



CALIFORNIA  
ENERGY  
COMMISSION

**Public Interest Energy Research Program  
Research Development and Demonstration Plan**

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Attachment VII - Glossary of Terms Used in  
the PIEREA Climate Change Research Plan  
and Roadmaps

**Contractor/Consultant Report**

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# CALIFORNIA ENERGY COMMISSION

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**Abiotic:** Not living.

**Acre-foot:** An amount of water that covers an acre (43,560 ft<sup>2</sup>) to a depth of one foot. An acre-foot is equal to 325,851 gallons, which is considered to be a year's supply for two families.

**Additionality:** A requirement (in the Kyoto Protocol) that a carbon sequestration project must be "additional to any that would otherwise occur" for it to be counted as carbon mitigation.

**Afforestation:** Planting trees in areas where trees have been absent in recent times.

**Agroforestry:** Planting and managing trees in conjunction with agricultural crops.

**Albedo:** The fraction of light that is reflected by an object.

**Anaerobic Digester:** A technology that processes manure and traps the methane produced by its decomposition for use as a fuel to produce electricity.

**Aquifer:** A water-bearing stratum of permeable rock, sand, or gravel.

**Autotrophic:** Being able to synthesize food from inorganic substances (e.g., from light or chemical energy).

**Behavioral Economics:** A discipline that links economics with psychology and other behavioral sciences in the study of decision making.

**Biomass:** Vegetative or animal wastes that can be used for energy generation.

**Biome:** A major ecological community type, such as a grassland or desert.

**Biopower:** Energy produced from biomass.

**Bioregion:** A geographic area that shares common soil, watershed, climate, vegetation, and animals.

**Biotic:** Related to living things.

**Business-as Usual (BAU):** Maintaining the status quo. Analyses that employ BAU scenarios assume that the factors examined will remain as they are at the time of the assessment.

**CAFE Standards:** Corporate Average Fuel Economy (CAFE) standards. Originally established by the Energy Policy and Conservation Act of 1975, these standards set a target fuel efficiency for automobiles.

**Cap and Trade:** A type of emissions-reduction policy wherein the quantity of a pollutant's emissions allowable in a certain region from regulated sources is limited, or "capped" at a quantity that is less than the historic amount for that region, in an effort to reduce emissions. Companies responsible for those emissions are given "allowances" to emit a certain quantity of that pollutant. Entities that emit less than their allotted quantity may trade them with those that emit more than their allotted share.

**Carbon-based Residuals:** Carbon-based residues such as wood and paper that are sent to landfills, but could be used as a biopower fuel source.

**Carbon Dioxide (CO<sub>2</sub>):** A byproduct of the burning of fossil fuels and biomass. Carbon dioxide is a greenhouse gas that contributes to global warming.

**Carbon Flux:** The exchange of carbon between the Earth's water and land and the atmosphere.

**Carbon Inventory:** The amount of carbon emissions (releases) and sinks (captures) for a given area and/or ecosystem.

**Carbon Monoxide (CO):** Carbon monoxide is produced when hydrocarbon-based fuels are not burned completely. It inhibits the ability of blood to carry oxygen and is regulated as a criteria pollutant.

**Carbon Sequestration:** A method of keeping carbon emissions from reaching the atmosphere by capturing, isolating, and diverting them to secure storage, and/or to remove CO<sub>2</sub> from the atmosphere by various means and store it.

**Carbon Sink:** A terrestrial or aquatic repository for atmospheric carbon.

**Chlorofluorocarbons:** Otherwise known as *CFCs*, this family of chemical compounds are mostly used as refrigerants and industrial cleansers. When they rise into the stratosphere, they can break down the ozone layer, which protects the Earth from harmful radiation.

**Clathrate:** A compound found deep in oceans that contains methane. Destabilization of these clathrates could release great amounts of methane (a greenhouse gas) into the atmosphere.

