

DELAND GIBSON/CLEAN ENERGY INSURANCE PRACTICE

GLOSSARY OF CLEAN ENERGY TERMS

The definitions appearing in this Glossary are provided solely for general informational purposes. They are not intended to be complete descriptions of all terms, conditions and exclusions applicable to the products and services defined. Also, in the case of any inconsistency between the definitions in this Glossary and the definitions appearing in the actual insurance policy, the definitions contained in the actual policy shall govern.

A

Aerosol

A collection of airborne solid or liquid particles, with a typical size between 0.01 and 10 micrometers (μm) and residing in the atmosphere for at least several hours. Aerosols may be of either natural or anthropogenic origin. Aerosols may influence climate in two ways: directly through scattering and absorbing radiation, and indirectly through acting as condensation nuclei for cloud formation or modifying the optical properties and lifetime of clouds. The term has also come to be associated, erroneously, with the propellant used in "aerosol sprays."

Adaptation

Adjustment in natural or human systems to a new or changing environment. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation.

Afforestation

Planting of new forests on lands that historically have not contained forests.

Albedo

The fraction of solar radiation reflected by a surface or object, often expressed as a percentage. Snow covered surfaces have a high albedo; the albedo of soils ranges from high to low; vegetation covered surfaces and oceans have a low albedo. The Earth's albedo varies mainly through varying cloudiness, snow, ice, leaf area and land cover changes.

Alternative Energy

Energy derived from nontraditional sources (e.g., compressed natural gas, solar, hydroelectric, wind).

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Annex I

Countries/Parties

Group of countries included in Annex I (as amended in 1998) to the United Nations Framework Convention on Climate Change, including all the developed countries in the Organization of Economic Co-operation and Development, and economies in transition. By default, the other countries are referred to as Non-Annex I countries. Under Articles 4.2 (a) and 4.2 (b) of the Convention, Annex I countries commit themselves specifically to the aim of returning individually or jointly to their 1990 levels of greenhouse gas emissions by the year 2000.

Anthropogenic

Made by people or resulting from human activities. Usually used in the context of emissions that are produced as a result of human activities.

Atmosphere

The gaseous envelope surrounding the Earth. The dry atmosphere consists almost entirely of nitrogen (78.1% volume mixing ratio) and oxygen (20.9% volume mixing ratio), together with a number of trace gases, such as argon (0.93% volume mixing ratio), helium, radioactively active greenhouse gases such as carbon dioxide (0.035% volume mixing ratio), and ozone. In addition the atmosphere contains water vapor, whose amount is highly variable but typically 1% volume mixing ratio. The atmosphere also contains clouds and aerosols.

Atmospheric Lifetime

The lifetime of a greenhouse gas refers to the approximate amount of time it would take for the anthropogenic increment to an atmospheric pollutant concentration to return to its natural level (assuming emissions cease) as a result of either being converted to another chemical compound or being taken out of the atmosphere via a sink. This time depends on the pollutant's sources and sinks as well as its reactivity. The lifetime of a pollutant is often considered in conjunction with the mixing of pollutants in the atmosphere; a long lifetime will allow the pollutant to mix throughout the atmosphere. Average lifetimes can vary from about a week (sulfate aerosols) to more than a century (chlorofluorocarbons (CFCs), carbon dioxide).

B

Biogeochemical Cycle

Movements through the Earth system of key chemical constituents essential to life, such as carbon, nitrogen, oxygen, and phosphorus.

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Biomass

Total dry weight of all living organisms that can be supported at each tropic level in a food chain. Also, materials that is biological in origin, including organic material (both living and dead) from above and below ground, for example, trees, crops, grasses, tree litter, roots, and animals and animal waste.

Biosphere

The part of the Earth system comprising all ecosystems and living organisms, in the atmosphere, on land (terrestrial biosphere) or in the oceans (marine biosphere), including derived dead organic matter, such as litter, soil organic matter and oceanic detritus.

Black Carbon

Operationally defined species based on measurement of light absorption and chemical reactivity and/or thermal stability; consists of soot, charcoal, and/or possible light-absorbing refractory organic matter. (Source: Charlson and Heintzenberg, 1995, p. 401.)

Borehole

Any exploratory hole drilled into the Earth or ice to gather geophysical data. Climate researchers often take ice core samples, a type of borehole, to predict atmospheric composition in earlier years.

C

Cap and Trade

Cap and Trade is a market-based policy tool for protecting human health and the environment. A cap and trade program first sets an aggressive cap, or maximum limit, on emissions. Sources covered by the program then receive authorizations to emit in the form of emissions allowances, with the total amount of allowances limited by the cap. Each source can design its own compliance strategy to meet the overall reduction requirement, including sale or purchase of allowances, installation of pollution controls, implementation of efficiency measures, among other options. Individual control requirements are not specified under a cap and trade program, but each emissions source must surrender allowances equal to its actual emissions in order to comply. Sources must also completely and accurately measure and report all emissions in a timely manner to guarantee that the overall cap is achieved.

