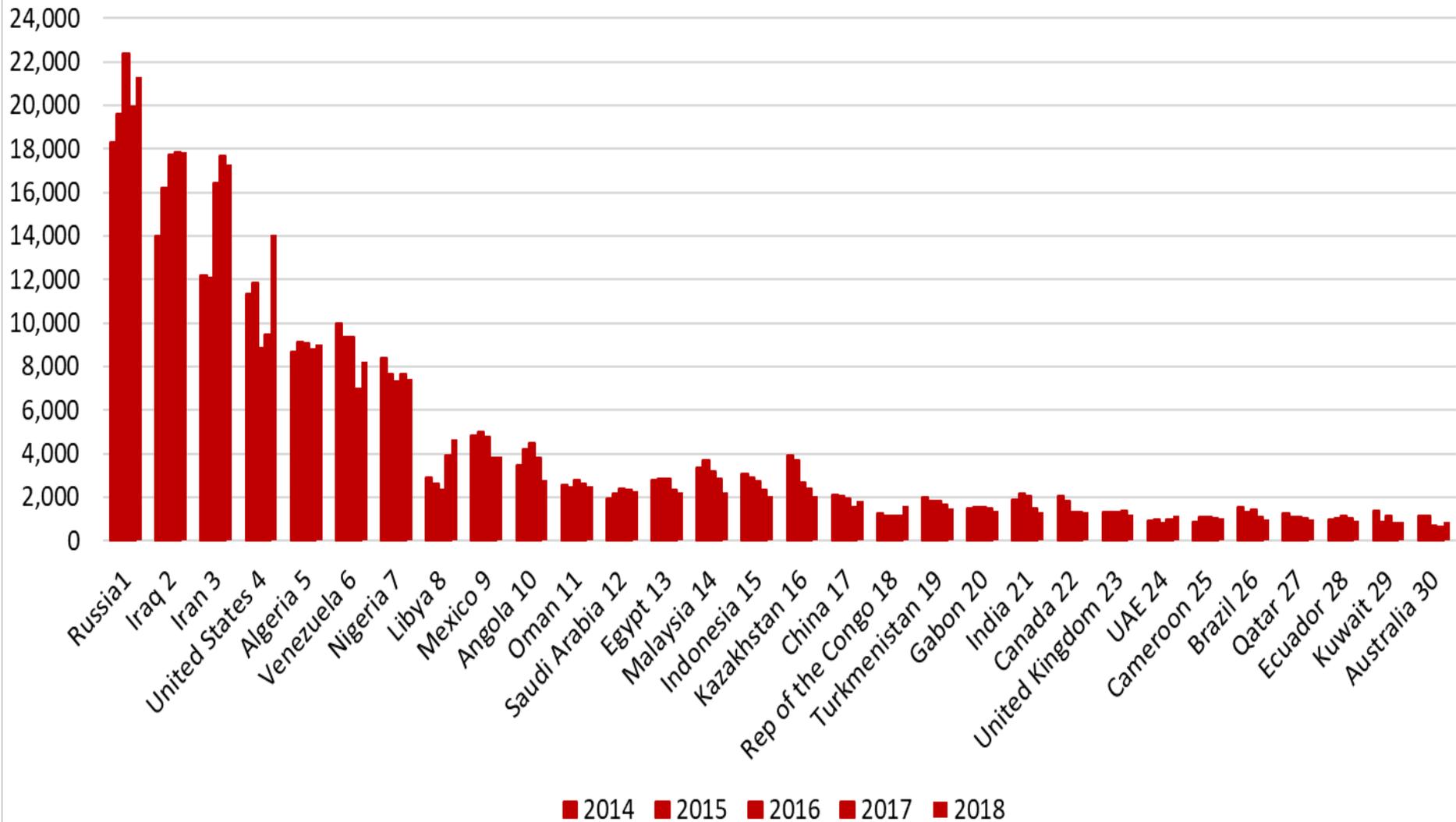
Summary

- Public goods are neither rival nor excludable.
- In Our case, the Public Good is the Environment Because people are not charged for their use of public goods, they have an incentive to free ride when the good is provided privately.
- Governments provide public goods, making quantity decisions based upon cost-benefit analysis.

**EXTRACTIVE INDUSTRY, OIL INDUSTRY
&
CALCULATION OF ENVIRONMENTAL
EXTERNALITY/COSTS FOR AUDIT
- RESEARCH, FIELD STUDY
&
FINDINGS**

	Country	Oil Production (bbl/day) ^[1]	Oil Production per capita (bbl/day/million people) ^[5]
-	World Production	80,622,000	10,798
01	USA	15,043,000	35,922
02	Saudi Arabia (OPEC)	12,000,000	324,866
03	Russia	10,800,000	73,292
04	Iraq (OPEC)	4,451,516	119,664
05	Iran (OPEC)	3,990,956	49,714
06	China	3,980,650	2,836
07	Canada	3,662,694	100,931
08	United Arab Emirates (OPEC)	3,106,077	335,103
09	Kuwait (OPEC)	2,923,825	721,575
10	India	2,515,459	554
11	Venezuela (OPEC)	2,276,967	69,914
12	Mexico	2,186,877	17,142

The new ranking – top 30 flaring countries
(2014 – 2018)
Ranked by 2018 flare volume



Contaminant Fees for Air Emission Permits or Approvals
Minnesota State (USA) Clean Air Act 1991: Imposition of Contamination Fee*

Sl. No.	Contaminants	Fee Per Ton of
1	Ammonia	\$ 11.30
2	Carbon Monoxide	\$0.30
3	Chlorine & Chlorine Oxides	\$7.60
4	Hydrocarbons	\$11.30
5	Hydrogen Chloride	\$7.60
6	Nitrogen Oxides	\$7.60
7	Sulfur and Sulfur Oxides	\$8.80
8	Total Particulate	\$11.30
9	Other Contaminants	\$11.30

*Fee Collected for Potential Contamination of the Environment

Country	CO₂ tax Rate per pound	NO_x tax rate per pound
Denmark	\$14.30	-
Sweden	-	\$ 2.18

Source: Jain, Deepak and Mukta Kumra (2001), "Market and Environment" as a Part of the Joint Education Programme of Center for Preventive Environmental Management (CPEM), Nagpur

Table 1. Norwegian CO₂ taxes and emissions in 2006. NOK/tonne CO₂ and million tonne CO₂

Sector	Energy source	Stationary combustion, NOK/tonne CO ₂	Mobile combustion, NOK/tonne CO ₂	Process emissions, NOK/tonne CO ₂	Emissions mill. tonne CO ₂
Extraction of crude oil/natural gas and pipe transport	Natural gas	338	-	-	10.5
	Light mineral oil: middle distillates	297	297	-	0.4
	Unspecified	-	-	0	0.9
Private households	Petrol	-	341	-	3.7
	Light mineral oils: paraffin	208	-	-	0.3
	Light mineral oils: middle distillates	199	199	-	1.1
	Light mineral oils: special distillates	190	-	-	0.0
	LPG/Natural gas	0	0	-	0.0
	Coal and coke	0	-	-	0.0
	Unspecified	0	-	0	0.1

NOK- Norwegian Krone: 1 NOK = Rs. 7.90

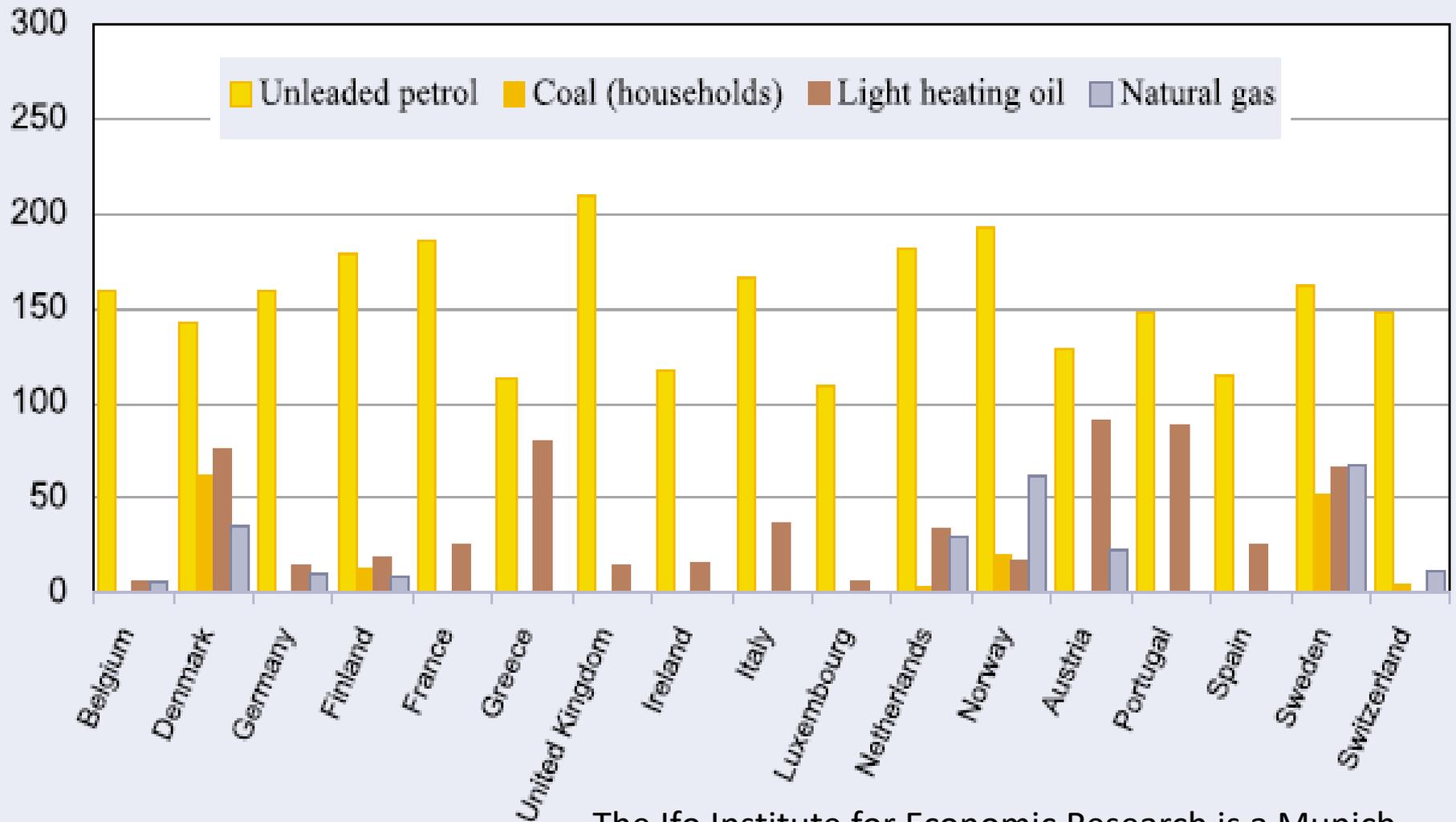
Inland transport by road, domestic shipping (e.g. fishing) and domestic air service	Petrol	-	341	-	0.1
	Light mineral oils: paraffin		208		0.9
	Light mineral oils: middle distillates	-	199	-	5.7
	Light mineral oils: special distillates	-	190	-	0.2
	Heavy mineral oils	-	169	-	0.3
	LPG/Natural gas	-	0	-	0.0
	Unspecified	-	-	0	0.0
Other process emissions	Unspecified	-	-	0	7.3
Other stationary combustion		0 - 208*	-	-	7.6
Other mobile combustion		-	0 - 341**	-	4.2
Total emissions		19.1	16.5	7.6	43.3

