

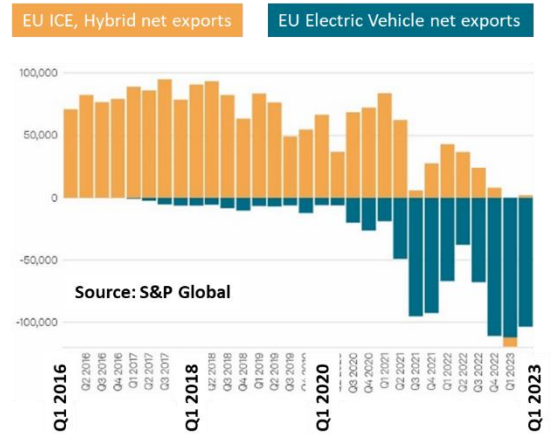
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Market Update

The changing nature of transport sector in Europe

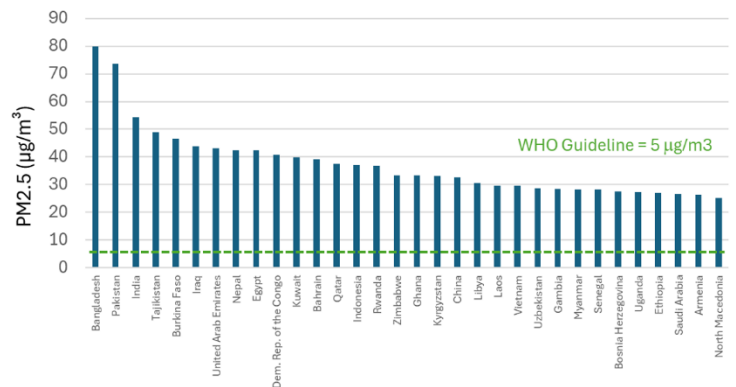
Changes in the European vehicle make-up worth noting:

- According to [ACEA](#), the share of new battery electric cars sold in Europe reduced from 13.9% in March 2023 to 13% in March 2024. On the other hand, the share of hybrids increased from 24.4% to 29% in that same period.
- S&P Global, in an [article](#) covering the changing dynamics of the automotive sector vis-à-vis China, noted that Europe has swung from an exporter to a net importer of vehicles from China, especially for electric vehicles
- According to a Benchmark Mineral Intelligence analysis, European domestic battery production will fall short of demand by > 450 GWh in 2030 – and that European manufacturers will account for only a third of that production.



2023 World Air Quality Report shows long way to go for cleaner air

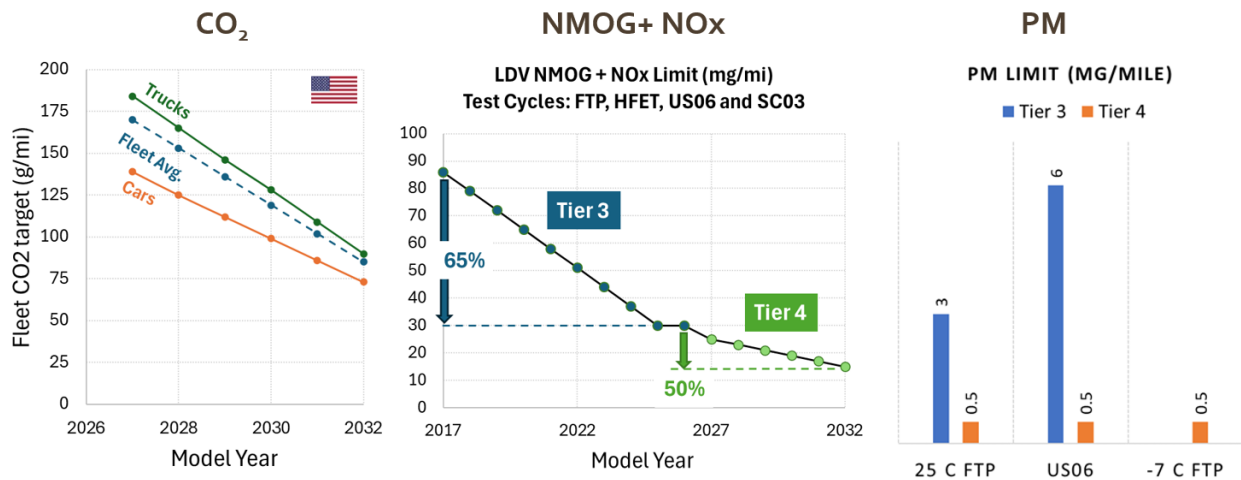
Even as the major developed regions work towards their final regulations on criteria pollutants, the problem of unhealthy air is far from solved. IQAir has [published](#) the 2023 annual report on air quality across the world, and it shows that much of the world's populations is still breathing dangerous levels of unhealthy air. A total of 124 (92.5%) out of 134 countries and regions exceeded the WHO annual PM2.5 guideline value of 5 $\mu\text{g}/\text{m}^3$. Highly populated countries in Asia are especially at risk. 83 of the world's worst polluted cities are in are in India. India's population-weighted PM level in 2023 of 54.4 $\mu\text{g}/\text{m}^3$ was >10X higher than the WHO PM2.5 annual guideline.



