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Glossary of Decarbonization Terms (September 2021)

by Practical Law Finance

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A PDF glossary of terms used to explain decarbonization and the transition of the US energy industry to cleaner or zero emissions energy.

Biofuel - A fuel that is produced from feedstocks, including corn, soybeans, sugarcane, algae, and plant and animal oils. There are two main types of biofuels:

- **Ethanol**. Produced from biomass, such as corn, soybeans, and sugarcane. The federal government has promoted the use of ethanol to help reduce reliance on oil imports and as a result, almost all gas sold in the US includes some ethanol.
- **Biodiesel**. Used as a substitute for diesel, biodiesel is typically made from vegetable oils, such as soybeans. Unlike traditional diesel, biodiesel is non-toxic and biodegradable. Biodiesel is often used in combination with petroleum-based diesel but can also be used alone.

For more information on biofuels and alternative sources generally, see Practice Note, Renewable Energy: Overview (US).

Biomass - Organic matter, including wood, wood waste, and agricultural crops (for example, sugarcane, corn, and soybeans) that can be used to, among other things:

- Generate electricity.
- Heat homes.
- Produce transportation fuels, such as ethanol and biodiesel.

For more information on biomass and how it is used, see Practice Note, Renewable Energy: Overview (US): Biomass Energy.

Blue Hydrogen - Produced from natural gas while using carbon capture and sequestration (CCS) technology to reduce or eliminate greenhouse gases emitted from this process. Blue hydrogen and green hydrogen are two technologies currently being developed to transition to a cleaner energy future. They differ from:

- Gray hydrogen which is produced from natural gas or oil without the use of CCS technology. This is the most common type of hydrogen currently being produced.
- Brown or black hydrogen which is produced from coal gasification. The color depends on the type of coal used with:
  - brown hydrogen produced from lignite coal; and
  - black hydrogen produced from bituminous coal.

Cap-and-Trade - A market-based system for reducing greenhouse gas (GHG) emissions by imposing a "cap" on the amount of GHGs that a company is allowed to emit and granting the company an allowance to pollute within this cap. A company that does not use its full allowance can "trade" or sell its excess polluting allowances to other companies or bank them for future use. A company that wants to exceed its cap must purchase allowances (or carbon credits) from other companies. In the US, there is no cap-and-trade system at the national or federal level. However, there are two state-level carbon trading schemes:

- **Regional Greenhouse Gas Initiative (RGGI).** Eleven northeastern and mid-Atlantic states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and Virginia) participate in a regional CO_2 cap-and-trade system for fossil fuel-fired power plants with a capacity of 25 megawatts (MWs) or more. Launched in 2009, the RGGI establishes a regional cap on the amount of CO_2 that power plants can emit by issuing a limited number of tradable CO_2 allowances. Power plants can comply with the cap by purchasing allowances from quarterly auctions from other generators within the region or from carbon offset projects. For more information on this program, see Legal Update, Regional Greenhouse Gas Initiative

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Proposes Program to Further Reduce Carbon Emissions and The Regional Greenhouse Gas Initiative.

- **California's AB-32 Cap-and-Trade Program**. In 2013, California launched the first economy-wide emissions trading platform in the US, covering large electric power plants, large industrial plants, and fuel distributors. Covered emitters must hold enough allowances to cover their emissions and can buy and sell allowances on the open market. The program's GHG cap declined by 3% annually from 2015 to 2020 and is designed to decrease an additional 5% from 2021 to 2030. For more information on this program, see the California Air Resource Board: Cap-and-Trade Program

For more information on cap and trade programs, see Practice Notes, UNFCCC, the Kyoto Protocol and the Paris Agreement and Country Q&A, Environmental law and practice in the United States: overview.

Carbon Capture and Sequestration - Also known as carbon capture and storage (CCS), this is the process of capturing carbon dioxide (CO_2) (the most commonly produced greenhouse gas (GHG)) from power plants and other large industrial facilities or the atmosphere and then transporting it by pipeline or ship (as a pressurized cryogenic liquid), to be:

- Stored or injected in underground geological reservoirs (for example, depleted oil and gas fields or deep saline aquifer formations).
- Used or recycled to make products (for example, chemicals, fuels, cements, and plastics). When the captured carbon is used or recycled, this process may be referred to as carbon capture, utilization, and sequestration (CCUS).

