ipcc
INTERGOVERNMENTAL PANEL ON climate change
Working Group III – Mitigation of Climate Change

Annex I:

Glossary

Chapter:	Annex 1	
Title:	Glossary	
Editors:	Glossary Editors:	Julian Allwood, Valentina Bosetti, Navroz K. Dubash, Luis Gómez-Echeverri, Christoph von Stechow
	Glossary Contributors:	Marcio D'Agosto, Giovanno Baiocchi, John Barrett, John Broome, Steffen Brunner, Micheline Cariño Olvera, Harry Clark, Leon Clarke, Heleen De Coninck, Esteve Corbera, Felix Creutzig, Gian Carlo Delgado, Manfred Fischedick, Marc Fleurbaey, Don Fullerton, Richard Harper, Edgar Hertwich, Damon Robert Honnery, Michael Jakob, Charles Kolstad, Elmar Kriegler, Howard Kunreuther, Andreas Löschel, Oswaldo Lucon, Axel Michaelowa, Jan Minx, Luis Mundaca, Jin Murakami, Jos Olivier, Michael Rauscher, Keywan Riahi, H-Holger Rogner, Steffen Schlömer, Ralph Sims, Pete Smith, David Stern, Neil Strachan, Kevin Urama, Diana Ürge-Vorsatz, David Victor, Elke Weber, Jonathan Wiener, Mitsutsune Yamaguchi, Azni Zain Ahmed

1

2

Annex 1: Glossary

This glossary defines some specific terms as the Lead Authors intend them to be interpreted in the context of this report. Glossary **entries** (highlighted in bold) are by preference subjects; a main entry can contain ***subentries***, in italic, for example, ***Primary Energy*** is defined under the entry **Energy**. Red, italicized *words* indicate that the term is defined in the Glossary.The Glossary is followed by a list of acronyms/abbreviations, a list of chemical compounds, and a list of SI prefixes.

Abrupt climate change

A large-scale change in the *climate system* that takes place over a few decades or less, persists (or is anticipated to persist) for at least a few decades, and causes substantial disruptions in human and natural systems. See also *Climate threshold*.

Adaptability

See *Adaptive capacity*.

Adaptation

The process of adjustment to actual or expected *climate* and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected *climate* and its effects.[1]

Adaptation Fund

A Fund established under the *Kyoto Protocol* in 2001 and officially launched in 2007. The Fund finances *adaptation* projects and programmes in *developing countries* that are parties to the *Kyoto Protocol*. Financing comes mainly from sales of *Certified Emissions Reductions (CERs)* and a share of proceeds amounting to 2% of the value of CERs issued each year for *Clean Development Mechanism (CDM)* projects. The Adaptation Fund can also receive funds from government, private sector, and individuals.

Adaptive capacity

The ability of systems, *institutions*, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.[2]

Additionality

Mitigation projects (e.g., under the *Kyoto Mechanisms*), *mitigation policies*, or *climate finance* are additional if they go beyond a *business-as-usual* level, or *baseline*. Additionality is required to guarantee the environmental integrity of project-based offset mechanisms, but difficult to establish in practice due to the counterfactual nature of the *baseline*.

Adverse side-effect

The negative effects that a *policy* or *measure* aimed at one objective might have on other objectives, without yet evaluating the net effect on overall social welfare. Adverse side-effects are often subject

[1] Reflecting progress in science, this glossary entry differs in breadth and focus from the entry used in the Fourth Assessment Report and other IPCC reports.

[2] This glossary entry builds from definitions used in previous IPCC reports and the Millennium Ecosystem Assessment (MEA, 2005).

to *uncertainty* and depend on, among others, local circumstances and implementation practices. See also *Co-benefit*, *Risk*, and *Risk trade-off*.

Aerosol

A suspension of airborne solid or liquid particles, with a typical size between a few nanometres and 10 µm that reside in the *atmosphere* for at least several hours. For convenience the term *aerosol*, which includes both the particles and the suspending gas, is often used in this report in its plural form to mean *aerosol particles*. Aerosols may be of either natural or anthropogenic origin. Aerosols may influence *climate* in several ways: directly through scattering and absorbing radiation, and indirectly by acting as cloud condensation nuclei or ice nuclei, modifying the optical properties and lifetime of clouds. Atmospheric aerosols, whether natural or anthropogenic, originate from two different pathways: emissions of primary *particulate matter*, and formation of secondary *particulate matter* from gaseous *precursors*. The bulk of aerosols are of natural origin. Some scientists use group labels that refer to the chemical composition, namely: sea salt, organic carbon, *black carbon*, mineral species (mainly desert dust), sulphate, nitrate, and ammonium. These labels are, however, imperfect as aerosols combine particles to create complex mixtures. See also *Short-lived climate pollutants*.

Afforestation

Planting of new *forests* on lands that historically have not contained *forests*. Afforestation projects are eligible under a number of schemes including, among others, *Joint Implementation (JI)* and the *Clean Development Mechanism (CDM)* under the *Kyoto Protocol* for which particular criteria apply (e.g., proof must be given that the land was not forested for at least 50 years or converted to alternative uses before 31 December 1989).

For a discussion of the term *forest* and related terms such as afforestation, *reforestation* and *deforestation*, see the IPCC Special Report on Land Use, Land-Use Change and Forestry (IPCC, 2000). See also the report on Definitions and Methodological Options to Inventory Emissions from Direct Human-induced Degradation of Forests and Devegetation of Other Vegetation Types (IPCC, 2003).

Agreement

In this report, the degree of agreement is the level of concurrence in the literature on a particular finding as assessed by the authors. See also *Evidence*, *Confidence*, *Likelihood*, and *Uncertainty*.

Agriculture, Forestry and Other Land Use (AFOLU)

AFOLU plays a central role for *food security* and *sustainable development*. The main *mitigation* options within AFOLU involve one or more of three strategies: *prevention* of emissions to the *atmosphere* by conserving existing *carbon pools* in soils or vegetation or by reducing emissions of *methane* and *nitrous* oxide; *sequestration* – increasing the size of existing *carbon pools*, and thereby extracting *carbon dioxide* from the *atmosphere*; and *substitution* – substituting biological products for *fossil fuels* or energy-intensive products, thereby reducing *carbon dioxide* emissions. Demand-side measures (e.g. by reducing losses and wastes of food, changes in human diet, or changes in wood consumption) may also play a role.

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, and vegetation-covered surfaces and oceans have a low albedo. The Earth's planetary albedo varies mainly through varying cloudiness, snow, ice, leaf area and land cover changes.

Alliance of Small Island States (AOSIS)

The Alliance of Small Island States (AOSIS) is a coalition of small islands and low-lying coastal countries with a membership of 44 states and observers that share and are active in global debates

and negotiations on the environment, especially those related to their vulnerability to the adverse effects of *climate change*. Established in 1990, AOSIS acts as an ad-hoc lobby and negotiating voice for small island development states (SIDS) within the United Nations including the *United Nations Framework Convention on Climate Change (UNFCCC) climate change* negotiations.

Ancillary benefits

See *Co-benefits*.

Annex I Parties/countries

The group of countries listed in Annex I to the *UNFCCC*. Under Articles 4.2 (a) and 4.2 (b) of the *UNFCCC*, Annex I Parties were committed to adopting national *policies* and *measures* with the non-legally binding aim to return their *greenhouse gas* emissions to 1990 levels by 2000. The group is largely similar to the *Annex B Parties* to the *Kyoto Protocol* that also adopted emissions reduction targets for 2008-2012. By default, the other countries are referred to as *Non-Annex I Parties*.

Annex II Parties/countries

The group of countries listed in Annex II to the *UNFCCC*. Under Article 4 of the *UNFCCC*, these countries have a special obligation to provide financial resources to meet the agreed full incremental costs of implementing *measures* mentioned under Article 12, paragraph 1. They are also obliged to provide financial resources, including for the transfer of technology, to meet the agreed incremental costs of implementing *measures* covered by Article 12, paragraph 1 and agreed between *developing country* Parties and international entities referred to in Article 11 of the *UNFCCC*. This group of countries shall also assist countries that are particularly vulnerable to the adverse effects of *climate change*.

Annex B Parties/countries

The subset of *Annex I Parties* that have accepted *greenhouse gas (GHG)* emission reduction targets for the period 2008-2012 under Article 3 of the *Kyoto Protocol*. By default, the other countries are referred to as *Non-Annex I Parties*.

Assigned Amount (AA)

Under the *Kyoto Protocol*, the assigned amount is the quantity of *greenhouse gas* emissions that an *Annex B country* has agreed to as its *cap* on its emissions in the first five-year commitment period (2008 to 2012). The AA is the country's total *greenhouse gas* emissions in 1990 multiplied by five (for the five-year commitment period) and by the percentage it agreed to as listed in Annex B of the *Kyoto Protocol* (e.g. 92% for the EU). See also *Assigned Amount Unit*.

Assigned Amount Unit (AAU)

An AAU equals 1 tonne (metric ton) of *CO_2-equivalent emissions* calculated using the *Global Warming* Potential. See also *Assigned Amount*.

Atmosphere

The gaseous envelope surrounding the Earth, divided into five layers – the *troposphere* which contains half of the Earth's atmosphere, the *stratosphere*, the mesosphere, the thermosphere, and the exosphere, which is the outer limit of the atmosphere. 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 and radiatively active *greenhouse gases* such as *carbon dioxide* (0.035% volume mixing ratio) and *ozone*. In addition, the atmosphere contains the *greenhouse gas* water vapour, whose amounts are highly variable but typically around 1% volume mixing ratio. The atmosphere also contains clouds and *aerosols*.

Backstop technology

Models estimating *mitigation* often use an arbitrary carbon-free technology (often for power generation) that might become available in the future in unlimited supply over the horizon of the *model*. This allows modellers to explore the consequences and importance of a generic solution technology without becoming enmeshed in picking the actual technology. This "backstop" technology might be a nuclear technology, fossil technology with *Carbon Dioxide Capture and Storage*, *solar energy*, or something as yet unimagined. The backstop technology is typically assumed either not to currently exist, or to exist only at higher costs relative to conventional alternatives.

Banking (of Assigned Amount Units)

Any transfer of *Assigned Amount Units* from an existing period into a future commitment period. According to the *Kyoto Protocol* [Article 3 (13)], parties included in Annex I to the *UNFCCC* may save excess AAUs from the first commitment period for compliance with their respective *cap* in subsequent commitment periods (post-2012).

Baseline/reference

The baseline (or reference) is the state against which change is measured. In the context of *transformation pathways*, the term 'baseline scenarios' refers to *scenarios* that are based on the assumption that no *mitigation policies* or *measures* will be implemented beyond those that are already in force and/or are legislated or planned to be adopted. Baseline scenarios are not intended to be predictions of the future, but rather counterfactual constructions that can serve to highlight the level of emissions that would occur without further *policy* effort. Typically, baseline scenarios are then compared to *mitigation scenarios* that are constructed to meet different goals for *greenhouse gas (GHG)* emissions, atmospheric concentrations or temperature change. The term 'baseline scenario' is used interchangeably with 'reference scenario' and 'no policy scenario'. In much of the literature the term is also synonymous with the term 'business-as-usual (BAU) scenario,' although the term "BAU" has fallen out of favour because the idea of "business as usual" in century-long socioeconomic projections is hard to fathom. See also *Climate scenario*, *Emission scenario*, *Representative concentration pathways*, *Shared socio-economic pathways*, *Socio-economic scenarios*, *SRES scenarios*, and *Stabilization*.

Behaviour

In the context of this report, behaviour refers to human decisions and actions (and the perceptions and judgments on which they are based) that directly or indirectly influence *mitigation* or the effects of potential *climate change* impacts (*adaptation*). Human decisions and actions are relevant at different levels, from international, national, and subnational actors, to NGO, tribe, or firm-level decision makers, to communities, households, and individual citizens and consumers. See also *Behaviour change* and *Drivers of behaviour*.

Behaviour change

In this report, *behaviour* change refers to alteration of human decisions and actions in ways that mitigate *climate change* and/or reduce negative consequences of *climate change* impacts. See also *Drivers of behaviour*.

Biochar

Biomass stabilization can be an alternative or enhancement to *bioenergy* in a land-based *mitigation* strategy. Heating *biomass* with exclusion of air produces a stable carbon-rich co-product (char). When added to soil a system, char creates a system that has greater abatement potential than typical *bioenergy*. The relative benefit of biochar systems is increased if changes in crop yield and soil emissions of *methane* and *nitrous oxide* are taken into account.

Biochemical oxygen demand (BOD)

The amount of dissolved oxygen consumed by micro-organisms (bacteria) in the bio-chemical oxidation of organic and inorganic matter in waste water. See also *Chemical oxygen demand*.

Biodiversity

The variability among living organisms from terrestrial, marine, and other *ecosystems*. Biodiversity includes variability at the genetic, species, and *ecosystem* levels.[3]

Bioenergy

Energy derived from any form of *biomass* such as recently living organisms or their metabolic by-products.

Bioenergy and Carbon Dioxide Capture and Storage (BECCS)

The application of *Carbon Dioxide Capture and Storage (CCS)* technology to *bioenergy* conversion processes. Depending on the total life-cycle emissions, including total marginal consequential effects (from *indirect land use change* and other processes), BECCS has the potential for net *carbon dioxide* removal from the *atmosphere*. See also *Sequestration*.

