GLOSSARY

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"first flush" phenomenon
The higher pollutant concentrations found at the beginning of a storm or spring snowmelt.

"peaky" waterways
The "peakiness" of a waterway describes the more rapid increase and decline in stream flow and the higher stream levels after a storm in urbanized watersheds compared to the more gradual rise and decline in stream volumes and lower water levels in less-developed drainage basins after the same storm event, largely because of the greater amounts of impervious surfaces and runoff generated within urban areas.

A

Absorption Chiller
Utilizes heat instead of mechanical energy to provide cooling. A thermal compressor (fuelled by the waste heat from the CHP system) is used in place of an electrically powered mechanical compressor in the refrigeration process.

accessibility
In transportation, a measure of the ease with which people are able to get places they want or need to go.

acid mine drainage
Surface water or groundwater that is highly acidic due to oxidation of sulphide minerals at a mineral mine.

Active Transportation
Means of transportation that involve more physical activity, typically considered walking, biking, and use of public transit (bus and rail).

adaptation
Focuses on the need for strategies to deal with the climate change that is unavoidable because of increased carbon already in the atmosphere.

Additionality

The extent to which a new action (policy, project etc.) adds to the benefits or costs associated with existing conditions.

aerobic
Living systems or processes that require, or are not destroyed by, the presence of oxygen.

albedo
A measure of how reflective a surface is. A perfectly black surface has an albedo of 0, while a perfectly white surface has an albedo of 1.

allocation
For a chain which produces multiple products or services, the partitioning of inventory quantities among these co-products or co-services.

ambient standard
A minimum level of overall environmental quality that must be reached.

ambient temperature
The temperature of the surrounding environment.

ambient water quality
The concentration of pollutants found within waterbodies and waterways.

ammonification
The release of ammonia by Decomposers when they break down the complex nitrogen compounds in organic material

anaerobic
A living system or process that occurs in, or is not destroyed by, the absence of oxygen.

Anthropocene
A term bestowed by Noble Laureate Paul Crutzen to describe the last 200-yearperiod of human industrialization. The prefix “anthro” points to the decisive impact of human population growth and technological development on the planetary biosphere since 1800, as its principal agents of change superceding all other factors.

anthropogenic
Caused or produced by humans.

anthropogenic CO_2 emissions
Human release of CO_2 into the atmosphere by burning fossil fuels and changing land use.

Anthropogenic
Relating to or resulting from the influence that humans have on the natural world.

aqueduct

An aqueduct is a water supply or navigable channel constructed to convey water. In modern engineering, the term is used for any system of pipes, ditches, canals, tunnels, and other structures used for this purpose.

aquifer
Rock or sediment that is capable of supplying groundwater from a well at a useful rate.

aquitard
Earth material with low hydraulic conductivity.

arsenic
A type of water pollutant that can be fatal in large doses and can cause health problems in small doses over a long time.

artesian well
Water well drilled into a confined aquifer where the water level in the well moves above the local water table.

assimilation
Acquisition and incorporation of nutrients or resources by plants e.g. nitrogen or carbon.

avoided cost
A type of direct method that equates the value of an environmental improvement with a cost that can then be avoided.

Avoided Cost of Power
The marginal cost for a utility to produce one more unit of power.

axial precession
The movement in the axis of rotation, which change in the direction of Earth's axis of rotation relative to the stars.

axial tilt
The angle between a planet's axis of rotation and the line perpendicular to the plane in which it orbits. The Earth's current axial tilt is 23.5 degrees.

B

benefit transfer
A method for estimating the value of a natural amenity by applying estimates from a complex study of a slightly different (but similar) amenity to the case at hand.

Betz's Law
The theoretical highest possible efficiency for wind turbines, 59 percent, derived in 1919 by German physicist, Albert Betz.

bioaccumulation
The increase in concentration of a substance in an organism over time.

bioassay
An assay for determining the potency (or concentration) of a substance that causes a biological change in experimental animals.

biocatalysis
Catalysis conducted by enzymes catalysis within the body, for example.

biochemical oxygen demand
The amount of oxygen used by aerobic (in presence of oxygen) bacterial decomposition of organic matter.

Biocomplexity
A defining characteristic of living things and their relationships to each other. The biocomplexity concept emphasizes the multiple dependent connections within ecosystems, and between ecosystems and human societies.

biodiesel
A fuel usually made from soybean, canola, or other vegetable oils; animal fats; and recycled grease and oils. It can serve as a substitute for conventional diesel or distillate fuel.

biodiversity and extinction
Thriving ecosystems are characterized by diverse plant and animal populations; there is, therefore, a strong correlation between current ecosystem decline globally, and the rate of extinction of species, which is in the order of a thousand times that of background rates.
This has prompted scientists to label the current period the Sixth Mass Extinction in the long history of the biosphere, and the first since the end of the dinosaurs.

biodiversity
The number of different species within an ecosystem (or globally). Biodiversity is also considered a metric of ecosystem health.

biofuels

Liquid fuels and blending components produced from biomass materials, used primarily in combination with transportation fuels, such as gasoline.

biogeochemical cycles
A concept describing how chemical elements (e.g., nitrogen, carbon) or molecules (e.g. water) are transformed and stored by both physical and biological components of the Earth system.

bioleaching of minerals
Microbial dissolution of metals.

biological components of the earth system
All living organisms, including plants, animals and microbes.

biological nitrogen fixation
Where microbes convert N_2 gas in the atmosphere into ammonium that can be absorbed by plants.

biological processes
Processes of ore formation that involve the action of living organisms. Examples include the formation of pearls in oysters, as well as phosphorous ore in the feces of birds and the bones and teeth of fish.

biological treatment
A treatment technology that uses bacteria to consume organic fraction of municipal solid waste/wastewater.

biomass
Organic, non-fossil material of biological origin that is renewable because it can be quickly re-grown, taking up the carbon that is released when it is burned.

biomimicry
Biomimicry or biomimetics is the examination of nature, its models, systems, processes, and elements to emulate or take inspiration from in order to solve human problems. The terms biomimicry and biomimetics come from the Greek word, “bios” meaning life, and “mimesis” meaning to imitate. Examples include adhesive glue from mussels, solar cells made like leaves, fabric that emulates shark skin, harvesting water from fog like a beetle, etc.

biooxidation of minerals
Microbial enrichment of metals in a solid phase.

bioremediation
Method of groundwater remediation involving the addition oxygen or nutrients. to stimulate growth of microorganisms, which decompose an organic pollutant.

biosorption of minerals
Attachment of metals to cells.

black smoker
Discharge of mineral-rich waters up to 350 ^{o}C from cracks in oceanic crust; these waters precipitate a variety of metallic sulfide ore minerals that make the water appear black.

bottled water
Drinking water packaged in plastic bottles or glass bottles, bottled water is not a sustainable solution to the water crisis because of the nonrenewable energy and material resources involved in manufacturing and transporting it.

Building Automation System (BAS)
Controls and monitors a building mechanical and lighting systems through a computerized, intelligent network of electronic devices.

C

Car Sharing
A program that allows for more than one person to have use of a car. Generally, it works like a short-term (hourly) car rental service. Cars are located near residences and work places to facilitate the access to the vehicles and to reduce the need for individual car ownership.

carbon neutrality
To be carbon neutral, the carbon emissions of a consumable product or human activity must either not involve the consumption of carbon-based energy (a difficult thing to achieve under our present regime), or offset that consumption through the drawdown of an equivalent amount of atmospheric carbon during its lifecycle.

carbon sequestration
The storage of carbon dioxide underground in geologic formations consisting of depleted oil and gas wells, unmineable coal beds, and deep saline aquifers.

carcinogenicity
Defines the ability or tendency to produce cancer.

Carpooling

When two or more people travel to and from proximal departure and arrival destinations in the same vehicle.