It is estimated that CCS technology can capture up to 90% of the CO_2 emissions produced from the use of fossil fuels in electricity generation and industrial processes. However, this will require significant government support in the form of tax credits, research and development funding, and other subsidies and capital investment from the private sector.

Carbon Credit - A tradable permit or certificate that gives the holder of the credit the right to emit into the atmosphere one metric ton of carbon dioxide or an equivalent amount of another greenhouse gas (GHG). The credits are generated by companies that:

- Produce a lower amount emissions than permitted under cap-and-trade programs. These programs allow companies that have exceeded their cap to buy carbon credits from companies that have not exceeded their caps to meet their carbon reduction targets.
- Develop carbon reduction projects, for example, renewable energy projects or reforestation or afforestation (the process of planting new forests in an area where there was no previous tree cover projects. As a forest grows, it naturally removes CO_2 from the atmosphere and stores it in its trees).

For more information on carbon credits and how they are used, see Practice Notes, Lower-Carbon, Carbon-Neutral, and "Green" LNG and Green Marketing in the US.

Carbon Footprint - The estimated amount of carbon dioxide or other greenhouse gases (GHG) attributable to an individual or entity. Many companies have announced or implemented initiatives to reduce their GHG emissions. These initiatives include:

- Investing in renewable energy, energy efficiency, and other carbon reduction projects. For more information, see Practice Notes, Renewable Energy: Overview (US) and Lower-Carbon, Carbon-Neutral, and "Green" LNG.
- Adopting or pursuing strategies and technologies to capture GHG before they are released into the atmosphere.
- Entering into transactions that promote carbon reduction activities including sustainability-linked loans, green loans, and green bonds (see Practice Notes, Understanding Sustainability-Linked Loans, Understanding Green Loans, and Understanding Green Bonds).

Carbon Intensity - Also known as emission intensity, this is the measure of carbon emitted by an economic activity or product. This includes emissions from power plants, vehicles, and agricultural activities. In the case of electricity generation, carbon intensity is the amount of carbon dioxide (CO_2) produced to generate one kilowatt per hour (kW/hour) of electricity. Electricity generated from coal-fired plants, therefore, has a higher carbon intensity than that generated from renewable power plants.

There are several actions energy companies can take to reduce the carbon intensity of their operations. These actions include:

- Powering their operations with electricity generated from renewable resources.
- Improving the efficiency of their energy infrastructure.
- In the case of upstream oil and gas producers, reducing the amount natural gas that is flared or vented.
- Replacing coal-fired power plants with power plants powered with natural gas or renewable sources (most notably wind and solar).

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For more information on the US energy industry, see Practice Notes, US Oil & Gas Industry: Overview, Renewable Energy: Overview (US) and Country Q&A, Electricity regulation in the United States: overview.

Carbon Offset - This is the balancing out, canceling, or reduction of the amount of greenhouse gas (GHG) an entity releases into the atmosphere from its activities (for example, electricity generation or consumption or the production of liquefied natural gas) in one location by purchasing offset credits from companies that invest in carbon reduction or sustainable projects in another location. For example, a US oil and gas company may offset its GHG emissions by purchasing carbon offset credits from a carbon reduction project in Asia. Examples of a qualifying carbon reduction project include:

- Energy efficiency projects.
- Renewable energy projects.
- Reforestation or afforestation (the process of planting new forests in an area where there was no previous tree cover projects. As the forest grows, it naturally removes CO_2 from the atmosphere and stores it in its trees) projects.

To be valid, carbon offset credits must be verified and certified by an independent third party. Once verified and certified, these credits can be purchased and traded. Individuals, businesses, and other organizations may purchase carbon offset credits to meet mandatory or voluntary GHG emission reduction targets or to reduce their carbon footprint.

For more information on carbon offsets and how they are used, see Practice Notes, Lower-Carbon, Carbon-Neutral, and "Green" LNG and Green Marketing in the US.

Decarbonization - The process of reducing of the amount of greenhouse gas (GHG) emissions released into the atmosphere. In the context of the energy industry, this refers to the reduction of GHG in all steps of the energy value chain. This may include:

- Reducing flaring or venting during oil and gas production.
- Powering oil and gas extraction processes using renewable energy (most notably wind or solar) or carbon-free resources (for example, nuclear energy).
- Installing more energy efficient equipment to reduce leaks during the transportation and storage of fossil fuels.
- Replacing carbon intensive fuels with lower carbon or carbon neutral alternatives (for example, green hydrogen, wind, solar, and nuclear energy).
- Capturing and sequestering carbon emissions before they are released into the atmosphere.
- Using technologies and techniques developed in oil and gas drilling to convert the heat produced from these activities into geothermal energy.
- Monitoring emissions to respond to and eliminate leaks as soon as possible.
- Offsetting GHG emissions by investing in carbon neutral activities or the purchase of carbon offset credits.