Bioethanol

Ethanol produced from *biomass* (e.g. sugar cane or corn). See also *Biofuel*.

Biofuel

A fuel, generally in liquid form, produced from organic matter or combustible oils produced by living or recently living plants. Examples of biofuel include alcohol (*bioethanol*), black liquor from the paper-manufacturing process, and soybean oil.

First-generation manufactured biofuel

First-generation manufactured biofuel is derived from grains, oilseeds, animal fats, and waste vegetable oils with mature conversion technologies.

Second-generation biofuel

Second-generation biofuel uses non-traditional biochemical and thermochemical conversion processes and feedstock mostly derived from the lignocellulosic fractions of, for example, agricultural and forestry residues, municipal solid waste, etc.

Third-generation biofuel

Third-generation biofuel would be derived from feedstocks such as algae and energy crops by advanced processes still under development.

These second- and third-generation biofuels produced through new processes are also referred to as next-generation or advanced biofuels, or advanced biofuel technologies.

Biomass

The total mass of living organisms in a given area or volume; dead plant material can be included as dead biomass. In the context of this report, biomass includes products, by-products, and waste of biological origin (plants or animal matter), excluding material embedded in geological formations and transformed to *fossil fuels* or peat. The *International Energy Agency* (World Energy Outlook 2010) defines traditional biomass as biomass consumption in the residential sector in *developing*

[3] This glossary entry builds from definitions used in the Global Biodiversity Assessment (Heywood, 1995) and the Millennium Ecosystem Assessment (MEA, 2005).

countries that refers to the use of wood, charcoal, agricultural residues, and animal dung for cooking and heating. All other biomass use is defined as modern biomass.

Biomass burning

Biomass burning is the burning of living and dead vegetation.

Biosphere (terrestrial and marine)

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 (BC)

Operationally defined *aerosol* species based on measurement of light absorption and chemical reactivity and/or thermal stability. It is sometimes referred to as soot. Black carbon is mostly formed by the incomplete combustion of *fossil fuels*, *biofuels*, and *biomass* but it also occurs naturally. It stays in the *atmosphere* only for days or weeks. It is the most strongly light-absorbing component of *particulate matter (PM)* and has a warming effect by absorbing heat into the *atmosphere* and reducing the *albedo* when deposited on ice or snow.

Burden sharing

In the context of *mitigation*, burden sharing refers to sharing the effort of reducing the *sources* or enhancing the *sinks* of *greenhouse gases (GHGs)* from historical or projected levels, usually allocated by some criteria. Burden sharing includes reducing the *sources* and enhancing the *sinks* of *GHGs* as well as sharing the cost burden across countries.

Business as usual (BAU)

See *Baseline/reference*.

Cancún Agreements

The Cancún Agreements are a set of decisions adopted at *COP*16/CMP6 of the *UNFCCC*, including the following, among others: the newly established the *Green Climate Fund*, a newly established technology mechanism, a process for advancing discussions on *adaptation*, a formal process for reporting *mitigation* commitments, a goal of limiting global temperature increase to 2°C, and an agreement on MRV – Measuring, Reporting and Verifying for those countries that receive international support for their *mitigation* efforts.

Cap, on emissions

Mandated restraint as an upper limit on emissions within a given period. For example, the *Kyoto Protocol* mandates emissions caps in a scheduled timeframe on the anthropogenic *greenhouse gas (GHG)* emissions released by *Annex B countries*.

Carbon budget

A carbon budget is the area under a *greenhouse gas (GHG)* emissions trajectory, and is based on assumptions about total emissions permissible to avoid a certain level of temperature rise. Carbon budgets may be defined at the global level, national, or sub-national levels.

Carbon credit

See *Emission allowance*.

Carbon cycle

The term used to describe the flow of carbon (in various forms, e.g., as *carbon dioxide*) through the *atmosphere*, ocean, terrestrial and marine *biosphere* and lithosphere. In this report, the reference

unit for the global carbon cycle is GtC or equivalently PgC (10^{15}g). Carbon is the major chemical constituent of most organic matter and is stored in the following major *sinks*: organic molecules in the *biosphere*, *carbon dioxide* in the *atmosphere*, organic matter in the soils, in the lithosphere, and in the oceans.

Carbon dioxide (CO_2)

A naturally occurring gas, also a by-product of burning *fossil fuels* from fossil carbon deposits, such as oil, gas and coal, of burning *biomass*, of *land use changes* and of industrial processes (e.g., cement production). 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 Capture and Storage (CCS)

A process in which a relatively pure stream of *carbon dioxide* from industrial and energy-related *sources* is separated (captured), conditioned, compressed, and transported to a storage location for long-term isolation from the *atmosphere*. See also *Bioenergy and carbon capture and storage (BECCS)*, *CCS-ready*, and *Sequestration*.

Carbon dioxide fertilization

The enhancement of the growth of plants as a result of increased atmospheric *carbon dioxide* concentration.

Carbon Dioxide Removal (CDR)

Carbon Dioxide Removal methods refer to a set of techniques that aim to remove *carbon dioxide* directly from the *atmosphere* by either (1) increasing natural *sinks* for carbon or (2) using chemical engineering to remove the *carbon dioxide*, with the intent of reducing the atmospheric *carbon dioxide* concentration. CDR methods involve the ocean, land, and technical systems, including such methods as *iron fertilization*, large-scale *afforestation*, and *direct capture* of *carbon dioxide* from the *atmosphere* using engineered chemical means. Some CDR methods fall under the category of *geoengineering*, though this may not be the case for others, with the distinction being based on the magnitude, scale, and impact of the particular CDR activities. The boundary between CDR and *mitigation* is not clear and there could be some overlap between the two given current definitions (IPCC, 2012, p. 2). See also *Solar Radiation Management (SRM)*.

Carbon footprint

Measure of the exclusive total amount of emissions of *carbon dioxide* that is directly and indirectly caused by an activity or is accumulated over the life stages of a product (Wiedmann and Minx, 2008).

Carbon intensity

The amount of emissions of *carbon dioxide* released per unit of another variable such as *Gross Domestic Product (GDP)*, output energy use, or transport.

Carbon leakage

See *Leakage*.

Carbon pool

See *Reservoir*.

Carbon price

Required payment (to some public authority as a tax rate, or on some *emission permit* exchange) for the emission of 1 tonne of *carbon dioxide* into the *atmosphere*. In some models it is represented by

the shadow price of an additional unit of *carbon dioxide* emitted, in others by the rate of *carbon tax*, or the price of *emission permits*.

Carbon sequestration

See *Sequestration*.

Carbon tax

A levy on the carbon content of *fossil fuels*. Because virtually all of the carbon in *fossil fuels* is ultimately emitted as *carbon dioxide*, a carbon tax is equivalent to an emission tax on *carbon dioxide* emissions.

CCS-ready

New large-scale, stationary *carbon dioxide* point *sources* intended to be retrofitted with *Carbon Dioxide Capture and Storage (CCS)* could be designed and located to be "CCS-ready" by reserving space for the capture installation, designing the unit for optimal performance when capture is added, and siting the plant to enable access to storage locations. See also *Bioenergy and Carbon Dioxide Capture and Storage (BECCS)*.

Certified Emission Reduction Unit (CER)

Equal to one metric tonne of *CO_2-equivalent emissions* reduced or of *carbon dioxide* removed from the *atmosphere* through the *Clean Development Mechanism (CDM)* (defined in Article 12 of the *Kyoto Protocol*) project, calculated using *Global Warming Potentials*. See also *Emissions Reduction Units* and *Emissions trading*.

Chemical oxygen demand (COD)

The quantity of oxygen required for the complete oxidation of organic chemical compounds in water; used as a measure of the level of organic pollutants in natural and waste waters. See also *Biochemical oxygen demand*.

Chlorofluorocarbons (CFCs)

A chlorofluorocarbon is an organic compound that contains chlorine, carbon, hydrogen, and fluorine and is used for refrigeration, air conditioning, packaging, plastic foam, insulation, solvents, or *aerosol* propellants. Because they are not destroyed in the lower *atmosphere*, CFCs drift into the upper *atmosphere* where, given suitable conditions, they break down *ozone*. It is one of the *greenhouse gases* covered under the 1987 *Montreal Protocol* as a result of which, manufacturing of these gases has been phased out and they are being replaced by other compounds, including *hydrochlorofluorocarbons* and *hydrofluorocarbons*, which are *greenhouse gases* covered under the *Kyoto Protocol*.

Clean Development Mechanism (CDM)

A mechanism defined under Article 12 of the *Kyoto Protocol* through which investors (governments or companies) from developed (*Annex B*) *countries* may finance *greenhouse gas* emission reduction or removal projects in developing (*Non-Annex B*) *countries*, and receive *Certified Emission Reduction Units (CERs)* for doing so. The *CERs* can be credited towards the commitments of the respective *developed countries*. The *CDM* is intended to facilitate the two objectives of promoting *sustainable* development in *developing countries* and of helping *industrialized countries* to reach their emissions commitments in a cost-effective way. See also *Kyoto Mechanisms*.

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 or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant 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 a change in the state of the *climate* that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the *atmosphere* or in *land use*. Note that the *United Nations Framework Convention on Climate Change (UNFCCC)*, in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. The *UNFCCC* thus makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes. See also *Climate change commitment*.

Climate change commitment

Due to the thermal inertia of the ocean and slow processes in the cryosphere and land surfaces, the *climate* would continue to change even if the atmospheric composition were held fixed at today's values. Past change in atmospheric composition leads to a committed *climate change*, which continues for as long as a radiative imbalance persists and until all components of the *climate system* have adjusted to a new state. The further change in temperature after the composition of the *atmosphere* is held constant is referred to as the constant composition temperature commitment or simply committed warming or warming commitment. Climate change commitment includes other future changes, for example in the hydrological cycle, in extreme weather events, in extreme climate events, and in sea level change. The constant emission commitment is the committed climate change that would result from keeping *anthropogenic emissions* constant and the zero emission commitment is the climate change commitment when emissions are set to zero. See also *Climate change*.

Climate (change) feedback

An interaction in which a perturbation in one *climate* quantity causes a change in a second, and the change in the second quantity ultimately leads to an additional change in the first. A negative feedback is one in which the initial perturbation is weakened by the changes it causes; a positive feedback is one in which the initial perturbation is enhanced. In this Assessment Report, a somewhat narrower definition is often used in which the climate quantity that is perturbed is the global mean surface temperature, which in turn causes changes in the global radiation budget. In either case, the initial perturbation can either be externally forced or arise as part of internal variability.

Climate engineering

See *Geoengineering*.

Climate finance

There is no agreed definition of climate finance. The term "climate finance" is applied both to the financial resources devoted to addressing *climate change* globally and to financial flows to *developing countries* to assist them in addressing *climate change*. The literature includes multiple concepts within each of these broad categories.

Climate model (spectrum or hierarchy)

A numerical representation of the *climate system* based on the physical, chemical and biological properties of its components, their interactions and feedback processes, and accounting for some of its known properties. The climate system can be represented by models of varying complexity, that is, for any one component or combination of components a spectrum or hierarchy of models can be identified, differing in such aspects as the number of spatial dimensions, the extent to which physical, chemical or biological processes are explicitly represented, or the level at which empirical parametrizations are involved. Coupled Atmosphere-Ocean *General Circulation Models* (AOGCMs) provide a representation of the *climate system* that is near or at the most comprehensive end of the spectrum currently available. There is an evolution towards more complex models with interactive chemistry and biology. Climate models are applied as a research tool to study and simulate the *climate*, and for operational purposes, including monthly, seasonal and interannual *climate predictions*.

Climate prediction

A climate prediction or climate forecast is the result of an attempt to produce (starting from a particular state of the *climate system*) an estimate of the actual evolution of the climate in the future, for example, at seasonal, interannual, or decadal time scales. Because the future evolution of the *climate system* may be highly sensitive to initial conditions, such predictions are usually probabilistic in nature. See also *Climate projection*, and *Climate scenario*.

Climate projection

A climate projection is the simulated response of the *climate system* to a scenario of future *emission* or concentration of *greenhouse gases* and *aerosols*, generally derived using *climate models*. Climate projections are distinguished from *climate predictions* by their dependence on the emission/concentration/*radiative-forcing scenario* used, which is in turn based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized. See also *Climate scenario*.

Climate scenario

A plausible and often simplified representation of the future *climate*, based on an internally consistent set of climatological relationships that has been constructed for explicit use in investigating the potential consequences of anthropogenic *climate change*, often serving as input to impact models. *Climate projections* often serve as the raw material for constructing *climate scenarios*, but *climate scenarios* usually require additional information such as the observed current *climate*. See also *Baseline, Emission scenario, Mitigation scenario, Representative concentration pathways, Scenario, Shared socio-economic pathways, Socio-economic scenario, SRES scenarios, Stabilization*, and *Transformation pathway*.

Climate sensitivity

In IPCC reports, equilibrium climate sensitivity (units: °C) refers to the equilibrium (steady state) change in the annual global mean surface temperature following a doubling of the atmospheric *equivalent carbon dioxide concentration*. Owing to computational constraints, the equilibrium climate sensitivity in a *climate model* is sometimes estimated by running an atmospheric *general circulation model* coupled to a mixed-layer ocean model, because equilibrium climate sensitivity is largely determined by atmospheric processes. Efficient models can be run to equilibrium with a dynamic ocean. The climate sensitivity parameter (units: °C $(W\ m^{-2})^{-1}$) refers to the equilibrium change in the annual global mean surface temperature following a unit change in *radiative forcing*.

