Beijing, People's Republic of China, 2005, early morning. The photo on the right was taken during a sunny, otherwise clear day; the photo on the left was taken about 10 days later, after it had rained for approximately 2 days. The day of the photo on the right, walking in the city was difficult due to breathing the very polluted air. Photos taken by Bobak Ha'Eri. Wikimedia Commons.
Economic Costs

**Hidden/External Costs:** NOT included in the price of goods or services. Include health costs and environmental costs.

**Internal Costs:** Internal costs of goods are included in the purchase price of an item and include:

- Raw materials
- Cost of manufacturing
- Pollution control
- Labor production
- Marketing
- Transportation
- Mark-up to retailers

Cotton-fabric production in Mali. The costs of air pollution abatement in a factory would be included in the costs of manufacturing, and passed on to the next purchaser in the supply chain. Wikimedia Commons.
Economic Costs Related to Pollution:

- Increased costs for raw materials

- Increased costs due to environmental protection of air, water, and land: extraction and processing/expensive pollution control devices

- Decrease in non-renewable resources: over use or pollution = increased costs. Substitutes may cause increased air pollution - low quality coal has high sulfur content causing increased air pollution

- Decrease in renewable resources, i.e. trees, due to over-harvesting

- Increased costs due to supply and demand issues

Logging in Oregon c1905. Trees all over the country used to be this big. Once this forest was cut down, there was less CO$_2$ and other air pollutants taken out of the air.
Economic Costs of Air Pollution to business, industry, and consumers

- Research & Development (R & D) for design more efficient & less polluting
- Air pollution-abatement equipment such as scrubbers for smokestacks
- Clean-up costs paid by company
- Fines for non-compliance

Drilling operations to verify status of the Bruin Lagoon, PA hazardous waste Superfund Site. This site was contaminated with heavy metals, sulfuric acid, and crude oil waste. Although initially deemed a land and water hazardous waste site, in May 1984, during the site cleanup activities, an unidentified crust layer was penetrated resulting in a major release of sulfur dioxide, hydrogen sulfide, and sulfuric acid mist. Periodic releases of highly toxic gases such as sulfur dioxide occurred during further cleanup, which was completed in 1991. Wikimedia, US Army Corps of Engineers photo
Economic Costs of Air Pollution to business, industry, and consumers

- Increased fees for disposal of waste materials (including manufacturing wastes) that cannot be exhausted or incinerated, due to their effect on air pollution
- Increased transportation costs. Landfills are built farther away from populations to reduce smell and traffic
- Increased costs of fossil fuels as resources dwindle
- Increased cost in non-polluting waste disposal
Health Costs of Air Pollution

- Increased cases of asthma, allergies, and heart disease may be correlated to increased air pollution
- Increased number of work and school absences
- Decreased productivity
- Increased number of emergency room visits related to respiratory issues
- Increased costs of medical care, esp. for chronic illness such as asthma caused or exacerbated by air pollution
- Premature death
California: A Case Study

According to the Los Angeles Times (Nov. 13, 08):

- $28 billion per year lost by CA economy due to health costs of pollution
- Approx. $25 billion per year is related to 3,000 smog-related deaths per year
- Approx. $3 billion per year related to lost productivity, missed work and school days, and respiratory illnesses such as asthma

“We are going to pay for it [air pollution] one way or the other. Either we pay to fix the problem or we pay in loss of life and poor health...This study adds another piece to the puzzle as the public and policy makers try to understand where do we go from here.”

-Jane Hall, Cal State Fullerton study team leader & co-director, Cal State Fullerton, Institute for Economics and Environment Studies, 2009
Environmental Costs: Global Climate Change

- Greenhouse Effect - increased warming changes rainfall, temperature, melts ice in glaciers and the ocean
- Increased destructive weather events, such as hurricanes, flooding, wildfires, desertification due to warming. Consider cost of rebuilding, decreased productivity
- Changes ecology of an area which may increase or decrease populations, i.e. mosquitoes that carry tropical diseases now moving northward as areas warm and are wetter
- CO2 released with many of these changes, further increasing air pollution and warming
Environmental Cost: Acid Deposition

- Sulfur dioxide (SO2) and nitrogen oxides (NOX) in the air are deposited as dry or wet pollutants and combine with moisture in the air to create acidic rain, snow, sleet, fog, or dew

Sources:
- electrical generation facilities
- motor vehicles/ internal combustion engines
- factories
- residential heating equipment

Origins of acid deposition: VOC= Volatile Organic Compounds; SO2= sulfur dioxide; NOx= nitrous oxide + nitrous dioxide; Hg= mercury; anthropogenic= made by humans. Wikimedia Commons from US EPA.
Environmental Cost: Acid Deposition

• Changes soil chemistry by reducing microbial action important in soils and leaching away important minerals and nutrients such as calcium and magnesium

• May weaken natural defenses of trees and make them more vulnerable to pests and disease (e.g. Eastern US spruce-fir forests)