Capital Costs

Costs associated with the capital or investment expenditures on land, plant, equipment and

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inventories. Unlike labor and operating costs, capital costs are independent of the level of output.

Capital Stocks

The accumulation of machines and structures that are available to an economy at any point in time to produce goods or render services. These activities usually require a quantity of energy that is determined largely by the rate at which that machine or structure is used.

Carbon Cycle

All parts (reservoirs) and fluxes of carbon. The cycle is usually thought of as four main reservoirs of carbon interconnected by pathways of exchange. The reservoirs are the atmosphere, terrestrial biosphere (usually includes freshwater systems), oceans, and sediments (includes fossil fuels). The annual movements of carbon, the carbon exchanges between reservoirs, occur because of various chemical, physical, geological, and biological processes. The ocean contains the largest pool of carbon near the surface of the Earth, but most of that pool is not involved with rapid exchange with the atmosphere.

Carbon Dioxide

A naturally occurring gas, and also a by-product of burning fossil fuels and biomass, as well as land-use changes and other industrial processes. It is the principal anthropogenic greenhouse gas that affects the Earth's radiative balance. It is the reference gas against which other greenhouse gases are measured and therefore has a Global Warming Potential of 1.

Carbon Dioxide Fertilization

The enhancement of the growth of plants as a result of increased atmospheric CO₂ concentration. Depending on their mechanism of photosynthesis, certain types of plants are more sensitive to changes in atmospheric CO₂ concentration.

Carbon Dioxide Equivalent

A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as "million metric tons of carbon dioxide equivalents (MMT_{CO2Eq}).\" The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. The use of carbon equivalents (MMTCE) is declining.

$MMT_{CO2Eq} = (\text{million metric tons of a gas}) * (\text{GWP of the gas})$

Carbon Intensity

The amount of carbon by weight emitted per unit of energy consumed. A common measure of

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carbon intensity is weight of carbon per British thermal unit (Btu) of energy. When there is only one fossil fuel under consideration, the carbon intensity and the emissions coefficient are identical. When there are several fuels, carbon intensity is based on their combined emissions coefficients weighted by their energy consumption levels.

Carbon Sequestration

The uptake and storage of carbon. Trees and plants, for example, absorb carbon dioxide, release the oxygen and store the carbon. Fossil fuels were at one time biomass and continue to store the carbon until burned.

Chlorofluorocarbons

Greenhouse gases covered under the 1987 Montreal Protocol and used for refrigeration, air conditioning, packaging, insulation, solvents, or aerosol propellants. Since they are not destroyed in the lower atmosphere, CFCs drift into the upper atmosphere where, given suitable conditions, they break down ozone. These gases are being replaced by other compounds, including hydrochlorofluorocarbons and hydrofluorocarbons, which are greenhouse gases covered under the Kyoto Protocol.

Clean Development Mechanisms

Article 12 of the Kyoto Protocol provides for the CDM whereby developed countries are able to invest in emissions reducing projects in developing countries to obtain credit to assist in meeting their assigned amounts. The details of the CDM have yet to be negotiated at the international level. However, it does allow countries to use credits obtained from the year 2000 for the purposes of meeting their assigned amounts. Participation is voluntary, and open to private and public entities alike on a Party-approved basis.

Climate

Climate in a narrow sense is usually defined as the "average weather," or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands of years. The classical period is 3 decades, as defined by the World Meteorological Organization (WMO). These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.

Climate Change

Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). Climate change may result from: natural factors, such as changes in the sun's intensity or slow changes in the Earth's

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orbit around the sun; natural processes within the climate system (e.g. changes in ocean circulation); human activities that change the atmosphere's composition (e.g. through burning fossil fuels) and the land surface (e.g. deforestation, reforestation, urbanization, desertification, etc.)

Climate Feedback

An interaction mechanism between processes in the climate system is called a climate feedback, when the result of an initial process triggers changes in a second process that in turn influences the initial one. A positive feedback intensifies the original process, and a negative feedback reduces it.

Climate Lag

The delay that occurs in climate change as a result of some factor that changes only very slowly. For example, the effects of releasing more carbon dioxide into the atmosphere may not be known for some time because a large fraction is dissolved in the ocean and only released to the atmosphere many years later.

Climate Model

A quantitative way of representing the interactions of the atmosphere, oceans, land surface, and ice. Models can range from relatively simple to quite comprehensive.

Climate Sensitivity

In IPCC Reports, equilibrium climate sensitivity refers to the equilibrium change in global mean surface temperature following a doubling of the atmospheric (equivalent) CO₂ concentration. More generally, equilibrium climate sensitivity refers to the equilibrium change in surface air temperature following a unit change in radiative forcing (degrees Celsius, per watts per square meter, $\hat{A}^{\circ}\text{C}/\text{Wm}^{-2}$). In practice, the evaluation of the equilibrium climate sensitivity requires very long simulations with Coupled General Circulation Models (Climate model). The effective climate sensitivity is a related measure that circumvents this requirement. It is evaluated from model output for evolving non-equilibrium conditions. It is a measure of the strengths of the feedbacks at a particular time and may vary with forcing history and climate state.