Source: Statistics Norway and Ministry of Finance (2005a)

AVERAGE TAX ON A TONNE OF CO₂

Selected Energy Sources

in ECU

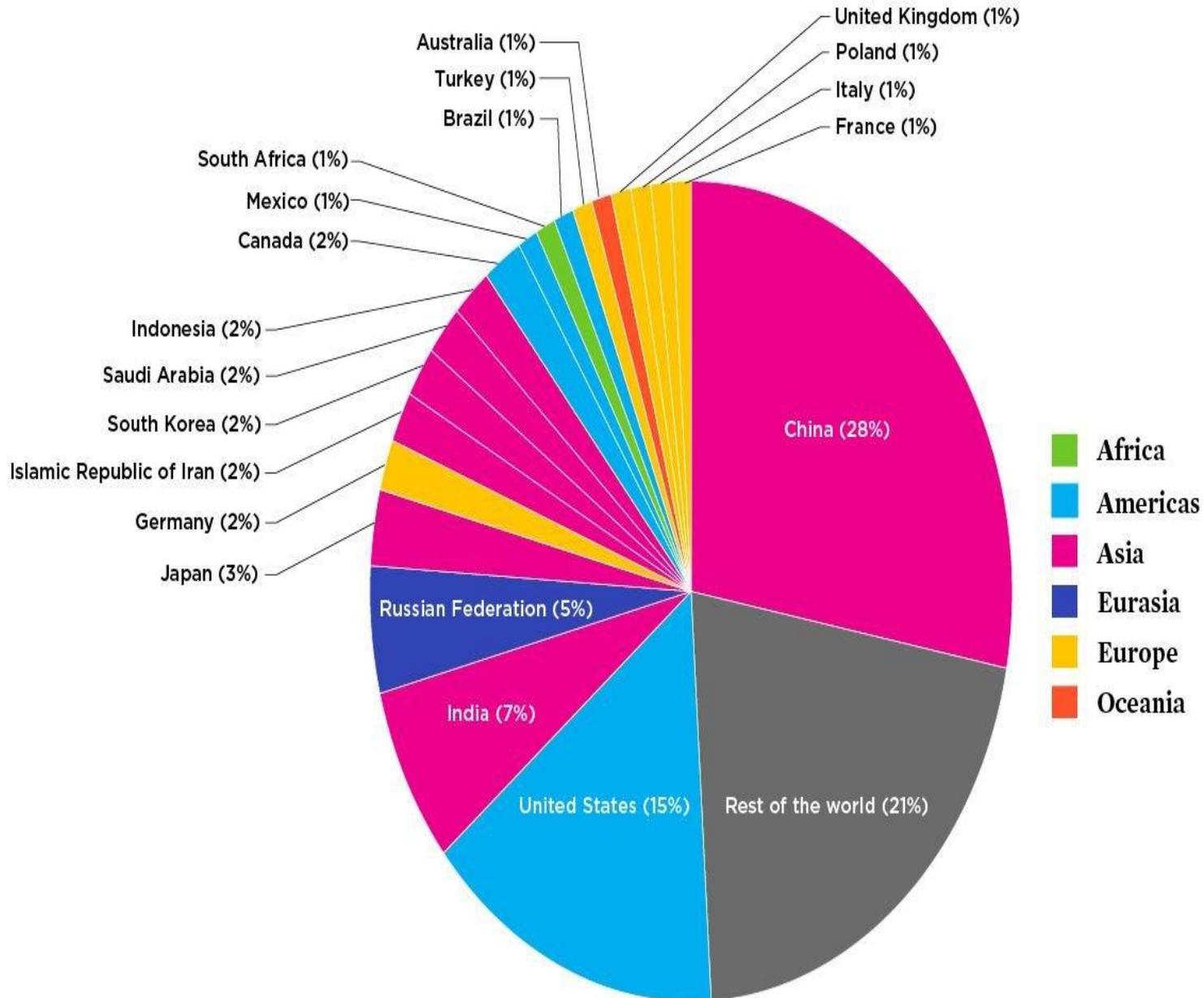


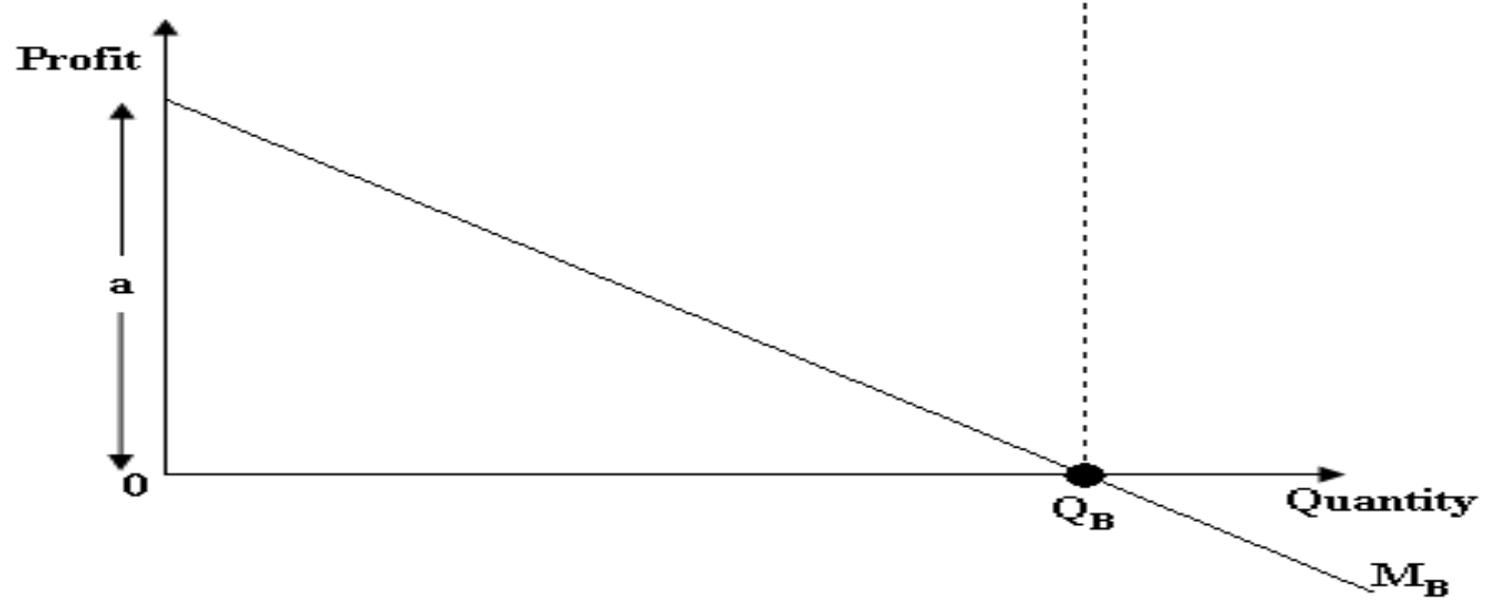
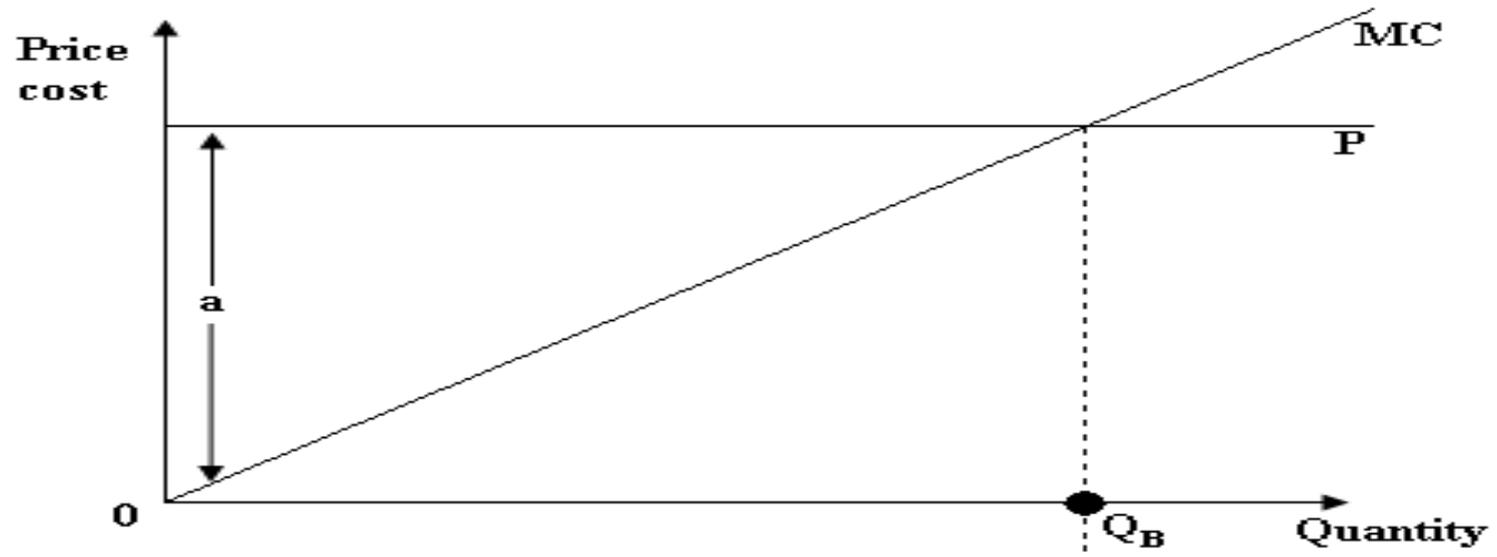
The Ifo Institute for Economic Research is a Munich-based research institution

