

## US Climate Change Science Program ([www.climatechange.gov](http://www.climatechange.gov))

### **Key Definitions**

**Weather** The specific conditions of the atmosphere at a particular place and time, measured in terms of variables that include temperature, precipitation, cloudiness, humidity, air pressure, and wind.

**Weather Forecast** A prediction about the specific atmospheric conditions expected for a location in the short-term future (hours to days).

**Climate** The long-term average of conditions in the atmosphere, ocean, and ice sheets and sea ice described by statistics, such as means and extremes.

**Climate Forecast** A prediction about average or extreme climate conditions for a region in the long-term future (seasons to decades).

**Climate Variability** Natural changes in climate that fall within the normal range of extremes for a particular region, as measured by temperature, precipitation, and frequency of events.

Drivers of climate variability include the El Niño Southern Oscillation and other phenomena.

**Climate Change** A significant and persistent change in the mean state of the climate or its variability. Climate change occurs in response to changes in some aspect of Earth's environment: these include regular changes in Earth's orbit about the sun, re-arrangement of continents through plate tectonic motions, or anthropogenic modification of the atmosphere.

**Global Warming** The observed increase in average temperature near the Earth's surface and in the lowest layer of the atmosphere. In common usage, "global warming" often refers to the warming that has occurred as a result of increased emissions of greenhouse gases from human activities. Global warming is a type of climate change; it can also lead to other changes in climate conditions, such as changes in precipitation patterns.

**Climate System** The matter, energy, and processes involved in interactions among Earth's atmosphere, hydrosphere, cryosphere, lithosphere, biosphere, and Earth-Sun interactions.

**Likely, Very Likely, Extremely Likely, Virtually Certain** These terms are used by the Intergovernmental Panel on Climate Change (IPCC) to indicate how probable it is that a predicted outcome will occur in the climate system, according to expert judgment. A result that is deemed "likely" to occur has a greater than 66% probability of occurring. A "very likely" result has a greater than 90% probability. "Extremely likely" means greater than 95% probability and "virtually certain" means greater than 99% probability.

**Mitigation** Human interventions to reduce the sources of greenhouse gases or enhance the sinks that remove them from the atmosphere.

**Vulnerability** The degree to which physical, biological, and socio-economic systems are susceptible to and unable to cope with adverse impacts of climate change.

**Adaptation** Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects.

**Fossil fuels** Energy sources such as petroleum, coal, or natural gas, which are derived from living matter that existed during a previous geologic time period.

**Feedback** The process through which a system is controlled, changed, or modulated in response to its own output. Positive feedback results in amplification of the system output; negative feedback reduces the output of a system.

**Carbon Cycle** Circulation of carbon atoms through the Earth systems as a result of photosynthetic conversion of carbon dioxide into complex organic compounds by plants, which are consumed by other organisms, and return of the carbon to the atmosphere as carbon dioxide as a result of respiration, decay of organisms, and combustion of fossil fuels.

**1. *Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences.***

Thomas R. Karl, Susan J. Hassol, Christopher D. Miller, and William L. Murray, editors, 2006. A Report by

the Climate Change Science Program and the Subcommittee on Global Change Research, Washington, DC.

2. Based on IPCC, 2007: *Impacts, Adaptation and Vulnerability. Contribution of Working Group II*

3. Based on IPCC, 2007: *Mitigation of Climate Change. Contribution of Working Group III*

### **PEW Center on Global Climate Change Glossary:**

**Aerosols:** Solid or liquid particles suspended within the atmosphere (see "sulfate aerosols" and "black carbon aerosols").

**Afforestation:** Planting of new forests on lands that have not been recently forested.

**Albedo:** Refers to the ratio of light from the sun that is reflected by the Earth's surface to the light received by it. Unreflected light is converted to infrared radiation (i.e., heat), which causes atmospheric warming (see "radiative forcing"). Thus, surfaces with a high albedo (e.g., snow and ice) generally contribute to cooling, whereas surfaces with a low albedo (e.g., forests) generally contribute to warming. Changes in land use that significantly alter the characteristics of land surfaces can therefore influence the climate through changes in albedo.

