

Annex I

Glossary

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Notes: Glossary entries (highlighted in **bold**) are by preference subjects; a main entry can contain **subentries**, also in bold, e.g. **Final Energy** is defined under the entry **Energy**. Some definitions are adapted from Cleveland C.J. and C. Morris, 2006: Dictionary of Energy, Elsevier, Amsterdam. The Glossary is followed by a list of Acronyms/Abbreviations and by a list of Chemical Compounds (Annex II).

Activities Implemented Jointly (AIJ)

The pilot phase for Joint Implementation, as defined in Article 4.2(a) of the UNFCCC, which allows for project activity among developed countries (and their companies) and between developed and developing countries (and their companies). AIJ is intended to allow parties to the UNFCCC to gain experience in jointly implemented projects. AIJ under the pilot phase do not lead to any credits. Decisions remain about the future of AIJ projects and how they may relate to the Kyoto Mechanisms. As a simple form of tradable permits, AIJ and other market-based schemes represent potential mechanisms for stimulating additional resource flows for reducing emissions. See also Clean Development Mechanism, and Emissions Trading.

Actual net greenhouse gas removals by sinks

The sum of the verifiable changes in carbon stocks in the carbon pools within the project boundary of an afforestation or reforestation project, minus the increase in GHG emissions as a result of the implementation of the project activity. The term stems from the Clean Development Mechanism (CDM) afforestation and reforestation modalities and procedures.

Adaptation

Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. Various types of adaptation exist, e.g. anticipatory and reactive, private and public, and autonomous and planned. Examples are raising river or coastal dikes, the substitution of more temperature-shock resistant plants for sensitive ones, etc.

Adaptive capacity

The whole of capabilities, resources and institutions of a country or region to implement effective adaptation measures.

Additionality

Reduction in emissions by sources or enhancement of removals by sinks that is additional to any that would occur in the absence of a Joint Implementation (JI) or a Clean Development Mechanism (CDM) project activity as defined in the Kyoto Protocol Articles on JI and CDM. This definition may be further broadened to include financial, investment, technology, and environmental additionality. Under **financial additionality**, the project activity funding is additional to existing Global Environmental Facility, other financial commitments of parties included in Annex I, Official Development Assistance, and other systems of cooperation. Under **investment additionality**, the value of the Emissions Reduction Unit/Certified Emission Reduction Unit shall significantly improve the financial or commercial viability of the project activity. Under **technology additionality**, the technology used for the project activity shall be the best available for the circumstances of the host party. **Environmental additionality** refers to the environmental integrity of the claimed amount by which greenhouse gas emissions are reduced due to a project relative to its baseline. A project activity is further additional, if the incentive from the sale of emission allowances helps to overcome barriers to its implementation.

Aerosols

A collection of airborne solid or liquid particles, typically between 0.01 and 10 µm in size and residing in the atmosphere for at least several hours. Aerosols may be of either natural or anthropogenic origin. Aerosols may influence climate in several ways: directly through scattering and absorbing radiation, and indirectly through acting as condensation nuclei for cloud formation or modifying the optical properties and lifetime of clouds.

Afforestation

Direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources.¹ See also Re- and Deforestation.

Agreement

In this Report, the degree of agreement is the relative level of convergence of the literature as assessed by the authors.

Alliance of Small Island States (AOSIS)

Formed at the Second World Climate Conference (1990). AOSIS comprises small-island and low-lying coastal developing countries that are particularly vulnerable to the adverse consequences of climate change, such as sea-level rise, coral bleaching, and the increased frequency and intensity of tropical storms. With more than 35 states from the Atlantic, Caribbean, Indian Ocean, Mediterranean, and Pacific, AOSIS share common objectives on environmental and sustainable development matters in the UNFCCC process.

Ancillary benefits

Policies aimed at some target, e.g. climate change mitigation, may be paired with positive side effects, such as increased resource-use efficiency, reduced emissions of air pollutants associated with fossil fuel use, improved transportation, agriculture, land-use practices, employment, and fuel security. **Ancillary impacts** is also used when the effects may be negative. Policies directed at abating air pollution may consider greenhouse-gas mitigation an ancillary benefit, but this perspective is not considered in this assessment. See also **co-benefits**.

Annex I countries

The group of countries included in Annex I (as amended in 1998) to the UNFCCC, including all the OECD countries and economies in transition. Under Articles 4.2 (a) and 4.2 (b) of the Convention, Annex I countries committed themselves specifically to the aim of returning individually or jointly to their 1990 levels of greenhouse-gas emissions by the year 2000. By default, the other countries are referred to as Non-Annex I countries.

¹ For a discussion of the term *forest* and related terms such as *afforestation*, *reforestation*, and *deforestation* (ARD), see the IPCC Special Report on Land Use, Land-Use Change and Forestry, Cambridge University Press, 2000.

Annex II countries

The group of countries included in Annex II to the UNFCCC, including all OECD countries. Under Article 4.2 (g) of the Convention, these countries are expected to provide financial resources to assist developing countries to comply with their obligations, such as preparing national reports. Annex II countries are also expected to promote the transfer of environmentally sound technologies to developing countries.

Annex B countries

The countries included in Annex B to the Kyoto Protocol that have agreed to a target for their greenhouse-gas emissions, including all the Annex I countries (as amended in 1998) except for Turkey and Belarus.

Anthropogenic emissions

Emissions of greenhouse gases, greenhouse-gas precursors, and aerosols associated with human activities. These include the burning of fossil fuels, deforestation, land-use changes, livestock, fertilization, etc. that result in a net increase in emissions.

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 ceiling for its emissions in the first 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; 93% for the USA).

Assigned Amount Unit (AAU)

An AAU equals 1 tonne (metric ton) of CO₂-equivalent emissions calculated using the Global Warming Potential.

Backstop technology

Models estimating mitigation often characterize an arbitrary carbon-free technology (often for power generation) that becomes available in the future in unlimited supply over the horizon of the model. This allows models to explore the consequences and importance of a generic solution technology without becoming enmeshed in picking the technology. This "backstop" technology might be a nuclear technology, fossil technology with capture and sequestration, solar, 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

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).

Barrier

Any obstacle to reaching a goal, adaptation or mitigation potential that can be overcome or attenuated by a policy, programme, or measure. **Barrier removal** includes correcting market failures directly or reducing the transactions costs in the public and private sectors by e.g. improving institutional capacity, reducing risk and uncertainty, facilitating market transactions, and enforcing regulatory policies.

Baseline

The reference for measurable quantities from which an alternative outcome can be measured, e.g. a non-intervention scenario is used as a reference in the analysis of intervention scenarios.

Benchmark

A measurable variable used as a baseline or reference in evaluating the performance of an organization. Benchmarks may be drawn from internal experience, that of other organizations or from legal requirement and are often used to gauge changes in performance over time.

Benefit transfer

An application of monetary values from one particular analysis to another policy-decision setting, often in a geographic area other than the one in which the original study was performed.

