Climate Change Glossary

Sources: United States Environmental Protection Agency (EPA), Intergovernmental Panel on Climate Change (IPCC), Green House Office of the Commonwealth of Australia (Australia)

Disclaimer: These terms are provided for background purposes only. They are not definitive statutes of policy by either the EPA, IPCC or FCCC.

A

Absorption of Radiation. The uptake of radiation by a solid body, liquid or gas. The absorbed energy may be transferred or re-emitted. (EPA)

Acid Rain. Also known as "acid deposition." Acidic aerosols in the atmosphere are removed from the atmosphere by wet deposition (rain, snow, fog) or dry deposition (particles sticking to vegetation). Acidic aerosols are present in the atmosphere primarily due to discharges of gaseous sulfur oxides (sulfur dioxide) and nitrogen oxides from both anthropogenic and natural sources. In the atmosphere these gases combine with water to form acids. (EPA)

Aerosols. Particles of matter, solid or liquid, larger than a molecule but small enough to remain suspended in the atmosphere. Natural sources include salt particles from sea spray and clay particles as a result of weathering of rocks, both of which are carried upward by the wind. Aerosols can also originate as a result of human activities and in this case are often considered pollutants. See also Sulfate Aerosols. (EPA)

Afforestation. The Revised 1996 IPCC Inventory Guidelines defines afforestation as the planting of new forests on land which historically been covered by forest. (Australia)

Albedo. The ratio of reflected to incident light; albedo can be expressed as either a percentage or a fraction of 1. Snow covered areas have a high albedo (up to about 0.9 or 90%) due to their white color, while vegetation has a low albedo (generally about 0.1 or 10%) due to the dark color and light absorbed for photosynthesis. Clouds have an intermediate albedo and are the most important contributor to the Earth's albedo. The Earth's aggregate albedo is approximately 0.3. (EPA)

Alliance of Small Island States (AOSIS). The group of Pacific and Caribbean nations who call for relatively fast action by developed nations to reduce greenhouse gas emissions. The AOSIS countries fear the effects of rising sea levels and increased storm activity predicted to accompany global warming. Its plan is to hold Annex I Parties to a 20 percent reduction in carbon dioxide emissions by the year 2005. (EPA)

Allometric Equation. An equation that uses know growth measurements to estimate related unknown growth measurements (e.g. using tree trunk girth measurements to estimate root biomass). (Australia)

Annex I Parties. Industrialized countries that, as parties to the Framework Convention on Climate Change, have pledged to reduce their greenhouse gas emissions by the year 2000 to 1990 levels. Annex I Parties consist of countries belonging to the Organization for Economic Cooperation and Development (OECD) and countries designated as Economies-in-Transition. (EPA)

Anthropogenic. Derived from human activities. (EPA)

Atmosphere. The mixture of gases surrounding the Earth. The Earth's atmosphere consists of about 79.1% nitrogen (by volume), 20.9% oxygen, 0.036% carbon dioxide and trace amounts of other gases. The atmosphere can be divided into a number of layers according to its mixing or chemical characteristics, generally determined by its thermal properties (temperature). The layer nearest the Earth is the troposphere, which reaches up to an altitude of about 8 km (about 5 miles) in the polar regions and up to 17 km (nearly 11 miles) above the equator. The stratosphere, which reaches to an altitude of about 50km (31 miles) lies atop the troposphere. The mesosphere which extends up to 80-90 km is atop the stratosphere, and finally, the thermosphere, or ionosphere, gradually diminishes and forms a fuzzy border with outer space. There is relatively little mixing of gases between layers. (EPA)

B

Baseline Emissions. The emissions that would occur without policy intervention (in a business-as-usual scenario). Baseline estimates are needed to determine the effectiveness of emissions reduction programs (often called mitigation strategies). (EPA)

Berlin Mandate. A ruling negotiated at the first Conference of the Parties (COP 1), which took place in March, 1995, concluding that the present commitments under the Framework Convention on Climate Change are not adequate. Under the Framework Convention, developed countries pledged to take measures aimed at returning their greenhouse gas emissions to 1990 levels by the year 2000. The Berlin Mandate establishes a process that would enable the Parties to take appropriate action for the period beyond 2000, including a strengthening of developed country commitments, through the adoption of a protocol or other legal instruments. (EPA)