**Alliance of Small Island States (AOSIS):** A coalition of some 43 low-lying and small island countries, most of which are members of the G77 that are particularly vulnerable to the potential adverse consequences of climate change such as sea-level rise, coral bleaching, and increased frequency and intensity of tropical storms.

**Allocation:** Under an emissions trading scheme, permits to emit can initially either be given away for free, usually under a 'grandfathering' approach based on past emissions in a base year or an 'updating' approach based on the more recent emissions. The alternative is to auction permits in an initial market offering.

**Ancillary Benefits:** Complementary benefits of a climate policy including improvements in local air quality and reduced reliance of imported fossil fuels.

**Annex A:** A list in the Kyoto Protocol of the six greenhouse gases and the sources of emissions covered under the Kyoto Protocol. See also "Basket of Gases."

**Annex B:** A list in the Kyoto Protocol of 38 countries plus the European Community that agreed to QELRCs (emission targets), along with the QELRCs they accepted. The list is nearly identical to the Annex I Parties listed in the Convention except that it does not include Belarus or Turkey.

**Annex I Parties:** The 40 countries plus the European Economic Community listed in Annex I of the UNFCCC that agreed to try to limit their GHG emissions: Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, European Economic Community, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, The Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United States.

**Anthropogenic Emissions:** Emissions of greenhouse gasses resulting from human activities.

**Assigned Amount:** In the Kyoto Protocol, the permitted emissions, in CO<sub>2</sub> equivalents, during a commitment period. It is calculated using the Quantified Emission Limitation and Reduction Commitment (QELRC), together with rules specifying how and what emissions are to be counted.

**Base Year:** Targets for reducing GHG emissions are often defined in relation to a base year. In the Kyoto Protocol, 1990 is the base year for most countries for the major GHGs; 1995 can be used as the base year for some of the minor GHGs.

**Baselines:** The baseline estimates of population, GDP, energy use and hence resultant greenhouse gas emissions without climate policies, determine how big a reduction is required, and also what the impacts of climate change without policy will be.

**Basket of Gases:** This refers to the group six of greenhouse gases regulated under the Kyoto Protocol. They are listed in Annex A of the Kyoto Protocol and include: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF<sub>6</sub>).

**Berlin Mandate:** Decision of the Parties reached at the first session of the Conference of the Parties to the UNFCCC (COP-1) in 1995 in Berlin that the commitments made by Annex I countries were inadequate and thus needed to be strengthened.

**Biodiversity:** The variety of organisms found within a specified geographic region.

**Black Carbon Aerosols:** Particles of carbon in the atmosphere produced by inefficient combustion of fossil fuels or biomass. Black carbon aerosols absorb light from the sun, shading and cooling the Earth's surface, but contribute to significant warming of the atmosphere (see "radiative forcing").

**Bryd-Hagel Resolution:** In June 1997, anticipating the December 1997 meeting in Kyoto, Senator Robert C. Byrd (D-WV) introduced, with Sen. Chuck Hagel (R-NE) and 44 other cosponsors, a resolution stating that the impending Kyoto Protocol (or any subsequent international climate change agreement) should not - "(A) mandate new commitments to limit or reduce GHG emissions for the Annex I Parties [i.e. industrialized countries], unless the protocol or other agreement also mandates new specific scheduled commitments to limit or reduce GHG emissions for Developing Country Parties within the same compliance period, or (B) would result in serious harm to the economy of the United States..."

**Bubble:** An option in the Kyoto Protocol that allows a group of countries to meet their targets jointly by aggregating their total emissions. The member states of the European Union are utilizing this option.

**Capital Stock:** Existing investments in energy plant and equipment that may or may not be modified once installed.

**Carbon Dioxide (CO<sub>2</sub>):** CO<sub>2</sub> is a colorless, odorless, non-poisonous gas that is a normal part of the ambient air. Of the six greenhouse gases normally targeted, CO<sub>2</sub> contributes the most to human-induced global warming. Human activities such as fossil fuel combustion and deforestation have increased atmospheric concentrations of CO<sub>2</sub> by approximately 30 percent since the industrial revolution. CO<sub>2</sub> is the standard used to determine the "global warming potentials" (GWPs) of other gases. CO<sub>2</sub> has been assigned a 100-year GWP of 1 (i.e., the warming effects over a 100-year time frame relative to other gases).