Climate System (or Earth System)

The five physical components (atmosphere, hydrosphere, cryosphere, lithosphere, and biosphere) that are responsible for the climate and its variations.

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Coalbed Methane

Coalbed methane is methane contained in coal seams, and is often referred to as virgin coalbed methane, or coal seam gas. For more information, visit the Coalbed Methane Outreach program site.

Coal Mine Methane

Coal mine methane is the subset of CBM that is released from the coal seams during the process of coal mining. For more information, visit the Coalbed Methane Outreach program site.

Co-Benefit

The benefits of policies that are implemented for various reasons at the same time including climate change mitigation acknowledging that most policies designed to address greenhouse gas mitigation also have other, often at least equally important, rationales (e.g., related to objectives of development, sustainability, and equity). The term co-impact is also used in a more generic sense to cover both the positive and negative side of the benefits.

Concentration

Amount of a chemical in a particular volume or weight of air, water, soil, or other medium.

Conference of the Parties

The supreme body of the United Nations Framework Convention on Climate Change (UNFCCC). It comprises more than 180 nations that have ratified the Convention. Its first session was held in Berlin, Germany, in 1995 and it is expected to continue meeting on a yearly basis. The COP's role is to promote and review the implementation of the Convention. It will periodically review existing commitments in light of the Convention's objective, new scientific findings, and the effectiveness of national climate change programs.

Cost-effective

A criterion that specifies that a technology or measure deliver a good or service at equal or lower cost than current practice.

Cryosphere

One of the interrelated components of the Earth's system, the cryosphere is frozen water in the form of snow, permanently frozen ground (permafrost), floating ice, and glaciers. Fluctuations in the volume of the cryosphere cause changes in ocean sea level, which directly impact the atmosphere and biosphere.



D

Damage Function

The relation between changes in the climate and reductions in economic activity relative to the rate that would be possible in an unaltered climate.

Deforestation

Those practices or processes that result in the conversion of forested lands for non-forest uses. This is often cited as one of the major causes of the enhanced greenhouse effect for two reasons: 1) the burning or decomposition of the wood releases carbon dioxide; and 2) trees that once removed carbon dioxide from the atmosphere in the process of photosynthesis are no longer present.

Desertification

Land degradation in arid, semi-arid, and dry sub-humid areas resulting from various factors, including climatic variations and human activities. Further, the UNCCD (The United Nations Convention to Combat Desertification) defines land degradation as a reduction or loss, in arid, semi-arid, and dry sub-humid areas, of the biological or economic productivity and complexity of rain-fed cropland, irrigated cropland, or range, pasture, forest, and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as: (i) soil erosion caused by wind and/or water; (ii) deterioration of the physical, chemical and biological or economic properties of soil; and (iii) long-term loss of natural vegetation. Conversion of forest to non-forest.

Discount rate

The annual rate at which the effect of future events are reduced so as to be comparable to the effect of present events.

Diurnal Temperature Range

The difference between maximum and minimum temperature over a period of 24 hours.

E

Economic Potential

The portion of the technical potential for GHG emissions reductions or energy-efficiency improvements that could be achieved cost-effectively in the absence of market barriers. The

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achievement of the economic potential requires additional policies and measures to break down market barriers.

Eccentricity

The extent to which the Earth's orbit around the Sun departs from a perfect circle.

Ecosystem

Any natural unit or entity including living and non-living parts that interact to produce a stable system through cyclic exchange of materials.

Emissions

The release of a substance (usually a gas when referring to the subject of climate change) into the atmosphere.

Emissions Factor

A unique value for scaling emissions to activity data in terms of a standard rate of emissions per unit of activity (e.g., grams of carbon dioxide emitted per barrel of fossil fuel consumed).

Emission Permit

A non-transferable or tradeable allocation of entitlements by a government to an individual firm to emit a specific amount of a substance.

Emission Quota

The portion or share of total allowable emissions assigned to a country or group of countries within a framework of maximum total emissions and mandatory allocations of resources or assessments.

Emissions Scenario

Representation of the future development of emissions of greenhouse gases based on a set of assumptions about driving forces and their key relationships.

Emission Standard

A level of emission that under law may not be exceeded.

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Energy Intensity

The ratio of energy consumption to a measure of the demand for services (e.g., number of buildings, total floorspace, floorspace-hours, number of employees, or constant dollar value of Gross Domestic Product for services).

Enhanced Greenhouse Effect

The concept that the natural greenhouse effect has been enhanced by anthropogenic emissions of greenhouse gases. Increased concentrations of carbon dioxide, methane, and nitrous oxide, chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆), nitrogen trifluoride (NF₃), and other photochemically important gases caused by human activities such as fossil fuel consumption, trap more infra-red radiation, thereby exerting a warming influence on the climate.

Equivalent CO₂

The concentration of CO₂ that would cause the same amount of radiative forcing as a given mixture of CO₂ and other greenhouse gasses.

Evapotranspiration

The combined process of evaporation from the Earth's surface and transpiration from vegetation.