Biogeochemical Cycle. The chemical interactions that take place among the atmosphere, biosphere, hydrosphere, and geosphere. (EPA)

Biomass. Organic nonfossil material of biological origin. For example, trees and plants are biomass. (EPA)

Biomass Energy. Energy produced by combusting renewable biomass materials such as wood. The carbon dioxide emitted from burning biomass will not increase total atmospheric carbon dioxide if this consumption is done on a sustainable basis (i.e., if in a given period of time, regrowth of biomass takes up as much carbon dioxide as is released from biomass combustion). Biomass energy is often suggested as a replacement for fossil fuel combustion which has large greenhouse gas emissions. (EPA)

Biome. A naturally occurring community of flora and fauna (or the region occupied by such a community) adapted to the particular conditions in which they occur (e.g. tundra). (IPCC)

Biosphere. The region on land, in the oceans, and in the atmosphere inhabited by living organisms. (EPA)

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. (EPA)

C

Capital Costs. Costs associated with the capital or investment expenditures on land, plant, equipment and inventories. Unlike labor and operating costs, capital costs are independent of the level of output. (IPCC)

Capital Stocks. The accumulation of machines and structures that are available to an economy at any point in time to prune 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. (IPCC)

Carbon Cycle. The global scale exchange of carbon among its reservoirs, namely the atmosphere, oceans, vegetation, soils, and geologic deposits and minerals. This involves components in food chains, in the atmosphere as carbon dioxide, in the hydrosphere and in the geosphere. (EPA)

Carbonaceous Aerosol(s). Aerosol(s) (q.v.) containing carbon. (IPCC)

Carbon Dioxide (CO2). The greenhouse gas whose concentration is being most affected directly by human activities. CO2 also serves as the reference to compare all other greenhouse gases (see carbon dioxide equivalents). The major source of CO2 emissions is fossil fuel combustion. CO2 emissions are also a product of forest clearing, biomass burning, and non-energy production processes such as cement production. Atmospheric concentrations of CO2 have been increasing at a rate of about 0.5% per year and are now about 30% above preindustrial levels. (EPA)

Carbon Dioxide Equivalent (CDE). 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 (MMTCDE)" or "million short tons of carbon dioxide equivalents (MSTCDE)" The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP.

MMTCDE= (million metric tons of a gas) * (GWP of the gas)

For example, the GWP for methane is 24.5. This means that emissions of one million metric tons of methane is equivalent to emissions of 24.5 million metric tons of carbon dioxide. Carbon may also be used as the reference and other greenhouse gases may be converted to carbon equivalents. To convert carbon to carbon dioxide, multiply the carbon by 44/12 (the ratio of the molecular weight of carbon dioxide to carbon). (EPA)

Carbon Equivalent (CE). A metric measure used to compare the emissions of the different greenhouse gases based upon their global warming potential (GWP). Greenhouse gas emissions in the U.S. are most commonly expressed as "million metric tons of carbon equivalents" (MMTCE). Global warming potentials are used to convert greenhouse gases to carbon dioxide equivalents. Carbon dioxide equivalents can then be converted to carbon equivalents by multiplying the carbon dioxide equivalents by 12/44 (the

ratio of the molecular weight of carbon to carbon dioxide). Thus, the formula to derive carbon equivalents is:

MMTCE = (million metric tons of a gas) * (GWP of the gas) * (12/44) (EPA)

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. (EPA)

Carbon Sinks. Carbon reservoirs and conditions that take in and store more carbon (carbon sequestration) than they release. Carbon sinks can serve to partially offset greenhouse gas emissions. Forests and oceans are common carbon sinks. (EPA)

Chlorofluorocarbons and Related Compounds. This family of anthropogenic compounds includes chlorofluorcarbons (CFCs), bromofluorcarbons (halons), methyl chloroform, carbon tetrachloride, methyl bromide, and hydrochlorofluorcarbons (HCFCs). These compounds have been shown to deplete stratospheric ozone, and therefore are typically referred to as ozone depleting substances. The most ozone-depleting of these compounds are being phased out under the Montreal Protocol. (EPA)