• Nitrogen levels may increase in soils and waterways, disrupting delicate balances and leading to excessive growth of algae and other nuisance plants in waterways

• Animals and plants that depend on calcium-based shells or skeletons will be affected negatively as the acidic water and soil decreases available calcium, thinning shells

![Effect of acid rain on a forest, Jizera Mountains, Czech Republic. These trees will be unable to purify air and reduce carbon dioxide now that they have been damaged by acid rain.](https:///commons.wikimedia.org/wiki/File:Effect_of_acid_rain_on_a_forest,_Jizera_Mountains,_Czech_Republic.jpg)

In what ways does acid deposition adversely effect the “Human Environment”?
Additional Environmental Costs

- Ozone depletion (stratospheric) increases radiation to the earth’s surface, correlated with an increase in skin cancer in humans.

- Increased outdoor air pollutants: harmful to plants and animals.

- Increased indoor air pollutants: harmful to humans requiring air filters to reduce pollutants.

German road sign that indicates “No Traffic Allowed Due To Smog.”
Wikimedi Commons.
Who Pays the External Costs?

**Industries/businesses currently do not pay external costs of air pollution**

- Subsidies, tax breaks for using natural resources, i.e. timber industry, ranchers use state and federal lands for costs below market/full cost pricing
- Industry is generally not taxed for pollutants produced

**Consumers generally do not connect external costs with the products/services they buy or use,** i.e. Goods from China that use toxic substances such as lead in paint pollutes China, but consumers in other countries do not pay the cost of that pollution up front

**Taxpayers often end up paying for clean-up of polluted areas,** whether they were ‘part of the problem’ or not.
Gross Domestic Product

Gross Domestic Product (GDP) or Gross National Income (GNI) include goods and services produced by a country.

- This includes money spent on pollution, sickness, death, crime, as a POSITIVE benefit.
- Does not include a component to measure the depletion or degradation of natural resources.
- Traditional economic theories assume that natural resources are not essential because of our ability to find more economical substitutes for dwindling resources and services of the planet’s life support system.

US states GDP in billions of dollars as listed on List of U.S. states by GDP (nominal), based on figures for 2004. WikiCommons.
Economic Growth

- All economies depend on their natural resources: raw materials and a healthy, productive population.

- During an economic growth phase that includes degradation/depletion of resources, GDP rises.

- Once “ecological debts come due” and resources are no longer cheap or available, GDP declines as there is no longer income from those resources.

Atlanta Reflection. Wikimedia Commons.
• Economies need to shift from unsustainable growth to sustainable development

• Economic indicators would **ADD** to GDP anything that enhances quality of life

• Economic indicators would **SUBTRACT** activities that lead to a decline in quality of life or depletion of resources

Reforestation project in Senegal. United States Agency for International Development.

[Image: Reforestation project in Senegal. United States Agency for International Development. Wikimedia Commons.]
Full-Cost Pricing

Full Cost Pricing is encouraged by environmental economists because it reflects the ACTUAL costs to society and the environment.

- Preventing pollution is more cost-effective than cleaning it up
- Waste reduction in the form of recycling, reusing, life cycle planning will become more profitable than current burying/burning waste removal

Internal Costs + External Costs

Full-Cost Pricing

Photo of a modern material recovery facility (MRF)
Wikimedia Commons.
Paying for External Costs

• ALL costs are figured into price of goods & services

• Taxes

• Tradable pollution and resource-use rights ("cap-and-trade" for emissions)

• Laws/regulations

• Charge user fees that include external costs

• Provide subsidies for beneficial behaviors

Dome of the US Capitol building. Wikimedia Commons.
Benefits of Full-Cost Pricing

Our current economic system only includes internal costs of goods and services.

• Consumers are empowered to make informative decisions about the consequences of their purchases and lifestyle on ecosystems and human health.

• Consumers who make wise choices do not pay for products made with high health, environmental, and societal costs.

• Financial incentive to ‘use less stuff’ and to choose that ‘stuff’ wisely.

• Consumers can choose from a product made in a country that requires air pollution abatement equipment on factories over those that do not.
Benefits of Full-Cost Pricing

• Consumers can choose to decrease their use of electricity and heat from cheap conventional sources that may emit air pollution, and increase use of cleaner technologies that are less expensive in the long run.

• Initially, full-cost pricing may appear to increase prices, but over time the price is the same, and the actual/true/full price is now obvious, without part hidden

• Those who don’t purchase the item will not have to pay external costs, as they would under the traditional system by taxes for clean-up of pollution.

Consumers will be able to make more informed choices when EXTERNAL COSTS, such as air pollution and its effects on health and the environment, are considered.
“To waste, to destroy our natural resources, to skin and exhaust the land instead of using it so as to increase its usefulness, will result in undermining in the days of our children the very prosperity which we ought by right to hand down to them amplified and developed.”

~Theodore Roosevelt, seventh annual message, 3 December 1907