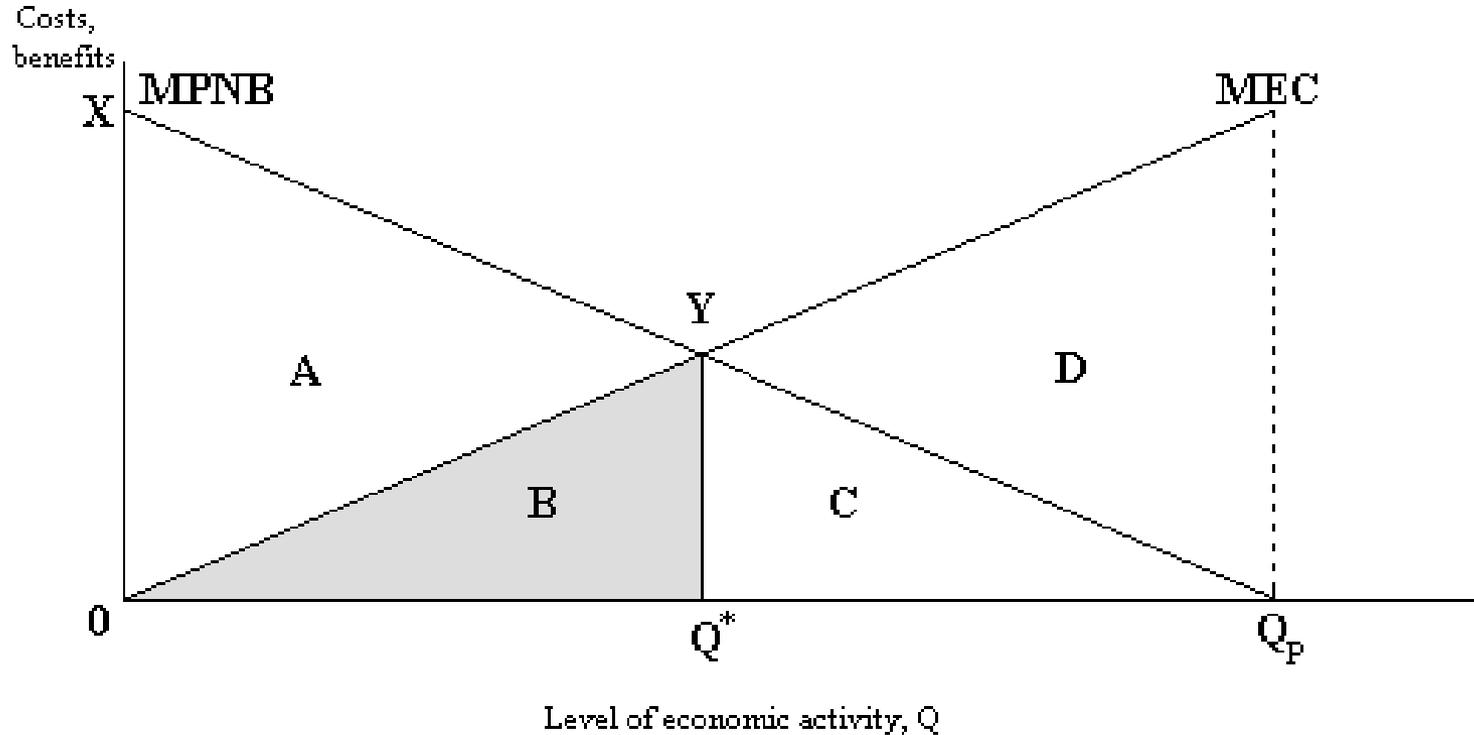
¹ DICE = Database of Institutional Comparison in Europe (www.cesifo.de).

Source: Calculation of the Ifo Institute.

Country wise share of emission of Carbon- di- Oxide







Economic definition of Optimal Pollution

AREA 'A'- Optimal Level of Pollution

AREA 'Q'- Optimal Level of Economic Activity

AREA ' Q_p '- Level of Economic Activity generating Maximum Private Benefits (for the producer)

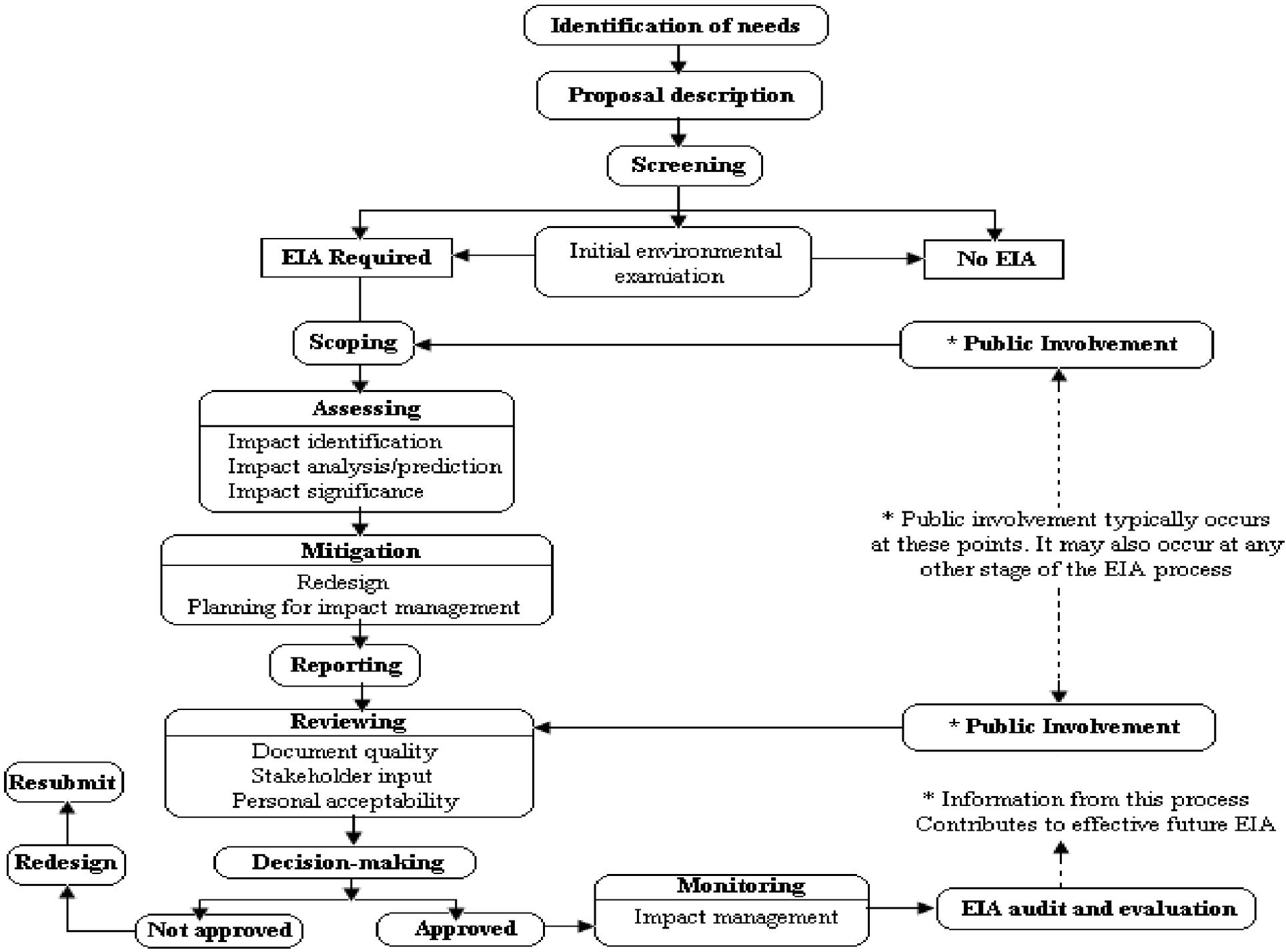
-
- **The United States (US) National Environmental Policy Act of 1969**
 - **Swedish Environmental Protection Law of 1969.**
 - **Enactment of Comprehensive Environment Protection Laws in Denmark (1973), Canada (1973), Australia (1974), The Netherlands (1981), Japan (1984) and the European Union (EU-1985)**
 - **The Stockholm United Nations Conference on Environment of 1972**
 - **Presentation Report of the World Commission on Environment and Development (chaired by Gro Harlem Brundtland) in 1987**
 - **The Montreal Protocol (on phasing out of Chlorofluorocarbons (CFCs) of 1987**
 - **The Earth Summit held in Rio de Janeiro (Brazil) in 1992 leading to the enactment of Agenda 21.**

Accidents relating to the industry that caused severe damage and posed alarming threat to the human beings, other living things and the overall environment enhanced global and local consciousness towards the need for adoption of practices in industry that subsequently led to evolution of CEM and EMS. Those accidents were-

- Release of Dioxin at Seveso in Italy in 1976
- The Bhopal Gas Tragedy of 1984, in which thousands died and were adversely impaired and/or affected due to accidental (and criminal negligence) leakage of Methyl Isocyanides gas.
- Spillage of huge quantities of pesticides by MNC Sandoz in the Rhine river that led to huge loss to the river and its organisms in particular and environment in general
- In 1989, a Russian oil tanker named Exxon Valdez wrecked o Sea and spilled huge quantities of oil killing thousands of marine organisms and plants besides by and large adversely affecting the sea water and environment.

KEY ELEMENTS OF EMS

- **Environmental Policy**
- **Environmental Standards**
- **Legal Requirements and Compliance**
- **Setting of Environmental Targets**
- **Organizational Structure and Responsibility**
- **Training, Awareness and Development of Competence**
- **Establishment of Communication**
- **Operational Control**
- **Monitoring and Measurement**
- **Non-Compliance and Non-Conformation Report for Subsequent Corrective and Preventive Action**
- **Maintenance of Records**
- **EMS Audit**
- **Management Review**



ENVIRONMENTAL POLICY

- Ensure safe and sound working environment at all our work places**
- Comply with all Rules and Regulations on Safety, Occupational Health and Environment Protection stipulated by statues besides our own policies and manuals**
- Adopt and promote safe and eco-friendly technology and review the performance of the systems in line with changing needs**
- Continuously work towards mitigation of adverse environmental impacts, if any of our operations on air, water and land**
- Prevent mishaps, minimize risks and hazards and remain trained, equipped and ready effective and prompt response to emergencies including disasters and accidents**

ENVIRONMENTAL POLICY

- Promote resource conservation and recycle options.**
- Prevent occupational diseases and accord due concern for the employees health as well as community around our operational areas.**
- Encourage external audit of our S, H & E standards so that the stakeholders and public confidence is safeguarded**
- Encourage knowledge up gradation and promote safety, health and Environmental awareness amongst all the employees**
- Remain committed for continual improvement and achievement of highest safety, health and environmental protection standards of the company leading towards sustainable development**
- Work towards preserving ecological balance and heritage in our operational areas**

- **ISO-9001: Quality Management System**
- **ISO: 14001 Environment Management System**
- **ISO/IEC 17025: Competency of Testing and Calibration Laboratories**
- **(NABL: National Accreditation Board for Testing and Calibration Laboratories)**
- **OHSAS-18001: Occupational Health & Safety Management System**

COMMONS

The operations of Oil Industries have implications and adverse impact on the Common Property Resources (CPR) popularly known as Commons in the literature of study of Commons. Commons are resources those are collectively owned by the local community. The International Association for Study of Commons (IASC) is the single most premier body of international repute and excellence that has pioneered research in the field of Commons. **Commons** or **Common Property Resources (CPR)** covers resources relating to agriculture, fisheries, forest resources, grazing areas, land tenure and use, social organization, water resources, wildlife, information and knowledge commons, global commons, history and also theory and experimental commons

- **Fisheries**

Includes: aquaculture; fisheries; co-management; coral reefs; fisheries' history; limited entry; marine-culture; marine property rights; quotas; sealing; seine fishing, shellfisheries; stewardship, whaling etc.

