coal-fired electric power plants, oil and gas wells, natural gas processing facilities, and steel, cement, hydrogen, and fertilizer production plants. The captured CO_2 is then stored in underground geological formations, rocks, or even the ocean.

c. Technological: technological carbon sequestration involves the use of an advanced and more expensive technology such as direct air capture or enhanced CO_2 mineralization (Lal 2008; Breyer et al. 2019).

BARRY D. SOLOMON

Further reading

Caparrós & Jacquemont 2003; Benítez et al. 2007.

See also: Climate change mitigation, Carbon capture, Sinks, Carbon stock.

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Carbon stock

Ecology: the amount of carbon stored in vegetative biomes including aquatic, grassland, forest, desert, and tundra. It is the carbon found in below-ground and above-ground biomass, soil, dead wood, litters, and other dead biomass. The portion of the carbon stock stored in mangroves, salt tidal marshes, and seagrass meadows within their soil, living biomass above ground (leaves, branches, stems), living biomass below ground (roots), and non-living biomass (for example, litter and dead wood) is referred to as blue carbon (Mcleod et al. 2011). Measured as tonne of elemental carbon (C) or tonne of carbon dioxide (CO_2) (conversion factor: 1 tonne of C is equal to 44/11 or 3.67 tonne of CO_2). Carbon stock can grow (through carbon sequestration) or shrink (through carbon flux) during the natural carbon cycle or due to human activities.

Ecological economics: an indicator of one of the important ecosystem services, namely, climate regulation. As the carbon stock in the biosphere increases—that is, with net annual carbon balance or sequestration—the amount of carbon in the atmosphere declines, resulting in climate regulation. Carbon stock and sequestration are therefore used as proxy indicators of climate regulation ecosystem service provided by ecosystems (Keith et al. 2021; TEEB 2009).

MAHADEV G. BHAT

See also: Ecosystem services, Carbon sequestration, Carbon capture, Climate change.

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Carbon taxes

A form of pollution tax (itself a form of environmental tax), which targets carbon emissions generated by economic agents without necessarily considering the climate damages that they create (externality). Along with carbon markets, they represent the two forms of carbon pricing. With a carbon tax, polluters can decide whether to abate emissions or pay the tax. Thus, carbon taxes account for heterogeneity among polluters and provide continuous incentives to reduce emissions (dynamic efficiency). Econometric studies

suggest that carbon taxes can substantially reduce emissions (e.g., Martin et al. 2014; Andersson 2019).

Many countries have implemented a carbon tax, following the example of Scandinavian countries in the 1990s (World Bank 2021). Carbon taxes may vary along a few key design features. Tax rates can be set according to the concept of social cost of carbon or to reach a policy goal in the most cost-effective way. Most schemes feature a tax escalator: the tax rate starts low and increases over time. Some tax schemes may exempt some sectors or emission sources. Exemptions hurt the scheme's effectiveness. Revenues can be redistributed uniformly to the population (generally making the scheme progressive), earmarked (for instance, to fund further emissions reductions), used to reduce pre-existing distortionary taxes (for instance, on labor), or allocated to the general budget. With a global carbon tax, or a system of harmonized carbon taxes, a global carbon price could in theory be achieved (Hoel 1992; Nordhaus 2015; Carattini et al. 2019).

STEFANO CARATTINI

Further reading

Baranzini et al. 2000.

See also: Carbon market, Carbon trading, Environmental taxes, Pollution taxes, Environmental externalities.

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Carbon trading

The exchange of carbon dioxide (CO_2) credits or allowances between companies in a CO_2 or greenhouse gas trading system or market. Forestry and agricultural offsets are also allowed in some cases. Such programs are based on the Coase theorem and have been established to encourage cost-effective mitigation of climate change, and are often an attractive alternative to a carbon tax though the programs can also work in tandem (Haites 2018; Narassimhan et al. 2018).

Usually, carbon trading is part of a cap-and-trade scheme where the total amount of CO_2 or greenhouse gases that can be emitted by all participating companies is limited. If a firm emits less than its emissions allocation or quota in a given year or has extra credits from the Clean Development Mechanism (CDM) program, it can sell excess credits or allowances to another firm whose emission control costs are probably higher or bank the credits. The largest carbon trading program is the European Union Emissions Trading System (EU ETS), which began in 2005. Carbon trading programs have also been established in several United States states and regions, South Korea, Japan, China, Kazakhstan, New Zealand, and Canada.

BARRY D. SOLOMON

See also: Carbon market, Coase theorem, Emissions trading, Cap and trade, Tradable permits, Clean Development Mechanism (CDM), Greenhouse gases, Climate change mitigation, Carbon taxes, Banks.

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