Carrying Capacity
The maximum population that a given environment can sustain.

chronic reference dose (RfD)
An estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure for a chronic duration (up to a lifetime) to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. It can be derived from a NOAEL, LOAEL, or benchmark dose, with uncertainty factors generally applied to reflect limitations of the data used. Generally used in EPA's noncancer health assessments.

climate
The average of the weather.

closed loops
The sustainable reform of industrial production and waste management emphasizes the recycling of materials back into the environment or into the industrial cycle, that is, to eliminate the concept of waste entirely.

Coase theorem
The idea that with property rights and frictionless negotiation, private agents will bargain to reach efficient outcomes even in the face of externalities.

Combined Heat and Power (CHP)
An integrated system, located at or near the building or facility, that generates utility grade electricity which satisfies at least a portion of the electrical load of the facility and captures/recycles the waste heat from the electric generating equipment to provide useful thermal energy to the facility.

combined sewer overflows (CSOs)
The over ow and discharge of excess wastewater to surface waters during storms, when diluted wastewater flows exceed the capacity of a combined sewer systems or sewage treatment plant.

combined sewer systems
A single set of underground pipes used to collect both sewage and. storm water runoff from streets for wastewater treatment.

combined sewer systems
Sewer systems that are designed to collect stormwater runoff and domestic and industrial wastewater within the same sewer pipes.

command and control
Regulations that set strict, specific guidelines to govern the behavior of polluters and resource users.

common but differentiated responsibilities
An ethical framework, promoted particularly by developing nations, that recognizes mitigation of global warming as a shared responsibility, but at the same time argues that the wealthy, industrialized countries of the West that have been the historical beneficiaries of carbon-based development should accept a greater burden for both reducing global carbon emissions, and providing developing nations with the technology and economic means to modernize in sustainable ways.

common pool resource
A resource that is open to all users, but which is highly rival in use.

community-supported agriculture
A collaborative system where local food producers and consumers share in the costs and harvests associated with farming.

compost
The stable, decomposed organic material resulting from the composting process.

condensation
Change in the physical state of water where it goes from gas to liquid.

cone of depression
A localized drop in the water table around a pumping well.

confined (or concentrated) animal feeding operation (CAFO)
The practice of raising livestock in high-density settings to maximize production speed; some of the largest CAFOs have more than 100,000 cattle, 10,000 hogs, or 1,000,000 chickens at a single facility; sometimes called factory farming.

confined aquifer
An aquifer that is bounded by aquitards below and above.

conjoint analysis
A stated preference valuation tool that allows an analyst to estimate the marginal values of multiple attributes of an environmental good.

Connectivity
An important feature of complex systems. Connections exist between even apparently remote and disparate things. For example, drought in Australia might impact the price of bread in Egypt, which in turn has repercussions for U.S. foreign policy.

constructed wetland
Marsh built to treat contaminated water.

consumptive water use
A societal use of water that is a type of off stream use where water does not return to the river or groundwater system immediately after use.

contaminant plume
A large body of flowing polluted groundwater.

contingent valuation
A stated preference valuation tool that describes a single environmental good and elicits survey responses from which the analyst can estimate people's value for that good.

Conventional CHP (Topping Cycle CHP)
Utilizes a single dedicated fuel source to sequentially produce useful electric and thermal power.

Cornucopian
The view that economic growth and technological innovation will continue to improve the conditions of humanity as they have done for the past 500 years, and that no environmental constraints are important or permanent.

corrosivity
The ability to corrode metal. Corrosive wastes are wastes that are acidic and capable of corroding metal such as tanks, containers, drums, and barrels.

cost effectiveness
The extent to which an outcome is achieved at the lowest cost possible.

cost-benefit analysis
Evaluation of how the overall benefits of a project compares to its costs.

cost-effective
As inexpensive as possible; cost minimizing.

counterfactual
The scenario against which a different scenario should be compared; in policy analysis, the way the world would have been in the absence of the policy.

Cradle-to-Grave
From creation to disposal; throughout the life cycle.

cretaceous period
The period between 65 and 145 million years ago, which was the final period of Earth's history that included dinosaurs.

Cultural Ecosystem Services
The aesthetic and spiritual values we place on nature as well as the educational and recreational activities dependent on ecosystems.

cultural eutrophication
Rapid aquatic plant growth, particularly algae, in a surface water body.

D

dam
A barrier built across a river to obstruct the flow of water.

deadweight loss
The extent to which net benefits are lower than they could be.

decomposers
Bacteria and fungi that break down rotting organic material, releasing component elements in the process.

deconstruction
The selective dismantling or removal of materials from buildings prior to or instead of conventional demolition.

denaturation
A process in which proteins or nucleic acids lose their tertiary structure and secondary structure by application of heat.

denitrifying bacteria
Microbes that convert nitrates to nitrous oxide or N_2 gases that are released back to the atmosphere.

derived demand

Demand for a good or service that comes not from a desire for the good or service itself, but from other activities that it enables or desires it fulfills.

desalination
Removing dissolved salt from seawater or saline groundwater.

Desiccant Dehumidification
Process that removes moisture (latent load) from a building air stream by passing the air over a desiccant wheel (normally a silica gel). The recovered heat from a CHP system is utilized to regenerate the desiccant by driving the moisture o the desiccant wheel to the outside.

deterministic risk assessment
Risk evaluation involving the calculation and expression of risks as single numerical values or "single point" estimates of risk, with uncertainty and variability discussed qualitatively.

diachronic/synchronic
A diachronic view of a system examines it evolution over time, while a synchronic view is concerned with its characteristics at a single point in time.

diesel
Any liquid fuel used in diesel engines.

digestion
The biochemical decomposition of organic matter of MSW, resulting in its partial gasification, liquefaction, and mineralization.

direct methods
Valuation tools that use data on actual market transactions to estimate the value of a change in the environment.

discharge area
Location on Earth where ground water leaves the groundwater flow system.

discounting
The process of converting future values (costs or benefits) into an equivalent amount of money received today; controls for human time preference.

drainage basin
Geographic area drained by a river and its tributaries.

E

e-commerce
Electronic commerce, commonly known as e-commerce, eCommerce or e-comm, refers to the entire online process of developing, marketing, selling, delivering, servicing and paying for products and services.

eccentricity
A measure of how much an ellipse departs from circularity.

eco-efficiency
An approach that seeks to minimize environmental impacts by maximizing material and energy efficiencies of production.

eco-efficiency
An evolutionary business model in which more goods and services are created with less use of resources, and fewer emissions of waste and pollution.

Ecological Footprint (EF)
Represents the area of land on earth that provides for resources consumed and assimilates the waste produced by a given entity.

ecological footprint
Ecological footprint is a measure of human demand on the Earth's ecosystems. It is a standardized measure of demand for natural capital that may be contrasted with the planet's ecological capacity to regenerate. It represents the amount of biologically productive land and sea area necessary to supply the resources a human population consumes, and to mitigate associated waste. Using this assessment, it is possible to estimate how much of the Earth (or how many planet Earths) it would take to support humanity if everybody followed a given lifestyle.

ecological services
Ecosystem functions that are essential to sustaining human health and well-being. Examples include provisioning services such as food, fiber and water; regulating services such as climate, flood, and disease control; cultural services such as spiritual and recreational benefits, and supporting services such as nutrient cycling. Also called ecosystem services.

economic input output life cycle assessment (EIO-LCA)
An aggregated approach to LCA in which the environmental impacts of a product or service are

determined through an analysis of the complete economy.

economic potential
The technical potential that can be produced below a given cost threshold, typically, the cost of a specified, locally relevant alternative.

Ecosystem
A dynamic complex of plant, animal, and microorganism communities and the nonliving environment interacting as a functional unit.