For more information, see Practice Note, US Oil & Gas Industry: Overview.

Fuel Cell - A device that generates an electrical current by converting the chemical energy of fuel (for example, hydrogen) directly into electrical energy. Fuel cells rely on a chemical reaction and emit less carbon than fossil fuel based technologies, such as coal-fired plants. In addition to being cleaner and more environmentally friendly, fuel cells are energy efficient and fuel flexible.

According to the Department of Energy (DOE), fuel cells have the potential to replace the internal combustion engine in vehicles and provide power in stationary and portable power applications. Despite these demonstrated benefits, there are many reasons why fuel cells are not yet widely used, including:

- The high capital costs of fuel cell power systems.
- The durability of fuel cell systems has not been established.
- The size and weight of current fuel cell systems must be reduced to meet the packaging requirements for automobiles.
- Better storage technologies have not yet been developed.

Fugitive Emissions - Emissions from the unintentional, accidental, or irregular release of carbon dioxide, methane, and other greenhouse gases from:

- Pressurized equipment including pipelines and storage facilities.
- Flaring and venting during oil and gas production.
- Improperly sealed wells.

This is also referred to as methane leak or slip.

For information on the regulation of fugitive emissions, see Legal Update, EPA Issues Two Final Rules to Roll Back Oil and Gas Methane Emissions Regulations and Practice Note, Biden Administration Energy and Climate Change Policies and Regulations: 2021 Tracker: EPA.

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Geothermal Energy - Energy that is generated from heat extracted from hot water or steam mined from the reservoirs in the earth's crust. The water or steam extracted can be used to heat water or generate electricity. Once the water is used, it is injected back into the earth.

Greenhouse Gases - Atmospheric gases that absorb and emit infrared radiation that are created naturally and are necessary to keep the earth warm and habitable. However, human-made GHGs, created by activities like burning fossil fuels, have increased GHG levels in the atmosphere. These increased GHG levels are considered to be a major cause of the greenhouse effect and, more specifically, global warming.

Examples of GHGs include:

- Carbon dioxide.
- Methane.
- Nitrous Oxide.
- Ozone.
- Water vapor.

In the US, state and federal agencies, including the Environmental Protection Agency, have created and are continuing to add and revise extensive regulations to limit human-made GHG emissions from, among other things, automobiles, buildings, factories, and power plants.

Green Hydrogen - A fuel produced using a chemical process known as electrolysis, a process where an electrical current is used to split water molecules into oxygen and hydrogen. The electricity used to power this process is derived from renewable sources (such as solar or wind) instead of fossil fuels and results in no carbon emissions.

Green hydrogen is considered essential to meeting the goals of the Paris Agreement and to transition from fossil fuels because of the many advantages it offers. These advantages include:

- It is abundant. There is more hydrogen in the universe than any other element.
- It can be used where it is produced or transported elsewhere.
- It can be stored in large amounts for a long time.
- It can be produced wherever there is water and electricity to generate more electricity or heat.

Green Premium - Initially coined by Bill Gates, this is the additional cost of choosing a clean technology rather than one that emits a greater amount of greenhouse gases. Examples of where green premium may apply include:

- The electricity generated from renewable resources versus fossil fuels.
- A cargo of regular liquefied natural gas (LNG) versus lower-carbon or carbon-neutral LNG.

In calculating the green premium, it has been recommended that market participants look beyond the additional financial costs of the cleaner technology to consider the environmental and social benefits that the cleaner alternative confers.

Green Washing - The practice of overstating the environmental benefits of a product, service, or idea. This can create confusion among market participants regarding whether the promoted financial product meets the stated green or sustainability goals. To minimize green washing, industry groups have issued guidelines that financial products must comply with to be marketed as a green or sustainable product. These guidelines include the Green Bond Principles, the Green Loan Principles, and the Sustainability-Linked Loan Principles.

For more information on green washing and the guidelines that have been issued to manage this risk, see Practice Notes, Understanding Green Bonds, Understanding Green Loans, and Understanding Sustainability-Linked Loans.