The effective climate sensitivity (units: °C) is an estimate of the global mean surface temperature response to doubled *carbon dioxide* concentration that is evaluated from model output or

observations for evolving non-equilibrium conditions. It is a measure of the strengths of the *climate feedbacks* at a particular time and may vary with forcing history and *climate* state, and therefore may differ from equilibrium climate sensitivity.

The transient climate response (units: °C) is the change in the global mean surface temperature, averaged over a 20-year period, centred at the time of atmospheric *carbon dioxide* doubling, in a *climate model* simulation in which *carbon dioxide* increases at 1% yr^{-1}. It is a measure of the strength and rapidity of the surface temperature response to *greenhouse gas* forcing.

Climate system

The climate system is the highly complex system consisting of five major components: the *atmosphere*, the hydrosphere, the cryosphere, the lithosphere and the *biosphere*, and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external forcings such as volcanic eruptions, solar variations and anthropogenic forcings such as the changing composition of the *atmosphere* and *land use change*.

Climate threshold

A limit within the *climate system* that, when crossed, induces a non-linear response to a given forcing. See also *Abrupt climate change*.

Climate variability

Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the *climate* on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the *climate system* (internal variability), or to variations in natural or anthropogenic external forcing (external variability). See also *Climate change*.

CO_2-equivalent concentration

The concentration of *carbon dioxide* that would cause the same *radiative forcing* as a given mixture of *carbon dioxide* and other forcing components. Those values may consider only *greenhouse gases*, or a combination of *greenhouse gases* and *aerosols*. CO_2-equivalent concentration is a metric for comparing *radiative forcing* of a mix of different *greenhouse gases* at a particular time but does not imply equivalence of the corresponding climate change responses nor future forcing. There is generally no connection between *CO_2-equivalent emissions* and resulting *CO_2-equivalent concentrations.*

CO_2-equivalent emission

The amount of *carbon dioxide* emission that would cause the same integrated *radiative forcing*, over a given time horizon, as an emitted amount of a *greenhouse gas* or a mixture of *greenhouse gases*. The equivalent carbon dioxide emission is obtained by multiplying the emission of a *greenhouse gas* by its *Global Warming Potential* for the given time horizon. For a mix of *greenhouse gases* it is obtained by summing the CO_2-equivalent emissions of each gas. CO_2-equivalent emission is a common scale for comparing emissions of different *greenhouse gases* but does not imply equivalence of the corresponding *climate change* responses. See also CO_2-equivalent concentration.

Co-benefits

The positive effects that a policy or measure aimed at one objective might have on other objectives, without yet evaluating the net effect on overall social welfare. Co-benefits are often subject to *uncertainty* and depend on, among others, local circumstances and implementation practices. Co-benefits are also called ancillary benefits. See also *Adverse side-effect, Risk,* and *Risk trade-off*.

Cogeneration

Cogeneration (also referred to as Combined Heat and Power, or CHP) is the simultaneous generation and useful application of electricity and useful heat.

Combined-cycle gas turbine (CCGT)

A power plant that combines two processes for generating electricity. First, fuel combustion drives a gas turbine. Second, exhaust gases from the turbine are used to heat water to drive a steam turbine.

Combined Heat and Power (CHP)

See Cogeneration.

Conference of the Parties (COP)

The supreme body of the *UNFCCC*, comprising countries with a right to vote that have ratified or acceded to the convention. See also *Meeting of the Parties (MOP)*.

Confidence

The validity of a finding based on the type, amount, quality, and consistency of *evidence* (e.g., mechanistic understanding, theory, data, models, expert judgment) and on the degree of *agreement*. In this report, confidence is expressed qualitatively (Mastrandrea et al., 2010). See WGI AR5 Figure 1.11 for the levels of confidence and WGI AR5 Table 1.1 for the list of *likelihood* qualifiers. See also *Uncertainty*.

Consumption-based accounting

Consumption-based accounting provides a measure of emissions released to the *atmosphere* in order to generate the goods and services consumed by a certain entity (e.g. person, firm, country, or region). See *Production-based accounting*.

Contingent Valuation Method (CVM)

An approach to quantitatively assess values assigned by people in monetary (willingness to pay) and non-monetary (willingness to contribute with time, resources etc.) terms. It is a direct method to estimate economic values for *ecosystem* and environmental services. In a survey, people are asked their willingness to pay/contribute for access to, or their willingness to accept compensation for removal of, a specific environmental service, based on a hypothetical *scenario* and description of the environmental service.

Conventional fuels

See *Fossil fuels*.

Copenhagen Accord

The Copenhagen Accord is the political (as opposed to legal) agreement that emerged at the 15th session of the *Conference of the Parties (COP)* at which delegates “agreed to take note” due to a lack of consensus that an agreement would require. Some of the key elements include: recognition of the importance of the scientific view on the need to limit the increase in global temperature to 2° C; commitment by *Annex I Parties* to implement economy-wide emissions targets by 2020 and non-*Annex I Parties* to implement *mitigation* actions; agreement to have emission targets of *Annex I Parties* and their delivery of finance for *developing countries* subject to Measurement, Reporting and Verification (MRV) and actions by *developing countries* to be subject to domestic MRV; calls for scaled up financing including a fast track financing of USD 30 billion and USD 100 billion by 2020; the establishment of a new *Green Climate Fund*; and the establishment of a new technology mechanism. Some of these elements were later adopted in the *Cancún Agreements*.

Cost–benefit analysis (CBA)

Monetary measurement of all negative and positive impacts associated with a given action. Costs and benefits are compared in terms of their difference and/or ratio as an indicator of how a given investment or other policy effort pays off seen from the society's point of view.

Cost effectiveness

A *policy* is more cost-effective if it achieves a given pollution abatement at lower cost. A critical condition for cost-effectiveness is that marginal compliance costs be equal among obliged parties.

Cost-effectiveness analysis (CEA)

A tool based on constrained optimization for comparing *policies* designed to meet a prespecified target.

Crediting period, Clean Development Mechanism

The time during which a project activity is able to generate *Certified Emission Reduction Units (CERs)*. Under certain conditions, the crediting period can be renewed up to two times.

Cropland management

The system of practices on land on which agricultural crops are grown and on land that is set aside or temporarily not being used for crop production (UNFCCC, 2002, p. 58).

Decarbonization

The process by which countries or other entities aim to achieve a low-carbon economy, or by which individuals aim to reduce their carbon consumption.

Decomposition approach

Decomposition methods disaggregate the total amount of historical changes of a policy variable into contributions made by its various determinants.

Deforestation

Conversion of *forest* to non-forest is one of the major *sources* of *greenhouse gas (GHG)* emissions. Under Article 3.3 of the *Kyoto Protocol*, "the net changes in greenhouse gas emissions by sources and removals by sinks resulting from direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation since 1990, measured as verifiable changes in carbon stocks in each commitment period, shall be sued to meet the commitments under this Article of each Party included in Annex I". Reducing emissions from deforestation is not eligible for *Joint Implementation (JI)* or *Clean Development Mechanism (CDM)* projects but has been introduced in the program of work under *REDD (Reducing Emissions from Deforestation and Forest Degradation)* under the *UNFCCC*.

For a discussion of the term *forest* and related terms such as *afforestation*, *reforestation*, and deforestation see the IPCC Special Report on Land Use, Land-Use Change and Forestry (IPCC, 2000). See also the report on Definitions and Methodological Options to Inventory Emissions from Direct Human-induced Degradation of Forests and Devegetation of Other Vegetation Types (IPCC, 2003).

Dematerialization

The ambition to reduce the total material inputs required to deliver a final service.

Descriptive/positive

Descriptive (also termed positive) approaches to analysis focus on how the world works or actors behave, not how they should behave in some idealized world.

Desertification

Land degradation in arid, semi-arid, and dry sub-humid areas resulting from various factors, including climatic variations and human activities. Land degradation in arid, semi-arid, and dry sub-humid areas is a reduction or loss of the biological or economic productivity and complexity of rainfed 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 (1) soil erosion caused by wind and/or water; (2) deterioration of the physical, chemical, biological, or economic properties of soil; and (3) long-term loss of natural vegetation (UNCCD, 1994).

Designated national authority (DNA)

A designated national authority is a national *institution* that authorizes and approves *Clean Development Mechansim (CDM)* projects in that country. In *CDM* host countries, the DNA assesses whether proposed projects assist the host country in achieving its *sustainable development* goals, certification of which is a prerequisite for registration of the project by the *CDM* Executive Board.

Developed countries

See *Industrialized/developing countries*.

Developing countries

See *Industrialized/developing countries*.

Development pathway

An evolution based on an array of technological, economic, social, institutional, cultural, and biophysical characteristics that determine the interactions between human and natural systems, including consumption and production patterns in all countries, over time at a particular scale.

Direct Air Capture

Chemical process by which a pure CO_2 stream is produced by capturing CO_2 from the ambient air.

Discounting

A mathematical operation making monetary (or other) amounts received or expended at different times (years) comparable across time. The discounter uses a fixed or possibly time-varying discount rate (>0) from year to year that makes future value worth less today.

Double dividend

The extent to which revenue-generating instruments, such as *carbon taxes* or auctioned (tradable) *emission permits* can (1) limit or reduce *greenhouse gas (GHG)* emissions and (2) offset at least part of the potential welfare losses of climate *policies* through recycling the revenue in the economy to reduce other taxes likely to cause distortions.

Drivers of behaviour

Determinants of human decisions and actions, including peoples' values and goals and the factors that constrain action, including economic factors and incentives, information access, regulatory and technological constraints, cognitive and emotional processing capacity, and social norms. See also *Behaviour* and *Behaviour change*.

Drivers of emissions

Drivers refer to the processes, mechanisms and properties that influence emissions through factors. Factors comprise the terms in a decomposition of emissions. Factors and drivers may in return affect *policies*, *measures* and other drivers.

Economic efficiency

Economic efficiency refers to an economy's allocation of resources (goods, services, inputs, productive activities). An allocation is efficient if it is not possible to reallocate resources so as to make at least one person better off without making someone else worse off. An allocation is inefficient if such a reallocation is possible. This is also known as the Pareto Criterion for efficiency.

Economies in Transition (EITs)

Countries with their economies changing from a planned economic system to a market economy.

Ecosystem

An ecosystem is a functional unit consisting of living organisms, their non-living environment, and the interactions within and between them. The components included in a given ecosystem and its spatial boundaries depend on the purpose for which the ecosystem is defined: in some cases they are relatively sharp, while in others they are diffuse. Ecosystem boundaries can change over time. Ecosystems are nested within other ecosystems, and their scale can range from very small to the entire *biosphere*. In the current era, most ecosystems either contain people as key organisms, or show the effects of human activities in their environment.

Ecosystem services

Ecological processes or functions having monetary or non-monetary value to individuals or society at large. These are frequently classified as (1) supporting services such as productivity or *biodiversity* maintenance, (2) provisioning services such as food, fiber, or fish, (3) regulating services such as *climate* regulation or carbon *sequestration*, and (4) cultural services such as tourism or spiritual and aesthetic appreciation.

Emissions

Anthropogenic emissions

Emissions of *greenhouse gases*, *aerosols*, and *precursors* of a *greenhouse gas* or *aerosol* caused by human activities. These activities include the burning of *fossil fuels*, *deforestation*, *land use changes*, livestock production, fertilization, waste management, and industrial processes.

Agricultural emissions

Emissions associated with agricultural systems – predominantly *methane (CH4)* or *nitrous oxide (N_2O)*. These include emissions from enteric fermentation in domestic livestock, manure management, rice cultivation, prescribed burning of savannas and grassland, and from soils.

Direct emissions

Emissions that physically arise from activities within well-defined boundaries or, for instance, a region, an economic sector, a company or a process.

Embodied emissions

Emissions that arise from the production of a product or the build-up of infrastructures.

Indirect emissions

Emissions that are a consequence of the activities within well-defined boundaries of, for instance, a region, an economic sector, a company or process, but which occur outside the specified boundaries. For example, emissions are described as indirect, if they relate to the use of heat but physically arise outside the boundaries of the heat user or to electricity production but physically arise outside of the boundaries of the power supply sector.

Scope 1, scope 2, and scope 3 emissions

Emissions responsibility as defined by the GHG Protocol, a private sector initiative. "Scope 1" indicates direct *greenhouse gas (GHG)* emissions that are from *sources* owned or controlled by the reporting entity. "Scope 2" indicates indirect *GHG* emissions associated with the production of electricity, heat, or steam purchased by the reporting entity. "Scope 3" indicates all other *indirect emissions*, i.e., emissions associated with the extraction and production of purchased materials, fuels, and services, including transport in vehicles not owned or controlled by the reporting entity, outsourced activities, waste disposal, etc. (WBCSD and WRI, 2004).

Territorial emissions

Emissions that take place within the territories of a particular jurisdiction.

Emission allowance

See *Emission permit*.

Emission factor/intensity

The emissions released per unit of activity. See also *Carbon intensity*.

Emission permit

An entitlement allocated by a government to a legal entity (company or other emitter) to emit a specified amount of a substance. Emission permits are often used as part of *emissions trading* schemes.

Emission quota

The portion of total allowable emissions assigned to a country or group of countries within a framework of maximum total emissions.