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.

Biocovers

Layers placed on top of landfills that are biologically active in oxidizing methane into CO₂.

Biofilters

Filters using biological material to filter or chemically process pollutants like oxidizing methane into CO₂.

Biodiversity

The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Bioenergy

Energy derived from biomass.

Biofuel

Any liquid, gaseous, or solid fuel produced from plant or animal organic matter. E.g. soybean oil, alcohol from fermented sugar, black liquor from the paper manufacturing process, wood as fuel, etc. **Second-generation biofuels** are products such as ethanol and biodiesel derived from ligno-cellulosic biomass by chemical or biological processes.

Biological options

Biological options for mitigation of climate change involve one or more of the three strategies: conservation - conserving an existing carbon pool, thereby preventing CO₂ emissions to the atmosphere; sequestration - increasing the size of existing carbon pools, thereby extracting CO₂ from the atmosphere; substitution - substituting biomass for fossil fuels or energy-intensive products, thereby reducing CO₂ emissions.

Biomass

The total mass of living organisms in a given area or of a given species usually expressed as dry weight. Organic matter consisting of, or recently derived from, living organisms (especially regarded as fuel) excluding peat. Biomass includes products, by-products and waste derived from such material. **Cellulosic biomass** is biomass from cellulose, the primary structural component of plants and trees

Black Carbon

Particle matter in the atmosphere that consists of soot, charcoal and/or possible light-absorbing refractory organic material. Black carbon is operationally defined matter based on measurement of light absorption and chemical reactivity and/or thermal stability.

Bottom-up models

Models represent reality by aggregating characteristics of specific activities and processes, considering technological, engineering and cost details. See also **top-down models**.

Bubble

Policy instrument for pollution abatement named for its treatment of multiple emission points as if they were contained in an imaginary bubble. Article 4 of the Kyoto Protocol allows a group of countries to meet their target listed in Annex B jointly by aggregating their total emissions under one 'bubble' and sharing the burden (e.g. the EU).

Carbon Capture and Storage (CCS)

A process consisting of separation of CO₂ from industrial and energy-related sources, transport to a storage location, and long-term isolation from the atmosphere.

Carbon cycle

The set of processes such as photosynthesis, respiration, decomposition, and air-sea exchange, by which carbon continuously cycles through various reservoirs, such as the atmosphere, living organisms, soils, and oceans.

Carbon dioxide (CO₂)

CO₂ is a naturally occurring gas, and a by-product of burning fossil fuels or biomass, of land-use changes and of industrial processes. It is the principal anthropogenic greenhouse gas that affects Earth's radiative balance. It is the reference gas against which other greenhouse gases are measured and therefore it has a Global Warming Potential of 1.

Carbon dioxide fertilization

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

Carbon intensity

The amount of emissions of CO₂ per unit of GDP.

Carbon leakage

The part of emissions reductions in Annex B countries that may be offset by an increase of the emissions in the non-constrained countries above their baseline levels. This can occur through (1) relocation of energy-intensive production in non-constrained regions; (2) increased consumption of fossil fuels in these regions through decline in the international price of oil and gas triggered by lower demand for these energies; and (3) changes in incomes (thus in energy demand) because of better terms of trade. Leakage also refers to GHG-related effects of GHG-emission reduction or CO₂-sequestration project activities that occur outside the project boundaries and that are measurable and attributable to the activity. On most occasions, leakage is understood as counteracting the initial activity. Nevertheless, there may be situations where effects attributable to the activity outside the project area lead to GHG-emission reductions. These are commonly called spill-over. While (negative) leakage leads to a discount of emission reductions as verified, positive spill-over may not in all cases be accounted for.

Carbon pool

Carbon pools are: above-ground biomass, belowground biomass, litter, dead wood and soil organic carbon. CDM project participants may choose not to account one or more carbon pools if they provide transparent and verifiable information showing that the choice will not increase the expected net anthropogenic GHG removals by sinks.

Carbon price

What has to be paid (to some public authority as a tax rate, or on some emission permit exchange) for the emission of 1 tonne of CO₂ into the atmosphere. In the models and this Report, the carbon price is the social cost of avoiding an additional unit of CO₂ equivalent emission. In some models it is represented by the shadow price of

an additional unit of CO₂ emitted, in others by the rate of carbon tax, or the price of emission-permit allowances. It has also been used in this Report as a cut-off rate for marginal abatement costs in the assessment of economic mitigation potentials.

Cap

Mandated restraint as an upper limit on emissions. The Kyoto Protocol mandates emissions caps in a scheduled timeframe on the anthropogenic GHG emissions released by Annex B countries. By 2008-2012 the EU e.g. must reduce its CO₂-equivalent emissions of six greenhouse gases to a level 8% lower than the 1990-level.

Capacity building

In the context of climate change, capacity building is developing technical skills and institutional capabilities in developing countries and economies in transition to enable their participation in all aspects of adaptation to, mitigation of, and research on climate change, and in the implementation of the Kyoto Mechanisms, etc.

CCS-ready

If rapid deployment of CCS is desired, new power plants 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 reservoirs.

Certified Emission Reduction Unit (CER)

Equal to one metric tonne of CO₂-equivalent emissions reduced or sequestered through a Clean Development Mechanism project, calculated using Global Warming Potentials. In order to reflect potential non-permanence of afforestation and reforestation project activities, the use of temporary certificates for Net Anthropogenic Greenhouse Gas Removal was decided by COP 9. See also **Emissions Reduction Units**.

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.

Chlorofluorocarbons (CFCs)

Greenhouse gases covered under the 1987 Montreal Protocol and used for refrigeration, air conditioning, packaging, 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. These gases are being replaced by other compounds, including hydrochlorofluorocarbons and hydrofluorocarbons, which are greenhouse gases covered under the Kyoto Protocol.

Clean Development Mechanism (CDM)

Defined in Article 12 of the Kyoto Protocol, the CDM is intended to meet two objectives: (1) to assist parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the convention; and (2) to assist parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments. Certified Emission Reduction Units from CDM projects undertaken in Non-Annex I countries that limit or reduce GHG emissions, when certified by operational entities designated by Conference of the Parties/ Meeting of the Parties, can be accrued to the investor (government or industry) from parties in Annex B. A share of the proceeds from certified project activities is used to cover administrative expenses as well as to assist developing country parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation.

Climate Change (CC)

Climate change refers to a change in the state of the climate that can be identified (e.g. 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, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

Note that 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.

Climate feedback

An interaction mechanism between processes in the climate system is a climate feedback when the result of an initial process triggers changes in secondary processes that in turn influence the initial one. A positive feedback intensifies the initial process; a negative feedback reduces the initial process. Example of a **positive climate feedback**: higher temperatures as initial process cause melting of the arctic ice leading to less reflection of solar radiation, what leads to higher temperatures. Example of a **negative feedback**: higher temperatures increase the amount of cloud cover (thickness or extent) that could reduce incoming solar radiation and so limit the increase in temperature.

