

Glossary

Abatement costs - Abatement costs are costs borne by firms when they are required to remove and/or reduce environmental byproducts created during production.

Annualized value - An annualized value is a constant stream of benefits or costs. The annualized cost is the constant amount that a party would have to pay at the end of each period t to add up to the same cost in present value terms as the varying stream of costs being annualized. Similarly, the annualized benefit is the constant amount that a party would accrue at the end of each period t to add up to the same benefit in present value terms as the varying stream of benefits being annualized.

Baseline - A baseline describes an initial, status quo scenario that is used for comparison with one or more alternative scenarios. In typical economic analyses the baseline is defined as the best assessment of the way the world would evolve absent the regulation or policy action.

Benefit-cost analysis (BCA) - A BCA is an evaluation of the social benefits and social costs of a policy action. The social benefits of a policy are measured by society's willingness-to-pay for the policy outcome. The social costs are measured by the opportunity costs of adopting the policy. BCA addresses the question of whether the benefits for those who gain from the action are sufficient to, in principle, compensate those burdened by costs such that everyone would be at least as well off as before the policy. The calculation of net benefits (benefits minus costs) answers this question and helps ascertain the economic efficiency of the policy. Where all benefits and costs can be quantified and expressed in monetary units, BCA provides decision makers with a clear indication of the most economically efficient alternative, that is, the alternative that generates the largest net benefits to society (ignoring distributional effects).

Benefit-cost ratio - A benefit-cost ratio is the ratio of the net present value (NPV) of benefits associated with a project or proposal, relative to the NPV of the costs of the project or proposal. The ratio indicates the benefits expected for each dollar of costs. Note that this ratio is not an indicator of the magnitude of net benefits. Two projects with the same benefit-cost ratio can have vastly different estimates of benefits and costs.

Benefit transfer - Benefit transfer is the use of estimated values of environmental quality changes drawn from primary (usually published) studies for the evaluation of similar changes of interest to the analyst.

Cessation lag - Cessation lag is the time between a reduction in exposure and the reduction in risk. See *latency* for a definition of a related but distinct concept.

Command-and-control regulation - Command-and-control regulation is a prescriptive regulation that stipulates how much pollution an individual source or plant is allowed to emit and/or what types of control equipment it must use to reduce pollution.

Compliance cost - A compliance cost is the private cost that a regulated entity incurs to comply with a regulation — for instance, through the planning, design, installation, and operation of pollution abatement equipment.

Consumption rate of interest - Consumption rate of interest is the rate at which individuals are willing to exchange consumption in one period (usually year) for consumption in the next period. This rate reflects the individual's rate of time preference.

Cost-effectiveness analysis (CEA) - CEA examines the costs associated with obtaining an additional unit of an environmental outcome. It is designed to identify the least expensive way of achieving a given environmental quality target, or the way of achieving the greatest improvement in some environmental target for a given expenditure of resources.

Distributional analysis - Distributional analysis assesses changes in social welfare by examining the effects of a regulation across different subpopulations and entities.

Distorted market - A distorted market is one that does not experience free and open competition due to government interventions and/or prevailing market conditions. Examples of distortions include externalities, regulations, pre-existing taxes, or imperfectly competitive markets.

Dollar year - The year to which the purchasing power of a dollar is indexed. For example, if costs and benefits are reported in 2016 dollars, it means that the purchasing power of those costs and benefits reflect what could have been bought in 2016.

Ecological production function - An ecological production function is a description of how ecosystems combine inputs to produce ecosystem services that consumers enjoy directly or are used in the production of goods or services that are enjoyed by consumers.

Economic efficiency - Economic efficiency can be defined as the maximization of social welfare. Under the efficient level of production, there is no way to rearrange production or reallocate goods such that someone is better off without making someone else worse off in the process.

Economic impact analysis (EIA) - Economic impact analyses (EIAs) examine how compliance costs, transfers, and other policy outcomes are distributed across groups. EIAs describe and often quantify outcomes such as changes in employment, plant closures or local government tax revenues that provide insight into the economic consequences of regulation.

Emissions tax - An emissions tax is a charge levied on each unit of pollution emitted.