Emission scenario

A plausible representation of the future development of emissions of substances that are potentially radiatively active (e.g., *greenhouse gases*, *aerosols*) based on a coherent and internally consistent set of assumptions about driving forces (such as demographic and socioeconomic development, *technological change*, *energy* and *land use*) and their key relationships. Concentration *scenarios*, derived from emission scenarios, are used as input to a *climate model* to compute *climate projections*. In IPCC (1992) a set of emission scenarios was presented which were used as a basis for the *climate projections* in IPCC (1996). These emission scenarios are referred to as the IS92 scenarios. In the IPCC Special Report on Emission Scenarios (Nakićenović and Swart, 2000) emission scenarios, the so-called *SRES scenarios*, were published, some of which were used, among others, as a basis for the *climate projections* presented in Chapters 9 to 11 of IPCC (2001) and Chapters 10 and 11 of IPCC (2007). New emission scenarios for *climate change*, the four *Representative Concentration Pathways*, were developed for, but independently of, the present IPCC assessment. See also *Baseline*, *Climate scenario*, *Mitigation scenario, Shared socio-economic pathways*, *Socio-economic scenario*, *Stabilization*, and *Transformation pathway*.

Emission trajectories

A projected development in time of the emission of a *greenhouse gas* or group of *greenhouse gases*, *aerosols*, and *greenhouse gas precursors*.

Emissions Reduction Unit (ERU)

Equal to one metric tonne of *CO_2-equivalent emissions* reduced or of *carbon dioxide* removed from the *atmosphere* through a *Joint Implementation* (defined in Article 6 of the *Kyoto Protocol*) project,

calculated using *Global Warming Potentials*. See also *Certified Emission Reduction Unit* and *Emissions trading*.

Emission standard

An emission level that, by law or by voluntary agreement, may not be exceeded. Many standards use emission factors in their prescription and therefore do not impose absolute limits on the emissions.

Emissions trading

A market-based instrument used to limit emissions. The environmental objective or sum of total allowed emissions is expressed as an emissions *cap*. The *cap* is divided in tradable *emission permits* that are allocated—either by auctioning or handing out for free (grandfathering)—to entities within the jurisdiction of the trading scheme. Entities need to surrender *emission permits* equal to the amount of their emissions (e.g. tonnes of *carbon dioxide*). An entity may sell excess permits. Trading schemes may occur at the intra-company, domestic, or international level and may apply to *carbon dioxide*, other *greenhouse gases*, or other substances. Emissions trading is also one of the mechanisms under the *Kyoto Protocol*. See *Kyoto Mechanisms*.

Energy

The power of "doing work" possessed at any instant by a body or system of bodies. Energy is classified in a variety of types and becomes available to human ends when it flows from one place to another or is converted from one type into another.

Primary energy

Primary energy (also referred to as energy sources) is the *energy* stored in natural resources (e.g. coal, crude oil, natural gas, uranium, and renewable sources). It is defined in several alternative ways. The *International Energy Agency (IEA)* utilizes the physical energy content method, which defines primary energy as energy that has not undergone any anthropogenic conversion. The method used in this report is the direct equivalent method (see Annex II), which counts one unit of secondary energy provided from non-combustible sources as one unit of primary energy, but treats combustion energy as the energy potential contained in fuels prior to treatment or combustion. Primary energy is transformed into secondary energy by cleaning (natural gas), refining (crude oil to oil products) or by conversion into electricity or heat. When the secondary energy is delivered at the end-use facilities it is called final energy (e.g. electricity at the wall outlet), where it becomes usable energy in supplying services (e.g. light).

Embodied energy

Embodied energy is the *energy* used to produce a material substance or product (such as processed metals or building materials), taking into account *energy* used at the manufacturing facility, *energy* used in producing the materials that are used in the manufacturing facility, and so on.

Final energy

See *Primary energy*.

Renewable energy

Any form of energy from solar, geophysical, or biological sources that is replenished by natural processes at a rate that equals or exceeds its rate of use. For a more detailed description see *Bioenergy*, *Solar energy*, *Hydropower*, *Ocean*, *Geothermal*, and *Wind energy*.

Secondary energy

See *Primary energy*.

Energy access

Access to clean, reliable and affordable *energy services* for cooking and heating, lighting, communications and productive uses (AGECC, 2010).

Energy carrier

A substance for delivering mechanical work or transfer of heat. Examples of energy carriers include: solid, liquid or gaseous fuels (e.g. *biomass*, coal, oil, natural gas, hydrogen); pressurized/heated/ cooled fluids (air, water, steam); and electric current.

Energy density

The ratio of stored *energy* to the volume or mass of a fuel or battery.

Energy efficiency

The ratio of useful *energy* output of a system, conversion process, or activity to its *energy* input. In economics, the term may describe the ratio of economic output to *energy* input. See also *Energy intensity*.

Energy intensity

The ratio of *energy* use to economic or physical output.

Energy poverty

A lack of access to modern *energy services*. See also *Energy access*.

Energy security

The goal of a given country, or the global community as a whole, to maintain an adequate, stable, and predictable *energy* supply. Measures encompass safeguarding the sufficiency of *energy* resources to meet national *energy* demand at competitive and stable prices and the resilience of the *energy* supply; enabling development and deployment of technologies; building sufficient infrastructure to generate, store and transmit *energy* supplies; and ensuring enforceable contracts of delivery.

Energy services

An *energy* service is the benefit received as a result of *energy* use.

Energy system

The *energy* system comprises all components related to the production, conversion, delivery, and use of *energy*.

Environmental effectiveness

A *policy* is environmentally effective to the extent by which it achieves its expected environmental target (e.g. *greenhouse gas (GHG)* emission reduction).

Environmental input-output analysis

An analytical method used to allocate environmental impacts arising in production to categories of final consumption, by means of the Leontief inverse of a country's economic input-output tables.

Environmental Kuznets Curve

The hypothesis that various environmental impacts first increase and then eventually decrease as income per capita increases.

Evidence

Information indicating the degree to which a belief or proposition is true or valid. In this report, the degree of evidence reflects the amount of scientific/technical information on which the Lead Authors are basing their findings. See also *Agreement*, *Confidence*, *Likelihood* and *Uncertainty*.

Externality / external cost / external benefit

Externalities arise from a human activity when agents responsible for the activity do not take full account of the activity's impacts on others' production and consumption possibilities, and no compensation exists for such impacts. When the impacts are negative, they are external costs. When the impacts are positive, they are external benefits.

Feed-in tariff

The price per unit of electricity (heat) that a utility or power (heat) supplier has to pay for distributed or renewable electricity (heat) fed into the power grid (heat supply system) by non-utility generators. A public authority regulates the tariff.

Flaring

Open air burning of waste gases and volatile liquids, through a chimney, at oil wells or rigs, in refineries or chemical plants, and at landfills.

Flexibility Mechanisms

See *Kyoto Mechanisms*.

Food security

A state that prevails when people have secure access to sufficient amounts of safe and nutritious food for normal growth, development, and an active and healthy life.[4]

Forest

A vegetation type dominated by trees. Many definitions of the term forest are in use throughout the world, reflecting wide differences in biogeophysical conditions, social structure and economics. According to the 2005 *UNFCCC* definition a forest is an area of land of at least 0.05 – 1 hectare, of which more than 10-30% is covered by tree canopy. Trees must have a potential to reach a minimum of 2-5 meters at maturity in situ. Parties to the Convention can choose to define a forest from within those ranges. Currently, the definition does not recognize different biomes, nor do they distinguish natural forests from plantations, an anomaly being pointed out by many as in need of rectification.

For a discussion of the term forest and related terms such as *afforestation*, *reforestation* and *deforestation* see the IPCC Report on Land Use, Land-Use Change and Forestry (IPCC, 2000). See also the Report on Definitions and Methodological Options to Inventory Emissions from Direct Human-induced Degradation of Forests and Devegetation of Other Vegetation Types (IPCC, 2003).

[4] This glossary entry builds on definitions used in FAO (2000) and previous IPCC reports.

Forest management

A system of practices for stewardship and use of *forest* land aimed at fulfilling relevant ecological (including *biological diversity*), economic and social functions of the *forest* in a sustainable manner (UNFCCC, 2002, p. 58).

Fossil fuels

Carbon-based fuels from fossil hydrocarbon deposits, including coal, peat, oil, and natural gas.

Free Rider

One who benefits from a common good without contributing to its creation or preservation.

Fuel cell

A fuel cell generates electricity in a direct and continuous way from the controlled electrochemical reaction of hydrogen or another fuel and oxygen. With hydrogen as fuel the cell emits only water and heat (no *carbon dioxide*) and the heat can be utilized (see also *Cogeneration*).

Fuel poverty

A condition in which a household is unable to guarantee a certain level of consumption of domestic *energy services* (especially heating) or suffers disproportionate expenditure burdens to meet these needs.

Fuel switching

In general, fuel switching refers to substituting fuel A for fuel B. In the context of *mitigation* it is implicit that fuel A has lower carbon content than fuel B, e.g. switching natural gas for coal.

Full-cost pricing

Setting the final prices of goods and services to include both the private costs of inputs and the *external costs* created by their production and use.

General circulation (climate) model (GCM)

See *Climate model*.

General equilibrium analysis

General equilibrium analysis considers simultaneously all the markets and feedback effects among these markets in an economy leading to market clearance. *(Computable) general equilibrium* models are the operational tools used to perform this type of analysis. See also *Market equilibrium*.

Geoengineering

Geoengineering refers to a broad set of methods and technologies that aim to deliberately alter the *climate system* in order to alleviate the impacts of *climate change*. Most, but not all, methods seek to either (1) reduce the amount of absorbed *solar energy* in the *climate system* (*Solar Radiation Management*) or (2) increase net carbon *sinks* from the *atmosphere* at a scale sufficiently large to alter *climate* (*Carbon Dioxide Removal*). Scale and intent are of central importance. Two key characteristics of geoengineering methods of particular concern are that they use or affect the *climate system* (e.g. *atmosphere*, land or ocean) globally or regionally and/or could have substantive unintended effects that cross national boundaries. Geoengineering is different from weather modification and ecological engineering, but the boundary can be fuzzy (IPCC, 2012, p. 2).

Geothermal energy

Accessible thermal *energy* stored in the Earth's interior.

Global Environment Facility (GEF)

The Global Environment Facility (GEF), established in 1991, helps *developing countries* fund projects and programmes that protect the global environment. GEF grants support projects related to *biodiversity*, *climate change*, international waters, land degradation, the *ozone* layer, and persistent organic pollutants.

Global mean surface temperature

An estimate of the global mean surface air temperature. However, for changes over time, only anomalies, as departures from a climatology, are used, most commonly based on the area-weighted global average of the sea surface temperature anomaly and land surface air temperature anomaly.

Global warming

Global warming refers to the gradual increase, observed or projected, in global surface temperature, as one of the consequences of *radiative forcing* caused by *anthropogenic emissions*.

Global Warming Potential (GWP)

An index, based on radiative properties of *greenhouse gases*, measuring the *radiative forcing* following a pulse emission of a unit mass of a given *greenhouse gas* in the present-day *atmosphere* integrated over a chosen time horizon, relative to that of *carbon dioxide*. The GWP represents the combined effect of the differing times these gases remain in the *atmosphere* and their relative effectiveness in causing *radiative forcing*. The *Kyoto Protocol* is based on GWPs from pulse emissions over a 100-year time frame. As for the *Kyoto Protocol*, this report uses GWP values derived from the IPCC Second Assessment Report: 21 for *methane (CH_4)*, 310 for *nitrous dioxide (N_2O)*, 1,300-11,700 for *hydrofluorocarbons (HFCs)*, 6500-9200 for *perfluorocarbons (PFCs)*, and 23,900 for *sulphur hexafluoride (SF_6)*.

Governance

Governance is a comprehensive and inclusive concept of the full range of means for deciding, managing, and implementing *policies* and *measures*. Whereas government is defined strictly in terms of the nation-state, the more inclusive concept of governance recognizes the contributions of various levels of government (global, international, regional, local) and the contributing roles of the private sector, of nongovernmental actors, and of civil society to addressing the many types of issues facing the global community.

Grazing land management

The system of practices on land used for livestock production aimed at manipulating the amount and type of vegetation and livestock produced (UNFCCC, 2002, p. 58).

Green Climate Fund (GCF)

The Green Climate Fund was established by the *Conference of the Parties (COP)* 16 in 2010 as an operating entity of the financial mechanism of the *UNFCCC*, in accordance with Article 11 of the Convention, to support projects, programmes and *policies* and other activities in *developing country* Parties. The Fund is governed by a Board and will receive guidance of the *COP*. The Fund is headquartered in Songdo, Republic of Korea.

Greenhouse effect

The infrared radiative effect of all infrared-absorbing constituents in the *atmosphere*. *Greenhouse gases*, clouds, and (to a small extent) *aerosols* absorb terrestrial radiation emitted by the Earth's surface and elsewhere in the *atmosphere*. These substances emit infrared radiation in all directions, but, everything else being equal, the net amount emitted to space is normally less than would have been emitted in the absence of these absorbers because of the decline of temperature with altitude

in the *troposphere* and the consequent weakening of emission. An increase in the concentration of *greenhouse gases* increases the magnitude of this effect; the difference is sometimes called the enhanced greenhouse effect. The change in a *greenhouse gas* concentration because of *anthropogenic emissions* contributes to an instantaneous *radiative forcing*. Surface temperature and *troposphere* warm in response to this forcing, gradually restoring the radiative balance at the top of the *atmosphere*.