Kyoto Protocol - A treaty developed in 1997 by the United Nations Framework Convention on Climate Change (UNFCCC) that sets legally binding and enforceable greenhouse gas (GHG) emissions standards on member countries. As part of the protocol, industrialized countries agreed to a 5% reduction in their GHG emissions from the 1990 levels by 2012, based on the average calculation of emissions during the first commitment period from 2008 to 2012. To assist countries in their efforts to reduce GHG emissions, the Kyoto Protocol installed the following mechanisms:

- Emissions trading, where a country can sell or trade excess emissions units to a country that is over its limit.
- Clean development mechanism, where an industrialized country can earn certified emission reduction credits by implementing an emissions reduction project in a developing country.

Joint implementation, where a country can receive emission reduction units by investing in an emissions reduction project in another country.

In 2012 the "Doha Amendment" to the Kyoto Protocol was adopted that establishes a second commitment period (2013–20). The amendment enters into force once three-quarters of the parties to the Kyoto Protocol (144) have ratified the amendment. As of June 16, 2020, 140 parties

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have ratified the amendment. The US has not ratified the Kyoto Protocol.

Net Zero - In the context of climate change and greenhouse gases (GHG) emissions, net zero refers to the goal of achieving a balance between the volumes of GHG produced and the GHG removed from the atmosphere to:

- Keep the rise in global mean temperatures well below 2# above pre-industrial levels.
- Limit global warming to 1.5# as agreed in the Paris Climate Agreement.

Net zero may be achieved by implementing several strategies, including:

- Decarbonizing the electricity sector. This requires increasing the percentage of US energy generation produced from renewable sources, including wind and solar.
- Increasing energy efficiency, including constructing more green buildings.
- Increasing the percentage of electric or zero-emission vehicles on the roads.
- Reducing the amount of methane, carbon dioxide, and volatile organic compounds released into the atmosphere.

As part of President Biden's Leaders' Summit on Climate that was held in April 2021, the Department of Energy (DOE), along with other governments, announced six new initiatives that are intended to:

- Expand international cooperation around tackling the climate crisis.
- Boost clean energy innovation.
- Advance an equitable transition to a net zero future.

These efforts are intended to meet the Biden Administration's ambitious domestic goals of 100% clean electricity by 2035 and net zero carbon emissions by 2050, while creating millions of good-paying jobs across the nation.

Paris Agreement - An international treaty adopted in Paris on December 12, 2015 at the 21st session of the Conference of the Parties (COP21) to the 1992 United Nations Framework Convention on Climate Change (UNFCCC) (UNFCCC). The nations that are signatories have agreed to limit global warming well below 2 degrees Celsius above pre-industrial levels or ideally to pursue efforts to limit the temperature increase to 1.5 degrees above pre-industrial levels.

Key elements of the Paris Agreement include:

- Requiring countries to submit plans on how they intend to meet their carbon emission goals. Each nation must submit its own nationally determined contribution (NDC) ahead of the conference, setting out a national climate action plan and outlining the steps it intends to take to curb its emissions. The NDCs must be as ambitious as possible and reviewed and tightened every five years.
- Monitoring, verifying, and reporting greenhouse gas (GHG) emissions.
- Helping developing nations list sources of emissions and track their goals.

The Paris Agreement went into effect on November 4, 2016, after it was ratified by 55 countries that accounted for at least 55% of global emissions, including the US. The US withdrew from the Paris Agreement during the Trump Administration, on November 4, 2020 (see Legal Update, US Sends Formal Notice to UN to Withdraw from Paris Climate Agreement). In January 2021, President Joe Biden signed a letter to re-enter the US into the agreement. Under the terms of the Paris Agreement, the re-entry was effective on February 19, 2021. For more information, see Practice Note, Biden Administration Energy and Climate Change Policies and Regulations: 2021 Tracker: Paris Climate Agreement and Climate Change Leadership.

Hundreds of companies have also pledged to reduce their GHG emissions to meet the goals of the Paris Agreement (see, for example, The Climate Pledge) by:

- Investing in renewable energy projects or meeting their electricity needs using renewable sources, mostly wind and solar.
- Using carbon credits or carbon offsets to reduce the amount of GHG emissions they cannot eliminate from their operations.

For more information on the Paris Agreement, see Practice Note, UNFCCC, the Kyoto Protocol, and the Paris Agreement.

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