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. (Australia)

Climate. The average weather (usually taken over a 30-year time period) for a particular region and time period. Climate is not the same as weather, but rather, it is the average pattern of weather for a particular region. Weather describes the short-term state of the atmosphere. Climatic elements include precipitation, temperature, humidity, sunshine, wind velocity, phenomena such as fog, frost, and hail storms, and other measures of the weather. (EPA)

Climate Change (also referred to as 'global climate change'). The term 'climate change' is sometimes used to refer to all forms of climatic inconsistency, but because the Earth's climate is never static, the term is more properly used to imply a significant change from one climatic condition to another. In some cases, 'climate change' has been used synonymously with the term, 'global warming'; scientists however, tend to use the term in the wider sense to also include natural changes in climate. See also Enhanced Greenhouse Effect. (EPA)

Climate Change Action Plan. Unveiled in October, 1993 by President Clinton, the CCAP is the U.S. plan for meeting its pledge to reduce greenhouse gas emissions under the terms of the Framework Convention on Climate Change (FCCC). The goal of the CCAP is to reduce U.S. emissions of anthropogenic greenhouse gases to 1990 levels by the year 2000. The CCAP, which consists of some 50 voluntary federal programs that span all sectors of the economy, uses a win-win approach by helping program

partners save energy, save money, and gain access to clean technology while also reducing greenhouse gas emissions. (EPA)

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Climate Feedback. An atmospheric, oceanic, terrestrial, or other process that is activated by the direct climate change induced by changes in radiative forcing. Climate feedbacks may increase (positive feedback) or diminish (negative feedback) the magnitude of the direct climate change. (EPA)

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. (EPA)

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. Also see General Circulation Model. (EPA)

Climate Modeling. The simulation of the climate using computer-based models. Also see General Circulation Model. (EPA)

Climate Sensitivity. The equilibrium response of the climate to a change in radiative forcing; for example, a doubling of the carbon dioxide concentration. (EPA)

Climate System (or Earth System). The atmosphere, the oceans, the biosphere, the cryosphere, and the geosphere, together make up the climate system. (EPA)

Cloud Condensation Nuclei. Airborne particles that serve as an initial site for the condensation of liquid water and which can lead to the formation of cloud droplets. (IPCC)

CO2 Fertilization. Te enhancement of plant growth as a result of elevated atmospheric CO2 concentrations. (IPCC)

Cogeneration. The process by which two different and useful forms of energy are produced at the same time. For example, while boiling water to generate electricity, the leftover steam can be sold for industrial processes or space heating. (EPA)

Commercialization. Sequence of actions necessary to achieve market entry and general market competitiveness of new innovative technologies, process and products. (IPCC)

Compost. Decayed organic matter that can be used as a fertilizer or soil additive. (EPA)

Conference of the Parties (COP). The COP is the collection of nations which have ratified the Framework Convention on Climate Change (FCCC), currently over 150 strong, and about 50 Observer States. The primary role of the COP is to keep the implementation of the Convention under review and to take the decisions necessary for the effective implementation of the Convention. The first COP (COP 1) took place in Berlin from March 28th to April 7th, 1995, and was attended by over 1000 observers and 2000 media representatives. (EPA)

Cost-effective. A criterion that specifies that a technology or measure deliver a good or service at equal or lower cost than current practice. (IPCC)

Cryosphere. The frozen part of the Earth's surface. The cryosphere includes the polar ice caps, continental ice sheets, mountain glaciers, sea ice, snow cover, lake and river ice, and permafrost. (EPA)

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. (IPCC)

Deforestation. Those practices or processes that result in the change of forested lands to 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 and contributing to carbon storage. (EPA)

Desertification. The progressive destruction or degradation of existing vegetative cover to form desert. This can occur due to overgrazing, deforestation, drought, and the burning of extensive areas. Once formed, deserts can only support a sparse range of vegetation. Climatic effects associated with this phenomenon include increased albedo, reduced atmospheric humidity, and greater atmospheric dust (aerosol) loading. (EPA)

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. (IPCC)

Diurnal Temperature Range. The difference between maximum and minimum temperature over a period of 24 hours. (IPCC)

