The Materials Ecosystem Glossary

The definitions used in this glossary were derived from multiple sources listed below and were modified to represent Dow's use of these terms. These definitions are subject to change and will be updated regularly as the materials science industry continues to shift and change rapidly.

advanced recycling: A process for transforming used plastics and other waste into raw materials, which can be used to produce new plastics and other products. This process can treat mixed or contaminated plastic waste that mechanical solutions cannot recycle. Advanced recycling typically uses thermal heat in the absence of oxygen, pressure or chemical catalysts to change and convert the chemical structure of the polymer into its basic molecular building blocks that are then used as raw material to make virgin-like plastics or other products. Also known as chemical or molecular recycling.
alternative feedstock: Any raw material that replaces fossil-based carbon as feedstock for manufacturing processes in the chemical industry. This includes plastic waste, biomass, other bio-based resources and gaseous effluents.
bio-based: The term bio-based describes materials (products or chemicals) derived in whole or in part from biomass resources, including marine agricultural, plant, animal and fungal sources.
bio-based feedstocks: Feedstocks derived from biomass, such as plants, animals and microorganisms**.** Bio-based feedstocks do not necessarily create materials that are biodegradable or compostable after use, and bio-based products often need to be recycled using the same process as other feedstocks.
blended finance model: An approach using a mix of development, philanthropic and private capital to catalyze development, often in developing countries.
by-product: A material produced through the process of making something else. For example, sawdust is a by-product of the lumber industry.
carbon capture and sequestration (CCS): The capture of carbon dioxide (CO2), generally from large sources such as power generation or industrial facilities that use either fossil fuels or biomass as fuel. The captured CO2, if not being used on site, is compressed and then transported via pipeline, rail, ship or truck for use in various applications. Captured CO2 may also be injected into geological formations deep below the ground, such as saline aquifers or depleted oil and gas reservoirs.
carbon dioxide (CO2): Carbon dioxide (CO2) is the main greenhouse gas emitted from human activities such as driving automobiles and powering businesses and homes.
carbon footprint (see "product carbon footprint"): The amount of greenhouse gases an individual, organization or product emits through all activities.
carbon & climate balancing types

- **carbon credits (on the voluntary carbon market)**: Credits that a project may recognize after being verified and certified: one carbon credit is equal to the avoidance or absorption of one tCO2e (a ton of carbon dioxide equivalent).
- **carbon neutral:** When the CO2 released from a company's activities into the atmosphere is balanced by an equal amount being removed.
- **carbon negative** or **climate positive:** When activity goes beyond achieving net-zero carbon emissions by removing more carbon dioxide from the atmosphere.
- **carbon positive:** When business emissions are above zero, not removing more carbon than produced. The term is generally confusing and best avoided.
- **climate neutral:** When greenhouse gas (GHG) is reduced to zero while all other negative environmental impacts from an organization are eliminated.

- **carbon offsetting:** Projects to neutralize the effects of organizations' remaining carbon emissions after the organization has undergone emissions reduction. For example, a company may do all it can to reduce its scope 1 and 2 carbon emissions in owned production and manufacturing but may be limited in reach and control to reduce "hard to abate" scope 3 emissions**,** such as its third-party electricity provider's emissions. To address these "hard to abate" emissions, an organization may invest in carbon removal technologies and programs, such as direct air capture, to offset its emissions further and regenerate the broader ecosystem.
- **carbon sink:** A natural or artificial process that removes carbon dioxide from the atmosphere. Forests and oceans are examples of natural ecosystems that are carbon sinks, whereas carbon capture technologies such as sequestering carbon through seaweed and then sinking it into the deep ocean is an example of an artificial carbon sink.

circular economy: A systems approach for industrial processes that is restorative or regenerative by design, aiming for climate-neutral and resource-efficient outcomes by reusing products or bio-based materials rather than virgin feedstock to make new products. A circular economy aims to fix the wasteful nature (make, use, dispose paradigm) of a linear economy.

circular polymers: Polymers produced from either post-consumer plastic waste or industrial waste through mechanical and advanced recycling technologies. Applications for circular polymers have the potential to include all plastics applications if advanced recycling technologies are used.

closing the loop: This concept is used in many contexts. In the circular economy, it refers to the process of recycling materials that comprise a product or package into raw materials for making other or similar products. In a linear economy, resources and materials are destined for waste in an open loop system where a product or material has no feedback path. In circular models, resources and materials are restorative and regenerative by value and designed to create a closed-loop system where a product or material can have multiple lives.

carbon dioxide equivalent (CO2e): A measure used to evaluate all greenhouse gases, including CO2, methane (CH4) and nitrous oxide (NO2) on the same scale based on their global warming potential (GWP).

consumer packaged goods (CPG): Items that consumers typically use daily and often buy, such as beverages, office supplies and tissues.

corn stover: Cobs, leaves and stalks that remain in fields after the harvest.

decarbonization: The process wherein people, countries, organizations or other initiatives aim to achieve zero fossil carbon existence. Decarbonization generally refers to a reduction of carbon emissions from electricity, industry and transport.