Climate sensitivity

In IPCC Reports, equilibrium climate sensitivity refers to the equilibrium change in annual mean global surface temperature following a doubling of the atmospheric CO₂-equivalent concentration. The evaluation of the equilibrium climate sensitivity is expensive and often hampered by computational constraints.

The **effective climate sensitivity** is a related measure that circumvents the computational problem by avoiding the requirement of equilibrium. It is evaluated from model output for evolving non-equilibrium conditions. It is a measure of the strengths of the feedbacks at a particular time and may vary with forcing history and climate state. The climate sensitivity parameter refers to the equilibrium change in the annual mean global surface temperature following a unit change in radiative forcing (K/W/m²)

The **transient climate response** is the change in the global surface temperature, averaged over a 20-year period, centred at the time of CO₂ doubling, i.e., at year 70 in a 1% per year compound CO₂ increase experiment with a global coupled climate model. It is a measure of the strength and rapidity of the surface temperature response to greenhouse gas forcing.

Climate threshold

The point at which the atmospheric concentration of greenhouse gases triggers a significant climatic or environmental event, which is considered unalterable, such as widespread bleaching of corals or a collapse of oceanic circulation systems.

CO₂-equivalent concentration

The concentration of carbon dioxide that would cause the same amount of radiative forcing as a given mixture of carbon dioxide and other greenhouse gases.

CO₂-equivalent emission

The amount of CO₂ emission that would cause the same radiative forcing as an emitted amount of a well mixed greenhouse gas, or a mixture of well mixed greenhouse gases, all multiplied with their respective Global Warming Potentials to take into account the differing times they remain in the atmosphere.

Co-benefits

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

Co-generation

The use of waste heat from thermal electricity-generation plants. The heat is e.g. condensing heat from steam turbines or hot flue gases exhausted from gas turbines, for industrial use, buildings or district heating. Synonym for **Combined Heat and Power (CHP)** generation.

Combined-cycle Gas Turbine (CCGT)

Power plant that combines two processes for generating electricity. First, gas or light fuel oil feeds a gas turbine that inevitably exhausts hot flue gases (>800°C). Second, heat recovered from these gases, with additional firing, is the source for producing steam that drives a steam turbine. The turbines rotate separate alternators.

It becomes an **integrated CCGT** when the fuel is syngas from a coal or biomass gasification reactor with exchange of energy flows between the gasification and CCGT plants.

Compliance

Compliance is whether and to what extent countries do adhere to the provisions of an accord. Compliance depends on implementing policies ordered, and on whether measures follow up the policies. Compliance is the degree to which the actors whose behaviour is targeted by the agreement, local government units, corporations, organizations or individuals, conform to the implementing obligations. See also **implementation**.

Conference of the Parties (COP)

The supreme body of the UNFCCC, comprising countries with right to vote that have ratified or acceded to the convention. The first session of the Conference of the Parties (COP-1) was held in Berlin (1995), followed by 2.Geneva (1996), 3.Kyoto (1997), 4.Buenos Aires (1998), 5.Bonn (1999), 6.The Hague/Bonn (2000, 2001), 7.Marrakech (2001), 8.Delhi (2002), 9.Milan (2003), 10.Buenos Aires (2004), 11.Montreal (2005), 12.Nairobi (2006). See also **Meeting of the Parties (MOP)**.

Contingent Valuation Method (CVM)

CVM is 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. A survey of people are asked their willingness to pay 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. See also **values**.

Cost

The consumption of resources such as labor time, capital, materials, fuels and so on as the consequence of an action. In economics all resources are valued at their **opportunity cost**, being the value of the most valuable alternative use of the resources. Costs are defined in a variety of ways and under a variety of assumptions that affect their value

Cost types include: **administrative costs** of planning, management, monitoring, audits, accounting, reporting, clerical activities, etc. associated with a project or programme; **damage costs** to ecosystems, economies and people due to negative effects from climate change; **implementation costs** of changing existing rules and regulation, capacity building efforts, information, training and education, etc. to put a policy into place; **private costs** are carried

by individuals, companies or other private entities that undertake the action, where **social costs** include additionally the external costs on the environment and on society as a whole.

Costs can be expressed as **total, average (unit, specific)** being the total divided by the number of units of the item for which the cost is being assessed, and **marginal or incremental** costs as the cost of the last additional unit.

The perspectives adopted in this report are: **Project level** considers a “standalone” activity that is assumed not to have significant indirect economic impacts on markets and prices (both demand and supply) beyond the activity itself. The activity can be the implementation of specific technical facilities, infrastructure, demand-side regulations, information efforts, technical standards, etc. **Technology level** considers a specific greenhouse-gas mitigation technology, usually with several applications in different projects and sectors. The literature on technologies covers their technical characteristics, especially evidence on learning curves as the technology diffuses and matures. **Sector level** considers sector policies in a “partial-equilibrium” context, for which other sectors and the macroeconomic variables are assumed to be as given. The policies can include economic instruments related to prices, taxes, trade, and financing, specific large-scale investment projects, and demand-side regulation efforts. **Macroeconomic level** considers the impacts of policies on real income and output, employment and economic welfare across all sectors and markets. The policies include all sorts of economic policies, such as taxes, subsidies, monetary policies, specific investment programmes, and technology and innovation policies. The negative of costs are benefits, and often both are considered together.

Cost-benefit analysis

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 analysis

A special case of cost-benefit analysis in which all the costs of a portfolio of projects are assessed in relation to a fixed policy goal. The policy goal in this case represents the benefits of the projects and all the other impacts are measured as costs or as negative costs (co-benefits). The policy goal can be, for example, a specified goal of emissions reductions of greenhouse gases.

Crediting period

The CDM crediting period is the time during which a project activity is able to generate GHG-emission reduction or CO₂ removal certificates. Under certain conditions, the crediting period can be renewed up to two times.

Deforestation

The natural or anthropogenic process that converts forest land to non-forest. See **afforestation** and **reforestation**.

Demand-side management (DSM)

Policies and programmes for influencing the demand for goods and/or services. In the energy sector, DSM aims at reducing the demand for electricity and energy sources. DSM helps to reduce greenhouse gas emissions.

Dematerialization

The process by which economic activity is decoupled from matter–energy throughput, through processes such as eco-efficient production or industrial ecology, allowing environmental impact to fall per unit of economic activity.

Deposit-refund system

A deposit or fee (tax) is paid when acquiring a commodity and a

refund or rebate is received for implementation of a specified action (mostly delivering the commodity at a particular place).

Desertification

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

Devegetation

This is loss of vegetation density within one land-cover class.

Development path

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 production and consumption patterns in all countries, over time at a particular scale. **Alternative development paths** refer to different possible trajectories of development, the continuation of current trends being just one of the many paths.