**Carbon Dioxide Equivalent (CO<sub>2</sub>e):** Carbon Dioxide Equivalent (CO<sub>2</sub>e). The emissions of a gas, by weight, multiplied by its "global warming potential."

**Carbon Sinks:** Processes that remove more carbon dioxide from the atmosphere than they release. Both the terrestrial biosphere and oceans can act as carbon sinks.

**Carbon Taxes:** A surcharge on the carbon content of oil, coal, and gas that discourages the use of fossil fuels and aims to reduce carbon dioxide emissions.

**Certified Emissions Reduction (CER):** Reductions of greenhouse gases achieved by a Clean Development Mechanism (CDM) project. A CER can be sold or counted toward Annex I countries' emissions commitments. Reductions must be additional to any that would otherwise occur.

**Chlorofluorocarbons (CFCs):** CFCs are synthetic industrial gases composed of chlorine, fluorine, and carbon. They have been used as refrigerants, aerosol propellants, cleaning solvents and in the manufacture of plastic foam. There are no natural sources of CFCs. CFCs have an atmospheric lifetime of decades to centuries, and they have 100-year "global warming potentials" thousands of times that of CO<sub>2</sub>, depending on the gas. In addition to being greenhouse gases, CFCs also contribute to ozone depletion in the stratosphere and are controlled under the Montreal Protocol.

**Clean Development Mechanism (CDM):** One of the three market mechanisms established by the Kyoto Protocol. The CDM is designed to promote sustainable development in developing countries and assist Annex I Parties in meeting their greenhouse gas emissions reduction commitments. It enables industrialized countries to invest in emission reduction projects in developing countries and to receive credits for reductions achieved.

**Climate:** The long-term average weather of a region including typical weather patterns, the frequency and intensity of storms, cold spells, and heat waves. Climate is not the same as weather.

**Climate Change:** Refers to changes in long-term trends in the average climate, such as changes in average temperatures. In IPCC usage, climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity. In UNFCCC usage, climate change refers to a change in climate that is attributable directly or indirectly to human activity that alters atmospheric composition.

**Climate Sensitivity:** The average global air surface temperature change resulting from a doubling of pre-industrial atmospheric CO<sub>2</sub> concentrations. The IPCC estimates climate sensitivity at 1.5-4.5°C (2.7-8.1°F).

**Climate Variability:** Refers to changes in patterns, such as precipitation patterns, in the weather and climate.

**Commitment Period:** The period under the Kyoto Protocol during which Annex I Parties' GHG emissions, averaged over the period, must be within their emission targets. The first commitment period runs from January 1, 2008 to December 31, 2012.

**Conference of the Parties (COP):** The supreme decision-making body comprised of the parties that have ratified the UN Framework Convention on Climate Change. It meets on an annual basis. As of February 2003, it is comprised of 188 countries.

**Discounting:** The process that reduces future costs and benefits to reflect the time value of money and the common preference of consumption now rather than later.

**Early Crediting:** A provision that allows crediting of emission reductions achieved prior to the start of a legally imposed emission control period. These credits can then be used to assist in achieving compliance once a legally imposed system begins.

**Ecosystem:** A community of organisms and its physical environment.

**Emissions:** The release of substances (e.g., greenhouse gases) into the atmosphere.

**Emissions Cap:** A mandated restraint in a scheduled timeframe that puts a "ceiling" on the total amount of anthropogenic greenhouse gas emissions that can be released into the atmosphere. This can be measured as gross emissions or as net emissions (emissions minus gases that are sequestered).

**Emissions Reduction Unit (ERU):** Emissions reductions generated by projects in Annex B countries that can be used by another Annex B country to help meet its commitments under the Kyoto Protocol. Reductions must be additional to those that would otherwise occur.

