

THE ALUMINUM ASSOCIATION

Aluminum Agenda: Climate

Benefits in use



Lightweight, durable and infinitely recyclable, aluminum can help solve many global energy and climate challenges. The U.S. aluminum industry is continuously innovating to reduce energy use and carbon impacts of production.

Aluminum is one of the world's most ubiquitous metals, used in everything from consumer goods to electronics to infrastructure. The U.S. aluminum industry is committed to continued improvement in every aspect of aluminum production and recycling. Notably, aluminum is incredibly sustainable in its use phase – making cars and trucks more energy efficient, buildings greener and packaging more recyclable. In addition, the industry is firmly committed to helping reduce the environmental impact of the production side. A recent life cycle assessment report tracks the environmental impact of producing a unit of aluminum in North America across several different markets.

INCREASING DEMAND, DECREASING IMPACT

Aluminum production is more sustainable today than ever before. U.S. aluminum producers have reduced their environmental impact while increasing output, meeting the growing demand for the material while prioritizing sustainability. Over the past 30 years, the aluminum industry in North America has cut the intensity of greenhouse gas emissions from primary aluminum production by more than half while doubling the amount of aluminum collected for recycling. A [Sector Snapshot](#) released in 2021 showcased positive environmental trendlines on virtually every measure over the past 25 years. The report is modeled after EPA sector snapshots and focuses on key environmental indicators in air, energy, GHG emissions, land management, water, waste, and scrap usage.

NEW TECHNOLOGIES ARE A GAME-CHANGERS

Aluminum's history is one of increasing efficiencies and new processes. Producing aluminum – particularly new (or primary) aluminum – is an inherently energy-intensive process. The processing of aluminum became economically viable when economical and large-scale electricity became available. Today, electric power represents about 20% to 40% of the cost of producing primary aluminum. Aluminum produced in North America is among the cleanest in the world thanks to a heavy reliance on renewable hydropower electricity generation, which has risen from 63% in 1995 to 78% today.

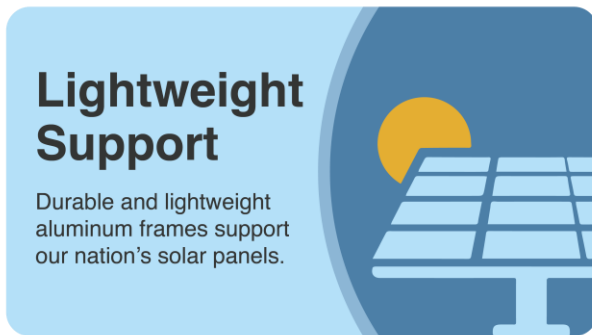
Several major aluminum companies in the United States and around the world are working to revolutionize primary aluminum production. One pathway is using **new inert anode technology**, which eliminates all direct greenhouse gas emissions in primary production. Instead of CO₂, the system emits oxygen during the smelting process. Another company is investigating a process utilizing aluminum chloride, which keeps any carbon generated in a closed loop. Aluminum companies are working with automakers to recover process scrap from stampers and remelt/cast it for the same products. And several companies are investing in industrial-scale carbon capture technologies to address carbon emissions from existing aluminum smelters.

MAKING OLD NEW AGAIN

Secondary Production is the process of recycling aluminum scrap into aluminum that can be used again—an environmentally sound process that is around 95% more energy efficient than primary production. Scrap segregated by chemical composition, or alloy type, maintains the highest value while scrap containing a mix of alloys and other materials has the lowest. New technologies, such as Laser Induced Breakdown Spectroscopy and Color Sorting, can separate aluminum and remove contaminants to improve the quality and value of the scrap. This fine-tuned recycling process allows more aluminum to be recycled over and over again rather than reaching the landfill. The industry is also developing molten aluminum purification technologies at scale that will allow higher value uses from previously contaminated aluminum.

ALUMINUM MAKES GOOD PRODUCTS GREAT AND GREAT PRODUCTS EVEN BETTER

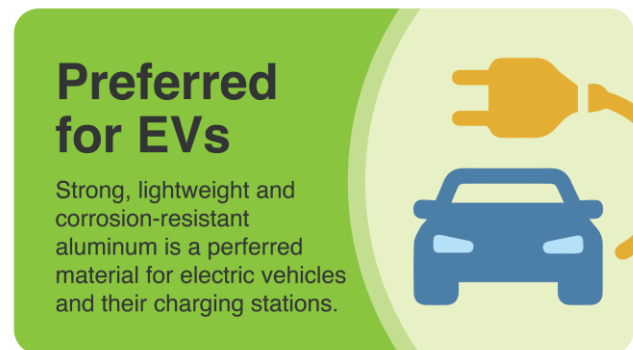
Aluminum is already a material tailor-made for a more circular economy. Aluminum is infinitely recyclable at the end of life, but it is during its use phase that the material really shines. Lightweight, durable and corrosion-resistant aluminum helps innovators do more with less environmental impact. From supporting increased fuel economy in vehicles and cooling efficiencies in buildings, to creating “green” buildings and the perfect, light weight beverage container, aluminum is providing economical and environmentally friendly solutions. Companies that choose aluminum are reaping the benefits and so is the environment.



Aluminum is a Key Material for Renewable Energy

With its lightweight strength and unmatched corrosion-resistance and durability, aluminum is widely used to build renewable energy platforms. According to the [World Bank's analysis](#), a robust effort to combat climate change could more than double demand for aluminum by 2050 compared to the base case scenario. According to the same study, aluminum is the single most widely used mineral material in solar photovoltaic (PV) applications. In fact, aluminum accounts for more than 85% of the mineral material demand for solar PV components – from frames to panels.

Aluminum is also a critical component in other low carbon technologies including wind, energy storage and hydroelectricity. The metal is used widely in both on-shore and off-shore wind projects, including tower platform components and turbines. Aluminum also forms a key component of electrical transmission infrastructure, bringing renewable power from generation areas to population centers. And aluminum-ion batteries have the potential to revolutionize energy storage systems – charging faster and holding a far greater charge for longer than lithium-ion alternatives. As one of the most abundant materials on the planet, the widespread adoption of aluminum-ion batteries would also help address concerns around rare-earth metal extraction and battery recycling.



The Green Metal for Smart Vehicle Design

The most innovative vehicles of today *and* tomorrow are designed with aluminum. It is the [fastest growing material](#), most environmentally friendly and cost-effective way to cut total carbon emissions, without sacrificing size or strength. Aluminum-intensive vehicles are already leading in safety, performance, efficiency and sustainability. When considering the full “life cycle” of the vehicle, government and auto industry studies confirm that among competing materials, aluminum offers the smallest total carbon footprint when all phases of a vehicle’s production are considered. Converting all pickup truck sales to aluminum-bodied pickup trucks could reduce life cycle energy demand and lower global warming potential by 7.8 metric tons of CO2 equivalent – and that could save 11 million barrels of oil.

Aluminum's growth in the automotive market is driving innovation and enabling automakers to differentiate from competitors. By 2030, aluminum content per vehicle will rise by more than 100 pounds compared to 2020 to meet the needs for future hybrid and electric vehicles. Light trucks like the electrified Ford F-150 Lightning are expected to have an average of nearly 550 pounds of aluminum content. Luxury sedans like the Tesla Model S and sports cars like the Acura NSX will boast more than 800 pounds of aluminum content.