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

Eddy Mixing. Mixing due to small scale turbulence processes (eddies). Such processes cannot be explicitly resolved by even the finest resolution Atmosphere-Ocean General Ciculation Models currently in uses and so their effects must be related to the larger scale conditions. (IPCC)

El Nino. A climatic phenomenon occurring irregularly, but generally every 3 to 5 years. El Ninos often first become evident during the Christmas season (El Nino means Christ child) in the surface oceans of the eastern tropical Pacific Ocean. The phenomenon involves seasonal changes in the direction of the tropical winds over the Pacific and abnormally warm surface ocean temperatures. The changes in the tropics are most intense in the Pacific region, these changes can disrupt weather patterns throughout the tropics and can extend to higher latitudes, especially in Central and North America. The relationship between these events and global weather patterns are currently the subject of much research in order to enhance prediction of seasonal to interannual fluctuations in the climate. (EPA)

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

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. (IPCC)

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. (IPCC)

Emission Standard. A level of emission that under law may not be exceeded. (IPCC)

Energy Intensity. Ration of energy consumption and economic or physical output. At the national level, energy intensity is the ratio of total domestic primary energy consumption or final energy consumption to gross domestic product or physical output. (IPCC)

Enhanced Greenhouse Effect. The natural greenhouse effect has been enhanced by anthropogenic emissions of greenhouse gases. Increased concentrations of carbon dioxide, methane, and nitrous oxide, CFCs, HFCs, PFCs, SF6, NF3, and other photochemically important gases caused by human activities such as fossil fuel consumption and adding waste to landfills, trap more infra-red radiation, thereby exerting a warming influence on the climate. See Climate Change and Global Warming. (EPA)

Equilibrium Response. The steady state response of the climate system (or a climate model)
To an imposed radiative forcing. (IPCC)

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. (IPCC)

Evapotranspiration. The sum of evaporation and plant transpiration. Potential evapotranspiration is the amount of water that could be evaporated or transpired at a given temperature and humidity, if there was plenty of water available. Actual evapotranspiration can not be any greater than precipitation, and will usually be less because some water will run off in rivers and flow to the oceans. If potential

evapotranspiration is greater than actual precipitation, then soils are extremely dry during at least a major part of the year. (EPA)

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. (IPCC)

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. (IPCC)

F

Falsifiability Rule. Science today recognizes that there is no way to prove the absolute truth of any hypothesis or model, since it is always possible that a different explanation might account for the same observation. In this sense, even the most well established physical laws are "conditional." Hence, with scientific methodology it is never possible to prove conclusively that a hypothesis is true, it is only possible to prove that it is false. (IPCC)

Feedback Mechanisms. A mechanism that connects one aspect of a system to another. The connection can be either amplifying (positive feedback) or moderating (negative feedback). See also Climate Feedback. (EPA)

Fertilization. A term used to denote efforts to enhance plant growth by increased application of nitrogen-based fertilizer or increased deposition of nitrates in precipitation. (EPA)

Final Energy. Energy supplied that is available to the consumer to be converted into useful energy (e.g. electricity at the wall outlet). (IPCC)

Fluorocarbons. Carbon-fluorine compounds that often contain other elements such as hydrogen, chlorine, or bromine. Common fluorocarbons include chlorofluorocarbons and related compounds (also know as ozone depleting substances), hydrofluorocarbons (HFCs), and perfluorcarbons (PFCs).

Flux. Shifts or flows of carbon over time from one pool to another (e.g. from the atmosphere to the forest). (Australia)

Flux Adjustment. To avoid the problem of a coupled atmosphere-ocean general circulation model drifting into some unrealistic climate state (e.g. excessively warm temperatures in the tropical Pacific ocean), adjustment terms can be applied to the fluxes of heat and precipitation (and sometimes the surface stresses resulting from the effect of the wind on the ocean surface) below being imposed on the model ocean. (IPCC)

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 emission of carbon dioxide. See also Radiative Forcing. (EPA)

Fossil Fuel. A general term for combustible geologic deposits of carbon in reduced (organic) form and of biological origin, including coal, oil, natural gas, oil shales, and tar sands. A major concern is that they emit carbon dioxide into the atmosphere when burnt, thus significantly contributing to the enhanced greenhouse effect. (EPA)