**Combined Heat and Power:** A technology for generating power (usually electricity) and heat together, which uses the heat in industrial processes or for building heating. Sometimes referred to as *cogeneration*.

**Command and Control:** A type of regulatory emissions policy that details specific methods for reducing emissions, sometimes including the type of technology that must be used.

**Computable General Equilibrium Paradigm:** A common economic model that does not take account of uncertainty. This paradigm assumes perfect knowledge of the present and future values of all included variables and parameters.

**Conservation Tillage:** Soil tillage practices such as minimum tillage, mulch tillage, ridge tillage, and no-till, which reduce erosion and soil loss and help retain carbon in the soil.

**Contingent Valuation:** A set of methods for estimating consumer preferences for goods or services in markets that do not yet exist.

**Coppicing:** The practice of cutting a tree or bush near the ground to promote the generation of more sprouts.

**Criteria Pollutants:** Air pollutants chosen for inclusion in the Clean Air Act Amendments and regulated under National Ambient Air Quality Standards (NAAQS). They include: sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), Volatile Organic Compounds (VOCs), particulate matter (PM), carbon monoxide (CO), and lead (Pb).

**Depth-duration-frequency Data:** Data on the amount, duration, and frequency of precipitation in an area. These data are used for water planning.

**Deterministic:** Modeling or analysis that assumes perfect knowledge of the present and future values of all included variables and parameters.

**Distributed Generation:** Electricity generation at or near the place it is used. DG technologies can include such diverse technologies as microturbines, photovoltaic modules, or fuel cells.

**Disturbance Regime:** The dynamics of disturbances (such as fires) in an area over a long period of time.

**Domain:** In modeling, the area which is being modeled.

**Downscaling:** Applying data gathered and/or aggregated at a large scale to a smaller-scale assessment, such as to examine the effects on a single air basin.

**Dynamical Model:** There are two meanings of dynamical (or *dynamic*) in the context of economic modeling: (1) A *dynamic model* represents the economy over a period of years or decades. The paths of variables such as prices and quantities are represented as they change over time, in contrast to a static model that represents a market or an economy only at one point in time. (2) In another context, *dynamic model* also refers to a type of model that incorporates taxation and fiscal policy into its analysis. In this context, the term *dynamic* means that both direct and indirect effects of taxes are represented in a model. For example, the government-levied tax will result in a certain quantity of revenue being raised (the direct effect). However, it will also (in general) result in indirect changes in consumers' and firms' choices regarding consumption, employment, and investment.

**Ecological Indicator:** A key attribute of an ecosystem that is used to gauge the health of the whole ecosystem.

**Econometric:** A type of economic analysis that applies economic theory and statistical methods to develop mathematical estimates of economic relationships. Econometric analyses are used to determine the accuracy of modeled data, when compared to observed data.

**Ecosystem:** A group of organisms that interact with each other and their physical environment.

**El Niño-Southern Oscillation:** El Niño is a warming of the surface layers in the eastern and central equatorial Pacific Ocean that happens about once every three or four years. This warming is accompanied by swings in the Southern Oscillation (SO), an interannual see-saw in tropical sea level pressure between the eastern and western hemispheres. The combination of these effects can create extreme disruptions of normal weather patterns.

**Emissions trading:** A market-based method of reducing emissions. It allows entities that reduce emissions in one source below a specified amount to use or trade that excess amount to offset emissions from another source. Emissions trading is recognized by the Kyoto Protocol.

**Endogenous Technological Change:** Technological change brought about by changes in prices or policy variables.

**Energy-to-GDP Ratio:** A measure of energy intensity—essentially, the amount of energy needed to produce products.

**ETo:** Reference evapotranspiration. A measure of the amount of water evaporated and transpired by well-maintained, well-watered turf grass. This amount is measured weekly in California at various California Irrigation Management Information System (CIMIS) facilities throughout the state.