Also, types of fish: cod, crab, salmon, etc.

Also, types of fishing vessels and fishing technologies

(See also Water Resources and Global Commons Sectors)

- **Forest Resources**

Includes: afforestation; agro-forestry; buffer zones; certification clear-cutting; community forestry; deforestation; forest management; forest policy; forest products; fuel-wood; harvesting, hunters and gatherers; plantations; rainforests; sacred groves; savannahs; silvi-culture; soil conservation; stewardship, timber; tropical forests; woodlots, etc.

Also: names of trees and forest products: acacia, bamboo, mangrove, palm, etc.

Also: research technology and methods, such as GIS, mapping, remote sensing, etc.

- **General and Multiple-use Commons**

Includes: biodiversity; conservation; ecology; ecosystems, environmental management; environmental policy; multiple resource management; multiple-use; natural resources; pollution; resource sharing; rural development; sustainable development, etc.

(See also: Global Commons Sector)

- **Global Commons**

Includes: acid rain, air pollution, air slots, atmosphere, carbon sequestration; climate change, electro-magnetic spectrum, governance and management of arctic regions; global warming, greenhouse effect; international treaties; oceans, outer space; governance, law and management of trans-boundary resources; trans-boundary disputes, radio spectrum, etc.

- **Grazing Areas**

Includes: cattle grazing; herding systems; husbandry; livestock management; nomads; overgrazing; pastoralism; range management; rangelands, transhumance, etc. Also: reindeer, caribou, etc.

- **History**

Includes historical publications

ex.: Cook, G. W. [1856] *The Acts for Facilitating the Inclosure of Commons in England and Wales...*

Also includes modern publications about the history of common pool and common property resources

ex.: Norberg, K. [1988] "Dividing up the Commons: Institutional Change in Rural France, 1789-1799." *Politics and Society* 16:265-286

- **Information and Knowledge Commons**

Includes: anti-commons, copyright, indigenous, local, scientific knowledge issues, intellectual property rights, the Internet, libraries, patents, virtual commons, etc.

• **Social Organization**

Includes: capacity building; clans; class structure; collectives; community organization and participation; cultural history; ejidos; ethnicity; family structure; gender; governance systems; group behavior; households; indigenous institutions; institutional change; kibbutzim; kinship; panchayats; participatory management; peasants; sherpas; social change; social conflict; social norms; tribal structure, village organization; women, etc.

(See also Information and Knowledge, Theory and General & Multiple-Use Sectors)

• **Theory & Experimental**

Includes: adaptive systems; agent-based computational economics; club goods; collective action; common property regimes and rights; complexity; conflict resolution; cooperation; covenantal theory; decision making; design principles; economics, institutional, and legal history; ecological economics; efficiency; experimental economics; free riding; game theory; IAD framework institutional analysis; institutional economics; mechanism design; models; new institutionalism; norms; policy, prisoner's dilemma' property rights; public goods and bads; reciprocity; rent seeking; rules; scarcity; self-governance; simulations; social capital; tragedy of the commons; trust, etc.

- **Urban Commons**

Includes: apartment complexes and housing collectives; city commons; industrialized areas; parking, playgrounds, sidewalks, waste management, urban green-space, urban forestry, etc.

(See also New Commons Sector)

- **Water Resources**

Includes: canals; coastal management; coral reefs; dams; dyke management; groundwater, irrigation systems; marine policy; river management; riparian rights; sea tenure; watersheds; water pollution; water scarcity, etc.

(See also Fisheries, Agriculture, & Forestry Sectors)

- **Wildlife**

Examples: animal conservation and protection; biological diversity; CAMPFIRE (Zimbabwean project); endangered species; hunters and gatherers; indigenous management systems; poaching; etc.

•COMMONS LIKELY TO BE AFFECTED BY MINING OPERATIONS

- River Water resources (especially covering the area where the local population is dependent on river water as a source of fishing)**
- Other water bodies like ponds, tanks (from where fishes are sourced, especially during the monsoons)**
- Agricultural Land (collectively owned by the local people and/or the village/tea garden management having issued temporary ownership to tenants)**
- Ground water sources (from where drinking water through tube-wells are sourced by the local population)**
- Ambient air quality**

The Coase Theorem

- The *Coase Theorem* is a proposition that if private parties can bargain without cost over the allocation of resources, they can solve the problem of externalities on their own.
- Transactions Costs
 - *Transaction costs* are the costs that parties incur in the process of agreeing to and following through on a bargain.

Why Private Solutions Do Not Always Work

- Sometimes the private solution approach fails because transaction costs can be so high that private agreement is not possible.

PUBLIC POLICY TOWARD EXTERNALITIES

- When externalities are significant and private solutions are not found, government may attempt to solve the problem through . . .
 - command-and-control policies.
 - market-based policies.

PUBLIC POLICY TOWARD EXTERNALITIES

- **Command-and-Control Policies**
 - Usually take the form of regulations:
 - Forbid certain behaviors.
 - Require certain behaviors.
 - **Examples:**
 - Requirements that all students be immunized.
 - Stipulations on pollution emission levels set by the Environmental Protection Agency (EPA).

PUBLIC POLICY TOWARD EXTERNALITIES

- Market-Based Policies
 - Government uses taxes and subsidies to align private incentives with social efficiency.
 - *Pigovian taxes* are taxes enacted to correct the effects of a negative externality.

Remember the DRS- cold drinks in glass bottles to be purchased against Payment of security money, which was refunded on returning the bottles

THEORETICAL APPROACH TO ENSURE AN EFFICIENT EMS

- **Total Private Cost (TCP), magnitude of externalities and Total Social Cost (TSC), of production by Mining/Extractive Industries.**
- **The application of the principles of Eco-efficiency, if any, in Mining/Extractive Industries.**
- **Compliance of Mining/Extractive Industries, Duliajan, with the existing environmental laws.**
- **Controlling environmental problems through Environmental Economics**
- **Compatibility of the existing environmental management practices and potential application of EMS, in the operations of the Mining/Extractive Industries**

METHODOLOGY

I. VARIABLES

- **Total Private Cost (TPC) of production of natural gas and oil by Mining/Extractive Industries and approximation of the magnitude of negative environmental externalities produced by the OIL, Duliajan during its operations**
- **Operational Performance Indicators (OPIs) and Management Performance Indicators (MPIs)**
- **Response of the people to the activities of the Oil Industry in the following categories were assessed -**
 - 1. Employees of Oil Industry.**
 - 2. Non-employees indirectly engaged in activities of Oil Industry.**
 - 3. Public Stakeholders.**

VARIABLES

II. DATA USED AND COLLECTION METHODS

Data on the following was collected for use –

- Total Cost of production of oil and natural gas by Mining/Extractive Industries (for specific time periods).
- Total production / output of oil and natural gas by Mining/Extractive Industries (for specific time periods).
- Magnitude of externalities in forms of emission of pollutants associated with exploration and production of fossil fuels like natural gas and mineral oil.

[Note: For this specific purpose, the ‘Interim Externality Values’ as published and enacted by “Ontario's Automobile Feebates”; “Federal Tax on Ozone Depleting Chemicals” as prescribed by the “National Energy Policy Act of 1992” of the U.S. Congress; Denmark's CO₂ Tax Structure (1992) and Sweden’s NO_x, Tax Structure was compared. Besides, the reports of the, Research & Development Department of the OIL, Duliajan and also that of the State Pollution Control Board, was examined]

VARIABLES

- For measuring / analyzing MPIs and OPIs, the following data of the Mining/Extractive Industries was used –
- Environmental Policy, legal requirements, objectives and targets, Structure and responsibility, training awareness and competence programmes, communication, operational control, emergency preparedness and response programme, non-conformance and corrective and preventive action, records, EMS Audit, etc.
- Response of people (all categories - stakeholders)

The following Methods was used for collection –

- Collection of Secondary Data through –
 - * Environmental Reports on operations .
 - * Environmental Assessment on operations.
 - * Management Policy and related official documents.
 - * Reports of the 'Safety and Environment' department.
 - * Reports of the State/Provincial Pollution Control Board (SPCB).
 - * Reports of the R & D Department.