Environmental justice - Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Fair treatment means that no group of people, including racial, ethnic or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, government and commercial operations or policies. Meaningful involvement occurs when (1) potentially affected community members have an appropriate opportunity to participate in decisions about a proposed activity that may affect their environment and/or health; (2) the public's contribution can influence the regulatory agency's decision; (3) their concerns will be considered in the decision-making process; and (4) the decision makers seek out and facilitate the involvement of those potentially affected.¹

Expected value - Expected value is the probabilistically weighted outcome that defines a statistical mean and a measure of the central tendency of a set of data. For a variable with a discrete number of outcomes, the expected value is calculated by multiplying each of the possible outcomes by the likelihood that each outcome will occur and then summing all of those values.

¹ Definition taken from <http://www.epa.gov/compliance/environmentaljustice/index.html> (accessed December 22, 2020)

Expert elicitation - Expert elicitation is a formal, highly structured and well-documented process for obtaining the judgments of multiple experts. Typically, an elicitation is conducted to evaluate uncertainty. This uncertainty could be associated with the value of a parameter to be used in a model, the likelihood and frequency of various future events or the relative merits of alternative models.

Externality - An externality occurs when the actions of one individual (or firm) have a direct, unintentional and uncompensated effect on the well-being of other individuals or the profits of other firms.

Flow pollutant - A flow pollutant is a pollutant for which the environment has some absorptive capacity. It does not accumulate in the environment as long as its emission rate does not exceed the absorptive capacity of the environment. Animal and human wastes are examples of flow pollutants.

General equilibrium - A general equilibrium modeling approach concurrently considers the effect of a regulation across all sectors in the economy.

Hedonic price - Hedonic price, recreational demand or locational choice models may be regarded as “reduced form” representations of ecological production from which the analyst can infer the values individuals ascribe to ecosystem services by observing the choices they make, provided that the analyst can adequately control for potentially confounding factors.

Hotspot - A hotspot is a geographic area with a high level of pollution/contamination within a larger geographic area of low or “normal” environmental quality.

Kaldor-Hicks criterion - The Kaldor-Hicks criterion is really a combination of two criteria: the Kaldor criterion and the Hicks criterion. The Kaldor criterion states that an activity will contribute to Pareto optimality if the maximum amount the gainers are hypothetically prepared to pay is greater than the minimum amount that the losers are hypothetically prepared to accept. Under the Hicks criterion, an activity will contribute to Pareto optimality if the maximum amount the losers are hypothetically prepared to offer to the gainers in order to prevent the change is less than the minimum amount the gainers are hypothetically prepared to accept as a bribe to forgo the change. In other words, the Hicks compensation test is conducted from the losers’ point of view, while the Kaldor compensation test is conducted from the gainers’ point of view. The Kaldor-Hicks criterion is widely applied in welfare economics and managerial economics. It forms an underlying rationale for BCA.

Latency - Latency is the time between the increase in exposure to a pollutant and the increase in health risk. See *cessation lag* for a definition of a related but distinct concept.

Marginal benefit - The marginal benefit is the benefit received from an incremental increase in the consumption of a good or service.

Marginal cost - The marginal cost is the change in total cost that results from a unit increase in output.

Marginal social benefit - The marginal social benefit is the marginal benefit received by the consumer of a good (marginal private benefit) plus the marginal benefit received by other members of society (external benefit).

Marginal social cost - The marginal social cost is the marginal cost incurred by the producer of a good (marginal private cost) plus the marginal cost imposed on other members of society (external cost).

Market failure - A market failure occurs when the allocation of goods and services by the free market is not economically efficient. The most common causes of market failure are externalities, market power and inadequate or asymmetric information. Externalities are the most likely cause of market failure in an environmental context.

Market-based approaches - Market-based approaches to environmental policy include instruments such as taxes, fees, charges and subsidies. These approaches create a price incentive to reduce pollution and leave decisions about the level of emissions to each source. Another example is an allowance trading system, which sets the total quantity of emissions and then allows trading of permits among firms.

Meta-analysis - Meta-analysis is an umbrella term for a suite of techniques that synthesize the results of empirical research. This could include a simple ranking of results, a meta-analytic average or other central tendency estimate, or a multivariate regression.