Fossil Fuel Combustion. Burning of coal, oil (including gasoline), or natural gas. This burning, usually to generate energy, releases carbon dioxide, as well as combustion by products that can include unburned hydrocarbons, methane, and carbon monoxide. Carbon monoxide, methane, and many of the unburned hydrocarbons slowly oxidize into carbon dioxide in the atmosphere. Common sources of fossil fuel combustion include cars and electric utilities. (EPA)

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. (IPCC)

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. (IPCC)

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. (EPA)

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

Gross Domestic Product (GDP). The value of all goods and services produced or consumed within a nation’s borders. (IPCC)

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. (EPA)

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

Global Warming. An increase in the near surface temperature of the Earth. Global warming has occurred in the distant past as the result of natural influences, but the term is most often used to refer to the warming predicted to occur as a result of increased emissions of greenhouse gases. Scientists generally agree that the Earth's surface has warmed by about 1 degree Fahrenheit in the past 140 years. The Intergovernmental Panel on Climate Change (IPCC) recently concluded that increased concentrations of greenhouse gases are causing an increase in the Earth's surface temperature and that increased concentrations of sulfate aerosols have led to relative cooling in some regions, generally over and downwind of heavily industrialized areas. Also see Climate Change and Enhanced Greenhouse Effect. (EPA)

Global Warming Potential (GWP). The index used to translate the level of emissions of various gases into a common measure in order to compare the relative radiative forcing of different gases without directly calculating the changes in atmospheric concentrations. GWPs are calculated as the ratio of the radiative forcing that would result from the emissions of one kilogram of a greenhouse gas to that from emission of one kilogram of carbon dioxide over a period of time (usually 100 years). Gases involved in complex atmospheric chemical processes have not been assigned GWPs due to complications that arise. Greenhouse gases are expressed in terms of Carbon Dioxide Equivalent. The International Panel on Climate Change (IPCC) has presented these GWPs and regularly updates them in new assessments. The chart below shows the original GWPs (assigned in 1990) and the most recent GWPs (assigned in 1996) for the most important greenhouse gases. (EPA)

GAS
GWP 1990
GWP 1996
Carbon Dioxide
1
1
Methane
22
21
Nitrous Oxide
270
310
HFC-134a
1,200
1,300
HFC-23
10,000
11,700
HFC-152a
150
140
HCF-125
NA*
2,800
PFCs**

5,400
7,850
SF6
NA*
23,900

* Not Applicable. GWP was not yet estimated for this gas.
**This figure is an average GWP for the two PFCs, CF4 and C2F6.

Greenhouse Effect. The effect produced as greenhouse gases allow incoming solar radiation to pass through the Earth's atmosphere, but prevent most of the outgoing infra-red radiation from the surface and lower atmosphere from escaping into outer space. This process occurs naturally and has kept the Earth's temperature about 59 degrees F warmer than it would otherwise be. Current life on Earth could not be sustained without the natural greenhouse effect. (EPA)

Greenhouse Gas. Any gas that absorbs infra-red radiation in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), halogenated fluorocarbons (HCFCs) , ozone (O3), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs). (EPA)

H

Halocarbons. Chemicals consisting of carbon, sometimes hydrogen, and either chlorine, fluorine bromine or iodine. (EPA)

Halons. These man-made substances (also known as bromofluorocarbons) are chlorofluorocarbons that contain bromine. See also Chlorofluorocarbons and Related Compounds. (EPA)

Hydrocarbons. Substances containing only hydrogen and carbon. Fossil fuels are made up of hydrocarbons. Some hydrocarbon compounds are major air pollutants. (EPA)

Hydrofluorocarbons (HFCs). These chemicals (along with perfluorocarbons) 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 12,100 (HFC-23). (EPA)

Hydrosphere. The part of the Earth composed of water including clouds, oceans, seas, ice caps, glaciers, lakes, rivers, underground water supplies, and atmospheric water vapor. (EPA)

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 that time. (EPA)

Infra-red Radiation. The heat energy that is emitted from all solids, liquids, and gases. In the context of the greenhouse issue, the term refers to the heat energy emitted by the Earth's surface and its atmosphere. Greenhouse gases strongly absorb this radiation in the Earth's atmosphere, and reradiate some back towards the surface, creating the greenhouse effect. (EPA)

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. (IPCC)

Intergovernmental Panel on Climate Change. The IPCC was established jointly by the United Nations Environment Programme 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. 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.