VARIABLES

- **Primary Data needs to be collected through interviews of–**
 - * **Officials of the Mining/Extractive Industries (especially from the department of Safety and Environment)**
 - * **Non-officials related to the Mining/Extractive Industries, viz. contractors, social clubs, NGO's, etc.**
 - * **Other social organizations**
 - * **Rural / Urban population affected / perceived to be affected by the operations of the OIL or the said mining industry**

DESIGN

- **To test the of incorporation of negative Externalities in the costs of production of oil & natural gas by Mining/Extractive Industries, the research one must study the official documents on total costs of production, total production/output and magnitude of externalities associated with specific levels of output**
- **To test the conformation of OPIs and MPIs with an efficient EMS, the it must be test the OPIs and MPIs. For this the determinants of OPI and MPI needs to be analyzed by assessing the official documents of the industry by canvassing of a questionnaire on the OPIs and MPIs for employees; and through soliciting opinion (both subjective and objective) of the employees on various aspects of EMS**

RESEARCH DESIGN (Continued)

- To test Mining/Extractive Industries compliance with the existing environmental laws, the design should examine the existing laws; OIL's environmental policy; OIL's compliance (official) reports; interview the officials of the State Pollution Control Board (SPCB); canvass questionnaire on compliance to the members/officials of SPCB; and conclusions on state of compliance must be assessed at two levels –
 - Official (documents, questionnaire, etc. based)
 - Ground/site level (though actual site visit backed by layman's knowledge/information on safety and waste/spill/pollution management)
- To test the compatibility of Mining/Extractive Industries operations and management with sustainable development, the design comprehensively should test the entire set of documents. Besides, more sets of questionnaire should be canvassed to the employees; non-employees related to the Industry through business/social obligations; other stakeholders like rural/urban people living near the sites of production of oil/natural gas

FINDINGS

- **It was found that contrary to the claims of the Mining/Extractive Industries, local population in and around the OCS in almost all areas of operations of the industry, reported contamination of ground water that is a Common Property Resource (CPR)**
- **Presence of negative environmental externality cannot be ruled out and there is evidence of non-equilibrium in the extraction/production of crude oil as the core principle of the Coase Theorem is violated**
- **Mining/Extractive Industries' social cost liability status is not in conformation with the broader goals of Sustainable Development and specific goals of EMS and Eco-efficiency**

FINDINGS (Continued)

- **The reporting of the Mining/Extractive Industry authorities regarding the actual amount (tentative) of sludge or hydrocarbon contamination may be under-reported as witnessed from data available from the Oil industries around the globe. Moreover, annual spillage of hydrocarbons due to major and fatal accidents and/incidents too has not been accounted for**
- **Releases of contaminants during accidents are not accounted in the annual sludge and/or contaminant documentation but are part of a different documentation**

FINDINGS (Continued)

- **The study also reveals that there are direct adverse implications of the operations of these industries on the Commons and are observed relating to five aspects-**
 - 1. River Water resources (especially covering the area where the local population is dependent on river water as a source of fishing)**
 - 2. Other water bodies like ponds, tanks (from where fishes are sourced, especially during the monsoons)**
 - 3. Agricultural Land (collectively owned by the local people and/or the village/tea garden management having issued temporary ownership to tenants)**
 - 4. Ground water sources (from where drinking water through tube-wells are sourced by the local population)**
 - 5. Ambient air quality**

FINDINGS (Continued)

- **There is lack of conservation efforts on the part of the regulatory body and also the local governments**
- **Absence of governance by the regulatory body Pollution control boards is proof of the passive role played by the them. Their role is limited to control of damages in the post-externality creation scenario**
- **There is lack of conservation efforts on the part of the regulatory body and also the local governments**

**The Environment, Pandemic Covid- 19
& Implications on Industrial Practices
(A context for the Auditors)**

Figure 1: COVID-19 in Leading Oil Consuming Countries

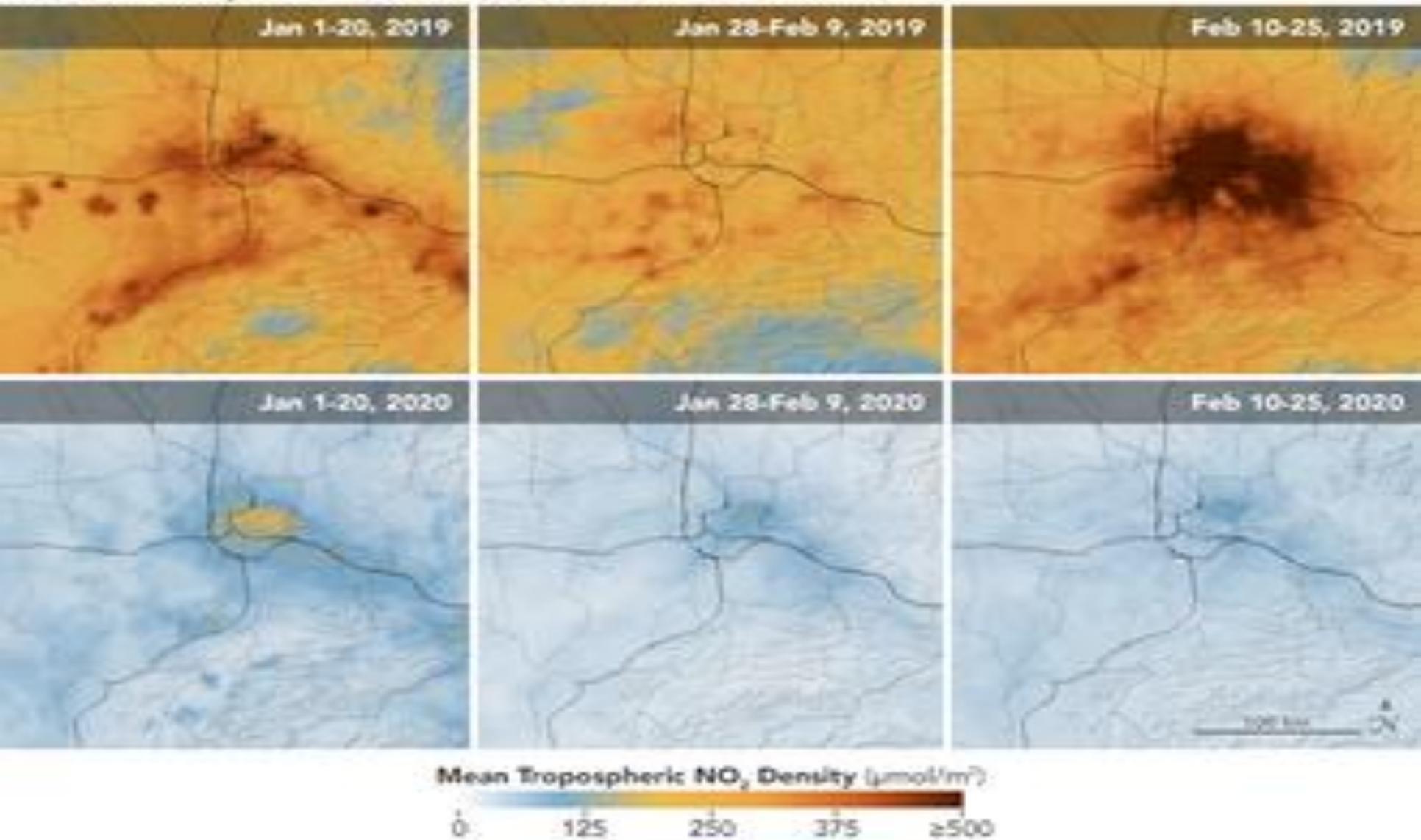
						COVID19 (As on 27 March 2020),1720, IST			
	Country	Current GDP (Billion USD)	Population (million)	Oil Consumption (mbpd) in 2018	Share (%) total oil consumed	Number Infections	Deaths	Share (%) of Infections	Share (%) of Deaths
1	United States	20544	340	20.46	20.49	85996	1300	15.84	5.34
2	China	13608	1400	13.52	13.55	81894	3296	15.09	13.53
3	India	2719	1353	5.16	5.16	775	20	0.14	0.08
4	Japan	4971	127	3.85	3.86	1387	47	0.26	0.19
5	Saudi Arabia	787	34	3.72	3.73	1012	3	0.19	0.01
6	Russia	1658	144	3.23	3.23	1036	3	0.19	0.01
7	Brazil	1869	209	3.08	3.09	2985	77	0.55	0.32
8	South Korea	1619	51	2.79	2.80	9332	139	1.72	0.57
9	Canada	1713	37	2.45	2.45	4046	40	0.75	0.16
10	Germany	3948	83	2.32	2.32	47278	281	8.71	1.15
11	Iran	600	82	1.88	1.88	32332	2378	5.96	9.76
12	Mexico	1221	126	1.81	1.81	585	8	0.11	0.03
13	Indonesia	1042	260	1.79	1.79	1046	87	0.19	0.36
14	UK	2855	66	1.62	1.62	11816	580	2.18	2.38
15	France	2778	67	1.61	1.61	29581	1698	5.45	6.97
16	Thailand	505	69	1.48	1.48	1136	5	0.21	0.02
17	Singapore	364	6	1.45	1.45	683	2	0.13	0.01
18	Spain	1419	47	1.34	1.34	57786	4365	10.65	17.92
19	Italy	2084	61	1.25	1.25	80589	8215	14.85	33.72
20	Australia	455	9	1.09	1.10	3143	13	0.58	0.05
21	Taiwan	589	23	1.07	1.08	267	2	0.05	0.01
22	Turkey	771	82	1.00	1.00	3629	75	0.67	0.31
	Total	68119	4676	77.97	78.09	458334	22634	84.44	92.91
	Rest of the World	17800	3124	21.87	21.91	84444	1727	15.56	7.09
	Grand Total	85919	7800	99.84	100.00	542778	24361	100.00	100.00

Source: Prepared by the author from various published sources like World Bank and Joh Hopkin University.

- The coronavirus pandemic has caused a global reduction in economic activity and although this is major cause for concern, the ramping down of human activity appears to have had a positive impact on the environment. Industrial and transport emissions and effluents have reduced, and measurable data supports the clearing of pollutants in the atmosphere, soil and water.
- The month of May, which usually records peak carbon emissions due to the decomposition of leaves, has recorded what might be the lowest levels of pollutants in the air since the 2008 financial crisis.
- China and Northern Italy have also recorded significant reductions in their nitrogen dioxide levels.
- Further, sources suggest that there has been a 25 percent drop in energy use and emissions in China over two weeks which is likely to decrease the overall annual carbon emissions of the country by 1 percent.

Pollutant Drops in Wuhan—and Does not Rebound

Unlike 2019, NO_2 levels in 2020 did not rise after the Chinese New Year.



Images from the [NASA Earth Observatory](#) show a stark drop in pollution in [Wuhan](#), when comparing NO_2 levels in early 2019 (top) and early 2020 (bottom)

- In India the results were similar too; March 22 was the ‘Janata Curfew’, following which, a significant dip in air pollution levels was measured across the country. Cities like Delhi, Bengaluru, Kolkata and Lucknow saw their average Air Quality Index (AQI) staying within two digits.

- Another example of cleaner air was seen when, on April 3rd, residents of Jalandhar, a city in Punjab state, woke up to a view of the Dhauladhar mountain range, a rare feat in normal times, considering the distance between the two places- lying nearly 213 kilometres apart from each other and have not been visible from the city in recent memory.

- Water bodies have also been clearing and the rivers Yamuna and Ganga have seen significant improvement since the enforcement of a nationwide lockdown. According to the real-time water monitoring data of the Central Pollution Control Board (CPCB), the average water quality of 27 points of the Ganga seen in recent days, is suitable for bathing and propagation of wildlife and fisheries.