External Impacts/Externalities

Impacts generated by climate change (or some other environmental change) that cannot be evaluated by a competitive market because of a lack of information and or the inability to act on the information.

Externalities

By-products of activities that affect the well-being of people or damage the environment, where those impacts are not reflected in market prices. The costs (or benefits) associated with externalities do not enter standard cost accounting schemes.

F

Feedback Mechanisms

Factors which increase or amplify (positive feedback) or decrease (negative feedback) the rate of a process. An example of positive climatic feedback is the ice-albedo feedback. Final Energy Energy supplied that is available to the consumer to be converted into useful energy (e.g.

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electricity at the wall outlet).

Fluorocarbons

Carbon-fluorine compounds that often contain other elements such as hydrogen, chlorine, or bromine. Common fluorocarbons include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

Forcing Mechanism

A process that alters the energy balance of the climate system, i.e. changes the relative balance between incoming solar radiation and outgoing infrared radiation from Earth. Such mechanisms include changes in solar irradiance, volcanic eruptions, and enhancement of the natural greenhouse effect by emissions of greenhouse gases.

Fossil Fuel Reserves

The quantity of a fossil fuel that is known to exist, based on geological and engineering evidence, and that can be recovered under current economic conditions and operating capabilities.

Fossil Fuel Resources

The quantity of fossil fuel that is thought to exist and that may be recoverable based on an explicit scenario for future economic conditions and operating capabilities.

Framework Convention on Climate Change (FCCC)

The landmark international treaty unveiled at the United Nations Conference on Environment and Development (UNCED, also known as the "Rio Summit"), in June 1992. The FCCC commits signatory countries to stabilize anthropogenic (i.e., human-induced) greenhouse gas emissions to "levels that would prevent dangerous anthropogenic interference with the climate system". The FCCC also requires that all signatory parties develop and update national inventories of anthropogenic emissions of all greenhouse gases not otherwise controlled by the Montreal Protocol. Out of 155 countries that have ratified this accord, the U.S. was the first industrialized nation to do so.

Full-cost Pricing

The pricing of commercial goods such as electric power that would include in the final price faced by the end user not only the private cost of inputs, but also the cost of externalities created by their production and use. (IPCC)

G

General Circulation Model (GCM)

A global, three-dimensional computer model of the climate system which can be used to simulate human-induced climate change. GCMs are highly complex and they represent the effects of such factors as reflective and absorptive properties of atmospheric water vapor, greenhouse gas concentrations, clouds, annual and daily solar heating, ocean temperatures and ice boundaries. The most recent GCMs include global representations of the atmosphere, oceans, and land surface.

Geosphere

The soils, sediments, and rock layers of the Earth's crust, both continental and beneath the ocean floors.

Glacier

A multi-year surplus accumulation of snowfall in excess of snowmelt on land and resulting in a mass of ice at least 0.1 km² in area that shows some evidence of movement in response to gravity. A glacier may terminate on land or in water. Glacier ice is the largest reservoir of fresh water on Earth, and second only to the oceans as the largest reservoir of total water. Glaciers are found on every continent except Australia.

Global Warming

Global warming is an average increase in the temperature of the atmosphere near the Earth's surface and in the troposphere, which can contribute to changes in global climate patterns. Global warming can occur from a variety of causes, both natural and human induced. In common usage, "global warming" often refers to the warming that can occur as a result of increased emissions of greenhouse gases from human activities.

Global Warming Potential (GWP)

Global Warming Potential (GWP) is defined as the cumulative radiative forcing effects of a gas over a specified time horizon resulting from the emission of a unit mass of gas relative to a reference gas. The GWP-weighted emissions of direct greenhouse gases in the U.S. Inventory are presented in terms of equivalent emissions of carbon dioxide (CO₂), using units of teragrams of carbon dioxide equivalents (Tg CO₂ Eq.).

Conversion: Tg = 10⁹ kg = 10⁶ metric tons = 1 million metric tons

The molecular weight of carbon is 12, and the molecular weight of oxygen is 16; therefore, the molecular weight of CO₂ is 44 (i.e., 12+[16 x 2]), as compared to 12 for carbon alone. Thus,

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carbon comprises 12/44ths of carbon dioxide by weight.

Greenhouse Effect

Trapping and build-up of heat in the atmosphere (troposphere) near the Earth's surface. Some of the heat flowing back toward space from the Earth's surface is absorbed by water vapor, carbon dioxide, ozone, and several other gases in the atmosphere and then reradiated back toward the Earth's surface. If the atmospheric concentrations of these greenhouse gases rise, the average temperature of the lower atmosphere will gradually increase.

Greenhouse Gas (GHG)

Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, but are not limited to, water vapor, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), ozone (O₃), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆).

H

Halocarbons

Compounds containing either chlorine, bromine or fluorine and carbon. Such compounds can act as powerful greenhouse gases in the atmosphere. The chlorine and bromine containing halocarbons are also involved in the depletion of the ozone layer.

Hydrocarbons

Substances containing only hydrogen and carbon. Fossil fuels are made up of hydrocarbons.