Ecosystem
All living organisms and non-living things that exist and interact in a certain area at the same time.

ecosystem function
Processes such as decomposition, production, nutrient cycling, and fluxes of nutrients and energy that allow an ecosystem to maintain its integrity as a habitat.

Ecosystem Goods and Services
An essential service an ecosystem provides that supports life and makes economic activity possible. For example, ecosystems clean air and water naturally, recycle nutrients and waste generated by human economic activity.

ecosystem services
Resources and processes through which the environment gives benefits to humanity.

ecosystem services
The benefits humans receive from ecosystems.

Ecosystem Services
The benefits people obtain from ecosystems.

ecosystems
Dynamic systems of human, plant, animal, and microorganism communities and the nonliving environment that interact as a functional unit

efficiency
The fraction of energy at the input that is delivered to the output of a device. Electric motors can convert incoming electricity to rotary motion at more than 90 percent efficiency, while gasoline engines convert only about 25 percent of the chemical energy of the fuel to motion of the wheels.

efficient
Having the feature that net benefits are maximized.

electricity grid
The network of wires and transformers that delivers electric power from generation stations such as those powered by coal, natural gas, hydroelectricity, sunlight or wind to end uses such as lighting, transportation, refrigeration, computation or communication. The electricity grid is conventionally divided into higher voltage transmission lines for long distances, lower voltage distribution lines for short distances and transformers in substations for converting the voltage between the two categories.

embodied energy
The sum of all energy used to produce a good, including all of the materials, processes, and transportation involved.

emergy (EMbodied energy)
The unit of energy into which any resource, product, or process can be converted to simplify comparisons between diverse items.

emergy performance index (EMPI)
Value produced by converting all materials and processes to amounts of energy in order to evaluate renewability and sustainability.

Emergy
The amount of energy of one kind (solar) that has been used directly or indirectly (through a transformation process) to make a service or a product as one type and it is expressed in units of (solar) enjoule.

Emjoule
The unit of emergy or emergy joule. Using emergy, sunlight, fuel, electricity, and human service can be put on a common basis by expressing each of them in the emjoules of solar energy that is required to produce them. If solar energy is the baseline, then the results are solar emjoules (abbreviated seJ). Sometimes other baselines such as coal emjoules or electrical emjoules have been used but in most cases emergy data are given in solar emjoules.

end-of-life costs
Those costs that arise through activities associated with the disposition of a product at the end of its useful life. These include costs associated with disposal, recycling, reuse, and remanufacturing.

energy carrier

A medium, such as electricity, gasoline or hydrogen, that can move energy from one place to another, usually from the point of production (e.g. an electrical generator or petroleum refinery) to the point of use (e.g. an electric light or motor or a gasoline engine).

energy density
The amount of energy contained in a given volume (say a gas tank). The higher the energy density of a fuel, the farther the car will go on a tank of the fuel.

Energy Density
The energy contained in a volume or mass divided by the volume or mass it occupies. High energy density materials pack a large energy into a small space or mass; low energy density materials require more space or mass to store the same amount of energy. The electrical energy of batteries is at the low end of the energy density scale, the chemical energy of gasoline is at the high end, approximately a factor of 30-50 larger than batteries.

enrichment factor
Ratio of the metal concentration needed for an economic ore deposit over the average abundance of that metal in Earth's crust.

Entropy
The degree of disorder in a substance, system or process as in the second law of thermodynamics that states that the make-up of energy tends to change from a more-ordered state to a less-ordered state, whereby increasing entropy.

envelope
The physical barrier between the interior and exterior of a building including the walls, roof, foundation, and windows.

environmental performance indicators (EPI)
Any of the ways in which environmental outcomes and/or impacts can be assessed.

environmental sustainability index (ESI)
A composite value produced by including ecological, social, economic, and policy data.

epidemiology
The study of the distribution and determinants of health-related states or events in specified populations.

eutectics
A combination of two or more compounds of either organic, inorganic or both which may have a different melting point to their individual and separate compounds.

eutrophication
Accelerated plant growth and decay caused by nitrogen pollution.

evaporation
The process whereby water is converted from a liquid into a vapor, as a result of absorbing energy (usually from solar radiation).

evaporation
Where water changes from liquid to gas at ambient temperatures.

evapotranspiration
Evaporation from vegetated land that includes water transpired by plants as well as evaporation from open water and soils.

excessive plant nutrient
A type of water pollutant involving a limiting plant nutrient that usually is present in water at low concentrations and therefore, restricts the total amount of plant growth, examples include nitrogen and phosphorous.

Exergy
The maximum work that can be extracted from a system as it moves to thermodynamic equilibrium with a reference state.

extended product/producer responsibility
The creation of financial incentives, and legal disincentives, to encourage manufacturers to make more environmentally friendly products that incorporate end-of-life costs into product design and business plans.

externality
Cost of an activity not paid by the person doing the activity.

externality tax
A tax on something that causes negative externalities.

externalization
The process by which costs inherent to the production of goods (particularly environmental costs) are not included in the actual price paid.

extinction
The death of all individuals within a species. A species may be functionally extinct when a low number of surviving individuals are unable to reproduce.

extirpation
Local extinction of a species; elimination or removal of a species from the area of observation.

F

fermentation
The conversion of sugars into alcohols or hydrocarbons by microbes.

finned Tube
Tube with an extending part on a surface to facilitate cooling.

Fischer-Tropsch synthesis
The inorganic catalytic reaction between CO and H_2 (synthesis gas), which produces diesel and jet fuel.

fluxes
Transformations or flow of materials from one pool to another in a biogeochemical cycle.

food miles
The distance food travels from producer to consumer.

food security
The measure of the availability and access to sufficient, safe, and nutritious food.

fossil fuels
Oil, gas and coal produced by chemical transformation of land plants (coal) and marine animals (oil and gas) trapped in the earth's crust under high pressure and temperature and without access to oxygen. The formation of fossil fuels can take.

free rider
A person who does not contribute to a public good in hopes that they can benefit from provision by other people.

Fuel Cell
An exothermic electrochemical reaction that combines hydrogen and oxygen ions through an electrolyte material to generate electricity (DC) and heat.

functional unit
The basis for comparing two or more products, processes, or services that assures equality of the function delivered.

G

gas phase
One of the three classical states of matter.

Gas Turbine
An internal-combustion engine consisting essentially of an air compressor, combustion chamber, and turbine wheel that is turned by the expanding products of combustion.

gasification
The conversion of biomass at very high temperature (1000 - 1200 ^oC) in an oxygen atmosphere that results in a “synthesis gas” intermediate - a mixture of carbon monoxide (CO) and hydrogen (H_2).

gasoline
A toxic translucent, petroleum-derived liquid that is primarily used as a fuel in internal combustion engines. The term "gasoline" is often shortened in colloquial usage to gas. Under normal ambient conditions its material state is liquid, unlike liquefied petroleum gas or "natural gas."

genetic effects
Effects from some agent, like radiation that are seen in the offspring of the individual who received the agent. The agent must be encountered pre-conception.

genetic engineering of microbes (mineral application)
Creating microorganisms specialized in extracting metal from ore.

geographical potential
The energy flux for a particular renewable energy theoretically extractable from geographical areas that are considered suitable and available.

geothermal energy
Energy from the earth.

geothermal energy

Hot water or steam extracted from geothermal reservoirs in the earth's crust. Water or steam extracted from geothermal reservoirs can be used for geothermal heat pumps, water heating, or electricity generation. Geothermal heat or cooling may also come from ground source heat exchange taking advantage of the constant temperature in the ground below the surface.

geothermal plant
A power plant in which the prime mover is a steam turbine. The turbine is driven either by steam produced from hot water or by natural steam that heat source is found in rock.

ghost acres
The acres of land needed to indirectly support human needs, or land that is unavailable because of habitat degradation.

glacial period
A long period of time in which ice -sheets and glaciers are advanced in their extent.