Discounting

A mathematical operation making monetary (or other) amounts received or expended at different points in time (years) comparable across time. The operator uses a fixed or possibly time-varying discount rate (>0) from year to year that makes future value worth less today. In a **descriptive discounting approach** one accepts the discount rates people (savers and investors) actually apply in their day-to-day decisions (**private discount rate**). In a **prescriptive (ethical or normative) discounting approach** the discount rate is fixed from a social perspective, e.g. based on an ethical judgement about the interests of future generations (**social discount rate**).

District heating

Hot water (steam in old systems) is distributed from central stations to buildings and industries in a densely occupied area (a district, a city or an industrialized area such as the Ruhr or Saar in Germany). The insulated two-pipe network functions like a water-based central heating system in a building. The central heat sources can be waste-heat recovery at industrial processes, waste-incineration plants, cogeneration power plants or stand-alone boilers burning fossil fuels or biomass.

Double dividend

The extent to which revenue-generating instruments, such as carbon taxes or auctioned (tradable) carbon emission permits can (1) limit or reduce 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. In a world with involuntary unemployment, the climate change policy adopted may have an effect (a positive or negative ‘third dividend’) on employment. **Weak double dividend** occurs as long as there is a revenue-recycling effect. That is, revenues are recycled through reductions in the marginal rates of distorting taxes. **Strong double dividend** requires that the (beneficial) revenue-recycling effect more than offsets the combination of the primary cost and in this case, the net cost of abatement is negative. See also **interaction effect**.

Economies in Transition (EITs)

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

Economies of scale (scale economies)

The unit cost of an activity declines when the activity is extended (e.g., more units are produced).

Ecosystem

A system of living organisms interacting with each other and their physical environment. The boundaries of what could be called an ecosystem are somewhat arbitrary, depending on the focus of interest or study. Thus, the extent of an ecosystem may range from very small spatial scales to the entire planet Earth ultimately.

Emissions Direct / Indirect

Direct emissions or “point of emission” are defined at the point in the energy chain where they are released and are attributed to that point in the energy chain, whether a sector, a technology or an activity. E.g. emissions from coal-fired power plants are considered direct emissions from the energy supply sector. **Indirect emissions** or emissions “allocated to the end-use sector” refer to the energy use in end-use sectors and account for the emissions associated with the upstream production of the end-use energy. E.g. some emissions associated with electricity generation can be attributed to the buildings sector corresponding to the building sector’s use of electricity.

Emission factor

An emission factor is the rate of emission per unit of activity, output or input. E.g. a particular fossil fuel power plant has a CO₂ emission factor of 0.765 kg/kWh generated.

Emission permit

An emission permit is a non-transferable or tradable entitlement allocated by a government to a legal entity (company or other emitter) to emit a specified amount of a substance. A **tradable permit** is an economic policy instrument under which rights to discharge pollution - in this case an amount of greenhouse gas emissions - can be exchanged through either a free or a controlled permit-market.

Emission quota

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

Emissions Reduction Unit (ERU)

Equal to one metric tonne of CO₂-equivalent emissions reduced or sequestered arising from a Joint Implementation (defined in Article 6 of the Kyoto Protocol) project. See also **Certified Emission Reduction Unit** and **emissions trading**.

Emission standard

A level of emission 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 approach to achieving environmental objectives. It allows those reducing GHG emissions below their emission cap to use or trade the excess reductions to offset emissions at another source inside or outside the country. In general, trading can occur at the intra-company, domestic, and international levels. The Second Assessment Report by the IPCC adopted the convention of using permits for domestic trading systems and quotas for international trading systems. Emissions trading under Article 17 of the Kyoto Protocol is a tradable quota system based on the assigned amounts calculated from the emission reduction and limitation commitments listed in Annex B of the Protocol.

Emission trajectories

These are projections of future emission pathways, or observed emission patterns.

Energy

The amount of work or heat delivered. Energy is classified in a variety of types and becomes useful to human ends when it flows from one place to another or is converted from one type into another. **Primary energy** (also referred to as energy sources) is the energy embodied in natural resources (e.g., coal, crude oil, natural gas, uranium) that has not undergone any anthropogenic conversion. It is transformed into **secondary energy** by cleaning (natural gas), refining (oil in 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** (e.g., light). Daily, the sun supplies large quantities of energy as rainfall, winds, radiation, etc. Some share is stored in biomass or rivers that can be harvested by men. Some share is directly usable such as daylight, ventilation or ambient heat. **Renewable energy** is obtained from the continuing or repetitive currents of energy occurring in the natural environment and includes non-carbon technologies such as solar energy, hydropower, wind, tide and waves and geothermal heat, as well as carbon-neutral technologies such as biomass. **Embodied energy** is the energy used to produce a material substance (such as processed metals or building materials), taking into account energy used at the manufacturing facility (zero order), energy used in producing the materials that are used in the manufacturing facility (first order), and so on.

Energy efficiency

The ratio of useful energy output of a system, conversion process or activity to its energy input.

Energy intensity

The ratio of energy use to economic output. At the national level, energy intensity is the ratio of total domestic primary energy use or final energy use to Gross Domestic Product. See also **specific energy use**

Energy security

The various security measures that a given nation, or the global community as a whole, must carry out to maintain an adequate energy supply.

Energy Service Company (ESCO)

A company that offers energy services to end-users, guarantees the energy savings to be achieved tying them directly to its remuneration, as well as finances or assists in acquiring financing for the operation of the energy system, and retains an on-going role in monitoring the savings over the financing term.

Environmental effectiveness

The extent to which a measure, policy or instrument produces a decided, decisive or desired environmental effect.

Environmentally sustainable technologies

Technologies that are less polluting, use resources in a more sustainable manner, recycle more of their wastes and products, and handle residual wastes in a more acceptable manner than the technologies that they substitute. They are also more compatible with nationally determined socio-economic, cultural and environmental priorities.

Evidence

Information or signs indicating whether 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.

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 impact on others' production and consumption possibilities, while there exists no compensation for such impact. When the impact is negative, so are external costs. When positive they are referred to as external benefits.

Feed-in tariff

The price per unit of electricity that a utility or power supplier has to pay for distributed or renewable electricity fed into the grid 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.

Forecast

Projected outcome from established physical, technological, economic, social, behavioral, etc. patterns.

Forest

Defined under the Kyoto Protocol as a minimum area of land of 0.05-1.0 ha with tree-crown cover (or equivalent stocking level) of more than 10-30 % with trees with the potential to reach a minimum height of 2-5 m at maturity in situ. A forest may consist either of closed forest formations where trees of various storey and undergrowth cover a high proportion of the ground or of open forest. Young natural stands and all plantations that have yet to reach a crown density of 10-30 % or tree height of 2-5 m are included under forest, as are areas normally forming part of the forest area that are temporarily un-stocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest. See also **Afforestation**, **Deforestation** and **Reforestation**.

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 it emits only water and heat (no CO₂) and the heat can be utilized (see **cogeneration**).