**Emissions Trading:** A market mechanism that allows emitters (countries, companies or facilities) to buy emissions from or sell emissions to other emitters. Emissions trading is expected to bring down the costs of meeting emission targets by allowing those who can achieve reductions less expensively to sell excess reductions (e.g. reductions in excess of those required under some regulation) to those for whom achieving reductions is more costly.

**Energy Resources:** The available supply and price of fossil and alternative resources will play a huge role in estimating how much a greenhouse gas constraint will cost. In the U.S. context, natural gas supply (and thus price) is particularly important, as it is expected to be a transition fuel to a lower carbon economy.

**Enhanced Greenhouse Effect:** The increase in the natural greenhouse effect resulting from increases in atmospheric concentrations of GHGs due to emissions from human activities.

**Entry Into Force:** The point at which international climate change agreements become binding. The United Nations Framework Convention on Climate Change (UNFCCC) has entered into force. In order for the Kyoto

Protocol to do so as well, 55 Parties to the Convention must ratify (approve, accept, or accede to) the Protocol, including Annex I Parties accounting for 55 percent of that group's carbon dioxide emissions in 1990. As of June 2003, 110 countries had ratified the Protocol, representing 43.9 percent of Annex I emissions.

**European Community:** As a regional economic integration organization, the European Community can be and is a Party to the UNFCCC; however, it does not have a separate vote from its members (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom).

**Evapotranspiration:** The process by which water re-enters the atmosphere through evaporation from the ground and transpiration by plants.

**GDP:** Gross Domestic Product, a measure of overall economic activity.

**General Circulation Model (GCM):** A computer model of the basic dynamics and physics of the components of the global climate system (including the atmosphere and oceans) and their interactions which can be used to simulate climate variability and change.

**Global Warming:** The progressive gradual rise of the Earth's average surface temperature thought to be caused in part by increased concentrations of GHGs in the atmosphere.

**Global Warming Potential (GWP):** A system of multipliers devised to enable warming effects of different gases to be compared. The cumulative warming effect, over a specified time period, of an emission of a mass unit of CO<sub>2</sub> is assigned the value of 1. Effects of emissions of a mass unit of non-CO<sub>2</sub> greenhouse gases are estimated as multiples. For example, over the next 100 years, a gram of methane (CH<sub>4</sub>) in the atmosphere is currently estimated as having 23 times the warming effect as a gram of carbon dioxide; methane's 100-year GWP is thus 23. Estimates of GWP vary depending on the time-scale considered (e.g., 20-, 50-, or 100-year GWP), because the effects of some GHGs are more persistent than others.

**Greenhouse Effect:** The insulating effect of atmospheric greenhouse gases (e.g., water vapor, carbon dioxide, methane, etc.) that keeps the Earth's temperature about 60°F warmer than it would be otherwise.

**Greenhouse Gas (GHG):** Any gas that contributes to the "greenhouse effect."

**Group of 77 and China, or G77/China:** An international organization established in 1964 by 77 developing countries; membership has now increased to 133 countries. The group acts as a major negotiating bloc on some issues including climate change.

**HGWP (High Global Warming Potential):** Some industrially produced gases such as sulfur hexafluoride (SF<sub>6</sub>), perfluorocarbons (PFCs), and hydrofluorocarbons (HFCs) have extremely high GWPs. Emissions of these gases have a much greater effect on global warming than an equal emission (by weight) of the naturally occurring gases. Most of these gases have GWPs of 1,300 - 23,900 times that of CO<sub>2</sub>. These GWPs can be compared to the GWPs of CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O which are presently estimated to be 1, 23 and 296, respectively.

**Hot Air:** A situation in which emissions (of a country, sector, company or facility) are well below a target due to the target being above emissions that materialized under the normal course of events (i.e. without deliberate emission reduction efforts). Hot air can result from over-optimistic projections of growth. Emissions are often projected to grow roughly in proportion to GDP, and GDP is often projected to grow at historic rates. If a recession occurs and fuel use declines, emissions may be well below targets since targets are generally set in relation to emission projections. If emission trading is allowed, an emitter could sell the difference between actual emissions and emission targets. Such emissions are considered hot air because they do not represent reductions from what would have occurred in the normal course of events.