Global Warming Potential (GWP)
Each gas, based on its atmospheric chemistry, captures different amounts of reflected heat thus contributing differently to the greenhouse effect contributing to its GWP. Carbon dioxide, the least capture efficient of these gases, acts as the reference gas with a global warming potential of 1.

graphite matrix
Composite material with graphite being a metal (see metal matrices).

great ocean conveyor belt (or Termohaline Current)
The current spanning the Pacific, Antarctic, Indian and Atlantic Oceans that carries warm surface water to the cold deep ocean and takes 400-1000 years to complete one cycle.

green roof
Vegetation and planting media installed on a rooftop in order to store and delay stormwater runo from the roof's surface.

greenhouse effect
The process by which the atmosphere acts to trap heat, warming the climate.

greenhouse gases
Gases in Earth's atmosphere that absorb long-wave radiation and retain heat.

greenhouse gases
Those gases in the atmosphere that warm the climate, most importantly, water vapor, carbon dioxide, methane, and ozone.

greenwashing
Claims made by businesses about the superior contributions of their products and services to sustainability without substantive backing or via a very subjective analysis.

greywater
The water generated from activities such as handwashing, laundry, bathing, and dishwashing that can be recycled on-site to be used for irrigation of grounds and even for flushing toilets.

Gross Domestic Product
The sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.

groundwater discharge
Flow of water from below-ground into rivers, lakes, or the ocean.

groundwater mining
A depletion in groundwater resources caused by a large number of water wells that pumped water for a long time.

groundwater
Water located in small spaces between mineral grains and fractures in subsurface rock or sediment.

H

hard water
Water with abundant calcium and magnesium, which reduces its ability to develop soapsuds and enhances scale; hard water does not have negative health effects in people.

Heap leaching
Method of gold mining where cyanide-rich water percolates through finely ground gold ore and dissolves the gold over a period of months; eventually the water is collected and treated to remove the gold.

heat

A type of water pollutant that causes a drop in the dissolved oxygen content, which can stress fish.

heat of fusion
The amount of heat required to convert a unit mass of a solid at its melting point into a liquid without an increase in temperature.

heat pump
A device that allows heat to be removed at a lower temperature and supplied at a higher temperature, for example an air conditioner.

heat, ventilation and air conditioning systems (HVAC)
Systems such as furnaces and air conditioners that are commonly used in homes and commercial buildings.

heavy metal
A type of water pollutant involving elements such as lead, mercury, arsenic, cadmium, and chromium, which can accumulate through the food chain.

hedonic price analysis
A revealed preference tool that uses data on house prices and characteristics to estimate the value of features of the environment that vary among houses.

hedonic wage analysis
A revealed preference tool that uses data on wages and risk of death by job type estimate willingness to pay to reduce the risk of death.

high level radioactive waste (HLW)
The radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly from reprocessing and any solid waste derived from the liquid that contains a combination of transuranic and fission product nuclides in quantities that require permanent isolation.

Hushing
Method of placer mining developed by the ancient Romans where a torrent of water is sent through a landscape via an aqueduct.

Hybrid Vehicle
A car that contains two drive systems, one based on the internal combustion engine and one on the electric motor.
Conventional hybrids, such as the Toyota Prius, use the electric motor only when high power is needed: starting from a stop, passing, and going uphill. The electricity to run the motor is generated on board by an alternator powered by the internal combustion engine and by regenerative breaking. Plug-in hybrids such as the Chevy Volt, in contrast, use the electric motor as the main drive for the car, relying on the gasoline engine only when the battery is low or empty.

hydrated salt
A solid compound containing water molecules combined in a definite ratio as an integral part of a crystal.

Hydraulic mining
Method of placer mining where high pressure hoses cut into natural landscapes.

hydrological cycle
The continuous movement of water on, above and below the surface of the earth. This cycle is dominated by the global equilibrium in evaporation and condensation.

hydrology
The scientific examination of the occurrence, distribution, movement and properties of water within the natural environment.

hydrothermal
Ore forming process involving hot salty water that dissolves metallic elements from a large area and then precipitates ore minerals in a smaller area, commonly along rock fractures and faults.

hydrotreating
Reaction in the presence of hydrogen.

hypoxia
Very low oxygen water due to prolific growth of algae, algal death, and then decomposition, also called dead zone.

I

ice sheets
Glaciers big enough to cover a continent. Currently, ice sheets are found in Antarctica and Greenland, but during glacial periods, ice sheets have covered other land masses, including North America.

igneous crystallization
Ore forming process where molten rock cools to form igneous rock.

igneous rock

Forms by cooling and solidification of hot molten rock.

ignitability
Ability to create fire under certain conditions. Ignitable wastes can create fires under these certain conditions.

impacts
Long-term and more widespread results of an activity.

incineration
A thermal process of combusting MSW.

Indicator
A variable equal to an operational representation of an attribute of a system.

Indicator-Based Systems
Systems that use quantitative measures of economic progress, social welfare, or environmental activity that can be interpreted to explain the state of that system. Examples of these are gross domestic product, greenhouse gas emissions, and the unemployment rate.

Induction Generator
Converts the mechanical shaft power from the CHP prime mover to utility grade. Alternating Current Power. An induction generator can only operate when connected to an external reactive power source (normally provided by the utility grid).

industrial ecology
An applied science that is concerned with material and energy flows through industrial systems.

industrial revolution
The transition from simple tools and animal power for producing products to complex machinery powered by the combustion of fuels. The Industrial Revolution began in England in the mid-18th Century initially centered around the development of the steam engine powered by coal.

infiltration
Flow of water from the land surface into soils and rocks.

infrared spectrum
The light radiation just below the range of wavelengths visible to the human eye. Also referred to as thermal radiation.

infrastructure compatible
Compatible with existing oil pipelines, storage tanks, petroleum refineries, and internal combustion engines.

inorganic catalysis
Solid, inorganic materials such as platinum nanoparticles deposited onto activated carbon, which accelerate the rate of chemical reactions without being consumed in the process.

inputs
The specific resources or services used by an activity.

insolation
The measure of the amount of solar radiation falling on a surface.

instream water use
A societal use of water that does not remove it from its source.

instrumentalist
An attitude to environmental resources characteristic of the last 500-year period of global human economic development, whereby ecosystem provisions - water, minerals, oil and gas, etc. flare perceived only in terms of their use value to human beings, rather than as integral elements of a wider natural system.

integrated waste management
A practice of using several alternative waste management techniques to manage and dispose of MSW.

interdisciplinarity
A trend in higher education research and teaching of the last thirty years that emphasizes the bridging of traditional disciplines, and that is an essential framework for sustainability studies.

interglacial period
The warm periods of the Quaternary in which glaciers and ice-sheets retreat. These occur between the longer glacial periods.

internal combustion engine
The combustion of fuel inside or "internal" to the cylinder and moving piston which produces motion; gasoline engines are a common example. In contrast, steam engines are external combustion engines where combustion and steam generation are outside the cylinder containing the moving piston. The internal combustion engine is lighter and more portable than the steam engine, enabling modern

transportation in cars, diesel powered trains, ships and airplanes.

Internal Combustion Engine
The engine that converts the chemical energy of gasoline into the mechanical energy of motion, by exploding small amounts of fuel in the confined space of fixed cylinder containing a moving piston. A precise amount of fuel must be metered in, and a spark created at a precise moment in the piston's journey to produce the maximum explosive force to drive the piston. The internal combustion engine is an engineering marvel (the word engineering celebrates it) perfected over more than a century. In contrast, the electric motor is much simpler, more efficient and less expensive for the same power output.