Fossil fuel and the Extractive Industries

- A report by the London-based think tank CARBON TRACKER concludes that the coronavirus pandemic may have pushed the fossil fuel industry into "terminal decline" as demand for oil and gas decreases while governments aim to accelerate the clean energy transition.
- It predicts that an annual 2% decline in demand for fossil fuels could cause the future profits of oil, gas and coal companies to collapse from an estimated \$39tn to \$14tn- However, according to Bloomberg New Energy Finance more than half a trillion dollars worldwide are currently intended to be poured into high-carbon industries
- Preliminary disclosures from the Bank of England's Covid Corporate Financing Facility indicate that billions of pounds of taxpayer support are intended to be funneled to fossil fuel companies.

- According to Reclaim Finance the European Central Bank intends to allocate as much as €220bn (£193bn) to fossil fuel industries.
- An assessment by Ernst and Young finds that a stimulus program that focuses on renewable energy and climate-friendly projects could create more than 100,000 direct jobs across Australia and estimates that every \$1m spent on renewable energy and exports creates 4.8 full-time jobs in renewable infrastructure while \$1m on fossil fuel projects would only create 1.7 full-time jobs

An aerial photograph showing a large fleet of British Airways aircraft parked in neat rows on an airport tarmac. The aircraft are white with the airline's signature red, white, and blue tail livery. The tarmac is bordered by green grass and a paved path. The perspective is from a high angle, looking down at the planes.

The big picture latest

Covid-19 has accelerated
the global stranding of
fossil-fuel-economy assets

What does that mean
for our world?

Jeremy Leggett, 9th June 2020

Fossil-fuel and fossil-fuel-implicated assets amount to well over \$100 trillion

4th June 2020
Carbon Tracker's
latest report



"The fossil fuel industry is approaching terminal decline....
The size of the fossil fuel economy suggests its decline
could pose a significant threat to global financial stability."



The central premise

"The world faces two contrasting pathways. Either it can secure the 'trillion dollar green gigafall', the trillions that can be generated at low cost from the sun and the wind – particularly benefitting the poorest inhabitants of the world currently dependent upon high cost fossil fuel imports..."



"...Or it can stay locked into business as usual, tied into a declining industry that both threatens the global economy with the worst effects of a warming planet, and damages investors with losses, low returns and destabilised equity and credit markets."

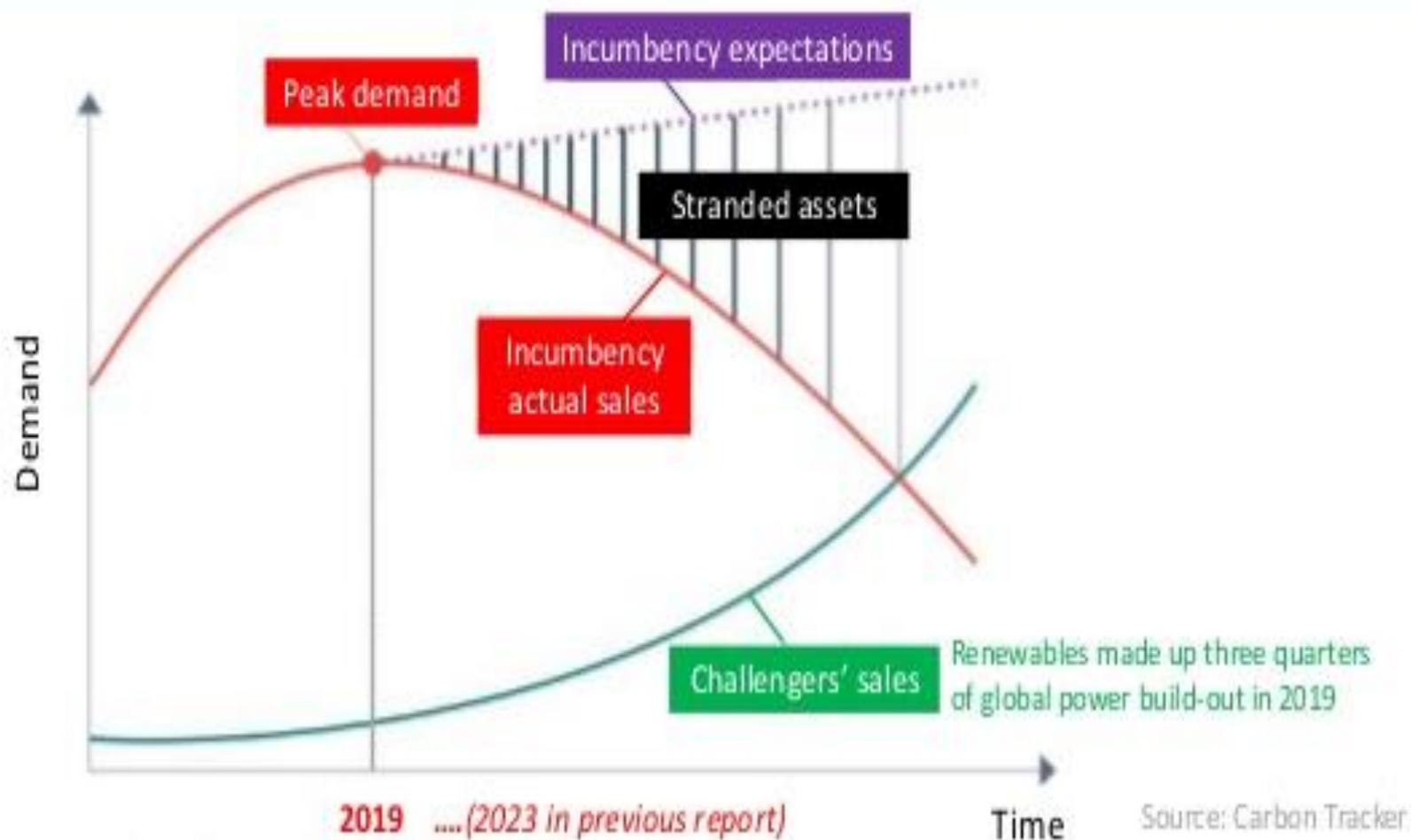
Carbon Tracker, Decline and Fall

The first requires an orderly retreat. The second requires persistence with the suicidal multi-trillion-dollar capital flows of fossil-fuel "normality". This choice is the battleground we will fight on for the rest of our vocational lives.

4th June
2020

“Coronavirus crisis could cause \$25 trillion fossil fuel industry collapse”

a typical headline



Analysis of “challengers’ sales” led to the best estimate of 2003 peak demand in Carbon Tracker’s previous report. Now Carbon Tracker (and other analysts) think peak fossil-fuel demand may already be in the rear-view mirror.

April - May
2020

Carbon Tracker predictions playing out

Oil Companies Are Collapsing, but Wind and Solar Energy Keep Growing 7th April, New York Times

Texas: how the home of US oil and gas fell in love with solar power 7th April, Financial Times

Oil slumps on worries that supply cuts are playing catch-up to falling demand 15th April, Reuters

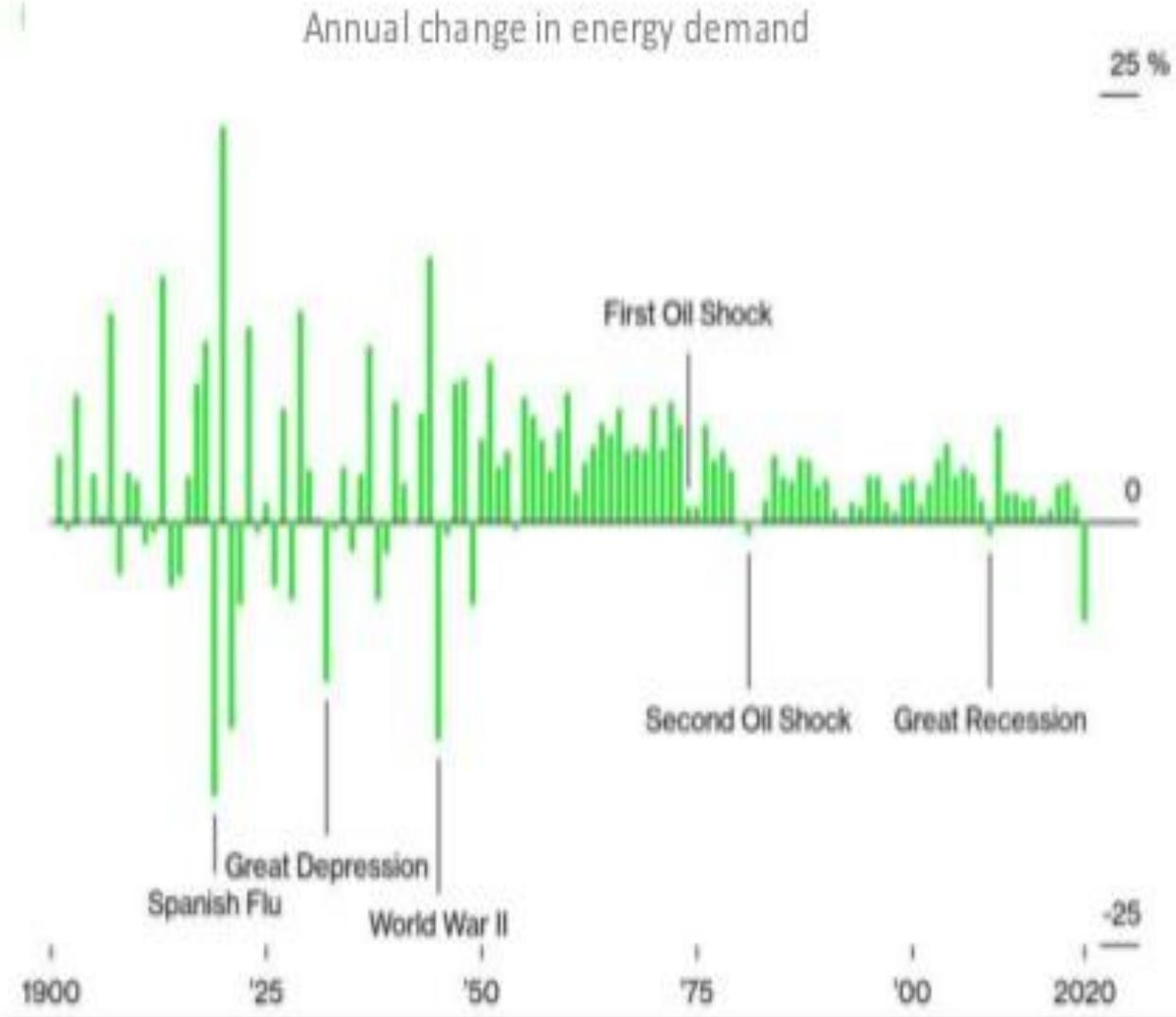
Big Oil's survival at stake in a world where 'everything has changed' 24th April, Financial Times

Renewables Are the Only Winners in Historic Decline in Energy Demand 30th April, Bloomberg