**Hydrofluorocarbons (HFCs):** HFCs are synthetic industrial gases, primarily used in refrigeration and semiconductor manufacturing as commercial substitutes for chlorofluorocarbons (CFCs). There are no natural sources of HFCs. The atmospheric lifetime of HFCs is decades to centuries, and they have 100-year "global

warming potentials" thousands of times that of CO<sub>2</sub>, depending on the gas. HFCs are among the six greenhouse gases to be curbed under the Kyoto Protocol.

**Incentive-based Regulation:** A regulation that uses the economic behavior of firms and households to attain desired environmental goals. Incentive-based programs involve taxes on emissions or tradable emission permits. The primary strength of incentive-based regulation is the flexibility it provides the polluter to find the least costly way to reduce emissions.

**Intergenerational Equity:** The fairness of the distribution of the costs and benefits of a policy when costs and benefits are borne by different generations. In the case of a climate change policy the impacts of inaction in the present will be felt in future generations.

**Intergovernmental Panel on Climate Change (IPCC):** The IPCC was established in 1988 by the World Meteorological Organization and the UN Environment Programme. The IPCC is responsible for providing the scientific and technical foundation for the United Nations Framework Convention on Climate Change (UNFCCC), primarily through the publication of periodic assessment reports (see "Second Assessment Report" and "Third Assessment Report").

**Joint Implementation (JI):** One of the three market mechanisms established by the Kyoto Protocol. Joint Implementation occurs when an Annex B country invests in an emissions reduction or sink enhancement project in another Annex B country to earn emission reduction units (ERUs).

**Kyoto Mechanisms:** The Kyoto Protocol creates three market-based mechanisms that have the potential to help countries reduce the cost of meeting their emissions reduction targets. These mechanisms are Joint Implementation (Article 6), the Clean Development Mechanisms (Article 17).

**Kyoto Protocol:** An international agreement adopted in December 1997 in Kyoto, Japan. The Protocol sets binding emission targets for developed countries that would reduce their emissions on average 5.2 percent below 1990 levels.

**Land Use, Land-Use Change and Forestry (LULUCF):** Land uses and land-use changes can act either as sinks or as emission sources. It is estimated that approximately one-fifth of global emissions result from LULUCF activities. The Kyoto Protocol allows Parties to receive emissions credit for certain LULUCF activities that reduce net emissions.

**Market Benefits:** Benefits of a climate policy that can be measured in terms of avoided market impacts such as changes in resource productivity (e.g., lower agricultural yields, scarcer water resources) and damages to human-built environment (e.g., coastal flooding due to sea-level rise).

**Mauna Loa Record:** The record of measurement of atmospheric CO<sub>2</sub> concentrations taken at Mauna Loa Observatory, Mauna Loa, Hawaii, since March 1958. This record shows the continuing increase in average annual atmospheric CO<sub>2</sub> concentrations.

**Methane (CH<sub>4</sub>):** CH<sub>4</sub> is among the six greenhouse gases to be curbed under the Kyoto Protocol. Atmospheric CH<sub>4</sub> is produced by natural processes, but there are also substantial emissions from human activities such as landfills, livestock and livestock wastes, natural gas and petroleum systems, coalmines, rice fields, and wastewater treatment. CH<sub>4</sub> has a relatively short atmospheric lifetime of approximately 10 years, but its 100-year GWP is currently estimated to be approximately 23 times that of CO<sub>2</sub>.

**Microwave Sounding Units (MSU):** Sensors carried aboard Earth orbiting satellites that have been used since 1979 to monitor tropospheric temperatures.

**Montreal Protocol:** (on Substances that Deplete the Ozone Layer) An international agreement that entered into force in January 1989 to phase out the use of ozone-depleting compounds such as methyl chloroform, carbon tetrachloride, and CFCs. CFCs are potent greenhouse gases which are not regulated by the Kyoto Protocol since they are covered by the Montreal Protocol.