Fuel switching

In general, this is substituting fuel A for fuel B. In the climate-change discussion it is implicit that fuel A has lower carbon content than fuel B, e.g., 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.

G77/China. See **Group of 77 and China**.

General circulation (climate) model (GCM)

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 all or some of its known properties. The climate system can be represented by models of varying complexity, i.e. for any one component or combination of components a 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 the parameters are assessed empirically. Coupled atmosphere/ocean/sea-ice General Circulation Models provide a comprehensive representation of the climate system. There is an evolution towards more complex models with active chemistry and biology.

General equilibrium analysis

General equilibrium analysis considers simultaneously all the markets and feedback effects among these markets in an economy leading to market clearance. See also **market equilibrium**.

Geo-engineering

Technological efforts to stabilize the climate system by direct intervention in the energy balance of the Earth for reducing global warming

Global Environmental 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 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 upon radiative properties of well mixed greenhouse gases, measuring the radiative forcing of a unit mass of a given well mixed greenhouse gas in today's atmosphere integrated over a chosen time horizon, relative to that of CO₂. The GWP represents the combined effect of the differing lengths of time that these gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation. The Kyoto Protocol is based on GWPs from pulse emissions over a 100-year time frame.

Green accounting

Attempts to integrate into macroeconomic studies a broader set of social welfare measures, covering e.g., social, environmental, and development oriented policy aspects. Green accounting includes both monetary valuations that attempt to calculate a 'green national product' with the economic damage by pollutants subtracted from the national product, and accounting systems that include quantitative non-monetary pollution, depletion and other data.

Greenhouse effect

Greenhouse gases effectively absorb infrared radiation, emitted by the Earth's surface, by the atmosphere itself due to the same gases and by clouds. Atmospheric radiation is emitted to all sides, including downward to the Earth's surface. Thus, greenhouse gases trap heat within the surface-troposphere system. This is called the greenhouse effect.

Thermal infrared radiation in the troposphere is strongly coupled to the temperature at the altitude at which it is emitted. In the troposphere, the temperature generally decreases with height. Effectively, infrared radiation emitted to space originates from an altitude with a temperature of, on average, -19°C, in balance with the net incoming solar radiation, whereas the Earth's surface is kept at a much higher temperature of, on average, +14°C.

An increase in the concentration of greenhouse gases leads to an increased infrared opacity of the atmosphere and therefore to an effective radiation into space from a higher altitude at a lower temperature. This causes a radiative forcing that leads to an enhancement of the greenhouse effect, the so-called **enhanced greenhouse effect**.

Greenhouse gases (GHGs)

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 infrared radiation emitted by the Earth's surface, the atmosphere and clouds. This property causes the greenhouse effect. Water vapour (H₂O), carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄) and ozone (O₃) 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. Besides carbon dioxide, nitrous oxide and methane, the Kyoto Protocol deals with the greenhouse gases sulphur hexafluoride, hydrofluorocarbons, and perfluorocarbons.

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. It is calculated without deducting for depreciation of fabricated assets or depletion and degradation of natural resources.

Gross National Product (GNP)

GNP is a measure of national income. It measures value added from domestic and foreign sources claimed by residents. GNP comprises Gross Domestic Product plus net receipts of primary income from non-resident income.

Gross World Product

An aggregation of the individual country's Gross Domestic Products to obtain the sum for the world.

Group of 77 and China (G77/China)

Originally 77, now more than 130, developing countries that act as a major negotiating bloc in the UNFCCC process. G77/China is also referred to as Non-Annex I countries in the context of the UNFCCC.

Governance

The way government is understood has changed in response to social, economic and technological changes over recent decades. There is a corresponding shift from *government* defined strictly by the nation-state to a more inclusive concept of *governance*, recognizing the contributions of various levels of government (global, international, regional, local) and the roles of the private sector, of non-governmental actors and of civil society.

Hot air

Under the terms of the 1997 Kyoto Protocol, national emission targets in Annex B are expressed relative to emissions in the year 1990. For countries in the former Soviet Union and Eastern Europe this target has proven to be higher than their current and projected emissions for reasons unrelated to climate-change mitigation activities. Russia and Ukraine, in particular, are expected to have a substantial volume of excess emission allowances over the period 2008-2012 relative to their forecast emissions. These allowances are sometimes referred to as hot air because, while they can be traded under the Kyoto Protocol's flexibility mechanisms, they did not result from mitigation activities.

Hybrid vehicle

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 gases or groups of gases to be curbed under the

Kyoto Protocol. They are produced commercially as a substitute for chlorofluorocarbons. HFCs are largely used in refrigeration and semiconductor manufacturing. Their Global Warming Potentials range from 1,300 to 11,700.

Implementation

Implementation describes the actions taken to meet commitments under a treaty and encompasses legal and effective phases. **Legal implementation** refers to legislation, regulations, judicial decrees, including other actions such as efforts to administer progress, which governments take to translate international accords into domestic law and policy. **Effective implementation** needs policies and programmes that induce changes in the behaviour and decisions of target groups. Target groups then take effective measures of mitigation and adaptation.

Income elasticity (of demand)

This is the ratio of the percentage change in quantity of demand for a good or service to a one percentage change in income. For most goods and services, demand goes up when income grows, making income elasticity positive. When the elasticity is less than one, goods and services are called necessities.

Industrial ecology

The relationship of a particular industry with its environment. It often refers to the conscious planning of industrial processes to minimize their negative externalities (e.g., by heat and materials cascading).

Inertia

In the context of climate-change mitigation, inertia relates to the difficulty of change resulting from pre-existing conditions within society such as physical man-made capital, natural capital and social non-physical capital, including institutions, regulations and norms. Existing structures lock in societies, making change more difficult.

Integrated assessment

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

Integrated Design Process (IDP) of buildings

Optimizing the orientation and shape of buildings and providing high-performance envelopes for minimizing heating and cooling loads. Passive techniques for heat transfer control, ventilation and daylight access reduce energy loads further. Properly sized and controlled, efficient mechanical systems address the left-over loads. IDP requires an iterative design process involving all the major stakeholders from building users to equipment suppliers, and can achieve 30-75% savings in energy use in new buildings at little or no additional investment cost.

Intelligent controls

In this report, the notion of 'intelligent control' refers to the application of information technology in buildings to control heating, ventilation, air-conditioning, and electricity use effectively. It requires effective monitoring of parameters such as temperature, convection, moisture, etc., with appropriate control measurements ('smart metering').

Interaction effect

The consequence of the interaction of climate-change policy instruments with existing domestic tax systems, including both cost-increasing tax interaction and cost-reducing revenue-recycling effect. The former reflects the impact that greenhouse gas policies can have on labour and capital markets through their effects on real wages and the real return to capital. Restricting allowable GHG

emissions, raises the carbon price and so the costs of production and the prices of output, thus reducing the real return to labour and capital. With policies that raise revenue for the government, carbon taxes and auctioned permits, the revenues can be recycled to reduce existing distortional taxes. See also **double dividend**.