Hydrochlorofluorocarbons (HCFCs)

Compounds containing hydrogen, fluorine, chlorine, and carbon atoms. Although ozone depleting substances, they are less potent at destroying stratospheric ozone than chlorofluorocarbons (CFCs). They have been introduced as temporary replacements for CFCs and are also greenhouse gases.

Hydrofluorocarbons (HFCs)

Compounds containing only hydrogen, fluorine, and carbon atoms. They were introduced as alternatives to ozone depleting substances in serving many industrial, commercial, and personal needs. HFCs are emitted as by-products of industrial processes and are also used in manufacturing. They do not significantly deplete the stratospheric ozone layer, but they are powerful greenhouse gases with global warming potentials ranging from 140 (HFC-152a) to 11,700 (HFC-23).

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Hydrologic Cycle

The process of evaporation, vertical and horizontal transport of vapor, condensation, precipitation, and the flow of water from continents to oceans. It is a major factor in determining climate through its influence on surface vegetation, the clouds, snow and ice, and soil moisture. The hydrologic cycle is responsible for 25 to 30 percent of the mid-latitudes' heat transport from the equatorial to polar regions.

Hydrosphere

The component of the climate system comprising liquid surface and subterranean water, such as: oceans, seas, rivers, fresh water lakes, underground water etc.

I

Ice Core

A cylindrical section of ice removed from a glacier or an ice sheet in order to study climate patterns of the past. By performing chemical analyses on the air trapped in the ice, scientists can estimate the percentage of carbon dioxide and other trace gases in the atmosphere at a given time.

IMAGE Model

The Integrated Model for Assessment of the Greenhouse Effect. This is one of the climate models applied for the construction of the IPCC SRES scenarios.

Infrared Radiation

Radiation emitted by the Earth's surface, the atmosphere and the clouds. It is also known as terrestrial or long-wave radiation. Infrared radiation has a distinctive range of wavelengths ("spectrum") longer than the wavelength of the red color in the visible part of the spectrum. The spectrum of infrared radiation is practically distinct from that of solar or short-wave radiation because of the difference in temperature between the Sun and the Earth-atmosphere system.

Intergovernmental Panel on Climate Change (IPCC)

The IPCC was established jointly by the United Nations Environment Program and the World Meteorological Organization in 1988. The purpose of the IPCC is to assess information in the scientific and technical literature related to all significant components of the issue of climate change. The IPCC draws upon hundreds of the world's expert scientists as authors and thousands as expert reviewers. Leading experts on climate change and environmental, social, and economic sciences from some 60 nations have helped the IPCC to prepare periodic assessments of the scientific underpinnings for understanding global climate change and its consequences.

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With its capacity for reporting on climate change, its consequences, and the viability of adaptation and mitigation measures, the IPCC is also looked to as the official advisory body to the world's governments on the state of the science of the climate change issue. For example, the IPCC organized the development of internationally accepted methods for conducting national greenhouse gas emission inventories.

Integrated Assessment

A method of analysis that combines results and models from the physical, biological, economic and social sciences, and the interactions between these components, in a consistent framework, to project the consequences of climate change and the policy responses to it.

International Emissions Trading

Article 17 of the Kyoto Protocol allows developed countries to participate in emissions trading for the purposes of meeting their assigned amounts.

J

Joint Implementation

Article 6 of the Kyoto Protocol permits Joint Implementation whereby developed countries are able to invest in projects in other developed countries to acquire credits to assist in meeting their assigned amounts. Countries are only able to use credits generated in the commitment period of 2008 to 2012. Participation is voluntary and open to private and public entities alike if approved by the Party to the Protocol.

K

Kyoto Lands

Land areas covered by activities of Article 3.3. of the Kyoto Protocol as well as any additional activities agreed under Article 3.4.

Kyoto Mechanisms

Mechanisms under the Kyoto Protocol including International Emissions Trading, Clean Development Mechanism and joint Implementation. It may also be argued that the trading bubble under Article 4 is a key mechanism.

Kyoto Protocol

An international agreement, reached in 1997 in Kyoto, Japan, which extends the commitments of the United Nations Framework Convention on Climate Change (UNFCCC). In particular, it sets

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targets for future emissions in developed countries.

L

Landfill

Land waste disposal site in which waste is generally spread in thin layers, compacted, and covered with a fresh layer of soil each day.

Longwave Radiation

The radiation emitted in the spectral wavelength greater than 4 micrometers corresponding to the radiation emitted from the Earth and atmosphere. It is sometimes referred to as 'terrestrial radiation' or 'infrared radiation,' although somewhat imprecisely.

LULUCF

Acronym for Land Use, Land Use Change and Forestry activities, all designed to increase carbon stores, or sinks, and so make sequestration easier.

M

Marginal Cost

The cost on one additional unit of effort. In terms of reducing emissions, it represents the cost of reducing emissions by one more unit.

Marginal Cost Pricing

The pricing of commercial goods and services such that the price equals the additional cost that arises from the expansion of production by one additional unit.