**Evapotranspiration:** Water loss from a combination of evaporation from the soil and transpiration from vegetation.

**Expected Utility Maximization:** The standard economic model of rational behavior.

**Feebate:** In emissions terminology, a fee levied on polluters to create a pool that will fund rebates to those that pollute less.

**Fluvial:** Relating to or living in a stream or river.

**Frozen Efficiency Forecast:** An analysis that looks at energy use over time with the assumption that energy efficiency will not change from its current status.

**Gasification:** The process of producing a gaseous fuel from a non-gaseous substance.

**Generation Mix:** A set of technologies used to generate electricity.

**Geographic Information Systems (GIS):** A computer system capable of assembling, storing, manipulating, and displaying geographically referenced information, i.e. data identified according to their locations. Practitioners also regard the total GIS as including operating personnel and the data that go into the system.<sup>1</sup>

**Global Climate Model/General Circulation Model:** A global, three-dimensional computer model of the climate system which can be used to simulate human-induced climate change. GCMs are highly complex and they represent the effects of such factors as reflective and absorptive properties of atmospheric water vapor, greenhouse gas concentrations, clouds, annual and daily solar heating, ocean temperatures and ice boundaries. The most recent GCMs include global representations of the atmosphere, oceans, and land surface.<sup>2</sup>

**Global Positioning System:** A system that can determine a precise location on the Earth, based on satellite data.

**Global Warming Potential:** An index that describes the radiative characteristics of greenhouse gases. It presents the combined effect of: (1) the time that these gases remain in the atmosphere, and (2) their relative effectiveness in absorbing outgoing infrared radiation (which increases global warming).<sup>3</sup>

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<sup>1</sup> USGS. ([www.usgs.gov/research/gis/title.html](http://www.usgs.gov/research/gis/title.html)).

<sup>2</sup> USEPA. *Inventory of GHG Emissions and Sinks 1990–1999*. Annex W. Glossary. ([www.epa.gov/globalwarming/publications/emissions/us2001/annex-w.pdf](http://www.epa.gov/globalwarming/publications/emissions/us2001/annex-w.pdf)).

<sup>3</sup> Adapted from *Climate Change 2001. Synthesis Report*. Edited by Robert Watson and the Core Writing Team. Contribution of Working Groups I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Annex B. Glossary of Terms. ([www.ipcc.ch/pub/gloss.htm](http://www.ipcc.ch/pub/gloss.htm)).

**Greenhouse Gases:** Gases that contribute to the greenhouse effect (which causes global warming). The primary GHGs are: water vapor (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O), methane (CH<sub>4</sub>), ozone (O<sub>3</sub>), sulfur hexafluoride (SF<sub>6</sub>), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs)

**Gross State Product:** The market value of all the goods and services produced in a state in a year, which acts as a measure of the state's economic activity.

**Herbivory:** Consumption of living plant material.

**Hydrofluorocarbons (HFCs):** Greenhouse gases produced for use as a refrigerant or in manufacturing.

**Hydrograph:** A graph showing the variation of water flow over time.

**Hydrological:** Having to do with the study of water on the Earth and its atmosphere.

**Hyperbolic Discounting:** Discount rates that increase as the time horizon grows shorter.

**Integrated Assessment Model:** IA models model the causes and effects of a specific issue and how that issue affects and is affected by other factors.

**Integrated Resource Planning:** A public planning process and framework within which the costs and benefits of both demand- and supply-side resources are evaluated to develop the least-total-cost mix of utility resource options. In many states, IRP includes a means for considering environmental damages caused by electricity supply/transmission and identifying cost-effective energy efficiency and renewable energy alternatives.<sup>4</sup>

**International Terrestrial Reference Frame:** An set of reference points on the Earth that are used to measure, in coordination with a Celestial Reference Frame in space, changes on the Earth's surface, such as sea level rise.