Inverter
Converts Direct Current electric power into utility grade Alternating Current electric power. Normally used with fuel cell systems.

isotopes
Atoms that have same number of protons but different numbers of neutrons. This means that they are the same element (e.g. oxygen), have the same chemical properties, but different masses.

J

Jevons paradox
The principle that as technological progress increases the efficiency of resource utilization, consumption of that resource will increase.

K

kWh and MWh
Units of energy used in power engineering. kWh is one kilowatt of power delivered for one hour, MWh is one megawatt of power delivered for one hour.

L

land use change
Human change in the use of land, e.g. deforestation or urbanization.

landfills
Designed, controlled and managed disposal sites for MSW spread in layers, compacted to the smallest practical volume, and covered by material applied at the end of each operating day.

last glacial maximum
The time at which ice sheets were at their greatest extent during the latest glacial period.

latent heat
The heat which flows to or from a material without a change to temperature.

leachate
Wastewater that collects contaminants as it trickles through MSW disposed in a landfill.

leaching
Loss of nitrates from soil in drainage water.

leaching
Using chemicals to dissolve metal from a large volume of crushed rock.

Li-ion battery
A type of rechargeable battery in which lithium ions move from the negative electrode to the positive electrode during discharge and from the positive electrode to negative electrode during charge.

liability
A legal construct meaning that an agent is held responsible by the courts to pay when that agent does something that imposes costs on other people in society.

life cycle assessment (LCA)
A method for quantifying the materials and energy needed to make or deliver a product or service that assesses the wastes produced and potential environmental impacts across all or a part of the product chain.

life cycle impact assessment (LCIA)
The stage of an LCA in which the environmental impacts associated with the manufacture and delivery use and disposal of a product is calculated.

life cycle inventory (LCI)
The stage of an LCA in which information on the use of energy and various materials used to make a product or service at each part of the manufacturing process is collected.

lifecycle

In terms of sustainability, the entire lifecycle of a product must be measured for its environmental impact, not simply its point of production, consumption, or disposal. A key aspect of general sustainability education is the understanding of where goods originate, the industrial processes required for their manufacture and transport, and their fate after use.

Lightweighting
Making a product out of materials that weigh less than were previously used.

lignocellulose
The non-food portion of plants such as the stalks and leaves of corn plants (corn stover).

liquified petroleum gas
A flammable mixture of hydrocarbon gases used as a fuel in heating appliances and vehicles.

little ice age
A cool period in the NH, primarily in Europe from the sixteenth to the nineteenth century.

locavore
A person who consumes locally-produced food products.

low impact cluster development
Low impact cluster development is the grouping of buildings on a portion of the site and devoting the undeveloped land to open space, recreation or agriculture. Though cluster development lowers development cost through savings on roads and infrastructure (sewers, electric and water lines, etc.), it has issues such as conflicts with many older zoning ordinances, perceptions of personal space (lower individual lot size) and maintenance of common areas.

low impact development
An approach to land development (or re-development) that uses natural drainage and environmental processes to manage stormwater as close to its source as possible.

low-emissions
Materials that have little to no volatile organic compounds and other toxic chemicals that are released into the environment after installation.

Low-Emittance Coatings
Microscopically thin, virtually invisible, metal or metallic oxide layers deposited on a window or skylight glazing surface primarily to reduce the U-factor by suppressing radioactive heat flow.

low-level radioactive waste (LLW)
Radioactive waste material that is not high-level radioactive waste, spent nuclear fuel, or byproduct material (see HLW).

M

marginal benefit
The additional benefit of doing one more unit of something.

marginal cost
The additional cost of doing one more unit of something.

market failure
A condition that causes a market not to yield the efficient outcome.

Maximum Sustainable Yield (MSY)
An outgrowth of carrying capacity and the goal is to reach the maximum amount of resource extraction while not depleting the resource from one harvest to the next.

McMansion
A slang term that describes a large, opulent house that may be generic in style and represents a good value for a homebuyer in terms of its size. This type of home is built to provide middle and/or upper middle-class homeowners with the luxurious housing experience that was previously only available to high-net-worth individuals.

mechanical biological treatment (MBT)
The process that combines sorting with a form of biological treatment such as composting or anaerobic digestion.

medical waste
Any municipal solid waste generated in the diagnosis, treatment, or immunization of human beings or animals.

medieval warm period
A warm period in the NH during the tenth and eleventh centuries.

mercury
A type of water pollutant that acts on the central nervous system and can cause loss of sight, feeling,

and hearing as well as nervousness, shakiness, and death.

Mercury amalgamation
Method of gold panning where liquid mercury is added to gold pans because mercury can form an alloy with gold.

metabolism and footprint
Two metaphors, related to the human body, for conceptualizing the relationship between consumption and waste at the social level. Metabolism emphasizes a system of inputs and outputs dependent upon "energy" and measured according to the "health" of the whole, while footprint is a popular metric for quantifying the environmental impacts of goods, services, and lifestyles.

metal matrices
Composite material with at least two constituent parts, one being a metal.

metamorphic rock
Forms when a preexisting rock changes the shape or type of minerals due to intense heat and pressure deep within the Earth.

metamorphism
Process of ore formation that occurs deep in the earth under very high temperature and pressure and produces several building stones, including marble and slate, as well as some nonmetallic ore, including asbestos, talc, and graphite.

Milankovitch cycles
Periodic variations in the Earth's orbit that influence its climate. These cycles are named after Milutin Milankovitch, a mathematician who quantified the theory.

mill tailings
Waste material from a conventional uranium recovery facility.

mineral conservation
Method of extending the mineral supply that includes improved efficiency, substitution, reduce, reuse, and recycle.

mineral
Naturally occurring inorganic solid with a defined chemical composition and crystal structure.

mineral recycling
Method of extending the mineral supply that involves processing used Minerals into new products to prevent waste of potentially useful materials.

mineral reserves
The known amount of ore in the world.

mineral resources
Total amount of a mineral used by society that is not necessarily profitable to Mine today but has some sort of economic potential.

mineral reuse
Method of extending the mineral supply that involves using a mineral multiple time.

mineral substitution
Method of extending the mineral supply; involves substituting a rare nonrenewable resource with either a more abundant nonrenewable resource or a renewable resource.

mitigation
Refers to the importance of reducing carbon emissions so as to prevent further, catastrophic changes in the climate system.

mobility
The ability to move or to get around.

Monte-Carlo method
A repeated random sampling from the distribution of values for each of the parameters in a generic (exposure or dose) equation to derive an estimate of the distribution of (doses or risks in) the population.

morbidity
The relative frequency of occurrence of a disease.

mortality
The number of deaths that occur at a specific time, in a specific group, or from a specific cause.

municipal solid waste (MSW)
Includes non-hazardous waste generated in households, commercial and business establishments, institutions, and non-hazardous industrial process wastes, agricultural wastes and sewage sludge. Specific definition is given in regulations.

N

Narrative Assessments

Descriptive documentation of a program, plan, or project.

native vegetation
"Wild" plants that have naturally evolved and successfully adapted to a region's environmental conditions.

negative externality
A cost that is borne by someone who did not agree to the activity that caused the cost.

net benefits
The difference between total benefits and total costs.

net present value
The present discounted value of a stream of net benefits.

nitrification
Conversion of ammonia into nitrates by microbes.

nominal voltage
Voltage of a fully charged cell or battery when delivering maximum amount of energy that can be withdrawn from a battery at a specific discharge rate.

non-point source
The term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act.

non-renewable fuels
Fuels that will be used up, irreplaceable.

non-use values
Values people have for nature that do not stem from direct interaction.

nonlinear
Changes in a system are nonlinear when they exhibit sudden changes in rate of increase or decline. The population of a particular tropical frog species, for example, may suddenly crash as a result of warming temperatures, rather than show gradual decline.

nonpoint source (of water pollution)
Large and diffuse location where a pollution source occurs.