Renewables sector shrugs off devastating effects of coronavirus 7th May, Financial Times

Clean power stocks outperform fossil fuel peers during pandemic 28th May, Financial Times

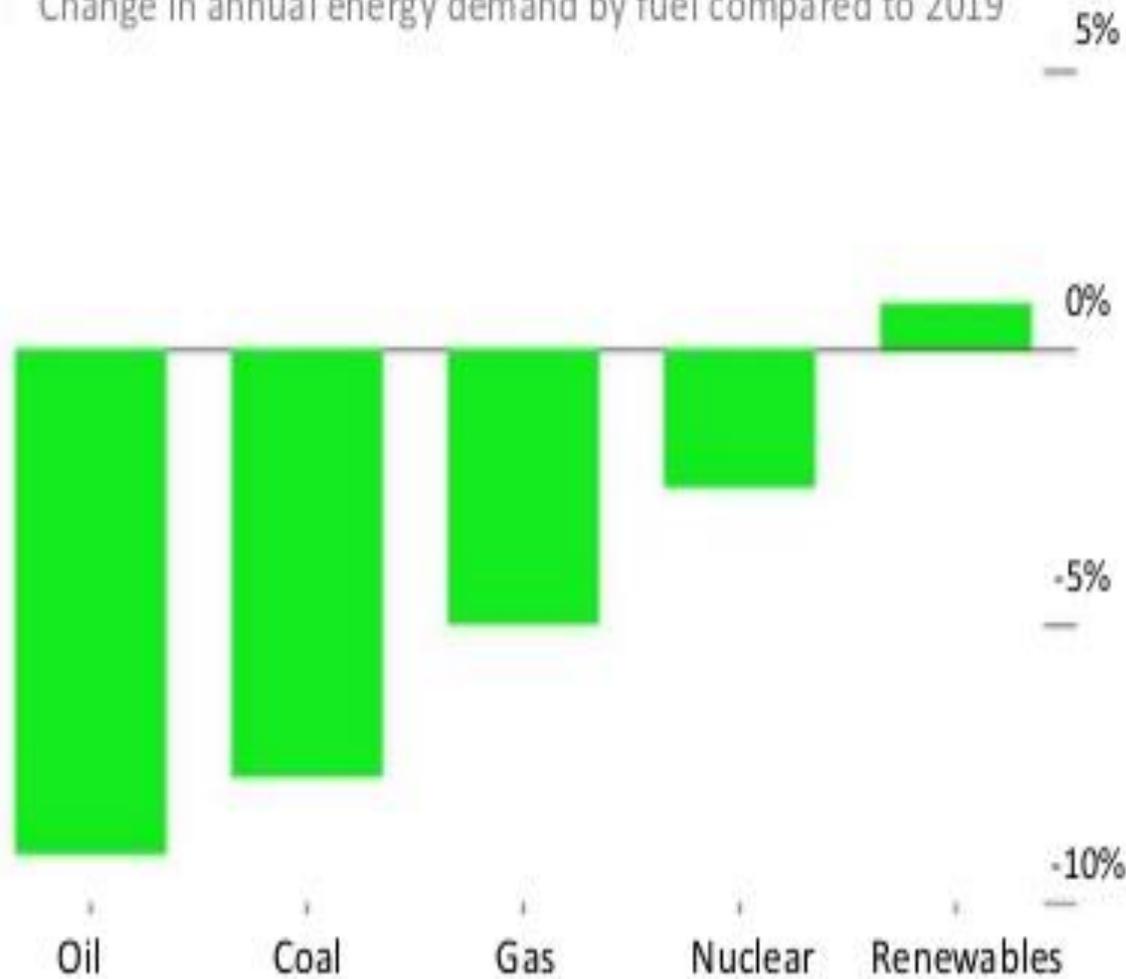
Global energy demand hasn't fallen so much in 70 years



30th April
2020

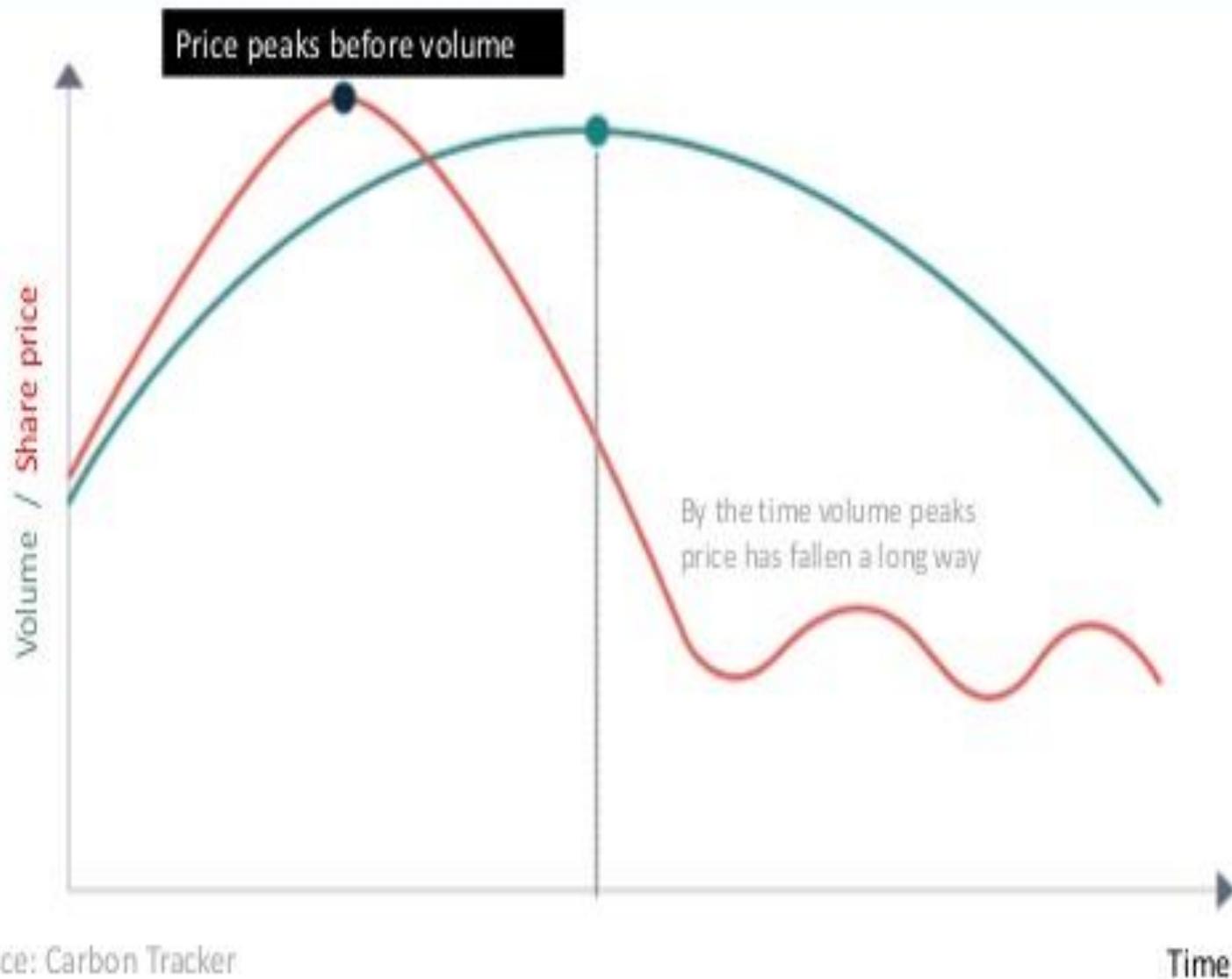
Only demand for renewables is growing in the new normal

Change in annual energy demand by fuel compared to 2019

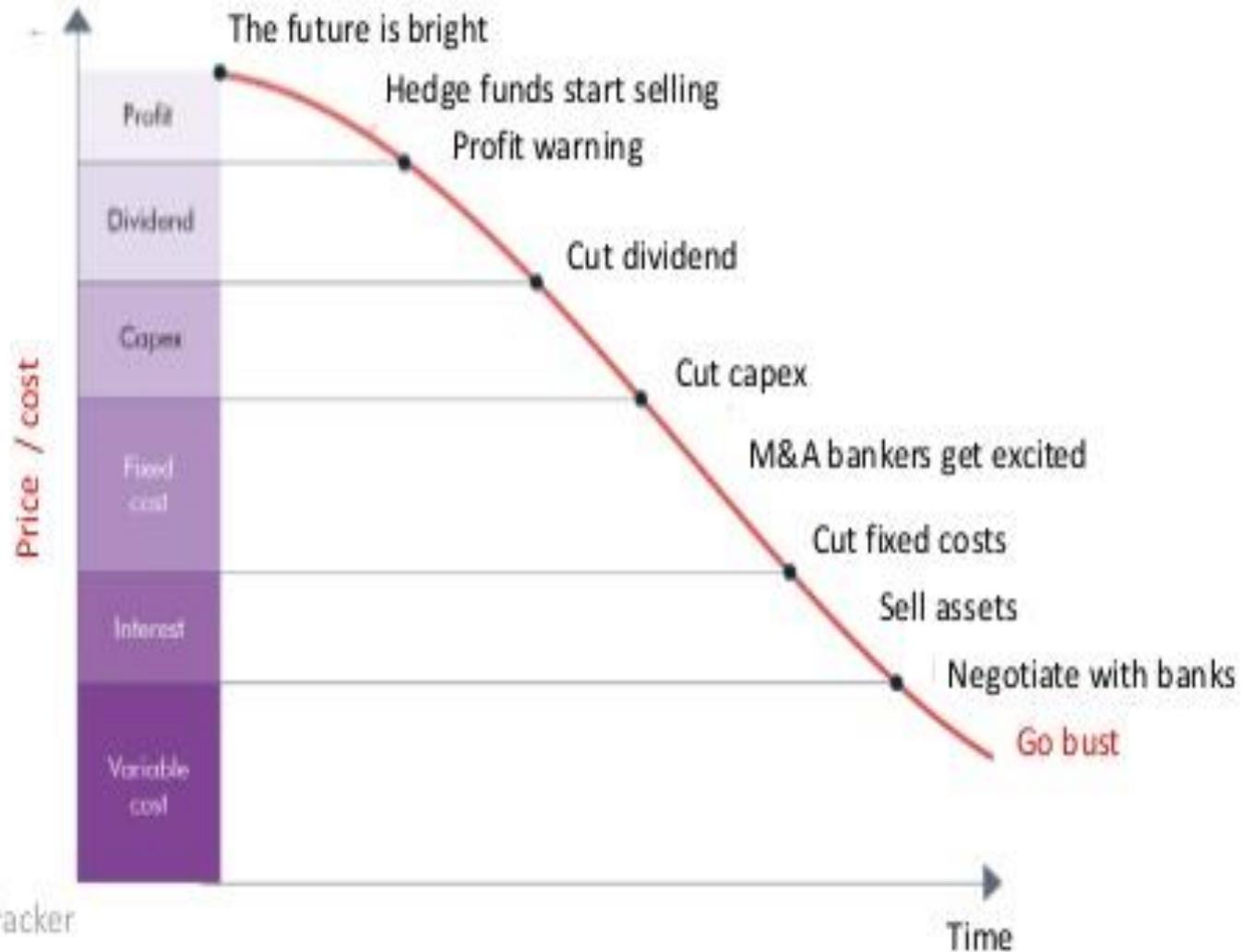


Source: Bloomberg, on IEA data

The pattern is clear, for those with eyes to see....