Intergovernmental Organization (IGO)

Organizations constituted of governments. Examples include the World Bank, the Organization of Economic Co-operation and Development (OECD), the International Civil Aviation Organization (ICAO), the Intergovernmental Panel on Climate Change (IPCC), and other UN and regional organizations. The Climate Convention allows accreditation of these IGOs to attend negotiating sessions.

International Energy Agency (IEA)

Established in 1974, the agency is linked with the OECD. It enables OECD member countries to take joint measures to meet oil supply emergencies, to share energy information, to coordinate their energy policies, and to cooperate in developing rational energy use programmes.

Joint Implementation (JI)

A market-based implementation mechanism defined in Article 6 of the Kyoto Protocol, allowing Annex I countries or companies from these countries to implement projects jointly that limit or reduce emissions or enhance sinks, and to share the Emissions Reduction Units. JI activity is also permitted in Article 4.2(a) of the UNFCCC. See also **Activities Implemented Jointly** and **Kyoto Mechanisms**.

Kyoto Mechanisms (also called Flexibility Mechanisms)

Economic mechanisms based on market principles that parties to the Kyoto Protocol can use in an attempt to lessen the potential economic impacts of greenhouse gas emission-reduction requirements. They include **Joint Implementation** (Article 6), **Clean Development Mechanism** (Article 12), and **Emissions trading** (Article 17).

Kyoto Protocol

The Kyoto Protocol to the UNFCCC was adopted at the Third Session of the Conference of the Parties (COP) in 1997 in Kyoto. It contains legally binding commitments, in addition to those included in the FCCC. Annex B countries agreed to reduce their anthropogenic GHG 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 came into force on 16 February 2005.

Landfill

A landfill is a solid waste disposal site where waste is deposited below, at or above ground level. Limited to engineered sites with cover materials, controlled placement of waste and management of liquids and gases. It excludes uncontrolled waste disposal.

Land-use

The total of arrangements, activities and inputs undertaken in a certain land-cover type (a set of human actions). The social and economic purposes for which land is managed (e.g., grazing, timber extraction, and conservation). Land-use change occurs when, e.g., forest is converted to agricultural land or to urban areas.

Leapfrogging

The ability of developing countries to bypass intermediate technologies and jump straight to advanced clean technologies. Leapfrogging can enable developing countries to move to a low-emissions development trajectory.

Learning by doing

As researchers and firms gain familiarity with a new technological process, or acquire experience through expanded production they can discover ways to improve processes and reduce cost. Learning by doing is a type of experience-based technological change.

Levelized cost price

The unique price of the outputs of a project that makes the present value of the revenues (benefits) equal to the present value of the costs over the lifetime of the project. See also **discounting** and **present value**.

Likelihood

The likelihood of an occurrence, outcome or result, where this can be estimated probabilistically, is expressed in IPCC reports using a standard terminology:

Particular, or a range of, occurrences/outcomes of an uncertain event owning a probability of	>99%	are said to be:	Virtually certain
	>90%		Very likely
	>66%		Likely
	33 to 66%		About as likely as not
	<33%		Unlikely
	<10%		Very unlikely
	<1%		Exceptionally unlikely

Lock-in effect

Technologies that cover large market shares continue to be used due to factors such as sunk investment costs, related infrastructure development, use of complementary technologies and associated social and institutional habits and structures.

Low-carbon technology

A technology that over its life cycle causes less CO₂-eq. emissions than other technological options do. See also **Environmentally sustainable technologies**.

Macroeconomic costs

These costs are usually measured as changes in Gross Domestic Product or changes in the growth of Gross Domestic Product, or as loss of welfare or consumption.

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. Economic theory shows that this way of pricing maximizes social welfare in a first-best economy.

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 regulation

Regulatory approaches using price mechanisms (e.g., taxes and auctioned tradable permits), among other instruments, to reduce GHG emissions.

Market distortions and imperfections

In practice, markets will always exhibit distortions and imperfections such as lack of information, distorted price signals, lack of competition, and/or institutional failures related to regulation, inadequate delineation of property rights, distortion-inducing fiscal systems, and limited financial markets

Market equilibrium

The point at which the demand for goods and services equals the supply; often described in terms of price levels, determined in a competitive market, 'clearing' the market.

Market Exchange Rate (MER)

This is 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.

Material efficiency options

In this report, options to reduce GHG emissions by decreasing the volume of materials needed for a certain product or service

Measures

Measures are technologies, processes, and practices that reduce GHG emissions or effects below anticipated future levels. Examples of measures are renewable energy technologies, waste minimization processes and public transport commuting practices, etc. See also **policies**.

Methane (CH₄)

Methane is one of the six greenhouse gases to be mitigated under the Kyoto Protocol. It is the major component of natural gas and associated with all hydrocarbon fuels, animal husbandry and agriculture. **Coal-bed methane** is the gas found in coal seams.

Methane recovery

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).

Meeting of the Parties (to the Kyoto Protocol) (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.

Millennium Development Goals (MDG)

A set of time-bound and measurable goals for combating poverty, hunger, disease, illiteracy, discrimination against women and environmental degradation, agreed at the UN Millennium Summit in 2000.

Mitigation

Technological change and substitution that reduce resource inputs and emissions per unit of output. Although several social, economic and technological policies would produce an emission reduction, with respect to climate change, mitigation means implementing policies to reduce GHG emissions and enhance sinks.

Mitigative capacity

This is a country's ability to reduce anthropogenic 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.

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-attribute analysis.

Integrates different decision parameters and values in a quantitative analysis without assigning monetary values to all parameters. Multi-attribute analysis can combine quantitative and qualitative information.

Multi-gas

Next to CO₂ also the other greenhouse gases (methane, nitrous

oxide and fluorinated gases) are taken into account in e.g. achieving reduction of emissions (**multi-gas reduction**) or stabilization of concentrations (**multi-gas stabilization**).

National Action Plans

Plans submitted to the COP by parties outlining the steps that they have adopted to limit their anthropogenic GHG emissions. Countries must submit these plans as a condition of participating in the UNFCCC and, subsequently, must communicate their progress to the COP regularly. The National Action Plans form part of the National Communications, which include the national inventory of GHG sources and sinks.

Net anthropogenic greenhouse gas removals by sinks

For CDM afforestation and reforestation projects, 'net anthropogenic GHG removals by sinks' equals the actual net GHG removals by sinks minus the baseline net GHG removals by sinks minus leakage.

Nitrous oxide (N₂O)

One of the six types of greenhouse gases to be curbed under the Kyoto Protocol.

Non-Annex I Countries/Parties

The countries that have ratified or acceded to the UNFCCC but are not included in Annex I.

Non-Annex B Countries/Parties

The countries not included in Annex B of the Kyoto Protocol.