Net benefits - Net benefits are calculated by subtracting total costs from total benefits.

Net future value - Net future value is similar to NPV, however, instead of discounting all future values back to the present, values are accumulated forward to some future time period — for example, to the end of the last year of a policy's effects.

Net present value (NPV) - The NPV is calculated as the present value of a stream of current and future benefits minus the present value of a stream of current and future costs.

Non-use value - Non-use value is the value that an individual may derive from a good or resource without consuming it, as opposed to the value obtained from use of the resource. Non-use values can include *bequest value*, where an individual places a value on the availability of a resource to future generations; *existence value*, where an individual values the mere knowledge of the existence of a good or resource; and *paternalistic altruism*, where an individual places a value on others' enjoyment of the resource.

Nudge - A nudge is a structural or design feature of an individual choice that alters people's behavior in a predictable way without precluding any options or significantly changing their economic incentives but that can still be easily avoided.

Operating costs - Operating costs are recurring expenditures associated with the operation and maintenance of equipment, including salaries and wages, energy inputs, materials and supplies, purchased services and maintenance or repair of equipment associated with pollution abatement or waste management.

Opportunity cost - Opportunity cost is the value of foregone allocation during some resource economic decision; the value of foregone allocation is often described as the "value of the next best alternative use" of the resource." Opportunity cost need not be assessed in monetary terms. It can be assessed in terms of anything that is of value to the person or persons doing the assessing. For example, a grove of trees used to produce paper may have a next-best-alternative use as habitat for spotted owls. Assessing opportunity costs is fundamental to assessing the true cost of any course of action. In the case where there is no explicit accounting or monetary cost (price) attached to a course of action, ignoring opportunity costs could produce the illusion that the action's benefits cost nothing at all. The unseen opportunity costs then become the implicit hidden costs of that course of action.

Pareto efficiency or Pareto optimality - Pareto efficiency is an economic state in which it is impossible to reallocate resources to make one individual better off without making another worse off.

Partial equilibrium - A partial equilibrium modeling approach accounts for market changes in the regulated sector. Market responses to the regulation may include reduced industry output or higher prices as firms pass on some costs directly to consumers. The goal of a partial equilibrium approach is to measure the net change in consumer and producer surplus relative to the pre-regulatory equilibrium.

Performance-based standard - A performance-based standard is a pollution control standard that requires polluters to meet a source-level emission standard without mandating the specific method by which they must comply with the standard. A performance-based standard is defined in terms of an emission *level* or an emission *rate* (i.e., emissions per unit of output or input).

Prescriptive regulation - A prescriptive regulation is a policy that stipulates how much pollution an individual source or plant is allowed to emit and/or what types of control equipment or approaches it must use to reduce pollution. Prescriptive regulations are also known as "direct regulatory instruments" or "command-and-control" regulations.

Price elasticity of demand - Elasticity of demand measures the relationship between changes in quantity demanded of a good and changes in its price. It is calculated as the percentage change in quantity demanded that occurs in response to a percentage change in price. As the price of a good rises, consumers will usually demand a lower quantity of that good. The greater the extent to which quantity demanded falls as price rises, the greater is the price elasticity of demand. Some goods for which consumers cannot easily find substitutes, such as gasoline, are considered price inelastic. Note that elasticity can differ between the short term and the long term. For example, if the price of gasoline rises, consumers will eventually find ways to conserve their use of the resource. Some of these ways, like finding a more fuel-efficient car, take time. Hence gasoline would be price inelastic in the short term and more price elastic in the long term.

Price elasticity of supply - Elasticity of supply measures the relationship between changes in quantity supplied of a good and changes in its price. It is measured as the percentage change in quantity supplied that occurs in response to a percentage change in price. For many goods the quantity supplied can be increased over time, for example, by locating alternative sources or investing in an expansion of production capacity. One might therefore expect that the price elasticity of supply will be greater in the long term than the short term for such a good, that is, that supply can adjust to price changes to a greater degree over a longer period of time.

Quality-adjusted life year (QALY) - QALY is a composite measure used to convert different types of health effects into a common, integrated unit, incorporating both the quality and quantity of life lived in different health states. This metric is commonly used in medical arenas to make decisions about medical interventions.