**Invasive Species:** Non-native species that can threaten species, ecosystems, or habitats.

**Knightian Uncertainty:** Also known as *deep uncertainty*. A type of uncertainty in economic analysis wherein values of fundamental quantities are not merely unknown, but also cannot plausibly be assigned probability distributions.

**Leakage:** In carbon sequestration scenarios, the loss of overall sequestration benefits attributable to displacement. Leakage occurs if success in protecting or increasing carbon in one location hastens the release of carbon elsewhere.

**Life-cycle Assessment:** An analytical method of identifying, quantifying, and assessing the environmental aspects of a product, process, or activity throughout its life.

**Loss Aversion:** The asymmetric weighting of gains and losses with respect to a neutral reference point.

**Lysimeter:** A device that measures water percolation through soil.

**Macroeconomics:** The study of the national economy as a whole.

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<sup>4</sup> California Energy Commission. Energy Glossary. (<http://www.energy.ca.gov/glossary/>).



**Marginal Abatement Curve (MAC):** An MAC shows the marginal cost of reducing an emission as compared with the marginal amount of reduction obtained. The MAC is derived by rank ordering individual emission reduction opportunities by cost per emission reduction amount. The curve is usually intended to capture the full set of all available abatement options. Any point along a MAC represents the marginal cost of abating an additional amount of an emission.<sup>5</sup>

**Methane (CH<sub>4</sub>):** A hydrocarbon and greenhouse gas that is produced from a variety of natural and human sources, most notably from the decomposition of organic matter.

**Microclimate:** An area that has a different environmental conditions than those within its surrounding climatic zone.

**Microeconomics:** The study of the components of the national economy.

**Mitigation:** To alleviate the harmful effects of something. In terms of climate change, to enact policies or conduct projects to reduce greenhouse gas emissions.

**Monetization:** To establish something as legal tender.

**Net Metering:** A method of tracking electricity use and generation through the same meter. Used for small distributed generation technologies such as photovoltaic modules on homes, the meter runs forwards when users are drawing electricity from the grid and backwards when the unit is contributing electricity to the grid.

**Nitrogen Oxides (NO<sub>x</sub>):** Various oxides of nitrogen, most notably nitrogen dioxide (NO<sub>2</sub>), which is produced by fossil fuel combustion and contributes to smog, acid rain, and eutrophication of water bodies.

**Nitrous Oxide (N<sub>2</sub>O):** A greenhouse gas produced by certain agricultural practices and fossil fuel combustion.

**Orography:** The study of the physical geometry of mountains and mountain ranges.

**Ozone (O<sub>3</sub>):** A form of oxygen that acts as a greenhouse gas in the troposphere (the lowest layer of the Earth's atmosphere) and as protective shield from harmful ultraviolet-B radiation in the stratosphere.

**Pacific Decadal Oscillation:** An El Niño-like pattern of Pacific climate variability that can persist for 20 to 30 years.

**Paleoclimatic Data:** Data that indicates climatic conditions in the geological past.

**Paleontological Data:** Data from past geological periods.

**Particulate Matter (PM):** Airborne particles or droplets from emissions that can be inhaled and lodged in the lungs. PM is regulated as a criteria pollutant.

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<sup>5</sup> Adapted from Environmental Protection Agency (EPA). 2001. *U.S. High GWP Gas Emissions 1990-2010: Inventories, Projections, and Opportunities for Reductions*. EPA 000-F-97-000. Washington, D.C. U.S. Environmental Protection Agency.

**Pathogen:** The causative agent of a disease.

**Perfluorocarbons (PFCs):** Greenhouse gases produced as refrigerants or as byproducts of industrial processes.

**Permanence:** For carbon sequestration, whether or not the carbon stored at the time of a trading agreement will continue to be stored in the future.