Greenhouse gas (GHG)

Greenhouse gases are those gaseous constituents of the *atmosphere*, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth's surface, the *atmosphere* itself, and by clouds. This property causes the *greenhouse effect*. Water vapour (H_2O), *carbon dioxide (CO_2)*, *nitrous oxide (N_2O)*, methane (CH_4) and ozone (O_3) are the primary *greenhouse gases* in the Earth's *atmosphere*. Moreover, there are a number of entirely human-made *greenhouse gases* in the *atmosphere*, such as the halocarbons and other chlorine- and bromine-containing substances, dealt with under the *Montreal Protocol*. Beside *CO_2*, *N_2O* and *CH_4*, the *Kyoto Protocol* deals with the *greenhouse gases sulphur hexafluoride (SF_6)*, *hydrofluorocarbons (HFCs)* and *perfluorocarbons (PFCs)*. For a list of well-mixed *greenhouse gases*, see WGI AR5 Table 2.A.1.

Gross Domestic Product (GDP)

The sum of gross value added, at purchasers' prices, by all resident and non-resident producers in the economy, plus any taxes and minus any subsidies not included in the value of the products in a country or a geographic region for a given period, normally one year. GDP is calculated without deducting for depreciation of fabricated assets or depletion and degradation of natural resources.

Gross National Expenditure (GNE)

The total amount of public and private consumption and capital expenditures of a nation. In general, national account is balanced such that *Gross Domestic Product (GDP)* + import = GNE + export.

Gross National Product (GNP)

The value added from domestic and foreign sources claimed by residents. GNP comprises *Gross Domestic Product (GDP)* plus net receipts of primary income from non-resident income.

Gross World Product (GWP)

An aggregation of the individual country's *Gross Domestic Products (GDP)* to obtain the world or global *GDP*.

Heat island

The relative warmth of a city compared with surrounding rural areas, associated with changes in runoff, effects on heat retention, and changes in surface *albedo*.

Human Development Index (HDI)

The HDI allows the assessment of countries' progress regarding social and economic development as a composite index of three indicators: (1) health measured by life expectancy at birth; (2) knowledge as measured by a combination of the adult literacy rate and the combined primary, secondary and tertiary school enrolment ratio; and (3) standard of living as *gross domestic product (GDP)* per capita (in purchasing power parity). The HDI sets a minimum and a maximum for each dimension, called goalposts, and then shows where each country stands in relation to these goalposts, expressed as a value between 0 and 1. The HDI only acts as a broad proxy for some of the key issues of human development; for instance, it does not reflect issues such as political participation or gender inequalities.

Hybrid vehiclep

Any vehicle that employs two sources of propulsion, especially a vehicle that combines an internal combustion engine with an electric motor.

Hydrofluorocarbons (HFCs)

One of the six types of *greenhouse gases* or groups of *greenhouse gases* to be mitigated under the *Kyoto Protocol*. They are produced commercially as a substitute for *chlorofluorocarbons*. HFCs largely are used in refrigeration and semiconductor manufacturing. See *Global Warming Potential*.

Hydropower

Power harnessed from the flow of water.

Indigenous people

Indigenous peoples and nations are those that, having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, consider themselves distinct from other sectors of the societies now prevailing on those territories, or parts of them. They form at present principally non-dominant sectors of society and are often determined to preserve, develop, and transmit to future generations their ancestral territories, and their ethnic identity, as the basis of their continued existence as peoples, in accordance with their own cultural patterns, social *institutions*, and common law system.[5]

Industrialized countries/developing countries

There is a diversity of approaches for categorizing countries on the basis of their level of development, and for defining terms such as industrialized, developed, or developing. Several categorizations are used in this report. (1) In the United Nations system, there is no established convention for designating of developed and developing countries or areas. (2) The United Nations Statistics Division specifies developed and developing regions based on common practice. In addition, specific countries are designated as *Least Developed Countries*, landlocked developing countries, small island developing states, and transition economies. Many countries appear in more than one of these categories. (3) The World Bank uses income as the main criterion for classifying countries as low, lower middle, upper middle, and high income. (4) The UNDP aggregates indicators for life expectancy, educational attainment, and income into a single composite *Human Development Index (HDI)* to classify countries as low, medium, high, or very high human development. See WGII AR5 Box 1-2.

Institution

Institutions are rules and norms held in common by social actors that guide, constrain and shape human interaction. Institutions can be formal, such as laws and policies, or informal, such as norms and conventions. Organizations – such as parliaments, regulatory agencies, private firms, and community bodies – develop and act in response to institutional frameworks and the incentives they frame. Institutions can guide, constrain and shape human interaction through direct control, through incentives, and through processes of socialization.

Institutional feasibility

Institutional feasibility has two key parts: (1) the extent of administrative workload, both for public authorities and for regulated entities, and (2) the extent to which the policy is viewed as legitimate, gains acceptance, is adopted, and is implemented.

[5] This glossary entry builds on the definitions used in Cobo (1987) and previous IPCC reports.

Integrated assessment

A method of analysis that combines results and models from the physical, biological, economic, and social sciences, and the interactions among these components in a consistent framework to evaluate the status and the consequences of environmental change and the *policy* responses to it.

International Energy Agency (IEA)

Established in 1973/4 in response to the oil crisis, the IEA's initial role was to help countries coordinate a collective response and strategy on *energy security*. Its members are from the Organisation for Economic Co-operation and Development (OECD). The IEA's role has evolved and expanded in recent years to help its members to engage in the global dialogue on *energy*, and to provide research, analysis, and statistics.

IPAT identity

IPAT is the lettering of a formula put forward to describe the impact of human activity on the environment. Impact (I) is viewed as the product of population size (P), affluence (A=GDP/person) and technology (T= impact per GDP unit). In this conceptualization, population growth by definition leads to greater environmental impact if A and T are constant, and likewise higher income leads to more impact (Ehrlich and J Holdren, 1971).

Iron fertilization

Deliberate introduction of iron to the upper ocean intended to enhance biological productivity which can sequester additional atmospheric *carbon dioxide* into the oceans. See *Geoengineering* and *Carbon Dioxide Removal*.

Jevon's paradox

See *Rebound effect*.

Joint Implementation (JI)

A mechanism defined in Article 6 of the *Kyoto Protocol*, through which investors (governments or companies) from developed (Annex B) countries may implement projects jointly that limit or reduce emissions or enhance *sinks*, and to share the *Emissions Reduction Units*. See also *Kyoto Mechanisms*.

Kaya identity

In this identity global emissions are equal to the population size, multiplied by per capita output (Gross World Product), multiplied by the energy-intensity of production, multiplied by the carbon-intensity of energy.

Kyoto Mechanisms (also referred to as Flexibility Mechanisms)

Market-based mechanisms that Parties to the *Kyoto Protocol* can use in an attempt to lessen the potential economic impacts of their commitment to limit or reduce *greenhouse gas* emissions. They include *Joint Implementation* (Article 6), *Clean Development Mechanism* (Article 12), and *Emissions trading* (Article 17).

Kyoto Protocol

The Kyoto Protocol to the *United Nations Framework Convention on Climate Change (UNFCCC)* was adopted in 1997 in Kyoto, Japan, at the Third Session of the *Conference of the Parties (COP)* to the *UNFCCC*. It contains legally binding commitments, in addition to those included in the *UNFCCC*. Countries included in Annex B of the Protocol (most Organisation for Economic Cooperation and Development countries and countries with economies in transition) agreed to reduce their anthropogenic *greenhouse gas* emissions (*carbon dioxide*, *methane*, *nitrous oxide*,

hydrofluorocarbons, *perfluorocarbons*, and *sulphur hexafluoride*) by at least 5% below 1990 levels in the commitment period 2008-2012. The *Kyoto Protocol* entered into force on 16 February 2005.

Land use (change; direct and indirect)

Land use refers to the total of arrangements, activities and inputs undertaken in a certain land cover type (a set of human actions). The term land use is also used in the sense of the social and economic purposes for which land is managed (e.g., grazing, timber extraction and conservation). In urban settlements it is related to land uses within cities and their hinterlands. Urban land use has implications on city management, structure, and form and thus on energy demand, *greenhouse gas* emissions, and mobility, among other aspects.

Land use change (LUC)

Land use change refers to a change in the use or management of land by humans, which may lead to a change in land cover. Land cover and land use change may have an impact on the surface *albedo*, evapotranspiration, *sources* and *sinks* of *greenhouse gases*, or other properties of the *climate system* and may thus give rise to *radiative forcing* and/or other impacts on *climate*, locally or globally. See also the IPCC Report on Land Use, Land-Use Change, and Forestry (IPCC, 2000).

Indirect land use change (iLUC)

Indirect land use change refers to shifts in land use induced by a change in the production level of an agricultural product elsewhere, often mediated by markets or driven by *policies*. For example, if agricultural land is diverted to fuel production, *forest* clearance may occur elsewhere to replace the former agricultural production. See also *Afforestation*, *Deforestation* and *Reforestation*.

Land value capture

A financing mechanism usually based around transit systems, or other infrastructure and services, that captures the increased value of land due to improved accessibility.

Leakage

Phenomena whereby the reduction in emissions (relative to a *baseline*) in a jurisdiction/sector associated with the implementation of *mitigation policy* is offset to some degree by an increase outside the jurisdiction/sector through induced changes in consumption, production, prices, and trade across the jurisdictions/sectors. Leakage can occur at a number of levels, be it a project, state, province, nation, or world region. See also *Rebound effect*.

Learning curve/rate

Decreasing cost-prices of technologies shown as a function of increasing (total or yearly) supplies. The learning rate is the percent decrease of the cost-price for every doubling of the cumulative supplies (also called progress ratio).

Least Developed Countries (LDC)

A list of countries designated by the Economic and Social Council of the United Nations (ECOSOC) as meeting three criteria: (1) a low income criterion below a certain threshold of gross national income per capita of between USD $750 and USD $900, (2) a human resource weakness based on indicators of health, education, adult literacy, and (3) an economic vulnerability weakness based on indicators on instability of agricultural production, instability of export of goods and services, economic importance of non-traditional activities, merchandise export concentration, and the handicap of economic smallness. Countries in this category are eligible for a number of programmes focused on assisting countries most in need. These privileges include certain benefits under the articles of the *UNFCCC*. See also *Industrialized/developing countries*.

Levelized cost of conserved carbon (LCCC)

See Annex II.3.2.1.

Levelized cost of conserved energy (LCCE)

See Annex II.3.2.1.

Levelized cost of energy (LCOE)

See Annex II.3.2.1.

Lifecycle Assessment (LCA)

A widely used technique defined by ISO 14040 as a "compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle". The results of LCA studies are strongly dependent on the system boundaries within which they are conducted. The technique is intended for relative comparison of two similar means to complete a product.

Likelihood

The chance of a specific outcome occurring, where this might be estimated probabilistically. This is expressed in this report using a standard terminology (Mastrandrea et al., 2010): Particular, or a range of, occurrences/outcomes of an uncertain event owning a probability of >99% are said to be Virtually certain, >90% are said to be Very likely, >66% are said to be Likely, 33 to 66% are said to be About as likely as not, <33% are said to be Unlikely, <10% are said to be Very unlikely, <1% are said to be Exceptionally unlikely. See also *Agreement*, *Confidence*, *Evidence* and *Uncertainty*.

Lock-in

Lock-in occurs when a market is stuck with a standard even though participants would be better off with an alternative.

Marginal abatement costs

The cost of one unit of additional *mitigation*.

Marginal cost pricing

The pricing of goods and services such that the price equals the additional cost arising when production is expanded by one unit.

Market barriers

In the context of climate change *mitigation*, market barriers are conditions that prevent or impede the diffusion of cost-effective technologies or practices that would mitigate *GHG* emissions.

Market-based mechanisms, GHG emissions

Regulatory approaches using price mechanisms (e.g. taxes and auctioned *emission permits*), among other instruments, to reduce the *sources* or enhance the *sinks* of *greenhouse gases (GHGs)*.

Market exchange Rate (MER)

The rate at which foreign currencies are exchanged. Most economies post such rates daily and they vary little across all the exchanges. For some developing economies, official rates and black-market rates may differ significantly and the MER is difficult to pin down.

Market failure

When private decisions are based on market prices that do not reflect the real scarcity of goods and services but rather reflect market distortions, they do not generate an efficient allocation of

resources but cause welfare losses. A market distortion is any event in which a market reaches a market clearing price that is substantially different from the price that a market would achieve while operating under conditions of perfect competition and state enforcement of legal contracts and the ownership of private property. Examples of factors causing market prices to deviate from real economic scarcity are environmental *externalities*, *public goods*, monopoly power, information asymmetry, *transaction costs*, and non-rational *behaviour*.

Material flow analysis

A systematic assessment of the flows and stocks of materials within a system defined in space and time (Brunner and Rechberger, 2004).

Measures

In climate policy, measures are technologies, processes or practices that contribute to *mitigation*, for example *renewable energy* technologies, waste minimization processes, public transport commuting practices, etc. See also *Policies*.

Meeting of the Parties (MOP)

The *Conference of the Parties (COP)* of the *UNFCCC* serves as the Meeting of the Parties (MOP), the supreme body of the *Kyoto Protocol*, since the latter entered into force on 16 February 2005. Only Parties to the *Kyoto Protocol* may participate in deliberations and make decisions.