design for recyclability: Designing end-use applications, such as packaging or automotive parts, from the beginning with the intention of making them compatible with existing recycling infrastructure at the end of the product's initial use.

downgauging: Enabling light-weighting without compromising material performance.

extended producer responsibility (EPR): An environmental policy approach that shifts the responsibility for managing post-use waste from municipalities to producers and potentially distributes responsibility through a product's supply chain.

feedstocks: Any (unprocessed) material used to supply a manufacturing process. Examples are crude oil, biomass, (renewable) electricity, hydrogen and coal.

flexible packaging: A package or container made of flexible or pliable materials that, when filled or closed, can be readily changed in shape. Flexible, resealable stand-up pouches for food are one example.

green chemistry: The design of chemical processes and products to eliminate or reduce the creation or use of hazardous substances. The practice applies across a chemical product's life cycle — design, manufacture, use and ultimate disposal.
greenhouse gas (GHG): Gas that accelerates the greenhouse effect, causing Earth's warming by trapping heat in the atmosphere. The seven main greenhouse gases are carbon dioxide, methane, nitrous oxide and four main categories of fluorinated gas: hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride and nitrogen trifluoride.
greenhouse gas (GHG) protocol: Global, comprehensive standardized frameworks to measure and manage greenhouse gas emissions from public and private sector operations, mitigation action and value chains. Internationally, it is the most used method to measure and reduce greenhouse gas emissions.
hard-to-recycle plastics: Some plastics use various polymers and other materials that increase the difficulty of recycling. The mixed material is a source of contamination during reprocessing and subsequent use and requires additional treatment, which enhances the quality of recycled plastics through a washing process before it is transformed into circular feedstocks.
materials ecosystem: The materials ecosystem is a web of interrelated services, technologies and products that transform plastic waste and renewable waste – such as used cooking oil and inedible plant waste – into useful materials. The ecosystem includes stakeholders in waste management, recycling, design, manufacturing, retail, brand ownership, public policy and consuemr segments.
life cycle assessment (LCA): A methodology for quantifying sustainability in which the environmental impact of a product, material, process or other activity is analyzed throughout its entire life cycle.
mechanical recycling: The processing of material waste into secondary raw materials or products without significantly changing the material's chemical structure.
mass balance: An approach to calculating the amount of recycled content in a final product when different feedstocks have been used to create that product. For example, different feedstocks cannot be physically separated once they are co-fed into large-scale chemical processing, and mass balance is used to accurately attribute the amount of recycled or bio-based content allocated to products.
materials recovery facility (MRF): A facility that acquires, sorts and prepares recyclable materials for marketing to end-user manufacturers. Also known as a materials reclamation facility, materials reuse facility or materials recycling facility.
monomer: A molecule that can be chemically bonded to other molecules to become a polymer.
nature-based solutions: Nature-based solutions involve addressing societal challenges by working with nature to benefit human well-being and biodiversity. These actions, designed and implemented with the full engagement and consent of local communities and Indigenous Peoples, underpin biodiversity. One example is Dow's Valuing Nature Sustainability 2025 Goal.
net zero: A target to completely negate the amount of greenhouse gases produced by human activity, achieved by reducing emissions in step with implementing carbon removal methods.
net-zero carbon emissions: When an activity emits carbon at the same level at which the carbon is removed from the atmosphere.
nuclear energy: The energy released during nuclear fission or fusion, primarily when used to generate electricity. It has the advantage of low greenhouse gas emissions.
Pack Studios: State-of-the-art Dow facilities situated in strategic locations worldwide, offering equipment, characterization and testing capabilities for packaging, paired with a network of industry expertise from Dow and Dow's partners.
polymer: Polymer is often used as a synonym for plastic. Polymers are technically a string of covalently bonded monomers. Ethylene and propylene are common monomers used to make polymers, such as polyethylene and polypropylene.

polypropylene (PP): A polymer based on the monomer propylene. PP is a tough and rigid polymer often used in automotive, medical and packaging applications.
post-consumer recycled (PCR) plastics: Any plastic material converted into a recycled feedstock and then processed into a new, recycled product. For example, a discarded detergent jug could move through the recycling process where it is broken down and transformed into the ingredients to create a new plastic product, such as a shampoo bottle from recycled content.
post-industrial resin/recycled content (PIR): A material diverted from manufacturing processes' waste streams.
primary, secondary and tertiary packaging structures: Primary packaging is the first layer of packaging that directly holds the product for sale. Secondary packaging is a wrap or containment of the primary packaging. Secondary packaging includes films and containers. Tertiary packaging or distribution packaging protects the product during distribution and provides efficient handling in the distribution center and retail environments. Tertiary packaging includes pallets, films and large shipping containers for transportation, storing and warehousing.
product carbon footprint (PCF): The measurement of the total amount of carbon dioxide emissions that are a direct or indirect result of an activity or are accumulated over the life cycle of a product. PCF helps companies and consumers understand the environmental impact of the products sold and bought.
product carbon neutrality: For a product to be "carbon neutral," carbon footprint or emissions resulting from making that product will have been negated, or balanced out to zero, through a combination of reducing emissions from the production process and investing in emissions reductions efforts outside of the producer's operations.
public-private partnerships (PPPs): Collaboration, typically between government or NGOs and a private-sector company that can be used to finance, build and operate projects, platforms and programs. Also known as PPPs, this type of collaboration has become increasingly popular over the past decade and represents a shift in how business and government/NGOs work together to solve problems.
pyrolysis: An advanced recycling process that uses thermal heat in the absence of oxygen to deconstruct materials primarily into liquids.
recycling infrastructure: The recycling facilities, collection vehicles, collection programs and sorting equipment that enable recycling.
regulatory & market mechanisms