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. (Australia)

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 assists 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. (Australia)

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. (Australia)

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. (Australia)

Kyoto Protocol. An international agreement, reached in 1997 in Kyoto, Japan, which extends the commitments of the UNFCCC. In particular, it sets targets for future emissions in developed countries. (Australia)

L

Lifetime (Atmospheric). 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 (CFCs, carbon dioxide).

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. (IPCC)

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. (IPCC)

Marine Biosphere. A collective term for all living marine organisms. (IPCC)

Market Barriers. Conditions that prevent or impede the diffusion of cost-effective technologies or practices that could mitigate GHG emissions. (IPCC)

Market Damages. 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. (IPCC)

Market Penetration. The share of a given market that is provided by a particular good or service at any given time. (IPCC)

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. (IPCC).

Market-based Incentives. Measures intended to directly change relative prices of energy services and overcome market barriers. (IPCC)

Mauna Loa. A volcano on the island of Hawaii where scientists have maintained the longest continuous collection of reliable daily atmospheric records. (EPA)

Measures. Actions that can be taken by a government or group of governments, often in conjunction with the private sector, to accelerate the use of technologies or other practices that reduce GHG emissions. (EPA)

Megatonne (Mt). One million (106) tonnes. Greenhouse gas emissions are often measured in megatonnes. (Australia)

Meteorology. The science of weather-related phenomena. (EPA)

Methane (CH4). A hydrocarbon that is a greenhouse gas with a global warming potential most recently estimated at 24.5. 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 oil, coal production , and incomplete fossil fuel combustion. The atmospheric concentration of methane has been shown to be increasing at a rate of about 0.6% per year and the concentration of about 1.7 parts per million by volume (ppmv) is more than twice its preindustrial value. However, the rate of increase of methane in the atmosphere may be stabilizing. (EPA)

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. (EPA)

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. (EPA)

N

Natural Regeneration. A management practice which utilizes naturally occurring tree propagules, such as seed, naturally occurring seedlings or volunteer growth, suckes, or coppice, for the renewal of stack in the forest or for reforestation after a harvesting operation. Natural regeneration is often enhanced by management activities, e.g. seedbed prepar4ation, supply of viable seed, etc. (Australia)
Nitrogen fertilization. Enhancement of plant growth through the deposition of nitrogen compounds. In IPCC reports, this typically refers to fertilization from anthropogenic sources of nitrogen such as, man-made fertilizers and nitrogen oxides released from burning fossil fuels. (IPCC)

Nitrogen Oxides (NOx). 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. (EPA)

Nitrous Oxide (N2O). A powerful greenhouse gas with a global warming potential of 320. 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. (EPA)

No Regrets. Measures whose benefits - such as improved performance or reduced emissions of local/regional pollutants, but excluding the benefits of climate change mitigation - equal or exceed their costs. They are sometimes know as "measures worth doing anyway." APCC)
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." (IPCC)
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. (IPCC)

O

Opportunity Cost. The cost of an economic activity foregone by the choice of another activity. APCC). Optimal control rate. The rate of intervention atwliich the net present value of the marginal costs of the intervention, equals the net present value of the marginal benefits of intervention. APCC)

Ozone (O3). Ozone consists of three atoms of oxygen bonded together in contrast to normal atmospheric oxygen which consists of two atoms of oxygen. Ozone is an important greenhouse gas found in both the stratosphere (about 90% of the total atmospheric loading) and the troposphere (about 10%). Ozone has other effects beyond acting as a greenhouse gas. In the stratosphere, ozone provides a protective layer shielding the Earth from ultraviolet radiation and subsequent harmful health effect on humans and the environment. In the troposphere, oxygen molecules in ozone combine with other chemicals and gases (oxidization) to cause smog. (EPA)