**National Action Plans:** Plans submitted to the Conference of the Parties (COP) by all Parties outlining the steps that they have adopted to limit their anthropogenic GHG emissions. Countries must submit these plans

as a condition of participating in the UN Framework Convention on Climate Change and, subsequently, must communicate their progress to the COP regularly.

**Negative Feedback:** A process that results in a reduction in the response of a system to an external influence. For example, increased plant productivity in response to global warming would be a negative feedback on warming, because the additional growth would act as a sink CO<sub>2</sub>, reducing the atmospheric CO<sub>2</sub> concentration.

**Nitrous Oxide (N<sub>2</sub>O):** N<sub>2</sub>O is among the six greenhouse gases to be curbed under the Kyoto Protocol. N<sub>2</sub>O is produced by natural processes, but there are also substantial emissions from human activities such as agriculture and fossil fuel combustion. The atmospheric lifetime of N<sub>2</sub>O is approximately 100 years, and its 100-year GWP is currently estimated to be 296 times that of CO<sub>2</sub>.

**Non-Annex B Parties:** Countries that are not listed in Annex B of the Kyoto Protocol.

**Non-Annex I Parties:** Countries that have ratified or acceded to the UNFCCC that are not listed in Annex I of the UNFCCC.

**Non-Market Benefits:** Benefits of a climate policy that can be measured in terms of avoided non-market impacts such as human-health impacts (e.g., increased incidence of tropical diseases) and damages to ecosystems (e.g., loss of biodiversity).

**Non-Party:** A state that has not ratified the UNFCCC. Non-parties may attend talks as observers.

**Perfluorocarbons (PFCs):** PFCs are among the six types of greenhouse gases to be curbed under the Kyoto Protocol. PFCs are synthetic industrial gases generated as a by-product of aluminum smelting and uranium enrichment. They also are used as substitutes for CFCs in the manufacture of semiconductors. There are no natural sources of PFCs. PFCs have atmospheric lifetimes of thousands to tens of thousands of years and 100-year GWPs thousands of times that of CO<sub>2</sub>, depending on the gas.

**Polluter Pays Principle (PPP):** The principle that countries should in some way compensate others for the effects of pollution that they (or their citizens) generate or have generated.

**Positive Feedback:** A process that results in an amplification of the response of a system to an external influence. For example, increased atmospheric water vapor in response to global warming would be a positive feedback on warming, because water vapor is a GHG.

**ppm or ppb:** Abbreviations for "parts per million" and "parts per billion," respectively - the units in which concentrations of greenhouse gases are commonly presented. For example, since the pre-industrial era, atmospheric concentrations of carbon dioxide have increased from 270 ppm to 370 ppm.

**Quantified Emission Limitation and Reduction QELRC:** Also known as QELRO (Quantified Emission Limitation and Reduction Objective): The quantified commitments for GHG emissions listed in Annex B of the Kyoto Protocol. QELRCs are specified in percentages relative to 1990 emissions.

**Radiative Forcing:** The term radiative forcing refers to changes in the energy balance of the earth-atmosphere system in response to a change in factors such as greenhouse gases, land-use change, or solar radiation. The climate system inherently attempts to balance incoming (e.g., light) and outgoing (e.g. heat) radiation. Positive radiative forcings increase the temperature of the lower atmosphere, which in turn increases temperatures at the Earth's surface. Negative radiative forcings cool the lower atmosphere. Radiative forcing is most commonly measured in units of watts per square meter (W/m<sup>2</sup>).

**Radiosondes:** Sensors carried aboard weather balloons that have been in continuous use since 1979 for the monitoring of tropospheric temperatures.

**Ratification:** After signing the UNFCCC or the Kyoto Protocol, a country must ratify it, often with the approval of its parliament or other legislature. In the case of the Kyoto Protocol, a Party must deposit its instrument of ratification with the UN Secretary General in New York.