Marine Biosphere

A collective term for all living marine organisms.

Market Barriers

Conditions that prevent or impede the diffusion of cost-effective technologies or practices that could mitigate GHG emissions.

Market Damages

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The value of damages generated by climate change (or some other environmental change) and evaluated based on information available to and usable by a competitive market.

Market Penetration

The share of a given market that is provided by a particular good or service at any given time.

Market Potential (or Currently Realizable Potential)

The portion of the economic potential for GHG emissions reductions or energy-efficiency improvements that could be achieved under existing market conditions, assuming no new policies and measures.

Market-based Incentives

Measures intended to directly change relative prices of energy services and overcome market barriers.

Methane (CH₄)

A hydrocarbon that is a greenhouse gas with a global warming potential most recently estimated at 23 times that of carbon dioxide (CO₂). Methane is produced through anaerobic (without oxygen) decomposition of waste in landfills, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion. The GWP is from the IPCC's Third Assessment Report (TAR). For more information visit EPA's Methane site.

Megaton (Mt)

One million (10⁶) tons. Greenhouse gas emissions are often measured in megatons.

Metric Ton

Common international measurement for the quantity of greenhouse gas emissions. A metric ton is equal to 2205 lbs or 1.1 short tons.

Million Metric Tons- MMT

Common international measurement for million metric tons of carbon dioxide equivalents (MMT CO₂) to describe the magnitude of greenhouse gas (GHG) emissions or reductions. See PDF file of some representations of 1 MMT of CO₂ in familiar equivalents.

Mitigation



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A human intervention to reduce the sources or enhance the sinks of substances that pollute the environment, for example greenhouse gases.

Mount Pinatubo

A volcano in the Philippine Islands that erupted in 1991. The eruption of Mount Pinatubo ejected enough particulate and sulfate aerosol matter into the atmosphere to block some of the incoming solar radiation from reaching Earth's atmosphere. This effectively cooled the planet from 1992 to 1994, masking the warming that had been occurring for most of the 1980s and 1990s.

Municipal Solid Waste (MSW)

Residential solid waste and some non-hazardous commercial, institutional, and industrial wastes. This material is generally sent to municipal landfills for disposal.

N

Natural Gas

Underground deposits of gases consisting of 50 to 90 percent methane (CH₄) and small amounts of heavier gaseous hydrocarbon compounds such as propane (C₃H₈) and butane (C₄H₁₀).

Nitrogen Oxides (NO_x)

Gases consisting of one molecule of nitrogen and varying numbers of oxygen molecules. Nitrogen oxides are produced in the emissions of vehicle exhausts and from power stations. In the atmosphere, nitrogen oxides can contribute to formation of photochemical ozone (smog), can impair visibility, and have health consequences; they are thus considered pollutants.

Nitrous Oxide (N₂O)

A powerful greenhouse gas with a global warming potential of 296 times that of carbon dioxide (CO₂). Major sources of nitrous oxide include soil cultivation practices, especially the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning. The GWP is from the IPCC's Third Assessment Report (TAR).

Non-Methane Volatile Organic Compounds (NMVOCs)

Organic compounds, other than methane, that participate in atmospheric photochemical reactions.

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No Regrets Mitigation Options

Those whose benefits, such as reduced energy costs and reduced emissions of local/regional pollutants, equal or exceed their cost to society, excluding the benefits of climate change mitigation. They are sometimes known as "measures worth doing anyway."

Non-market Damages

Damages generated by climate change (or some other environmental change) and that cannot be evaluated by a competitive market because of a lack of information and/or the inability to act on the information.

O

Opportunity Cost

The cost of an economic activity foregone by the choice of another activity.

Optimal control rate

The rate of intervention at which the net present value of the marginal costs of the intervention, equals the net present value of the marginal benefits of intervention.

Oxidize

To chemically transform a substance by combining it with oxygen.

Ozone (O₃)

Ozone, the triatomic form of oxygen (O₃), is a gaseous atmospheric constituent. In the troposphere, it is created both naturally and by photochemical reactions involving gases resulting from human activities (photochemical smog). In high concentrations, tropospheric ozone can be harmful to a wide range of living organisms. Tropospheric ozone acts as a greenhouse gas. In the stratosphere, ozone is created by the interaction between solar ultraviolet radiation and molecular oxygen (O₂). Stratospheric ozone plays a decisive role in the stratospheric radiative balance. Depletion of stratospheric ozone, due to chemical reactions that may be enhanced by climate change, results in an increased ground-level flux of ultraviolet (UV-) B radiation.

Ozone Depleting Substance (ODS)

A family of man-made compounds that includes, but are not limited to, chlorofluorocarbons (CFCs), bromofluorocarbons (halons), methyl chloroform, carbon tetrachloride, methyl bromide, and hydrochlorofluorocarbons (HCFCs). These compounds have been shown to

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deplete stratospheric ozone, and therefore are typically referred to as ODSs.