P

Parametrize (Parametrization). In climate modeling, this term refers to the technique of representing processes that cannot be explicitly resolved a the resolution of the model (sub-grid scale processes) by the relationships between the area averaged effect of such sub-gird scale processes and the larger scale flow. (IPCC)

Particulates. Tiny pieces of solid or liquid matter, such as soot, dust, fumes, or mist. (EPA)

Perfluorocarbons (PFCs). A group of human-made chemicals composed of carbon and fluorine only: CF4 and C2F6. These chemicals, specifically CF4 and C2F6, (along with hydrofluorocarbons) were introduced as alternatives to the ozone depleting substances. In addition, they 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 6,300 and C2F6 has a GWP of 12,500. (EPA)

Photosynthesis. The process by which green plants use light to synthesize organic compounds from carbon dioxide and water. In the process oxygen and water are released. Increased levels of carbon dioxide can increase net photosynthesis in some plants. Plants create a very important reservoir for carbon dioxide. (EPA)

Pollutant. Strictly, too much of any substance in the wrong place or at the wrong time is a pollutant. More specifically, atmospheric pollution may be defined as the presence of substances in the atmosphere, resulting from man-made activities or from natural processes that cause adverse effects to human health, property, and the environment. (EPA)

Portfolio Analysis. The mix of actions available to policy makers to reduce emissions or adapt to climate change. (IPCC)

Precautionary Approach. The approach promoted under the Framework Convention of Climate Change to help achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system. (EPA)

Precession. The tendency of the Earth's axis to wobble in space over a period of 23,000 years. The Earth's precession is one of the factors that results in the planet receiving different amounts of solar energy over extended periods of time. (EPA)

Primary Energy. Energy embodied in natural resources (e.g. coal, crude oil, sunlight, uranium) that has not undergone any anthropogenic conversions or transformations. (IPCC)

R

Radiation. Energy emitted in the form of electromagnetic waves. Radiation has differing characteristics depending upon the wavelength. Because the radiation from the Sun is relatively energetic, it has a short wavelength (ultra-violet, visible, and near infra-red) while energy re-radiated from the Earth's surface and the atmosphere has a longer wavelength (infra-red radiation) because the Earth is cooler than the Sun. (EPA)

Radiative Damping. An imposed positive radiative forcing (q.v.) on the Earth-atmosphere system (e.g., through the addition of greenhouse gases) that represents an energy surplus. The temperature of the surface and lower atmosphere will then increase and in turn increase the amount of infrared radiation being emitted into space, thus establishing a new energy balance. The amount that emissions of infrared radiation to space increases for a given increase in temperature is known as the rediative damping. (IPCC)

Radiative Forcing. A change in the balance between incoming solar radiation and outgoing infra-red radiation. Without any radiative forcing, solar radiation coming to the Earth would continue to be approximately equal to the infra-red radiation emitted from the Earth. The addition of greenhouse gases traps and increased fraction of the infra-red radiation, reradiating it back toward the surface and creating a warming influence (i.e., positive radiative forcing because incoming solar radiation will exceed outgoing infra-red radiation). (EPA)

Reforestation. 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. (Australia)

Regeneration. Renewal of forest or tree crop by natural or artificial means. (Australia)

Residence Time. The average time spent in a reservoir by an individual atom or molecule. Also, the age of a molecule when it leaves the reservoir. With respect to greenhouse gases, residence time usually refers to how long a particular molecule remains in the atmosphere. (EPA)

Reservoir. A component or components of the climate system where a greenhouse gas or precursor of greenhouse gas are stored. (Australia)

Respiration. The process by which animals use up stored foods (by combustion with oxygen) to produce energy. (EPA)

S

SBI. Subsidiary Body for Implementation. (IPCC)

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. (EPA)

Sink. A reservoir that uptakes a pollutant from another part of its cycle. Soil and trees tend to act as natural sinks for carbon. (EPA)

Soil moisture. Water stored in or at the continental surface and available for evaporation. In IPCC 1990 a single store (or bucket) was commonly used in climate modes. Today's models which incorporate canopy and soil process view soil moisture as the amount held in excess of plant "wilting point." (IPCC)

Solar luminosity. A measure of the brightness of (i.e. the amount of solar radiation (q.v.) being emitted by) the Sun. (IPCC)