**Reforestation:** Replanting of forests on lands that have recently been harvested.

**Regional Groups:** The five regional groups meet privately to discuss issues and nominate bureau members and other officials. They are Africa, Asia, Central and Eastern Europe (CEE), Latin America and the Caribbean (GRULAC), and the Western Europe and Others Group (WEOG).

**Renewable Energy:** Energy obtained from sources such as geothermal, wind, photovoltaic, solar, and biomass.

**Revenue Recycling:** If permits are auctioned, this gives considerable sums of money to be recycled back into the economy, either through a lump sum payment of offsetting other taxes. If the existing taxes that are correspondingly reduced were very inefficient, this allows this allows the possibility of both environmental and economic benefits from the trading system, commonly called the 'double dividend.'

**Second Assessment Report (SAR):** The Second Assessment Report, prepared by the Intergovernmental Panel on Climate Change, reviewed the existing scientific literature on climate change. Finalized in 1995, it is comprised of three volumes: Science; Impacts, Adaptations and Mitigation; and Economic and Social Dimensions of Climate Change.

**Secretariat of the UN Framework Convention:** The United Nations staff assigned the responsibility of conducting the affairs of the UNFCCC. In 1996 the Secretariat moved from Geneva, Switzerland, to Bonn, Germany.

**Sequestration:** Opportunities to remove atmospheric CO<sub>2</sub>, either through biological processes (e.g. plants and trees), or geological processes through storage of CO<sub>2</sub> in underground reservoirs.

**Sinks:** Any process, activity or mechanism that results in the net removal of greenhouse gases, aerosols, or precursors of greenhouse gases from the atmosphere.

**Source:** Any process or activity that results in the net release of greenhouse gases, aerosols, or precursors of greenhouse gases into the atmosphere.

**SRES Scenarios:** A suite of emissions scenarios developed by the Intergovernmental Panel on Climate Change in its Special Report on Emissions Scenarios (SRES). These scenarios were developed to explore a range of potential future greenhouse gas emissions pathways over the 21st century and their subsequent implications for global climate change.

**Stratosphere:** The region of the Earth's atmosphere 10-50 km above the surface of the planet.

**Subsidiary Body for Implementation (SBI):** A permanent body established by the UNFCCC that makes recommendations to the COP on policy and implementation issues. It is open to participation by all Parties and is composed of government representatives.

**Subsidiary Body for Scientific & Tech. Advice:** (SBSTA) A permanent body established by the UNFCCC that serves as a link between expert information sources such as the IPCC and the COP.

**Substitution:** The economic process of trading off inputs and consumption due to changes in prices arising from a constraint on greenhouse gas emissions. How the extremely flexible U.S. economy adapts to available substitutes and/or finds new methods of production under a greenhouse gas constraint will be critical in minimizing overall costs of reducing emissions.

**Sulfate Aerosols:** Sulfur-based particles derived from emissions of sulfur dioxide (SO<sub>2</sub>) from the burning of fossil fuels (particularly coal). Sulfate aerosols reflect incoming light from the sun, shading and cooling the Earth's surface (see "radiative forcing") and thus offset some of the warming historically caused by greenhouse gases.

**Sulfur Hexafluoride (SF<sub>6</sub>):** SF<sub>6</sub> is among the six types of greenhouse gases to be curbed under the Kyoto Protocol. SF<sub>6</sub> is a synthetic industrial gas largely used in heavy industry to insulate high-voltage equipment and to assist in the manufacturing of cable-cooling systems. There are no natural sources of SF<sub>6</sub>. SF<sub>6</sub> has an atmospheric lifetime of 3,200 years. Its 100-year GWP is currently estimated to be 22,200 times that of CO<sub>2</sub>.

**Supplementarity:** The Protocol does not allow Annex I parties to meet their emission targets entirely through use of emissions trading and the other Kyoto Mechanisms; use of the mechanisms must be supplemental to domestic actions to limit or reduce their emissions.