Ozone Layer

The layer of ozone that begins approximately 15 km above Earth and thins to an almost negligible amount at about 50 km, shields the Earth from harmful ultraviolet radiation from the sun. The highest natural concentration of ozone (approximately 10 parts per million by volume) occurs in the stratosphere at approximately 25 km above Earth. The stratospheric ozone concentration changes throughout the year as stratospheric circulation changes with the seasons. Natural events such as volcanoes and solar flares can produce changes in ozone concentration, but man-made changes are of the greatest concern.

Ozone Precursors

Chemical compounds, such as carbon monoxide, methane, non-methane hydrocarbons, and nitrogen oxides, which in the presence of solar radiation react with other chemical compounds to form ozone, mainly in the troposphere.

P

Particulate Matter (PM)

Very small pieces of solid or liquid matter such as particles of soot, dust, fumes, mists or aerosols. The physical characteristics of particles, and how they combine with other particles, are part of the feedback mechanisms of the atmosphere.

Parts Per Billion (ppb)

Number of parts of a chemical found in one billion parts of a particular gas, liquid, or solid mixture.

Parts Per Million (ppm)

Number of parts of a chemical found in one million parts of a particular gas, liquid, or solid.

Perfluorocarbons (PFCs)

A group of human-made chemicals composed of carbon and fluorine only. These chemicals (predominantly CF₄ and C₂F₆) were introduced as alternatives, along with hydrofluorocarbons, to the ozone depleting substances. In addition, PFCs are emitted as by-products of industrial processes and are also used in manufacturing. PFCs do not harm the stratospheric ozone layer, but they are powerful greenhouse gases: CF₄ has a global warming potential (GWP) of 5,700 and C₂F₆ has a GWP of 11,900. The GWP is from the IPCC's Third Assessment Report (TAR).

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Photosynthesis

The process by which plants take CO₂ from the air (or bicarbonate in water) to build carbohydrates, releasing O₂ in the process. There are several pathways of photosynthesis with different responses to atmospheric CO₂ concentrations.

Portfolio Analysis

The mix of actions available to policy makers to reduce emissions or adapt to climate change.

Precession

The comparatively slow torquing of the orbital planes of all satellites with respect to the Earth's axis, due to the bulge of the Earth at the equator which distorts the Earth's gravitational field. Precession is manifest by the slow rotation of the line of nodes of the orbit (westward for inclinations less than 90 degrees and eastward for inclinations greater than 90 degrees).

R

Radiation

Energy transfer in the form of electromagnetic waves or particles that release energy when absorbed by an object.

Radiative Forcing

Radiative forcing is the change in the net vertical irradiance (expressed in Watts per square metre: Wm⁻²) at the tropopause due to an internal change or a change in the external forcing of the climate system, such as, for example, a change in the concentration of carbon dioxide or the output of the Sun. Usually radiative forcing is computed after allowing for stratospheric temperatures to readjust to radiative equilibrium, but with all tropospheric properties held fixed at their unperturbed values. Radiative forcing is called instantaneous if no change in stratospheric temperature is accounted for. Practical problems with this definition, in particular with respect to radiative forcing associated with changes, by aerosols, of the precipitation formation by clouds, are discussed in Chapter 6 of the IPCC Third Assessment Report Working Group I: The Scientific Basis.

Recycling

Collecting and reprocessing a resource so it can be used again. An example is collecting aluminum cans, melting them down, and using the aluminum to make new cans or other aluminum products.

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Reforestation

Planting of forests on lands that have previously contained forests but that have been converted to some other use. The Revised 1996 IPCC Inventory Guidelines defines reforestation as the planting of forests on land which has historically contained forest but which has been used for another purpose since last being covered by forest.

Residence Time

The average time spent in a reservoir by an individual atom or molecule. With respect to greenhouse gases, residence time usually refers to how long a particular molecule remains in the atmosphere.

Respiration

The process whereby living organisms convert organic matter to CO₂, releasing energy and consuming O₂.

S

SBI

Subsidiary Body for Implementation.

Short Ton

Common measurement for a ton in the United States. A short ton is equal to 2,000 lbs or 0.907 metric tons.

Sink

Any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas or aerosol from the atmosphere.

Soil Carbon

A major component of the terrestrial biosphere pool in the carbon cycle. The amount of carbon in the soil is a function of the historical vegetative cover and productivity, which in turn is dependent in part upon climatic variables.

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Solar Radiation

Radiation emitted by the Sun. It is also referred to as short-wave radiation. Solar radiation has a distinctive range of wavelengths (spectrum) determined by the temperature of the Sun.

Source

Any process or activity which releases a greenhouse gas, an aerosol or a precursor of a greenhouse gas into the atmosphere.

Stratosphere

Region of the atmosphere between the troposphere and mesosphere, having a lower boundary of approximately 8 km at the poles to 15 km at the equator and an upper boundary of approximately 50 km. Depending upon latitude and season, the temperature in the lower stratosphere can increase, be isothermal, or even decrease with altitude, but the temperature in the upper stratosphere generally increases with height due to absorption of solar radiation by ozone.

Stratospheric Ozone

See ozone layer.