No-regret policy (options / potential)

Such policy would generate net social benefits whether or not there is climate change associated with anthropogenic emissions of greenhouse gases. **No-regret options** for GHG emissions reduction refer to options whose benefits (such as reduced energy costs and reduced emissions of local/regional pollutants) equal or exceed their costs to society, excluding the benefits of avoided climate change.

Normative analysis

Economic 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.

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.

Opportunities

Circumstances to decrease the gap between the market potential of any technology or practice and the economic potential or technical potential.

Ozone (O₃)

Ozone, the tri-atomic form of oxygen, is a gaseous atmospheric constituent. In the troposphere, ozone is created both naturally and by photochemical reactions involving gases resulting from human activities. Troposphere ozone acts as a greenhouse gas. In the stratosphere, ozone is created by the interaction between solar ultraviolet radiation and molecular oxygen (O₂). Stratospheric ozone plays a dominant role in the stratospheric radiative balance. Its concentration is highest in the ozone layer.

Pareto criterion

A criterion testing whether an individual's welfare can be increased without making others in the society worse off. A **Pareto improvement** occurs when an individual's welfare is improved without making the welfare of the rest of society worse off. A

Pareto optimum is reached when no one's welfare can be increased without making the welfare of the rest of society worse off, given a particular distribution of income. Different income distributions lead to different Pareto optima.

Passive solar design

Structural design and construction techniques that enable a building to utilize solar energy for heating, cooling, and lighting by non-mechanical means.

Perfluorocarbons (PFCs)

Among the six greenhouse gases to be abated under the Kyoto Protocol. These are by-products of aluminium smelting and uranium enrichment. They also replace chlorofluorocarbons in manufacturing semiconductors. The Global Warming Potential of PFCs is 6500–9200.

Policies

In UNFCCC parlance, policies are taken and/or mandated by a government - often in conjunction with business and industry within its own country, or with other countries - to accelerate mitigation and adaptation measures. Examples of policies are carbon or other energy taxes, fuel efficiency standards for automobiles, etc. **Common and co-ordinated or harmonised policies** refer to those adopted jointly by parties. See also **measures**.

Portfolio analysis

Deals with a portfolio of assets or policies that are characterized by different risks and pay-offs. The objective function is built up around the variability of returns and their risks, leading up to the decision rule to choose the portfolio with highest expected return.

Post-consumer waste

Waste from consumption activities, e.g. packaging materials, paper, glass, rests from fruits and vegetables, etc.

Potential

In the context of climate change, potential is the amount of mitigation or adaptation that could be - but is not yet - realized over time. As potential levels are identified: market, economic, technical and physical.

- **Market potential** indicates the amount of GHG mitigation that might be expected to occur under forecast market conditions including policies and measures in place at the time. It is based on private unit costs and discount rates, as they appear in the base year and as they are expected to change in the absence of any additional policies and measures.
- **Economic potential** is in most studies used as the amount of GHG mitigation that is cost-effective for a given carbon price, based on social cost pricing and discount rates, including energy savings, but without most externalities. Theoretically, it is defined as the potential for cost-effective GHG mitigation when non-market social costs and benefits are included with market costs and benefits in assessing the options for particular levels of carbon prices (as affected by mitigation policies) and when using social discount rates instead of private ones. This includes externalities, i.e., non-market costs and benefits such as environmental co-benefits
- **Technical potential** is the amount by which it is possible to reduce GHG emissions or improve energy efficiency by implementing a technology or practice that has already been demonstrated. No explicit reference to costs is made but adopting 'practical constraints' may take into account implicit economic considerations.
- **Physical potential** is the theoretical (thermodynamic) and sometimes, in practice, rather uncertain upper limit to mitigation.

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

Pre-industrial

The era before the industrial revolution of the late 18th and 19th centuries, after which the use of fossil fuel for mechanization started to increase.

Present value

The value of a money amount differs when the amount is available at different moments in time (years). To make amounts at differing times comparable and additive, a date is fixed as the 'present'. Amounts 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. **Net present value** is the difference between the present value of the revenues (benefits) with the present value of the costs. See also **discounting**.

Price elasticity of demand

The ratio of the percentage change in the quantity of demand for a good or service to one percentage change in the price of that good or service. When the absolute value of the elasticity is between 0 and 1, demand is called inelastic; when it is greater than one, demand is called elastic.

'Primary market' and 'secondary market' trading

In commodities and financial exchanges, buyers and sellers who trade directly with each other constitute the 'primary market', while buying and selling through exchange facilities represent the 'secondary market'.

Production frontier

The maximum outputs attainable with the optimal uses of available inputs (natural resources, labour, capital, information).

Public sector leadership programmes in energy efficiency

Government purchasing and procurement of energy-efficient products and services. Government agencies are responsible for a wide range of energy-consuming facilities and services such as government office buildings, schools, and health care facilities. The government is often a country's largest consumer of energy and largest buyer of energy-using equipment. Indirect beneficial impacts occur when governments act effectively as market leaders. First, government buying power can create or expand demand for energy-efficient products and services. Second, visible government energy-saving actions can serve as an example for others.

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, e.g., Gross Domestic Products 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).

Radiative forcing

Radiative forcing is the change in the net vertical irradiance (expressed in Watts per square metre: W/m²) at the tropopause due to an internal change or a change in the external forcing of the climate system, such as, for example, a change in the concentration of CO₂ or in the output of the sun.

Rebound effect

After implementation of efficient technologies and practices, part of the savings is taken back for more intensive or other consumption, e.g., improvements in car-engine efficiency lower the cost per kilometre driven, encouraging more car trips or the purchase of a more powerful vehicle.

Reforestation

Direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the 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. See also **afforestation** and **deforestation**.

Reservoir

A component of the climate system, other than the atmosphere, which has the capacity to store, accumulate or release a substance of concern, e.g., carbon, a greenhouse gas or a precursor. Oceans, soils, and forests are examples of reservoirs of carbon. **Stock** is the absolute quantity of substance of concerns, held within a reservoir at a specified time. See also **Carbon pool**.

Safe landing approach. See **tolerable windows approach**.

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.

Sequestration

Carbon storage in terrestrial or marine reservoirs. **Biological sequestration** includes direct removal of CO₂ from the atmosphere through land-use change, afforestation, reforestation, carbon storage in landfills and practices that enhance soil carbon in agriculture.

Shadow pricing

Setting prices of goods and services that are not, or 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.

Sinks

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

Smart metering. See **Intelligent control**.

Social cost of carbon (SCC)

The discounted monetized sum (e.g. expressed as a price of carbon in \$/tCO₂) of the annual net losses from impacts triggered by an additional ton of carbon emitted today. According to usage in economic theory, the social cost of carbon establishes an economically optimal price of carbon at which the associated marginal costs of mitigation would equal the marginal benefits of mitigation.