**Photochemical Model:** A computer model used to predict ambient air quality.

**Probable Maximum Flood:** The largest flood believed to be meteorologically possible in a region.

**Radiative Forcing:** The change in the balance between radiation coming into the atmosphere and the radiation going out.<sup>6</sup>

**Regional Climate Model:** A computer model capable of modeling potential climate changes in a small, focused region.

**Renewable Energy Production Tax Credit:** A tax credit given to renewable energy producers for generating power with specified renewable technologies. The RETC is used as an economic incentive for power producers to generate electricity from cleaner sources.

**Renewable Portfolio Standard:** A rule that establishes the percentage amount of renewable energy that a state must use by a certain date. California's RPS requires all electricity retailers to increase their use of wind, geothermal, biomass, and solar technologies by 1% per year until they reach 20% (by 2017).

**Roadmap:** A document that outlines a series of specific steps or activities necessary to reach a goal.

**Regional Climate Model:** A computer program capable of modeling potential regional climate, given a specific set of data and criteria.

**Revenue Recycling:** The return of revenues from programs such as carbon taxes and tradable emissions permit systems back into the economy, to offset other distortionary taxes.

**Soil Organic Carbon:** Also known as *humus*. Partially decomposed plant or animal matter that makes up the organic part of the soil.

**Standard Industrial Classification:** A four-digit code that identifies a company's type of business.

**Statistical Model:** A model that uses statistics obtained from observed data. Also known as an *empirical model*.

**Stochastic:** Something characterized by chance, probability, or randomness.

**Substrate:** A surface on which an organism lives.

**Sulfur Hexafluoride (SF<sub>6</sub>):** A potent greenhouse gas that is used as an industrial insulator and coolant.

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<sup>6</sup> UNEP. Introduction to Climate Change. <http://www.grida.no/climate/vital/04.htm>

**Sulfur Oxides (SO<sub>x</sub>):** Various oxides of sulfur—most notably, sulfur dioxide (SO<sub>2</sub>), which is produced by burning high-sulfur fossil fuels such as coal. SO<sub>2</sub> can cause acid rain and respiratory problems. When oxidized into sulfate aerosols, it can cause negative radiative forcing, cooling the Earth's surface.

**Supply Curve:** A method for graphically displaying the cost and availability of a resource or other market good.

**Thermohaline Circulation:** The global circulation of oceanic water temperature and salinity. A disruption of this circulation (which could occur as a result of global warming) could affect climate and oceanic ecosystems worldwide.

**Tons of Carbon Equivalent (TCE):** A measure for global warming potential gases. TCE indicates the potency of a greenhouse gas, when compared to that of carbon (which is used as a baseline measurement, with a value of "1").

**Total Maximum Daily Load (TMDL):** TMDLs are the maximum daily amount of a pollutant that can be released into a specified water body. TMDLs were established by the Clean Water Act and apply to water bodies that have been identified as needing remediation.

**Transition Zone (Water):** A geographic area where the characteristics of a region gradually blend into those of an adjoining region.

**Trophic:** Related to food relationship of organisms in a food chain.

**UV-B Radiation:** Ultraviolet radiation that is normally blocked from the Earth by the ozone layer. UV-B radiation contributes to skin cancer and various environmental impacts.

**Variabilization Policy:** A policy of charging a surcharge on a product or service based on the amount of that product or service used. For example, annual payments of a gasoline tax would cost more for the driver of an inefficient vehicle than they would for the driver of a more efficient vehicle, because the vehicle would need more gas.

**Volatile Organic Compounds (VOCs):** Organic compounds that evaporate readily into the atmosphere at normal temperatures. VOCs contribute significantly to photochemical smog production and certain health problems.<sup>7</sup> They are regulated as a criteria pollutant.

**Watershed:** The land area that drains to a local water body.

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<sup>7</sup> USEPA. *Inventory of GHG Emissions and Sinks 1990–1999*. Annex W. Glossary. ([www.epa.gov/globalwarming/publications/emissions/us2001/annex-w.pdf](http://www.epa.gov/globalwarming/publications/emissions/us2001/annex-w.pdf)).