- **Paris Agreement**: Signed in 2015, the agreement sets out a global and international framework to limit global warming to 1.5°C and avoid irreversible climate change. (Note: The carbon version of the Global Plastics Agreement is currently being negotiated.)
- **regulatory or compliance carbon market**: Marketplaces through which regulated organizations manage emissions permits (allowances) or offsets to meet regulatory requirements. This market is based on a cap-and-trade system of quotas to follow the regulations. Significant polluters, such as big oil and gas companies, are in this market.
- **voluntary carbon market**: The market started under the UNFCCC in 2000 to help northern hemisphere countries meet their Kyoto Protocol targets by financing emission reduction actions in southern hemisphere countries with the most vulnerability to climate change. This mechanism allows CO2 emitting activities (organizations and individuals) to take voluntary climate action by financing carbon reduction or carbon capture and storage programs with co-benefits to the local communities and biodiversity.

sources of business carbon emissions

- **scope 1**: Direct emissions from sources owned or controlled by the organization, e.g., the company's cars.

- **scope 2**: Indirect emissions from the production of electricity purchased and consumed by a company, e.g., the linked power plants.
- **scope 3**: All other indirect emissions the organization generates, e.g., the companies' buildings, waste, air travel, etc.

sustainable development: Development that meets the needs and expectations of today's generation without sacrificing the ability of future generations to meet their needs.
systems change: Confronting root causes of issues (rather than symptoms) by transforming structures, customs, mindsets, power dynamics and policies through strengthening collective power and the active collaboration of diverse people and organizations.
traceability: The ability to discover information about where and how a product was made, as well as its end-use journey, across the value chain.
Transform the Waste: Dow's public, corporate commitment to accelerate the circular ecosystem by transforming waste and alternative feedstocks rather than simply stopping waste from entering the environment. Through its Transform the Waste commitment, Dow aims to deliver 3 million metric tons of circular and renewable solutions annually by 2030. This commitment builds on a previous commitment called Stop the Waste.
United Nations Sustainable Development Goals (SDGs): Preceded by the Millennium Development Goals, the United Nations Member States adopted 17 Sustainable Development Goals as a call to action for all countries to continue developing a global partnership. The goals center on interrelated issues, including water, energy, climate, ocean, consumption, gender, health, etc.
value chain: The process or activities by which a company works across multiple players, partners and internal teams to create and sell a product, including marketing and after-sales service.
verified carbon reduction (VCR): carbon reduction programs, platforms and technologies verified by a third-party standard. Carbon offset registries are critical in determining legitimate carbon offsets.
virgin plastic: Typically referred to as the resin produced without recycled materials.
waste-pickers: A waste management role, often in the informal economy, where a person will salvage recyclable or reusable materials discarded by others to sell or for personal consumption. In a Dow context, waste-pickers help create circular economies by gathering and diverting waste from landfills and the environment.
waste-pickers cooperatives: Member-owned, democratically controlled organizations that can potentially help transition informal economy workers to the formal economy by strengthening their collective voice and negotiation power, securing incomes and facilitating access to basic services and social protection.
waste-workers: Often synonymous with waste pickers, this term represents a shift in viewing and actualizing this role as part of the formal economy with access to good jobs under a government municipality or private company. In a Dow context, co-creating with waste workers, similar to waste-pickers, is integral in solving the supply-side challenges in the circular economy.

SOURCE LIST:

- Amazon
- Association of Plastics Recyclers
- Bain & Company
- Bank of America
- Boston Consulting Group (BCG)

- Carbon Better
- Center for Strategic and International Studies
- ClimateSeed
- Delterra
- Earth.org
- Environmental Defense Fund
- Ellen MacArthur Foundation
- Environmental Protection Agency (EPA)
- European Environment Agency
- GHG Protocol
- Greenly
- Institute of Packaging Professionals
- International Energy Agency (IEA)
- Intergovernmental Panel on Climate Change
- International Labour Organization
- Joint Research Centre - EU
- McKinsey & Company
- Merriam-Webster
- National Geographic
- National Institutes of Health
- Nature-based Solutions Initiative
- Organisation for Economic Co-operation and Development (OECD)
- Packaging Europe
- Plastics Europe
- Renewable Carbon Institute
- Rochester Institute of Technology
- The European Chemical Industry Council (CEFIC)
- U.S. Energy Information Association
- UNFCCC
- United Nations
- United Nations Climate Change
- University of Michigan
- Women in Informal Employment: Globalizing and Organizing (WEIGO)
- World Bank
- World Economic Forum (WEF)
- World Resources Institute