....as is the fate of many an oil and gas company on a falling price curve

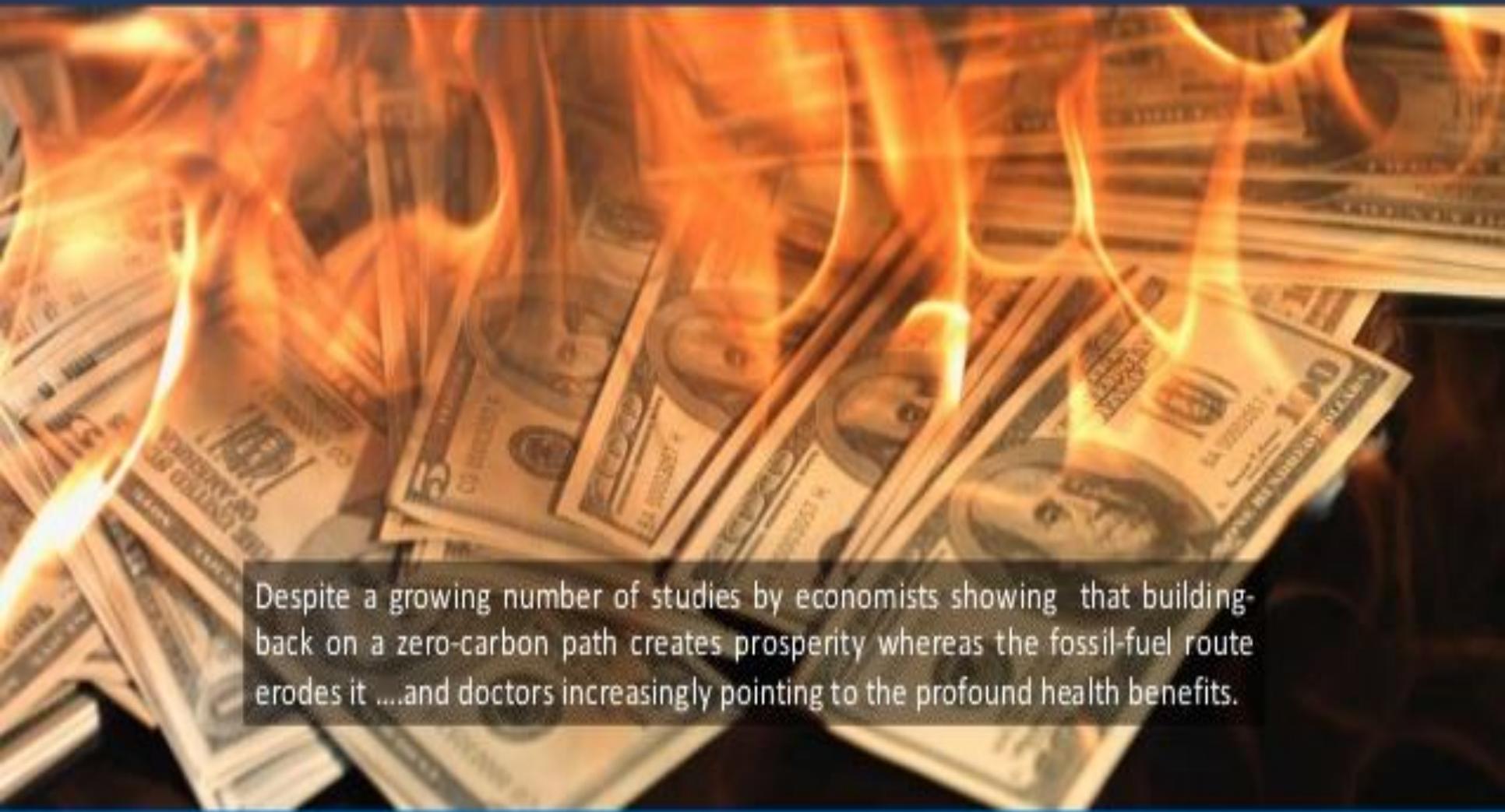


All of which might suggest solar is heading inevitably for a momentous future

BUT



It would be a mistake to conclude that the global green new deal is now inevitable



Despite a growing number of studies by economists showing that building-back on a zero-carbon path creates prosperity whereas the fossil-fuel route erodes itand doctors increasingly pointing to the profound health benefits.

In terms of a crystal ball, the big picture has to be a holistic one, spanning the entirety of society.

April - June
2020

Self-defence mechanisms in the fossil-fuel industries have momentum

Oil majors raise \$32bn of debt to weather crisis 5th April, Financial Timesto pay dividends!

US fossil fuel giants set for a coronavirus bailout bonanza 12th May, Guardian90 fossil-fuel, \$750 bn bond buyback

Coal generator uses investment treaty to fight Netherlands coal phaseout 22nd May, Climate Change News

Airlines and carmakers benefit from UK Covid relief scheme 5th June, Guardian53 (big) companies, £1.8 billion so far

Covid-19 relief for fossil fuel industries risks green recovery plans 6th June, Guardian

Environmentalists on back foot as Germany's newest coal plant opens 8th June, Financial Times

According to Bloomberg NEF, \$509bn is to be poured into high-carbon industries worldwide, with no conditions to ensure they reduce their carbon output. A further \$18 bn with conditions. Only \$12 bn for low-carbon industries.

May - June
2020

Many governments, states, cities and businesses are pushing hard in the right direction

A Radical Plan, and \$2.6 Trillion, Brings Europe Back From Abyss 26th May, Bloomberg

EU Pledges Green Focus in Coronavirus Recovery Program 27th May, Bloomberg

UK business leaders call for green coronavirus recovery plan 1st June, Financial Times

Starting gun fired for UN-backed 'Race to Zero' campaign 5th June, Business Green

...1,000 businesses (\$4.72tr p.a. revenue), 458 cities, 505 universities, 24 regions, and 36 major investors

US states weigh exit from power market in clean-energy dispute 8th June, Financial Times

Net zero-aligned businesses and governments now cover more than half of global GDP and a quarter of carbon emissions, according to the UK's Energy and Climate Intelligence Unit (ECIU).

Authoritarian and authoritarian-aspiring politicians tend to work as hard to mine fossil fuels as they work to undermine open societies



A liveable planet absolutely requires open societies in the mix

because the authoritarian and authoritarian-aspiring will surely burn their fossil fuels if they are given the chance.

Experiences of India in context of COVID-19

In the recent past and in light of the current COVID-19 pandemic, there have been growing examples that demonstrate an ill-functioning environmental protection laws and regulations in India and the need for a paradigm shift in protecting the environment

Among the top 50 most polluting cities in the world, 15 are in India

Suspension of industrial activities (including the coal- based sectors), transportation and other activities during lockdown imposed due to the outbreak of COVID-19 caused rapid improvement in air and water quality across the country.

Some studies have shown an association between air pollution and increased chances of death due to COVID-19

Experiences of India in context of COVID-19

- Water stress (in terms of water availability, access and quality) is another aspect of the bigger problem that constrains communities from maintaining basic hygiene and sanitation during outbreak of infectious diseases such as this one.
- Hence, dealing with pollution to maintain carrying capacity of the ecosystems and community health in a highly populated country with unplanned human settlements is a challenge
- Anthropogenic threats to the biodiversity and ecosystem in protected areas and biodiversity hotspots are considered to make the country more vulnerable to future pandemics- These include deforestation, poaching, illegal wildlife trade, lack of protection of indigenous species, unlocking protected areas for mining, road construction and other developmental projects.
- Protected area management principles, which are materialized through wildlife and forest protection laws,-are considered to fall short on several aspects in India.

Industrial disasters and COVID catastrophes

- There are several other impacts of anthropogenic threats on environment too- During the pandemic, the country has experienced a number of industrial disasters (e.g. gas leak in polymer plant in Andhra Pradesh, boiler explosion in thermal power plant, steel factory and chemical plant in Tamil Nadu and Gujarat and fire in biodiversity rich landscape in Assam caused by natural gas extraction-due to lack of compliance of environmental norms and poor safety standards- In fact because of Lockdown, sufficient manpower were not available or could not be deployed for preventing such incidents.
- These caused loss of lives, long term health impacts and detrimental impact on the environment.
- There lies the significance of stringent environmental safety standards for mining activities, infrastructure development, power projects (thermal, nuclear and hydro), real estate and other industrial projects

- In conclusion, the takeaway from this is that once nations come to grips with the coronavirus, better implementation of the environmental, transport and industry regulations should be considered a priority to ease the detrimental impacts of human activity on the environment.
- **The role of the Esteemed and Par Excellence Auditors [*Your ROLE becomes that of Environmental Green FIGHTER AUDITOR*] become quite significant in the aforesaid environmental events and subsequent circumstances. The Focus of the Auditors, while auditing the Extractive industries, will need to explore and prepare a check list for maintaining Preventive Environmental Management (PEM), instead of the End- of- the- Pipe Treatment of the Environmental problems.**
- The international community, as it fights to regain an accepted normal, ought to take into consideration, the enlightening results of this pandemic. The environment, for one, bounced back faster than we thought it could. And it would be downright irresponsible to let that knowledge take a backseat once social distancing and nationwide lockdowns are no longer required.







**WASTE POND FROM WHERE LEAKAGES
POLLUTE THE ENVIRONMENT**







CONCLUSION

It may be concluded that accurate estimation of the external costs of production of oil, coal and natural gas needs to be done. Of course such a measure is not the sole responsibility of Mining/Extractive Industries. All the stakeholders and research institutions can come together to carry out such an exercise that shall bring out approximate estimates of the external costs as practically it is not possible to find the actual costs. Incorporation of these external costs to the private costs of Mining/Extractive Industries can ensure sustainability as a voluntary corporate liability and fulfill the broader goal of Sustainable Development.

Environment- A Public Good

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