Methane (CH_4)

Methane is one of the six *greenhouse* gases to be mitigated under the *Kyoto Protocol* and is the major component of natural gas and associated with all hydrocarbon fuels. Significant emissions occur as a result of animal husbandry and agriculture and their management represents a major *mitigation* option. See also *Global Warming Potential*.

Methane recovery

Any process by which *methane* emissions (e.g. from oil or gas wells, coal beds, peat bogs, gas transmission pipelines, landfills, or anaerobic digesters) are captured and used as a fuel or for some other economic purpose (e.g. chemical feedstock).

Millennium Development Goals (MDG)

A set of eight time-bound and measurable goals for combating poverty, hunger, disease, illiteracy, discrimination against women and environmental degradation. These goals were agreed to at the UN Millennium Summit in 2000 together with an action plan to reach the goals.

Mitigation (of climate change)

A human intervention to reduce the *sources* or enhance the *sinks* of *greenhouse gases*. This report also assesses human interventions to reduce the *sources* of other substances which may contribute directly or indirectly to limiting *climate change*, including, for example, the reduction of *particulate matter* emissions that can directly alter the radiation balance (e.g., *black carbon*) or *measures* that control emissions of carbon monoxide, *nitrogen oxides*, *Volatile Organic Compounds* and other pollutants that can alter the concentration of tropospheric *ozone* which has an indirect effect on the *climate*.

Mitigation capacity

A country's ability to reduce anthropogenic *greenhouse gas (GHG)* emissions or to enhance natural *sinks*, where ability refers to skills, competencies, fitness, and proficiencies that a country has attained and depends on technology, *institutions*, wealth, equity, infrastructure, and information. Mitigative capacity is rooted in a country's *sustainable development* path.

Mitigation scenario

A plausible description of the future, describing the response of the (studied) system due to the implementation of *mitigation policies* and *measures*. See also *Baseline/reference*, *Climate scenario*, *Emission scenario*, *Representative Concentration Pathways*, *Scenario*, *Shared socio-economic pathways*, *Socio-economic scenarios*, *SRES scenarios*, *Stabilization*, and *Transformation pathways*.

Models

Models are structured imitations of a system's attributes and mechanisms to mimic appearance or functioning of systems, for example, the *climate*, the economy of a country, or a crop. Mathematical models assemble (many) variables and relations (often in a computer code) to simulate system functioning and performance for variations in parameters and inputs.

Computable General Equilibrium Model

Computable general equilibrium (CGE) models are a class of economic models that use actual economic data (i.e. input/output data), simplify the characterization of economic behaviour, and solve the whole system numerically. CGE models specify all economic relationships in mathematical terms and predict the changes in variables such as prices, output and economic welfare resulting from a change in economic policies, given information about technologies, consumer preferences (Hertel, 1997). See also *General equilibrium analysis*.

Integrated Model

Integrated models explore the interactions between multiple sectors of the economy or components of particular systems, such as the energy system. In the context of *transformation pathways*, they refer to models that, at a minimum, include full and disaggregated representations of the energy system and its linkage to the overall economy that will allow for consideration of interactions among different elements of that system. Integrated models may also include representations of the full economy, *land use* and *land use change*, and the *climate system*. See also *Integrated assessment*.

Sectoral Model

In the context of this report, sectoral models address only one of the core sectors that are discussed in this report, such as buildings, industry, transport, energy supply, and *AFOLU*.

Montreal Protocol

The Montreal Protocol on Substances that Deplete the Ozone Layer was adopted in Montreal in 1987, and subsequently adjusted and amended in London (1990), Copenhagen (1992), Vienna (1995), Montreal (1997) and Beijing (1999). It controls the consumption and production of chlorine- and bromine- containing chemicals that destroy stratospheric ozone, such as *chlorofluorocarbons*, methyl chloroform, carbon tetrachloride and many others.

Multi-criteria analysis

See *Multi-attribute analysis*.

Multi-attribute analysis

Integrates different decision parameters and values without assigning monetary values to all parameters. Multi-attribute analysis can combine quantitative and qualitative information. Also referred to as multi-criteria analysis.

Multi-gas

Next to *carbon dioxide*, there are other forcing components taken into account in, e.g. achieving reduction for a basket of *greenhouse gas* emissions (*carbon dioxide*, *methane*, *nitrous oxide*, and fluorinated gases) or *stabilization* of *CO_2-equivalent concentrations* (multi-gas *stabilization*, including *greenhouse gases* and *aerosols*).

Nationally Appropriate Mitigation Action (NAMA)

NAMAs are a concept for recognizing and financing emission reductions by *developing countries* in a post-2012 climate regime achieved through action considered appropriate in a given national context. The concept was first introduced in the Bali Action Plan in 2007 and is contained in the *Cancún Agreement*.

Nitrogen oxides (NO_x)

Any of several oxides of nitrogen.

Nitrous oxide (N_2O)

One of the six *greenhouse gases* to be mitigated under the *Kyoto Protocol*. The main anthropogenic source of *nitrous oxide* is agriculture (soil and animal manure management), but important contributions also come from sewage treatment, combustion of *fossil fuels*, and chemical industrial processes. Nitrous oxide is also produced naturally from a wide variety of biological sources in soil and water, particularly microbial action in wet tropical forests. See also *Global Warming Potential*.

Non-Annex I Parties/countries

Non-Annex I Parties are mostly *developing countries*. Certain groups of *developing countries* are recognized by the Convention as being especially vulnerable to the adverse impacts of *climate change*, including countries with low-lying coastal areas and those prone to *desertification* and drought. Others, such as countries that rely heavily on income from *fossil fuel* production and commerce, feel more vulnerable to the potential economic impacts of *climate change* response measures. The Convention emphasizes activities that promise to answer the special needs and concerns of these vulnerable countries, such as investment, insurance, and technology transfer. See also *Annex I Parties/countries*.

Normative analysis

Analysis in which judgments about the desirability of various *policies* are made. The conclusions rest on value judgments as well as on facts and theories.

Ocean energy

Energy obtained from the ocean via waves, tidal ranges, tidal and ocean currents, and thermal and saline gradients.

Offset (in climate policy)

A unit of *CO_2-equivalent emissions* that is reduced, avoided, or sequestered to compensate for emissions occurring elsewhere.

Oil sands and oil shale

Unconsolidated porous sands, sandstone rock, and shales containing bituminous material that can be mined and converted to a liquid fuel. See also *Unconventional fuels*.

Overshoot pathways

Emissions, concentration, or temperature pathways in which the metric of interest temporarily exceeds, or “overshoots” the long-term goal.

Ozone (O_3)

Ozone, the triatomic form of oxygen (O_3), is a gaseous atmospheric constituent. In the *troposphere*, it is created both naturally and by photochemical reactions involving gases resulting from human activities (smog). Tropospheric ozone acts as a *greenhouse gas*. In the *stratosphere*, it is created by the interaction between solar ultraviolet radiation and molecular oxygen (O_2). Stratospheric ozone plays a dominant role in the stratospheric radiative balance. Its concentration is highest in the ozone layer.

Paratransit

Denotes flexible passenger transportation, often but not only in areas with low population density, that does not follow fixed routes or schedules. Options include minibuses (matatus, marshrutka), shared taxis and jitneys. Sometimes paratransit is also called community transit.

Pareto optimum

Pareto optimum is a state in which no one's welfare can be increased without reducing someone else's welfare.

Particulate matter (PM)

Very small solid particles emitted during the combustion of fossil and *biomass* fuels. Particulate matter may consist of a wide variety of substances. Of greatest concern for health are particulates of diameter less than or equal to 10 nanometers, usually designated as PM_{10}. See also *Aerosol*.

Passive design

The word "passive" in this context implies the ideal target that the only *energy* required to use the designed product or service comes from renewable sources.

Path dependence

The generic situation where decisions, events, or outcomes at one point in time constrain *adaptation*, *mitigation*, or other actions or options at a later point in time.

Payback period

Mostly used in investment appraisal as financial payback, which is the time needed to repay the initial investment by the returns of a project. A payback gap exists when, for example, private investors and micro-financing schemes require higher profitability rates from *renewable energy* projects than from fossil-fired projects. *Energy* payback is the time an *energy* project needs to deliver as much *energy* as had been used for setting the project online. Carbon payback is the time a *renewable energy* project needs to deliver as much net *greenhouse gas* savings (with respect to the fossil reference *energy* system) as its realization has caused greenhouse gas emissions from a perspective of *lifecycle assessment* (including *land use changes* and loss of terrestrial carbon stocks).

Perfluorocarbons (PFCs)

One of the six types of *greenhouse gases* to be mitigated under the *Kyoto Protocol*. *Perfluorocarbons* are by-products of aluminium smelting and uranium enrichment. They also replace *chlorofluorocarbons* in manufacturing semiconductors. See also *Global Warming Potential*.

Photovoltaic cells (PV)

Electronic devices that generate electricity from light *energy*. See also *Solar energy*.

Policies (for mitigation of or adaptation to climate change)

Policies are a course of action taken and/or mandated by a government, e.g. to enhance *mitigation* and *adaptation*. Examples of *policies* aimed at *mitigation* are support mechanisms for *renewable*

energy supplies, carbon or energy taxes, fuel efficiency standards for automobiles, etc. See also *Measures*.

Polluter pays principle

The party causing the pollution is responsible for paying for remediation or for compensating the damage.

Potential

The possibility of something happening or of someone doing something in the future. Different metrics are used throughout this report for the quantification of different types of potentials, including the following:

Technical potential

Technical potential is the amount by which it is possible to pursue a specific objective through an increase in deployment of technologies or implementation of practices that were not previously used or implemented. Quantification of technical potentials may take into account other than technical considerations, including social, economic and/or environmental considerations.

Precautionary Principle

A provision under Article 3 of the *UNFCCC*, stipulating that the Parties should take precautionary *measures* to anticipate, prevent, or minimize the causes of *climate change* and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason to postpone such *measures*, taking into account that *policies* and *measures* to deal with *climate change* should be cost-effective in order to ensure global benefits at the lowest possible cost.

Precursors

Atmospheric compounds that are not *greenhouse gases* or *aerosols*, but that have an effect on *greenhouse gas* or *aerosol* concentrations by taking part in physical or chemical processes regulating their production or destruction rates.

Present value

Amounts of money available at different dates in the future are discounted back to a present value, and summed to get the present value of a series of future cash flows. See also *Discounting*.

Primary production

All forms of production accomplished by plants, also called primary producers.

Production-based accounting

Production-based accounting provides a measure of emissions released to the *atmosphere* for the production of goods and services by a certain entity (e.g. person, firm, country, or region). See also *Consumption-based accounting*.

Public good

Public goods are non-rivalrous (goods whose consumption by one consumer does not prevent simultaneous consumption by other consumers) and non-excludable (goods for which it is not possible to prevent people who have not paid for it from having access to it).

Purchasing power parity (PPP)

The purchasing power of a currency is expressed using a basket of goods and services that can be bought with a given amount in the home country. International comparison of, for example, *Gross*

Domestic Products (GDP) of countries can be based on the purchasing power of currencies rather than on current exchange rates. PPP estimates tend to lower per capita *GDPs* in *industrialized countries* and raise per capita *GDPs* in *developing countries*. (PPP is also an acronym for *polluter pays principle*).

Radiation management

See *Solar Radiation Management*.

Radiative forcing

Radiative forcing is the change in the net, downward minus upward, radiative flux (expressed in W m^{-2}) at the tropopause or top of *atmosphere* due to a change in an external driver of *climate change*, such as, for example, a change in the concentration of *carbon dioxide* or the output of the Sun.

Rebound effect

Phenomena whereby the reduction in energy consumption or emissions (relative to a *baseline*) associated with the implementation of *mitigation measures* in a jurisdiction is offset to some degree through induced changes in consumption, production, and prices within the same jurisdiction. The rebound effect is most typically ascribed to technological energy efficiency improvements. See also *Leakage*.

Reduced Emissions from Deforestation and Forest Degradation (REDD)

An effort to create financial value for the carbon stored in *forests*, offering incentives for d*eveloping countries* to reduce emissions from forested lands and invest in low-carbon paths to *sustainable development*. It is therefore a mechanism for *mitigation* that results from avoiding *deforestation*. REDD+ goes beyond *reforestation* and *forest* degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks. The concept was first introduced in 2005 in the 11th session of the *COP* in Montreal and later given greater recognition in the 13th session of the *COP* in 2007 at Bali and inclusion in the Bali Action Plan which called for "policy approaches and positive incentives on issues relating to reducing emissions to deforestation and forest degradation in developing countries (REDD) and the role of conservation, sustainable management of forests and enhancement of forest carbon stock in developing countries". Since then, support for REDD has increased and has slowly become a framework for action supported by a number of countries.

Reference scenario

See *Baseline/reference*.

Reforestation

Planting of *forests* on lands that have previously sustained *forests* but that have been converted to some other use. Under the *UNFCCC* and the *Kyoto Protocol*, reforestation is the direct human-induced conversion of non-forested land to forested land through planting, seeding, and/or human-induced promotion of natural seed sources, on land that was previously forested but converted to non-forested land. For the first commitment period of the *Kyoto Protocol*, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989.

For a discussion of the term *forest* and related terms such as *afforestation*, reforestation and *deforestation*, see the IPCC Report on Land Use, Land-Use Change and Forestry (IPCC, 2000). See also the Report on Definitions and Methodological Options to Inventory Emissions from Direct Human-induced Degradation of Forests and Devegetation of Other Vegetation Types (IPCC, 2003).