Rebound effect - A rebound effect is the reduction in expected gains from improvements in the energy efficiency of a technology that results from changes in consumer behavior. For example, tighter vehicle fuel economy standards lead to rebound effects because these regulations make it cheaper to consume energy or fuel on a per-unit basis causing demand for these services and therefore emissions from them to increase.

Shadow price of capital - The shadow price of capital accounts for the social value of displacing private capital investments. For example, when a public project displaces private sector investments, the correct method for measuring the social costs and benefits requires an adjustment of the estimated costs (and perhaps benefits as well) prior to discounting using the consumption rate of interest. This adjustment factor is referred to as the "shadow price of capital."

Social benefits - Social benefits are the sum of all positive changes in societal well-being experienced as a result of the regulation or policy action. Economists define benefits by focusing on changes in individual well-being, referred to as welfare or utility. Willingness to pay (WTP) is the preferred measure of these changes as it theoretically provides a full accounting of individual preferences across trade-offs between income and the favorable effects.

Social cost - Social cost means the sum of all opportunity costs, or reductions in societal well-being, incurred as a result of the regulation or policy action. These opportunity costs consist of the value lost to society of all the goods and services that will not be produced and consumed as regulated entities reallocate resources in order to comply with the regulation. To be complete, an estimate of social cost should include both the opportunity costs of current consumption that will be foregone because of the regulation, and also the losses that may result if the regulation reduces capital investment and thus future consumption.

Social opportunity cost of capital - Social opportunity cost of capital is the rate at which consumption in the next period is reduced because private investment is displaced by required investments from policy. This is the rate at which society can trade consumption over time due to productive capital.

Social rate of time preference - Social rate of time preference is the discount rate at which society is willing to trade consumption in one period (usually year) for consumption in the next period.

Social welfare function - A social welfare function establishes criteria under which efficiency and equity outcomes are transformed into a single metric, making them directly comparable. A potential output of such a function is a ranking of policy outcomes that have different aggregate levels and distributions of net benefits. A social welfare function can provide empirical evidence that a policy alternative yielding higher net benefits, but a less equitable distribution of wealth, ranks better or worse than a less efficient alternative with more egalitarian distributional consequences.

Stock pollutants - A stock pollutant is a pollutant for which the environment has little or no absorptive capacity, such as non-biodegradable plastic, heavy metals such as mercury, and radioactive waste. A stock pollutant accumulates through time.

Subsidy - A subsidy is a kind of financial assistance, such as a grant, tax break or trade barrier, that is implemented to encourage certain behavior. For example, the government may directly pay polluters to reduce their pollution emissions.

Technology standard - A pollution control standard that mandates the use of a specific control technology or production process by individual polluters.

Transaction costs - Transactions costs are the costs incurred when buying or selling a good or service. They may include the costs of searching out a buyer or seller, bargaining and enforcing contracts.

Transfers - Transfers are shifts in money or resources from one part of the economy (e.g., a group of individuals, firms, or institutions) to another in a way that does not affect the total resources that are available to society.

Use value - Use value is the value that an individual may derive from consumption or use of a good or resource.

Value of statistical life (VSL) - The VSL is the marginal rate of substitution (MRS) between mortality risk and money, i.e., the willingness-to-pay (WTP) for small reduction in the risk of premature mortality.

Value of statistical life year (VSLY) - The VSLY is an estimated dollar value for a year of statistical life. In practice this metric is typically derived by dividing a VSL estimate by remaining life expectancy or discounted remaining life expectancy. This approach usually assumes that each year of life over the life cycle has the same value.

Willingness to accept (WTA) - WTA is the amount of compensation an individual would be willing to take in exchange for giving up some good or service. In the case of an environmental policy, WTA is the least amount of money that an individual would accept to forego an environmental improvement (or endure an environmental decrement).

Willingness to pay (WTP) - WTP is the largest amount of money that an individual would pay to receive the benefits (or avoid the damages) resulting from a policy change, without being made worse off. In the case of an environmental policy, WTP is the maximum amount of money an individual would pay to obtain an improvement (or avoid a decrement) in an environmental effect of concern.