Solar Radiation. Energy from the Sun. Also referred to as short-wave radiation. Of importance to the climate system, solar radiation includes ultra-violet radiation, visible radiation, and infra-red radiation. (EPA)

Source. Any process or activity which releases a greenhouse gas, an aerosol or a precursor of a greenhouse gas into the atmosphere. (Australia)
Spatial scales. Continental is l- 100 million square kilometers, Regional is 100,000 to 10 million square kilometers, and Local is less than 100,000 square kilometers. (IPCC)
Spin-up. A technique used to initialize an AOGCM. At present it is not possible to diagnose accurately the state of the coupled atmosphere-ocean system and therefore it is not possible to prescribe observed starting condit9ions for and experiment with an AOGCM. Instead, the atmosphere and ocean components of the model are run separately, forced with "observed" boundary conditions, followed perhaps by a further period of "spin-up" when the atmosphere and ocean are coupled together, until the AOGCM is near to a steady state. (IPCC)
SBSTA

Subsidiary Body on Scientific and Technological Advice established under the UNFCC. (IPCC)

Stratosphere. The part of the atmosphere directly above the troposphere. See Atmosphere.

Sulfate Aerosol. 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). Global Climate Models which incorporate the effects of sulfate aerosols more accurately predict global temperature variations. (EPA)

Sulfur Dioxide (SO2). A compound composed of one sulfur and two oxygen molecules. Sulfur dioxide emitted into the atmosphere through natural and anthropogenic processes is changed in a complex series of chemical reactions in the atmosphere to sulfate aerosols. These aerosols result in negative radiative forcing (i.e., tending to cool the Earth's surface). (EPA)

Sulfur Hexafluoride (SF6). A very powerful greenhouse gas used primarily in electrical transmission and distribution systems. SF6 has a global warming potential of 24,900. (EPA)

Sustainable Development. Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (IPCC)
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. (Australia)

T

Terrestrial Biosphere. A collective term for all living organisms on land. OPCC)

Thermocline. The region of the world's ocean, typically at a depth of lkm, where temperature decreases rapidly with depth and which marks the boundary between the surface and Deep Ocean. OPCC).

Thermohaline Circulation. Large-scale density-driven circulation I the oceans, driven by differences in temperature and salinity. (IPCC)

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. (EPA)

Transient Climate Response. The tirne-dependent response of the climate system or model to a tirne-varying change of forcing. (IPCC)

Tropopause. The boundary between the troposphere (q.v.) and the stratosphere (q.v.) (IPCC)

Troposphere. The lowest layer of the atmosphere. The troposphere extends from the Earth's surface up to about 10-15 km. See also Atmosphere.

Tropospheric Ozone (O3). Ozone that is located in the troposphere and plays a significant role in the greenhouse gas effect and urban smog. See Ozone for more details. (EPA)

Tropospheric Ozone Precursor. Gases that influence the rate at which ozone is created and destroyed in the atmosphere. Such gases include: carbon monoxide (CO), nitrogen oxides (NOx), and nonmethane volatile organic compounds (NMVOCs). (EPA)

Turn-over time. The ratio between the mass of a reservoir (e.g. mass of N20 in the atmosphere) and the rate of removal from the reservoir (e.g. for N20, the rate of destruction by sunlight in the stratosphere (q.v.). (IPCC)

U

United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC arose from increasing international concern about the implications of climate change and a recognition that no one country can solve this global environmental problem alone. The ultimate objective of the UNFCCC is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous human-induced interference with the climate system. See also the Kyoto Protocol to the UNFCCC. (Australia)

V

Volatile Organic Compounds (VOC). Any one of several organic compounds which are released to the atmosphere by plants or through vaporization of oil products, and which are chemically reactive and are involved in the chemistry of tropospheric ozone production. Methane, while strictly falling within the definition of a VOC, is usually considered separately. (IPCC)

W

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. (EPA)

Weather. Weather is the specific condition of the atmosphere at a particular place and time. 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 is the average of weather over time and space. 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). (EPA)

Wet/Dry Deposition. The removal of a substance from the atmosphere either through being washed out as rain (wet deposition) or through deposition on a dry surface (dry deposition). (IPCC)

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)