Social unit costs of mitigation

Carbon prices in US\$/tCO₂ and US\$/tC-eq (as affected by mitigation policies and using social discount rates) required to achieve a particular level of mitigation (**economic potential**) in the form of a reduction below a baseline for 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 GHG concentrations in the atmosphere.

Source

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

Specific energy use

The energy used in the production of a unit material, product or service.

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.

Stabilization

Keeping constant the atmospheric concentrations of one or more GHG (e.g., CO₂) or of a CO₂-equivalent basket of GHG. Stabilization analyses or scenarios address the stabilization of the concentration of GHG in the atmosphere.

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 GHG emissions associated with the manufacture or use of the products and/or application of the technology.

Storyline

A narrative description of a scenario (or a family of scenarios) that highlights the scenario's main characteristics, relationships between key driving forces, and the dynamics of the scenarios.

Structural change

Changes, for example, in the relative share of Gross Domestic Product 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 ones.

Subsidy

Direct payment from the government or a tax reduction to a private party for implementing a practice the government wishes to encourage. The reduction of GHG emissions is stimulated by lowering existing subsidies that have the effect of raising emissions (such as subsidies to fossil fuel use) or by providing subsidies for practices that reduce emissions or enhance sinks (e.g. for insulation of buildings or for planting trees).

Sulphur hexafluoride (SF₆)

One of the six greenhouse gases to be curbed 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. Its Global Warming Potential is 23,900.

Supplementarity

The Kyoto Protocol states that emissions trading and Joint Implementation activities are to be supplemental to domestic policies (e.g. energy taxes, fuel efficiency standards) taken by developed countries to reduce their GHG emissions. Under some proposed definitions of supplementarity (e.g., a concrete ceiling on level of use), developed countries could be restricted in their use of the Kyoto Mechanisms to achieve their reduction targets. This is a subject for further negotiation and clarification by the parties.

Sustainable Development (SD)

The concept of sustainable development was introduced in the World Conservation Strategy (IUCN 1980) and had its roots in the concept of a sustainable society and in the management of renewable resources. Adopted by the WCED in 1987 and by the Rio Conference in 1992 as a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations. SD integrates the political, social, economic and environmental dimensions.

Targets and timetables

A target is the reduction of a specific percentage of GHG emissions from a baseline date (e.g., below 1990 levels) to be achieved by a set date or timetable (e.g., 2008-2012). Under the Kyoto Protocol the EU agreed to reduce its GHG emissions by 8% below 1990 levels by the 2008-2012 commitment period. Targets and timetables are an emissions cap on the total amount of GHG emissions that can be emitted by a country or region in a given time period.

Tax

A **carbon tax** is a levy on the carbon content of fossil fuels. Because virtually all of the carbon in fossil fuels is ultimately emitted as CO₂, a carbon tax is equivalent to an **emission tax** on each unit of CO₂-equivalent emissions. An **energy tax** - a levy on the energy content of fuels - reduces demand for energy and so reduces CO₂ emissions from fossil fuel use. An **eco-tax** is designed to influence human behaviour (specifically economic behaviour) to follow an ecologically benign path.

An **international carbon/emission/energy tax** is a tax imposed on specified sources in participating countries by an international authority. The revenue is distributed or used as specified by this authority or by participating countries. A **harmonized tax** commits participating countries to impose a tax at a common rate on the same sources, because imposing different rates across countries would not be cost-effective. A **tax credit** is a reduction of tax in order to stimulate purchasing of or investment in a certain product, like GHG emission reducing technologies. A **carbon charge** is the same as a carbon tax. See also **Interaction effect**

Technological change

Mostly considered as technological *improvement*, i.e., more or better goods and services can be provided from a given amount of resources (production factors). Economic models distinguish autonomous (exogenous), endogenous and induced technological change.

Autonomous (exogenous) technological change is imposed from outside the model, usually in the form of a time trend affecting energy demand or world output growth. **Endogenous technological change** is the outcome of economic activity *within* the model, i.e., the choice of technologies is included within the model and affects energy demand and/or economic growth. **Induced technological change** implies endogenous technological change but adds further changes *induced* by policies and measures, such as carbon taxes triggering R&D efforts.

Technology

The practical application of knowledge to achieve particular tasks that employs both technical artefacts (hardware, equipment) and (social) information ('software', know-how for production and use of artefacts).

Technology transfer

The exchange of knowledge, hardware and associated software, money and goods among stakeholders, which leads to the spreading of technology for adaptation or mitigation. The term encompasses both diffusion of technologies and technological cooperation across and within countries.

Tolerable windows approach (TWA)

This approach seeks to identify the set of all climate-protection strategies that are simultaneously compatible with 1) prescribed long-term climate-protection goals, and 2) normative restrictions on the emissions mitigation burden. The constraints may include limits on the magnitude and rate of global mean temperature change, on the weakening of the thermohaline circulation, on ecosystem losses and on economic welfare losses resulting from selected climate damages, adaptation costs and mitigation efforts. For a given set of constraints, and given a solution exists, the TWA delineates an emission corridor of complying emission paths.

Top-down models

Models applying macroeconomic theory, econometric and optimization techniques to aggregate economic variables. Using historical data on consumption, prices, incomes, and factor costs, top-down models assess final demand for goods and services, and supply from main sectors, such as the energy sector, transportation, agriculture, and industry. Some top-down models incorporate technology data, narrowing the gap to **bottom-up models**.

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 permit. See **emission permit**

Tradable quota system. See **emissions trading**.

Uncertainty

An expression of the degree to which a value is unknown (e.g. the future state of the climate system). Uncertainty can result from lack of information or from disagreement about what is known or even knowable. It may have many types of sources, from quantifiable errors in the data to ambiguously defined concepts or terminology, or uncertain projections of human behavior. Uncertainty can therefore be represented by quantitative measures (e.g., a range of values calculated by various models) or by qualitative statements (e.g., reflecting the judgment of a team of experts). See also **likelihood**.

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 Economic Community. Its ultimate objective is the 'stabilization 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 Convention parties included in Annex I aimed to return greenhouse gas emission not controlled by the Montreal Protocol to 1990 levels by the year 2000. The convention came into force in March 1994.

Value added

The net output of a sector or activity after adding up all outputs and subtracting intermediate inputs.

Values

Worth, desirability or utility based on individual preferences. Most social science disciplines use several definitions of value. Related to nature and environment, there is a distinction between intrinsic and instrumental values, the latter assigned by humans. Within instrumental values, there is an unsettled catalogue of different values, such as (direct and indirect) use, option, conservation, serendipity, bequest, existence, etc.

Mainstream economics define the total value of any resource as the sum of the values of the different individuals involved in the use of the resource. The economic values, which are the foundation of the estimation of costs, are measured in terms of the willingness to pay by individuals to receive the resource or by the willingness of individuals to accept payment to part with the resource. See also **contingent valuation method**.

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 to regulated obligations. Not all voluntary agreements are truly voluntary; some include rewards and/or penalties associated with joining or achieving commitments.