Renewable energy

See *Energy*.

Representative Concentration Pathways (RCPs)

Scenarios that include time series of emissions and concentrations of the full suite of *greenhouse gases* and *aerosols* and chemically active gases, as well as *land use*/land cover (Moss et al., 2008). The word *representative* signifies that each RCP provides only one of many possible *scenarios* that would lead to the specific *radiative forcing* characteristics. The term *pathway* emphasizes that not only the long-term concentration levels are of interest, but also the trajectory taken over time to reach that outcome (Moss et al., 2010).

RCPs usually refer to the portion of the concentration pathway extending up to 2100, for which Integrated Assessment Models produced corresponding *emission scenarios*. Extended Concentration Pathways (ECPs) describe extensions of the RCPs from 2100 to 2500 that were calculated using simple rules generated by stakeholder consultations, and do not represent fully consistent *scenarios*.

Four RCPs produced from Integrated Assessment Models were selected from the published literature and are used in the present IPCC Assessment as a basis for the *climate predictions* and *projections* presented in WGI AR5 Chapters 11 to 14:

RCP2.6 One pathway where *radiative forcing* peaks at approximately 3 W m^{-2} before 2100 and then declines (the corresponding ECP assuming constant emissions after 2100);

RCP4.5 and RCP6.0 Two intermediate *stabilization* pathways in which *radiative forcing* is stabilized at approximately 4.5 W m^{-2} and 6.0 W m^{-2} after 2100 (the corresponding ECPs assuming constant concentrations after 2150);

RCP8.5 One high pathway for which *radiative forcing* reaches greater than 8.5 W m^{-2} by 2100 and continues to rise for some amount of time (the corresponding ECP assuming constant emissions after 2100 and constant concentrations after 2250).

For further description of future *scenarios*, see WGI AR5 Box 1.1. See also *Baseline*, *Climate prediction*, *Climate projection*, *Climate scenario*, *Shared socio-economic pathways*, *Socio-economic scenario*, *SRES scenarios*, and *Transformation pathway*.

Reservoir

A component of the *climate system*, other than the *atmosphere*, which has the capacity to store, accumulate or release a substance of concern, for example, carbon, a *greenhouse gas* or a *precursor*. Oceans, soils and *forests* are examples of reservoirs of carbon. Pool is an equivalent term (note that the definition of pool often includes the *atmosphere*). The absolute quantity of the substance of concern held within a reservoir at a specified time is called the stock. In the context of *Carbon Dioxide Capture and Storage (CCS)*, this term is sometimes used to refer to a geological carbon storage location. See also *Sequestration*.

Resilience

The capacity of a social-ecological system to cope with a hazardous event or disturbance, responding or reorganizing in ways that maintain its essential function, identity, and structure, while also maintaining the capacity for *adaptation*, learning, and transformation (Arctic Council, 2013).

Revegetation

A direct human-induced activity to increase carbon stocks on sites through the establishment of vegetation that covers a minimum area of 0.05 hectares and does not meet the definitions of *afforestation* and *reforestation* contained here (UNFCCC, 2002, p. 58).

Risk

The potential, when the outcome is uncertain, for adverse consequences on lives, livelihoods, health, *ecosystems*, economic, social and cultural assets, services (including environmental services), and infrastructure.

Risk assessment

The qualitative and/or quantitative scientific estimation of *risks*.

Risk management

The plans, actions, or policies implemented to reduce the likelihood and/or consequences of a given *risk*.

Risk perception

The subjective judgment that people make about the characteristics and severity of a *risk*.

Risk tradeoff

The change in the portfolio of *risks* that occurs when a countervailing *risk* is generated (knowingly or inadvertently) by an intervention to reduce the target *risk* (Wiener and Graham, 2009). See also *Adverse side-effect*, and *Co-benefit*.

Risk transfer

The practice of formally or informally shifting the *risk* of financial consequences for particular negative events from one party to another.

Scenario

A plausible description of how the future may develop based on a coherent and internally consistent set of assumptions about key driving forces (e.g., rate of *technological change*, prices) and relationships. Note that scenarios are neither predictions nor forecasts, but are useful to provide a view of the implications of developments and actions. See also *Baseline*, *Climate scenario*, *Emission scenario*, *Mitigation scenario*, *Representative Concentration Pathways*, *Shared socio-economic pathways*, *Socioeconomic scenarios*, *SRES scenarios*, *Stabilization*, and *Transformation pathway*.

Sectoral mechanism

A mechanism to limit *greenhouse gas* emissions designed to operate at the scale of a sector. These mechanisms may be market based, such as a cap and trade scheme, or operate on the basis of regulatory mechanisms such as technology standards in the context of a sector.

Sensitivity analysis

Sensitivity analysis with respect to quantitative analysis assesses how changing assumptions alters the outcomes. For example, one chooses different values for specific parameters and re-runs a given model to assess the impact of these changes on model output.

Sequestration

The uptake (i.e. the addition of a substance of concern to a *reservoir*) of carbon containing substances, in particular *carbon dioxide*, in terrestrial or marine *reservoirs*. Biological sequestration includes direct removal of *carbon dioxide* from the *atmosphere* through *land-use change*, *afforestation*, *reforestation*, *revegetation*, carbon storage in landfills, and practices that enhance soil carbon in agriculture (*cropland management*, *grazing land management*). In parts of the literature, but not in this report, (carbon) sequestration is used to refer to *Carbon Dioxide Capture and Storage*.

Shadow pricing

Setting prices of goods and services that are not, or are incompletely, priced by market forces or by administrative regulation, at the height of their social marginal value. This technique is used in *cost-benefit analysis (CBA)*.

Shared socio-economic pathways (SSPs)

Currently, the idea of shared socio-economic pathways (SSPs) is developed as a basis for new emissions and *socio-economic scenarios*. An SSP is one of a collection of pathways that describe alternative futures of socio-economic development in the absence of climate *policy* intervention. The combination of SSP-based *socio-economic scenarios* and *Representative Concentration Pathway*-based *climate projections* should provide a useful integrative frame for climate impact and policy analysis. See also *Baseline*, *Climate scenario*, *Emission scenario*, *Mitigation scenario*, *Scenario*, *SRES scenarios*, *Stabilization*, and *Transformation pathway*.

Short-lived climate pollutant (SLCP)

Short-lived climate pollutants (SLCPs) emissions that have a warming influence on *climate* and have a relatively short lifetime in the *atmosphere* (a few days to a few decades). The main short-lived climate pollutants are *black carbon* ("soot"), *methane* and some *hydroflurorcarbons (HFCs)* some of which are regulated under the *Kyoto Protocol*. Some pollutants of this type, including *methane*, are also *precursors* to the formation of tropospheric *ozone*, a strong warming agent. These pollutants are of interest for at least two reasons. First, because they are short-lived, efforts to control them will have prompt effects on *global warming* – unlike long-lived pollutants that build up in the *atmosphere* and respond to changes in emissions at a more sluggish pace. Second, many of these pollutants also have adverse local impacts such as on human health.

Sink

Any process, activity or mechanism that removes a *greenhouse gas*, an *aerosol* or a *precursor* of a *greenhouse g*as or *aerosol* from the *atmosphere*.

Smart grids

A smart grid uses information and communications technology to gather data on the *behaviours* of suppliers and consumers in the production, distribution, and use of electricity. Through automated responses or the provision of price signals, this information can then be used to improve the efficiency, reliability, economics, and *sustainability* of the electricity network.

Smart meter

A meter that communicates consumption of electricity or gas back to the utility provider.

Social cost of carbon (SCC)

The net present value of climate damages (with harmful damages expressed as a positive number) from one more tonne of carbon in the form of *carbon dioxide*, conditional on a global *baseline mitigation* trajectory over time with associated emissions.

Socio-economic scenario

A *scenario* that describes a possible future in terms of population, *gross domestic product (GDP)*, and other socio-economic factors relevant to understanding the implications of *climate change*. See also *Baseline*, *Climate scenario*, *Emission scenario*, *Mitigation scenario*, *Representative Concentration Pathways*, *Scenario*, *Shared socio-economic pathways*, *SRES scenarios*, *Stabilization*, and *Transformation pathway*.

Social unit costs of mitigation

Carbon prices, in value/t_{CO2} or value/$t_{CO2\text{-}eq}$, required to achieve a particular level of *mitigation* of *carbon dioxide* or *greenhouse gas (GHG)* emissions. The reduction is usually associated with a *policy* target, such as a *cap* in an *emissions trading* scheme or a given level of *stabilization* of *carbon dioxide* or *GHG* concentrations in the *atmosphere*.

Solar energy

Energy from the Sun. Often the phrase is used to mean *energy* that is captured from solar radiation either as heat, as light that is converted into chemical energy by natural or artificial photosynthesis, or by photovoltaic panels and converted directly into electricity.

Solar Radiation Management (SRM)

Refers to the intentional modification of the Earth's shortwave radiative budget with the aim to reduce *climate change* according to a given metric (e.g., surface temperature, precipitation, regional impacts, etc.). Artificial injection of stratospheric *aerosols* and cloud brightening are two examples of SRM techniques. Methods to modify some fast-responding elements of the longwave radiative budget (such as cirrus clouds), although not strictly speaking SRM, can be related to SRM. SRM techniques do not fall within the usual definitions of *mitigation* and *adaptation* (IPCC, 2012, p. 2). See also *Carbon Dioxide Removal* and *Geoengineering*.

Source

Any process, activity or mechanism that releases a *greenhouse* gas, an *aerosol* or a *precursor* of a *greenhouse gas* or *aerosol* into the *atmosphere*. Source can also refer to, e.g., an *energy* source.

Spill-over effect

The effects of domestic or sector *mitigation measures* on other countries or sectors. Spill-over effects can be positive or negative and include effects on trade, (carbon) *leakage*, transfer of innovations, and diffusion of environmentally sound technology and other issues.

SRES scenarios

SRES scenarios are *emission scenarios* developed by Nakićenović and Swart (2000) and used, among others, as a basis for some of the *climate projections* shown in Chapters 9 to 11 of IPCC (2001) and Chapters 10 and 11 of IPCC (2007). The following terms are relevant for a better understanding of the structure and use of the set of SRES scenarios:

Scenario family: *Scenarios* that have a similar demographic, societal, economic and technical change storyline. Four scenario families comprise the SRES scenario set: A1, A2, B1 and B2.

Illustrative Scenario: A *scenario* that is illustrative for each of the six scenario groups reflected in the Summary for Policymakers of Nakićenović and Swart (2000). They include four revised marker scenarios for the scenario groups A1B, A2, B1, B2, and two additional *scenarios* for the A1FI and A1T groups. All scenario groups are equally sound.

Marker Scenario: A *scenario* that was originally posted in draft form on the SRES website to represent a given scenario family. The choice of markers was based on which of the initial quantifications best reflected the storyline, and the features of specific models. Markers are no more likely than other scenarios, but are considered by the SRES writing team as illustrative of a particular storyline. They are included in revised form in Nakićenović and Swart (2000). These scenarios received the closest scrutiny of the entire writing team and via the SRES open process. *Scenarios* were also selected to illustrate the other two scenario groups.

Storyline: A narrative description of a *scenario* (or family of *scenarios*), highlighting the main *scenario* characteristics, relationships between key driving forces and the dynamics of their evolution.

See also *Baseline*, *Climate scenario*, *Emission scenario*, *Mitigation scenario*, *Representative Concentration Pathways*, *Shared socio-economic pathways*, *Socio-economic scenario*, *Stabilization*, and *Transformation pathway*.

Stabilization (of GHG or CO_2-equivalent concentration)

A state in which the atmospheric concentrations of one *greenhouse gas (GHG)* (e.g. *carbon dioxide*) or of a *CO_2-equivalent* basket of *GHGs* (or a combination of *GHGs* and *aerosols*) remains constant over time.

Standards

Set of rules or codes mandating or defining product performance (e.g. grades, dimensions, characteristics, test methods, and rules for use). Product, technology or performance standards establish minimum requirements for affected products or technologies. Standards impose reductions in *greenhouse gas (GHG)* emissions associated with the manufacture or use of the products and/or application of the technology.

Stratosphere

The highly stratified region of the *atmosphere* above the *troposphere* extending from about 10 km (ranging from 9 km at high latitudes to 16 km in the tropics on average) to about 50 km altitude.

Structural change

Changes, for example, in the relative share of *Gross Domestic Product (GDP)* produced by the industrial, agricultural, or services sectors of an economy; or more generally, systems transformations whereby some components are either replaced or potentially substituted by other components.

Subsidiarity

The principle that decisions of government (other things being equal) are best made and implemented, if possible, at the lowest most decentralized level, that is, closest to the citizen. Subsidiarity is designed to strengthen accountability and reduce the dangers of making decisions in places remote from their point of application. The principle does not necessarily limit or constrain the action of higher orders of government, but merely counsels against the unnecessary assumption of responsibilities at a higher level.

Sulphur hexafluoride (SF6)

One of the six types of *greenhouse gases* to be mitigated under the *Kyoto Protocol*. It is largely used in heavy industry to insulate high-voltage equipment and to assist in the manufacturing of cable-cooling systems and semi-conductors. See *Global Warming Potential*.

Sustainability

A dynamic process that guarantees the persistence of natural and human systems in an equitable manner.

Sustainable development (SD)

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987).