Normalization
An acquired evolutionary trait characteristic of human beings, whereby even radical changes are quickly adapted to and represented as normal.

normative analysis
A study of how things should be.

northwest passage
A sea route for commerce through the Arctic Ocean north of Canada.

O

obliquity
See Axial Tilt.

off stream water use
A societal use of water that removes it from its source.

oil shocks
Two events of the 1970s triggered by OPEC's oil embargo and price increases that caused shortages of gasoline and eventually a tenfold increase in the price oil by 1981.

oil spill
A type of organic water pollutant involving the release of liquid petroleum into the environment due to human activity.

once through
A single pass of nuclear fuel through a reactor followed by long-term geologic storage.

open-pit mine
Type of surface mineral mine which commonly involve large holes that extract relatively low-grade metallic ore.

opportunity cost
The cost of foregoing the next best choice when making a decision.

ore deposit
Location with abundant ore.

ore
Rock with an enrichment of minerals that can be mined for profit.

Organic Rankine Cycle (ORC)
Uses an organic, high molecular mass fluid with a liquid-vapor phase change or boiling point occurring at a lower temperature than the water-steam phase

change. The fluid allows Rankine cycle heat recovery from lower temperature sources where the heat is converted into useful work, which can then be converted into electricity.

Outcomes
The short-term results of an activity.

outputs
The goods and services being created by an activity, and the manner and degree in which they are delivered.

overconsumption
A long-term result in which the increase in consumption is greater than the efficiency improvement.

oxygen-demanding waste
A type of water pollutant involving abundant dead organic matter.

P

Panning
Method of placer mining where water in a hand-held conical metal pan swirl around.

parafin
A white, odorless, tasteless, waxy solid to store heat with a specific heat capacity of 2.14 - 2.9 J g^{-1} K^{-1} and a heat of fusion of 200 - 300 J g^{-1}.

pathogens
Disease-causing microorganisms, e.g., viruses, bacteria, parasitic worms, and protozoa, which cause a variety of intestinal diseases such as dysentery, typhoid fever, hepatitis, and cholera.

peak oil / Hubbert's peak
A single oil well follows a pattern of increasing production in initial years as its plentiful resources are tapped to declining production in mature years as its resources are depleted. These two trends are separated by a peak in production of the well. M. King Hubbert extrapolated this pattern from one well to many and in 1956 predicted that the United States' oil production would peak n the mid-1970s. Although widely criticized at the time, Hubbert's prediction proved true. This success led to widespread predictions for the peak of world oil production. The concept of peak oil is an inevitable consequence of using oil faster than it can be made. However, attempts to predict when the peak will occur are notoriously difficult.

peak oil
The peak in world oil production that must come about as oil consumption surpasses the discovery of new oil.

performance standard
A regulation specifying something about the outcome of private behaviors.

permafrost
Soil that has a temperature that has remained below freezing (0 ^{o}C or 32 ^{o}F) for at least two years.

permeability
Measure of the speed that groundwater can flow through rock or sediment.

persistent organic pollutant
A group of organic water pollutants that are long-lived in the environment, accumulate through the food chain, and can be toxic.

Phantom Load or Vampire Power
Refers to the electrical load of appliances and chargers when they are not in use but plugged in, as they still draw power but provide no service.

phase change material
A material that stores heat in the form of latent heat of fusion.

phase change materials
Materials that can absorb and deliver larger amount of heat than common building materials because they can change their state (solid or liquid).

photosynthesis
The process in which plants use energy from sunlight to combine CO_2 from the atmosphere with water to make sugars, and in turn build biomass.

photovoltaic cells
An electronic device consisting of layers of semiconductor materials that are produced to form adjacent layers of materials with different electronic characteristics and electrical contacts and being capable of converting incident light directly into electricity (direct current).

physical components of the earth system

Nonliving factors such as rocks, minerals, water, climate, air, and energy.

placer deposit
Ore forming process where dense gold particles and diamonds are concentrated by flowing water in rivers and at beaches.

placer mine
Type of surface mineral mine which extracts gold or diamonds from river and beach. sediment by scooping up the sediment and then separating the ore by density.

Point of Production
The first (or at least an early) step in the energy chain, where the energy that ultimately will perform a function at the point of use is put into its working form. For gasoline-driven cars, this is the refinery where gasoline is produced from crude oil, for battery-driven cars this is the power generation plant where electricity is produced. Gasoline is then delivered to the pump and finally to the car, where it is converted (the point of use) to mechanical motion by the engine. Similarly, electricity is delivered to the battery of an electric car by the grid, and converted by the electric motor of the car (the point of use) to mechanical motion.

Point of Use
The last step in the energy chain, where energy accomplishes its intended function. For vehicles, this is the conversion of chemical energy in gasoline cars or electric energy in battery cars to motion of the wheels that moves the car along the road.

point source (of water pollution)
Readily identifiable and relatively small location where a pollution source occurs.

point source
Defined by Section 502(14) of the Clean Water Act as any single identifiable and discrete source of pollution from which pollutants are discharged, such as from a pipe, ditch, channel, culvert, confined animal feeding operation, or discharged from a floating vessel.

pollution prevention
Reducing or eliminating waste at the source by modifying production processes, promoting the use of non-toxic or less-toxic substances, implementing conservation techniques, and re-using materials rather than putting them into the waste streams.

pollution prevention
The active process of identifying areas, processes, and activities which generate excessive waste for the purpose of substitution, alteration, or elimination of the process to prevent waste generation in the first place.

pools
Amounts of material in biogeochemical cycles that share some common characteristic and are relatively uniform in nature.

pore space
Small spaces between mineral grains in subsurface rock or sediment.

porosity
Percentage of pore space in rock or sediment.

positive analysis
A study of how things are.

positive externality
A benefit that accrues to someone who did not agree to the activity that caused the benefit.

positive feedback
A runaway process which amplifies the effect of an initial change.

post-traumatic stress disorder
PTSD - a psychological condition affecting people who have suffered severe emotional trauma as a result of an experience such as combat, crime, or natural disaster, and causing sleep disturbances, flashbacks, anxiety, tiredness, and depression.

postindustrial information age
Is a way of capturing the nature of western economies, in which most people are no longer engaged in the production of goods (which is highly automated) but rather deal with the publication, consumption, and manipulation of information, especially by computers and computer networks. A post-industrial society has five primary characteristics: the domination of service, rather than manufacturing, the pre-eminence of the professional and technical classes, the central place of theoretical knowledge as a source of innovations, the dominating influence of technology, and levels of urbanization higher than anywhere else in the world.

precautionary principle

The proposition that decision-making should be driven by a concern for the avoidance of bad outcomes. In environmental terms, this means coordinating economic development and the profit motive with the need to maintain resilient ecosystems.

precipitation
The conversion of atmospheric water from vapor into liquid (rain) or solid forms (snow, hail) that then fall to Earth's surface.

present discounted value
The value of something in present-day (rather than future) terms.

primary energy
The energy embodied in natural resources prior to undergoing any human-made conversions or transformations. Examples include the chemical energy in coal or the sunlight falling on a solar cell before it is converted to electricity, the nuclear energy in the fuel of a nuclear reactor, or the kinetic energy of wind before it turns the blades of a turbine.

primary producers
The primary entry point of carbon into the biospherefin nearly all land and aquatic ecosystems plants perform this role by virtue of photosynthesis.