**Targets and Timetables:** Targets refer to the emission levels or emission rates set as goals for countries, sectors, companies, or facilities. When these goals are to be reached by specified years, the years at which goals are to be met are referred to as the timetables. In the Kyoto Protocol, a target is the percent reduction from the 1990 emissions baseline that the country has agreed to. On average, developed countries agreed to reduce emissions by 5.2% below 1990 emissions during the period 2008-2012, the first commitment period.

**Technological Change:** How much technological change will be additionally induced by climate policies is a crucial, but not well quantified, factor in assessing the costs of long-term mitigation of greenhouse gas emissions.

**Thermal expansion:** Expansion of a substance as a result of the addition of heat. In the context of climate change, thermal expansion of the world's oceans in response to global warming is considered the predominant driver of current and future sea-level rise.

**Thermohaline Circulation (THC):** A three-dimensional pattern of ocean circulation driven by wind, heat and salinity that is an important component of the ocean-atmosphere climate system. In the Atlantic, winds transport warm tropical surface water northward where it cools, becomes more dense, and sinks into the deep ocean, at which point it reverses direction and migrates back to the tropics, where it eventually warms and returns to the surface. This cycle or "conveyor belt" is a major mechanism for the global transport of heat, and thus has an important influence on the climate. Global warming is projected to increase sea-surface temperatures, which may slow the THC by reducing the sinking of cold water in the North Atlantic. In addition, ocean salinity also influences water density, and thus decreases in sea-surface salinity from the melting of ice caps and glaciers may also slow the THC.

**Third Assessment Report (TAR):** The most recent Assessment Report prepared by the Intergovernmental Panel on Climate Change, which reviewed the existing scientific literature on climate change, including new information acquired since the completion of the Second Assessment report (SAR). Finalized in 2001, it is comprised of three volumes: Science; Impacts and Adaptation; and Mitigation.

**Trace Gas:** A term used to refer to gases found in the Earth's atmosphere other than nitrogen, oxygen, argon and water vapor. When this terminology is used, carbon dioxide, methane, and nitrous oxide are classified as trace gases. Although trace gases taken together make up less than one percent of the atmosphere, carbon dioxide, methane and nitrous oxide are important in the climate system. Water vapor also plays an important role in the climate system; its concentrations in the lower atmosphere vary considerably from essentially zero in cold dry air masses to perhaps 4 percent by volume in humid tropical air masses.

**Troposphere:** The region of the Earth's atmosphere 0-10 km above the planet's surface.

**Umbrella Group:** Negotiating group within the UNFCCC process comprising the United States, Canada, Japan, Australia, New Zealand, Norway, Iceland, Russia, and Ukraine.

**UN Framework Convention on Climate Change:** (UNFCCC) A treaty signed at the 1992 Earth Summit in Rio de Janeiro that calls for the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." The treaty includes a non-binding call for developed countries to return their emissions to 1990 levels by the year 2000. The treaty took effect in March 1994 upon ratification by more than 50 countries. The United States was the first industrialized nation to ratify the Convention.

**Uncertainty:** Uncertainty is a prominent feature of the benefits and costs of climate change. Decision makers need to compare risk of premature or unnecessary actions with risk of failing to take actions that

subsequently prove to be warranted. This is complicated by potential irreversibilities in climate impacts and long term investments.

**Urban Heat Island (UHI):** Refers to the tendency for urban areas to have warmer air temperatures than the surrounding rural landscape, due to the low albedo of streets, sidewalks, parking lots, and buildings. These surfaces absorb solar radiation during the day and release it at night, resulting in higher night temperatures.

**Vector-borne disease:** Disease that results from an infection transmitted to humans and other animals by blood-feeding arthropods, such as mosquitoes, ticks, and fleas. Examples of vector-borne diseases include Dengue fever, viral encephalitis, Lyme disease, and malaria.

**Water Vapor (H<sub>2</sub>O):** Water vapor is the primary gas responsible for the greenhouse effect. It is believed that increases in temperature caused by anthropogenic emissions of greenhouse gases will increase the amount of water vapor in the atmosphere, resulting in additional warming (see "positive feedback").

**Weather:** Describes the short-term (i.e., hourly and daily) state of the atmosphere. Weather is not the same as climate.