Technological change (TC)

Economic models distinguish autonomous (exogenous), endogenous, and induced technological change.

Autonomous (exogenous) technological change

Autonomous (exogenous) technological change is imposed from outside the model (i.e., as a parameter), usually in the form of a time trend affecting factor and/or energy productivity and therefore energy demand or output growth.

Endogenous technological change

Endogenous technological change is the outcome of economic activity within the model (i.e., as a variable) so that factor productivity or the choice of technologies is included within the model and affects energy demand and/or economic growth.

Induced technological change

Induced technological change implies endogenous technological change but adds further changes induced by *policies* and *measures*, such as *carbon taxes* triggering research and development efforts.

Technological learning

See *Learning curve/rate*.

Technological/knowledge spillovers

Any positive *externality* that results from purposeful investment in technological innovation or development (Weyant and Olavson, 1999).

Trace gas

A minor constituent of the *atmosphere*, next to nitrogen and oxygen that together make up 99% of all volume. The most important trace gases contributing to the *greenhouse effect* are *carbon dioxide*, *ozone*, *methane*, *nitrous oxide*, *perfluorocarbons*, *chlorofluorocarbons*, *hydrofluorocarbons*, *sulphur hexafluoride* and water vapour.

Tradable (green) certificates scheme

A market-based mechanism to achieve an environmentally desirable outcome (*renewable energy* generation, *energy efficiency* requirements) in a cost-effective way by allowing purchase and sale of certificates representing under and over-compliance respectively with a quota.

Tradable (emission) permit

See *Emission permit*.

Tradable quota system

See *Emissions trading*.

Transaction costs

The costs that arise from initiating and completing transactions, such as finding partners, holding negotiations, consulting with lawyers or other experts, monitoring agreements, or opportunity costs, such as lost time or resources (Michaelowa et al., 2003).

Transit oriented development

Urban development within walking distance of a transit station, usually dense and mixed with the character of a walkable environment.

Transformation pathway

The trajectory taken over time to meet different goals for *greenhouse gas (GHG)* emissions, atmospheric concentrations or temperature change, implying a set of economic, *technological*, and *behaviour changes*. This can encompass changes in the way energy and infrastructure is used and produced, natural resources are managed, *institutions* are set up, and in the pace and direction of *technological change*. See also *Baseline/reference*, *Climate scenario*, *Emission scenario*, *Mitigation scenario*, *Representative Concentration Pathways*, *Scenario*, *Shared socio-economic pathways*, *Socio-economic scenarios*, *SRES scenarios*, and *Stabilization*.

Troposphere

The lowest part of the *atmosphere*, from the surface to about 10 km in altitude at mid-latitudes (ranging from 9 km at 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 also *Stratosphere*.

Uncertainty

A cognitive state of incomplete knowledge that can result from a lack of information or from disagreement about what is known or even knowable. It may have many types of sources, from imprecision in the data to ambiguously defined concepts or terminology, or uncertain projections of human *behaviour*. Uncertainty can therefore be represented by quantitative measures (e.g., a probability density function) or by qualitative statements (e.g., reflecting the judgment of a team of experts) (see Moss and Schneider, 2000; Manning et al., 2004; Mastrandrea et al., 2010). See also *Agreement*, *Evidence*, *Confidence* and *Likelihood*.

Unconventional resources

A loose term to describe *fossil fuel* reserves that cannot be extracted by the well-established drilling and mining processes that dominated extraction of coal, gas and oil throughout the 20th Century. The boundary between conventional and unconventional resources is not clearly defined. Unconventional oils include oil shales, tar sands/bitumen, heavy and extra heavy crude oils, and deep-sea oil occurrences. Unconventional natural gas includes gas in Devonian shales, tight sandstone formations, geopressured aquifers, coal-bed gas, and methane in clathrate structures (gas hydrates) (Rogner, 1997).

United Nations Framework Convention on Climate Change (UNFCCC)

The Convention was adopted on 9 May 1992 in New York and signed at the 1992 Earth Summit in Rio de Janeiro by more than 150 countries and the European Community. Its ultimate objective is the 'stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system'. It contains commitments for all Parties under the principle of 'common but differentiated responsibilities'. Under the Convention, parties included in *Annex I* aimed to return *greenhouse gas* emissions not controlled by the *Montreal Protocol* to 1990 levels by the year 2000. The convention entered in force in March 1994. In 1997, the *UNFCCC* adopted the *Kyoto Protocol*.

Urban heat island

See *Heat island*.

Verified Emissions Reductions

Emission reductions that are verified by an independent third party outside the framework of the *UNFCCC* and its *Kyoto Protocol*. Also called Voluntary Emission Reductions.

Volatile Organic Compounds (VOCs)

Important class of organic chemical air pollutants that are volatile at ambient air conditions. Other terms used to represent VOCs are *hydrocarbons* (HCs), *reactive organic gases* (ROGs) and *non-methane volatile organic compounds* (NMVOCs). NMVOCs are major contributors – together with *nitrogen oxides (NO_X)*, and carbon monoxide (CO) – to the formation of photochemical oxidants such as *ozone*.

Voluntary action

Informal programmes, self-commitments, and declarations, where the parties (individual companies or groups of companies) entering into the action set their own targets and often do their own monitoring and reporting.

Voluntary agreement

An agreement between a government authority and one or more private parties to achieve environmental objectives or to improve environmental performance beyond compliance with regulated obligations. Not all voluntary agreements are truly voluntary; some include rewards and/or penalties associated with joining or achieving commitments.

Voluntary Emission Reductions

See *Verified Emissions Reductions*.

Wind energy

Kinetic *energy* from air currents arising from uneven heating of the Earth's surface. A wind turbine is a rotating machine for converting the kinetic energy of the wind to mechanical shaft energy to generate electricity. A windmill has oblique vanes or sails and the mechanical power obtained is mostly used directly, for example, for water pumping. A wind farm, wind project, or wind power plant is a group of wind turbines interconnected to a common utility system through a system of transformers, distribution lines, and (usually) one substation.

References

United Nations Secretary General's Advisory Group on Energy and Climate (AGECC) (2010). *Energy for a Sustainable Future. New York, NY, USA.*

Arctic Council (2013). Glossary of terms. In: *Arctic Resilience Interim Report 2013*. Stockholm Environment Institute and Stockholm Resilience Centre, Stockholm, Sweden.

Brunner, P. H. and H. Rechberger (2004). Practical handbook of material flow analysis. *The International Journal of Life Cycle Assessment*, **9**(5), 337-338.

Cobo, J.R.M. (1987). *Study of the problem of discrimination against indigenous populations*. Sub-commission on Prevention of Discrimination and Protection of Minorities. New York: United Nations, 1987.

Ehrlich, P. R. and J.P. Holdren (1971). Impact of population growth. *Science*, **171**(3977), 1212-1217.

Food and Agricultural Organization of the United Nations (FAO) (2000). *State of food insecurity in the world 2000.* Rome, Italy.

Hertel, T. T. W. (1997). *Global trade analysis: modeling and applications*. T. W. Hertel (Ed.). Cambridge University Press, Cambridge, United Kingdom.

Heywood, V.H. (ed.) (1995). *The Global Biodiversity Assessment.* United Nations Environment Programme. Cambridge University Press, Cambridge, United Kingdom.

IPCC (1992). *Climate Change 1992: The Supplementary Report to the IPCC Scientific Assessment* [Houghton, J.T., B.A. Callander, and S.K. Varney (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 116 pp.

IPCC (1996). *Climate Change 1995: The Science of Climate Change. Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change* [Houghton, J.T., L.G. Meira Filho, B.A. Callander, N. Harris, A. Kattenberg, and K. Maskell (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 572 pp.

IPCC (2000). *Land Use, Land-Use Change, and Forestry. Special Report of the Intergovernmental Panel on Climate Change* [Watson, R.T., I.R. Noble, B. Bolin, N.H. Ravindranath, D.J. Verardo, and D.J. Dokken (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 377 pp.

IPCC (2001). *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* [Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 881 pp.

IPCC (2003). *Definitions and Methodological Options to Inventory Emissions from Direct Human-Induced Degradation of Forests and Devegetation of Other Vegetation Types* [Penman, J., M. Gytarsky, T. Hiraishi, T. Krug, D. Kruger, R. Pipatti, L. Buendia, K. Miwa, T. Ngara, K. Tanabe, and F. Wagner (eds.)]. The Institute for Global Environmental Strategies (IGES), Japan , 32 pp.

IPCC (2007). *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, M. Marquis, K. Averyt, M.M.B. Tignor, H.L. Miller Jr., and Z. Chen (eds)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.

IPCC (2012). *Meeting Report of the Intergovernmental Panel on Climate Change Expert Meeting on Geoengineering* [O. Edenhofer, R. Pichs-Madruga, Y. Sokona, C. Field, V. Barros, T.F. Stocker, Q. Dahe, J. Minx, K. Mach, G.-K. Plattner, S. Schlömer, G. Hansen, and M. Mastrandrea (eds.)]. IPCC Working Group III Technical Support Unit, Potsdam Institute for Climate Impact Research, Potsdam, Germany, 99 pp.

Manning, M.R., M. Petit, D. Easterling, J. Murphy, A. Patwardhan, H-H. Rogner, R. Swart, and G. Yohe (eds.) (2004). *IPCC Workshop on Describing Scientific Uncertainties in Climate Change to Support Analysis of Risk of Options*. Workshop Report. Intergovernmental Panel on Climate Change, Geneva, Switzerland.

Mastrandrea, M.D., C.B. Field, T.F. Stocker, O. Edenhofer, K.L. Ebi, D.J. Frame, H. Held, E. Kriegler, K.J. Mach, P.R. Matschoss, G.-K. Plattner, G.W. Yohe, and F.W. Zwiers (2010). Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties. Intergovernmental Panel on Climate Change (IPCC). Published online at: http://www.ipcc-wg2.gov/meetings/CGCs/index.html#UR

Michaelowa, A., M. Stronzik., F. Eckermann, and A. Hunt (2003). Transaction costs of the Kyoto Mechanisms. *Climate policy*, **3**(3), 261-278.

Millennium Ecosystem Assessment (MEA) (2005). *Ecosystems and Human Well-being: Current States and Trends*. World Resources Institute, Washington, D.C. [Appendix D, p. 893].

Moss, R., and S. Schneider (2000). Uncertainties in the IPCC TAR: Recommendations to Lead Authors for More Consistent Assessment and Reporting. In: *IPCC Supporting Material: Guidance Papers on Cross Cutting Issues in the Third Assessment Report of the IPCC* [Pachauri, R., T. Taniguchi, and K. Tanaka (eds.)]. Intergovernmental Panel on Climate Change, Geneva, Switzerland, pp. 33–51.

Moss, R., M. Babiker, S. Brinkman, E. Calvo, T. Carter, J. Edmonds, I. Elgizouli, S. Emori, L. Erda, K. Hibbard, R. Jones, M. Kainuma, J. Kelleher, J.F. Lamarque, M. Manning, B. Matthews, J. Meehl, L. Meyer, J. Mitchell, N. Nakicenovic, B. O'Neill, R. Pichs, K. Riahi, S. Rose, P. Runci, R. Stouffer, D. van Vuuren, J. Weyant, T. Wilbanks, J.P. van Ypersele, and M. Zurek (2008). *Towards new scenarios for analysis of emissions, climate change, impacts and response strategies*. Intergovernmental Panel on Climate Change, Geneva, Switzerland, 132 pp.

Moss, R., J.A. Edmonds, K.A. Hibbard, M.R. Manning, S.K. Rose, D.P. van Vuuren, T.R. Carter, S. Emori, M. Kainuma, T. Kram, G.A. Meehl, J.F.B. Mitchell, N. Nakicenovic, K. Riahi, S.J. Smith, R.J. Stouffer, A.M. Thomson, J.P. Weyant, and T.J. Wilbanks (2010). The next generation of scenarios for climate change research and assessment. *Nature*, **463**, 747-756.

Nakićenović, N. and R. Swart (eds.) (2000). Special Report on Emissions Scenarios. A Special Report of Working Group III of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 599 pp.

Rogner, H. H. (1997). An assessment of world hydrocarbon resources. *Annual review of energy and the environment*, **22**(1), 217-262.

UNFCCC (2000). Report on the Conference of the Parties on its Seventh Session, held at Marrakesh from 29 October to 10 November 2001. Addendum. Part Two: Action Taken by the Conference of the Parties. (FCCC/CP/2001/13/Add.1).

United Nations Convention to Combat Desertification (UNCCD) (1994). *Article 1: Use of terms*. United Nations Convention to Combat Desertification. 17 June 1994: Paris, France.

Weyant, J. P. and T. Olavson (1999). Issues in modeling induced technological change in energy, environmental, and climate policy. Environmental Modeling & Assessment, 4(2-3), 67-85.

World Business Council on Sustainable Development (WBCSD) and World Resources Institute (WRI). (2004). *The Greenhouse Gas Protocol - A Corporate Accounting and Reporting Standard*. Geneva and Washington, DC.

Wiedmann, T. and J. Minx (2007). A definition of'carbon footprint. *Ecological economics research trends*, **1**, 1-11.

Wiener, J. B. and J. D. Graham (2009). *Risk vs. risk: Tradeoffs in protecting health and the environment*. Harvard University Press, Cambridge, MA, USA.

World Commission on Environment and Development (WCED) (1987). *Our Common Future*. Oxford University Press, Oxford, United Kingdom.