Prime Mover
The term utilized to denote the CHP system equipment that converts input fuel into mechanical shaft power (reciprocating engine, gas turbine, steam turbine, micro-turbine).

probabilistic risk assessment
Risk evaluation involving the calculation and expression of risks using multiple risk descriptors to provide the likelihood of various risk levels. Probabilistic risk results approximate a full range of possible outcomes and the likelihood of each, which often is presented as a frequency distribution graph, thus allowing uncertainty or variability to be expressed quantitatively.

product chain
Those stages in the conception, design, manufacture, marketing, use, and end-of-life that define the impacts of a product or service on society.

product stewardship
An approach to product development in which products are conceived, designed, manufactured, and marketed within a "systems thinking" context. It is a way of framing environmental problems that recognizes the three parts of the sustainability paradigm, and incorporates the concepts of sustainable manufacturing, marketing, utility-to-society, impacts of the use of the product, and end-of-life disposition of the product.

Provisioning Ecosystem Services
Aspects of the natural world used by us to meet our resource needs, e.g. food, water, timber, and fiber.

proxy data
Information about the climate that accumulates through natural phenomena.

public good
A good with two features: (i) it has a benefit that does not diminish with the number of people enjoying it, and (ii) no one can be excluded from consuming it.

Pyrolysis
The conversion of biomass at moderately high temperature (500 - 800 ^{o}C) in an inert atmosphere that results in a "bio-oil" intermediate.

Q

Quantitative Data
Information that can be quantified numerically such as tons of waste, gallons of gasoline, and gallons of wastewater.

quaternary period
The most recent geological period, spanning the time from 2.6 million years ago to today.

R

radiative forcing
Change in net irradiance (an energy flux) measured at some boundary. For this text the boundary is typically at the surface of the earth or the top of atmosphere. A positive change indicates warming and a negative change indicates cooling.

radioactive half-lives
The amount of time necessary to decrease the radioactivity of radioactive material to one-half the original level.

radioactive waste

Any waste that emits energy as rays, waves, or streams of energetic particles.

rain barrel
A cistern, barrel or storage system that collects and stores the rainwater or snowmelt from roofs that would otherwise be diverted to storm drains and streams as stormwater runoff.

rainwater harvesting
Catching and storing rainwater for reuse before it reaches the ground.

reactivity
Materials susceptible to unstable conditions. Reactive wastes are unstable under normal conditions and can create explosions and or toxic fumes, gases, and vapors when mixed with water.

recharge area
Location on Earth where surface water infiltrates into the ground rather than runs off into rivers or evaporates.

Reciprocating Engine
A heat engine that uses one or more reciprocating pistons to convert pressure into mechanical rotating shaft power.

reclaimed mine
Mineral mine restored to a useful landscape.

recycling
Separation physical/mechanical process by which secondary raw materials (such as paper, metals, glass, and plastics) are obtained from MSW.

Regulating Ecosystem Services
Processes in the Earth system that control key physical and biological elements of our environment, e.g. climate regulation, flood regulation, disease regulation, water purification.

remote responsibilities
An ethical extension of systems literacy and the principle of connectivity: we are linked to peoples and places remote from us through the web of global industrial production and commerce, and thus have responsibility toward them.

renewable fuels
Fuels that are never exhausted or can be replaced.

renewable generation variability
The variation of the output of a solar or wind plant depending on weather. Solar plants often produce only 15-20 percent of their maximum output (also called installed capacity) because the sun shines only during the day and passing clouds can obscure it; wind plants produce 20-40 percent of their maximum capacity because the wind speed varies with weather conditions, often becoming calm for days at a time.

reprocessing
Chemically processing spent nuclear fuel to recover the unused portion, which is then passed through the reactor again to produce more power. Reprocessing uses a greater fraction of the energy of the fuel but also increases the risk of illegal diversion of nuclear material for weapons proliferation.

reservoir
Large artificial lake used as a source of water.

resilience and vulnerability
Important terms of measurement for the impact of environmental change, particularly on human communities. The goal of sustainability analysis and policy, at all levels, is to enhance the resilience of communities to change, in other words, to mitigate their vulnerability.

Resilience
The ability of an ecological community to change in response to disturbance and the degree or time needed for that system that provides desirable to go back to its original state.

respiration
Metabolic process in all organisms that generates energy and synthesizes biomass while releasing CO_2 as a by-product.

reuse
Using a component of MSW in its original form more than once.

revealed preference
Valuation tools that use behaviors such as job choice, housing choice, and recreational site choice to reveal information about the values people have for features of the environment.

river discharge
Volume of water moving through a river channel over time.

rock

A solid coherent piece of planet Earth.

S

saltwater intrusion
Saltwater that enters an aquifer due to over pumping of freshwater aquifers near ocean coastlines.

saturated zone
Subsurface area where groundwater completely fills pore spaces in rock or sediment.

scenario
A global development path based on specific assumptions for the economic, technological and social global context, predicting energy demand, energy cost, and growth of energy technologies.

scoping
The stage of an LCA in which the rationale for carrying out the assessment is made explicit, where the boundaries of the system is defined, where the data quantity, quality, and sources are specified, and where any assumptions that underlie the LCA are stated.

sediment
A type of water pollutant that degrades drinking water and can kill underwater plants that need sunlight for photosynthesis.

sedimentary processes
Processes of ore formation that occur in rivers and concentrate sand and gravel (used in construction), as well as dense gold particles and diamonds that weathered away from bedrock.

sedimentary rock
Forms by hardening of layers of sediment (loose grains such as sand or mud) deposited at Earth's surface or by mineral precipitation, i.e., formation of minerals in water from dissolved mineral matter.

sensible heat
The heat energy stored in a substance as a result of an increase in its temperature.

sensitivity analysis
Evaluation of how sensitive the results of an analysis is to changes in assumptions used in the analysis.

septic tank system
An individual sewage treatment system for homes in rural and even some urban settings.

Sequestered
Removed from the atmosphere.

sewage treatment plant
A facility that processes wastewater with the main goal of removing organic matter (oxygen-demanding waste) and killing bacteria.

slag
Glassy unwanted by-product of smelting ore.

sludge
Concentrated organic solid produced during primary and secondary treatment of sewage treatment.

Sluice box
Method of placer mining where running water passes through a wooden box with riffles on the bottom.

smart grid
The addition of sensors to monitor power flow and two-way communication to transmit the power flow information to the utility and the customer in real time. The addition of sensors and communication to the grid enables several new operating modes: the customer decide in real time to curtail his electricity use during peak times when rates are high (known as demand-response), the utility can identify precisely the time and place of power flow failures due to weather or other events, and the grid can be equipped with automatic circuit breakers (known as fault current limiters) and other protection devices that respond immediately to power flow failures, limiting damage to the grid and the risk of triggering a cascade of failures.

smelting
Heating ore minerals with different chemicals to extract the metal.

snowball earth
A condition in which the entire planet is covered in ice, last thought to have happened 650 million years ago.

soil moisture
Water in the unsaturated zone.

solar energy
The sun's radiation that reaches the earth.

solar radiation
The energy emitted by the sun in the form of light.

solid waste
According to the Resource Conservation and Recovery Act (RCRA), solid waste is: garbage; refuse; sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility; and other discarded materials, including solid, liquid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities.

solvent
Capacity of a liquid such as water to dissolve soluble minerals.

somatic effects
Effects from some agent, like radiation that are seen in the individual who receives the agent.

spring
River that emerges from underground due to an abrupt intersection of the water table with the land surface.

stated preference
Valuation tools that use survey responses to hypothetical questions rather than data on actual choices.