Streamflow

The volume of water that moves over a designated point over a fixed period of time. It is often expressed as cubic feet per second (ft³/sec).

Sulfate Aerosols

Particulate matter that consists of compounds of sulfur formed by the interaction of sulfur dioxide and sulfur trioxide with other compounds in the atmosphere. Sulfate aerosols are injected into the atmosphere from the combustion of fossil fuels and the eruption of volcanoes like Mt. Pinatubo. Recent theory suggests that sulfate aerosols may lower the Earth's temperature by reflecting away solar radiation (negative radiative forcing). General Circulation Models which incorporate the effects of sulfate aerosols more accurately predict global temperature variations.

Sulfur Hexafluoride (SF₆)

A colorless gas soluble in alcohol and ether, slightly soluble in water. A very powerful greenhouse gas used primarily in electrical transmission and distribution systems and as a dielectric in electronics. The global warming potential of SF₆ is 22,200. This GWP is from the IPCC's Third Assessment Report (TAR).

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Sustainable Development

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

Sustainable Yield

In relation to wood products, the sustainable yield of a forest is the maximum level of harvest of commercial timber or project mix that can be maintained for a given area in perpetuity under a given management regime. The forested area must be sufficiently large to support a large number of stands at different stages in the projection cycle. The average yield over time must be equal to the average growth increment, in terms of product, of the area as a whole.

T

Thermohaline Circulation

Large-scale density-driven circulation in the ocean, caused by differences in temperature and salinity. In the North Atlantic the thermohaline circulation consists of warm surface water flowing northward and cold deep water flowing southward, resulting in a net poleward transport of heat. The surface water sinks in highly restricted sinking regions located in high latitudes.

Trace Gas

Any one of the less common gases found in the Earth's atmosphere. Nitrogen, oxygen, and argon make up more than 99 percent of the Earth's atmosphere. Other gases, such as carbon dioxide, water vapor, methane, oxides of nitrogen, ozone, and ammonia, are considered trace gases. Although relatively unimportant in terms of their absolute volume, they have significant effects on the Earth's weather and climate.

Troposphere

The lowest part of the atmosphere from the surface to about 10 km in altitude in mid-latitudes (ranging from 9 km in high latitudes to 16 km in the tropics on average) where clouds and "weather" phenomena occur. In the troposphere temperatures generally decrease with height. See

Tropospheric Ozone (O₃)

See ozone.

Tropospheric Ozone Precursors

See ozone precursors.



U

Ultraviolet Radiation (UV)

The energy range just beyond the violet end of the visible spectrum. Although ultraviolet radiation constitutes only about 5 percent of the total energy emitted from the sun, it is the major energy source for the stratosphere and mesosphere, playing a dominant role in both energy balance and chemical composition.

Most ultraviolet radiation is blocked by Earth's atmosphere, but some solar ultraviolet penetrates and aids in plant photosynthesis and helps produce vitamin D in humans. Too much ultraviolet radiation can burn the skin, cause skin cancer and cataracts, and damage vegetation.

Uncertainty

An expression of the degree to which a value (future state) is unknown. Contrary to risk, uncertainty suggests unknown probability of occurrence. Uncertainty can result from lack of information or from disagreement about what is known. It may have many types of sources, from quantifiable errors in the data to ambiguously defined concepts or terminology, or uncertain projections of human behavior. Uncertainty can therefore be represented by quantitative measures or by qualitative statements.

United Nations Framework Convention on Climate Change (UNFCCC)

The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The Convention enjoys near universal membership, with 189 countries having ratified.

Under the Convention, governments:

- gather and share information on greenhouse gas emissions, national policies and best practices
- launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries
- cooperate in preparing for adaptation to the impacts of climate change

The Convention entered into force on 21 March 1994.

W

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Wastewater

Water that has been used and contains dissolved or suspended waste materials.

Water Vapor

The most abundant greenhouse gas, it is the water present in the atmosphere in gaseous form. Water vapor is an important part of the natural greenhouse effect. While humans are not significantly increasing its concentration, it contributes to the enhanced greenhouse effect because the warming influence of greenhouse gases leads to a positive water vapor feedback. In addition to its role as a natural greenhouse gas, water vapor plays an important role in regulating the temperature of the planet because clouds form when excess water vapor in the atmosphere condenses to form ice and water droplets and precipitation.

Weather

Atmospheric condition at any given time or place. It is measured in terms of such things as wind, temperature, humidity, atmospheric pressure, cloudiness, and precipitation. In most places, weather can change from hour-to-hour, day-to-day, and season-to-season. Climate in a narrow sense is usually defined as the "average weather", or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. A simple way of remembering the difference is that climate is what you expect (e.g. cold winters) and 'weather' is what you get (e.g. a blizzard).

WGII LESS Scenario

Scenarios developed for the SAR WGII to assess low CO2 emitting supply systems for the world. The scenarios are referred to as LESS: Low-Emissions Supply System. (IPCC)

Sources:

<http://www.epa.gov/climatechange/glossary.html>

<http://www.climatechange.ca.gov/glossary/index.html>

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