Steam Turbine
Utilizes the Rankine Cycle to extract heat from steam and transform the heat into mechanical shaft power by expanding the steam from high pressure to low pressure through the turbine blades.

stormwater runoff
The overland flow of precipitation generated by that portion of rain and snowmelt that does not infiltrate into the ground, is not taken up by plants, and is not evaporated into the atmosphere.

strategic mineral
Mineral considered essential to a country for some military, industrial, or commercial purpose but the country must import the mineral to meet its needs.

streamflow
Flow of water in streams.

strip mine
Type of surface mineral mine which extracts horizontal layers of ore or rock.

strong sustainability
All forms of capital must be maintained intact independent of one another. The implicit assumption is that different forms of capital are mainly complementary; that is, all forms are generally necessary for any form to be of value. Produced capital used in harvesting and processing timber, for example, is of no value in the absence of stocks of timber to harvest. Only by maintaining both natural and produced capital stocks intact can non-declining income be assured.

superconducting cable
An underground cable made of superconductor, which loses all resistance to electric current at low temperature. Superconducting cables made of second-generation coated conductors based on the copper oxide family of superconductors discovered in 1986 are now entering the grid. Because superconductors conduct electricity without producing heat, they can carry up to five times more power than conventional copper cables in the same cross-sectional area.

superfund
A federal program created in 1980 and designed to identify and clean up the worst of the hazardous chemical waste sites in the U.S.

Supporting Ecosystem Services
The biogeochemical cycles, as well as biological and physical processes that drive ecosystem function, e.g. soil formation, nutrient cycling, and photosynthesis.

surface mine
Mineral mine that occurs at Earth's surface.

surface runoff
Flow of water over the land surface.

surface runoff
Unchanneled overland flow of water.

sustainable development
Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

swales
Graded and engineered landscape features designed as vegetated, shallow, open channels or ditches that are usually planted with flood tolerant and erosion resistant plants.

Synchronous Generator

Converts the mechanical shaft power from the CHP prime mover to utility grade. Alternating Current Power. A synchronous generator is self-exciting (contains its own source of reactive power) and can operate independent of, or isolated from, the utility grid.

synthetic biology
The field of biology in which microbes are engineered to control metabolic pathways.

systems literacy
An educational philosophy that emphasizes a student's competence in a wide variety of disciplines, so that he or she might better understand the operations of those complex systems, both human and natural, that underpin sustainability.

systems thinking
In the context of sustainability, systems thinking is a way of conceiving human-created and natural systems as functional parts of a larger, integrated system.

T

Tailings
Fine-grained waste produced from processing ore.

technical potential
The geographical potential after the losses due to conversion of the primary energy flux to secondary energy carriers or forms, such as electricity.

technology standard
A regulation specifying what kind of technology agents must or must not use in their activities.

telework
Working from a remote location, usually a home office, by electronically linking to a company.

thermal mass
The ability of a material to absorb heat energy. High density materials like concrete, bricks and tiles need a lot of heat to change their temperature and thus, have a high thermal mass. Lightweight materials such as wood have a low thermal mass.

tipping point
The critical moment of nonlinear change whereby a system changes suddenly from one state to another.

total dissolved solids
Total amount of dissolved material in water, typically reported in parts per million (ppm) units.

toxic chemical
A type of organic water pollutant involving chemicals with a severe human health risk.

toxicity
The degree to which a chemical substance (or physical agent) elicits a deleterious or adverse effect upon the biological system of an organism exposed to the substance over a designated time period.

tradable permits
A policy in which the total amount of an activity is limited, but agents can trade the rights to engage in that activity (permits).

transesterification
The base catalyzed reaction of plant oil with methanol with breaks the oil into long fatty acid chains, which can be used as a low-quality diesel fuel.

transpiration
Loss of water by plants to the atmosphere. transuranic radioactive waste (TRU) TRU waste contains more than 100 nanocuries of alpha-emitting transuranic isotopes, with half-lives greater than twenty years, per gram of waste.

travel cost analysis
A revealed preference tool that estimates the values of natural resource amenities by analyzing data on recreational site characteristics and people's visitation patterns and travel costs.

triple bottom line
A reference to the value of a business going beyond dollar profitability to include social and environmental costs and benefits as well.

Triple Bottom Line
Accounting for ecological and social performance in addition to financial performance

U

U-factor
The rate of heat loss is indicated in terms of the of a window assembly. The lower the U-factor, the greater a window's resistance to heat flow and the better its insulating properties.

unconfined aquifer

Aquifer with no aquitard above it.

underground fuel storage tank
A type of water pollutant if it leaks.

underground mine
Mineral mine that involves a network of tunnels to access and extract the ore.

unsaturated zone
Subsurface area where pore spaces contain only air and water films on mineral grains.

urban sprawl
Any environment characterized by;
(1) a population widely dispersed in low density residential development;
(2) rigid separation of homes, shops, and workplaces;
(3) a lack of distinct, thriving activity centers, such as strong downtowns or suburban town centers; and
(4) a network of roads marked by large block size and poor access from one place to another has been found to correlate with increased body mass index.

use values
Benefits associated with direct interaction with nature and the environment.

V

valuation
The process of estimating a dollar value for an amenity or a disamentity.

value of a statistical life
A statistical concept that can be used as the value of reducing the number of deaths in a population by one.

visible spectrum
The light radiation that is in the range of wavelengths that is visible to the human eye.

volatile organic compounds
(VOC) - an organic compound that evaporates at a relatively low temperature and contributes to air pollution, e.g. ethylene, propylene, benzene, or styrene).

W

walkability
Walkability is a measure of how friendly an area is to walking. Walkability has many health, environmental, and economic benefits. Factors influencing walkability includes the presence or absence and quality of footpaths, sidewalks or another pedestrian rights-of-way, traffic and road conditions, land use patterns, building accessibility, destination density and safety, among others. Walkability is an important concept in sustainable urban design.

Waste Heat to Power (Bottoming Cycle CHP)
Captures the waste heat generated by an industrial or commercial process, utilizing the waste heat as the free fuel source for generating electricity.

waste minimization
Measures or techniques that reduce the amount of wastes generated during industrial production processes; the term is also applied to recycling and other efforts to reduce the amount of waste going into the waste management system.

waste prevention
The design, manufacture, purchase or use of materials or products to reduce their amount or toxicity before they enter the municipal solid waste stream. Because it is intended to reduce pollution and conserve resources, waste prevention should not increase the net amount or toxicity of wastes generated throughout the life of a product.

waste to energy
Combustion of MSW to generate electrical energy or heat

water conservation
Using less water and using it more efficiently.

water crisis
A global situation where people in many areas lack access to sufficient water or clean water or both.

water cycle
The continuous movement of water through water reservoirs located on, above, and below Earth's surface.

water pollution
Contamination of water by an excess amount of a substance that can cause harm to human beings and the ecosystem.

water reservoir (in water cycle)
General location on Earth where water is located including oceans, atmosphere, glaciers, groundwater, lakes, rivers, and biosphere.

water table
Interface between the unsaturated zone and saturated zone.

water table well
Water well drilled into an unconfined aquifer where the water level in the well coincides with the water table.

watershed
A geographic area that naturally drains to a specific waterway or waterbody.

watts per square meter (W/m^2)
Energy (Joules) per second moving through a surface (square meter). A flux of energy through a surface area.

weak sustainability
All forms of capital are more or less substitutes for one another; no regard has to be given to the composition of the stock of capital. Weak sustainability allows for the depletion or degradation of natural resources, so long as such depletion is offset by increases in the stocks of other forms of capital (for example, by investing royalties from depleting mineral reserves in factories).

weather
A description of the short-term state of the atmosphere.

weathering
Ore forming process where soil water in a tropical rain forest environment concentrates insoluble elements such as aluminum (bauxite) by dissolving away the soluble elements.

Wedge Approach
A way of expressing the concept that there is no one solution to the challenge of reducing greenhouse gas emissions. Each technology, action or change is represented by a triangular wedge in a chart of time vs. emissions.

welfare
Broadly defined, welfare is well-being.

well-mixed gas
A gas that can be found at the same concentration throughout the lower atmosphere regardless of location.

willingness to accept
The amount of money you would have to pay someone to compensate them for a deleterious change.

willingness to pay
The amount of money someone is willing to pay for something good.