Regulations / Reports

U.S. EPA MY 2027+ Light- and Medium-duty Multipollutant Rule

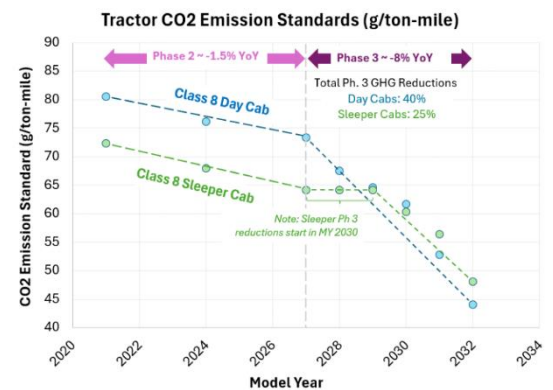
The U.S. EPA has finalized the CO₂ and criteria pollutant standards for light- and medium-duty vehicles for model years 2027 and beyond. The rule requires a 50% reduction in CO₂ (~fuel consumption) from MY 2027 through 2032, and a similar reduction in combined hydrocarbon and NO_x emissions. A particulate filter enforcing particle mass limit of 0.5 mg/mi is also included for a broad range of testing conditions. The rule is technology neutral but expected to drive increased market share of electrified powertrains (including hybrids).



U.S. EPA MY 2027+ Heavy-Duty GHG Phase 3 Standards

The U.S. EPA has [finalized](#) GHG standards for heavy-duty vehicles for model years 2027 and beyond. These “Phase 3” standards result in a significant increase in stringency compared to the previous rule, with the aim of accelerating ZEV adoption. Still, the rule is technology neutral, that is, the limits can be met through a combination of any powertrain solution.

For Class 8 long haul trucks, the rule requires 25% - 40% reduction in CO₂ emissions from 2027 through 2032, expected to result in a similar level of ZEV market share if the ICE efficiency does not significantly improve beyond 2027.



Low Carbon Transportation Materials Program

The U.S. Federal Highway Administration (FHWA) has [launched](#) the Low Carbon Transportation Materials Program which will provide \$2 billion in incentivized funding for low carbon construction materials including steel, concrete, and asphalt, and products used in transportation.

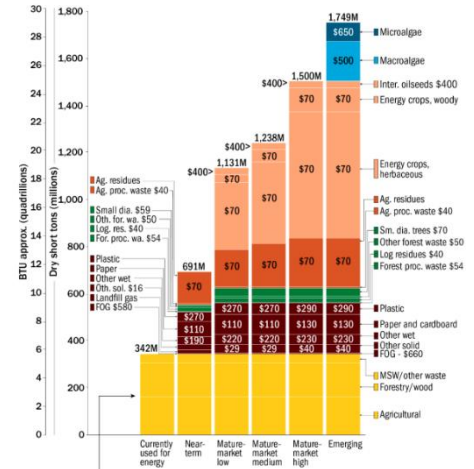
Europe published CO₂ accounting methodology for batteries

Decarbonization of transport will require a full lifecycle accounting of the greenhouse gas emissions from all powertrain types. The European Commission has taken a step in that direction and [published](#) a draft methodology for calculating the carbon footprint of batteries used in electric vehicles. The act will require calculation of CO₂ emissions resulting from battery raw materials extraction, processing and transport, production of battery components, manufacturing, and transport of batteries to final use, and end of life processing and recycling. The act describes in detail the treatment of carbon intensity of electricity used for each step. The footprint of batteries will be calculated based on their estimated use through the life of the vehicle, and expressed as g-CO_{2,eq}/kWh.

Renewable Fuels & Electrification

Biomass potential of the U.S. quantified: 2X – 5X compared to today

The U.S. Department of Energy (DOE) Bioenergy Technology Office (BETO) has [published](#) the “2023 Billion-Ton Report” which estimates that the U.S. can potentially increase biomass production from the current capacity of 342M tons to as much as 1.7 billion tons. The report considers biomass production potential from sources with varying degree of maturity. Importantly, this is a conservative estimate, including sustainability considerations (e.g. considering land for CO₂ sequestration and water management), and does not take away from food production. Additional biomass could be derived from waste & byproducts (e.g. paper and plastic), forest timber, agricultural resources, and microalgae. The report also discusses the costs associated with each of these resources.



Sustainable Aviation Fuel (SAF) Credits

The U.S. Department of the Treasury and Internal Revenue Service (IRS) released [guidance](#) on SAF credits, previously announced as part of the Inflation Reduction Act (IRA). According to this guidance, SAF that achieves a GHG emissions reduction of 50% is eligible for \$1.25 credit per gallon, and for an additional \$0.01 per gallon for each percentage point the reduction exceeds 50%, up to \$0.50 per gallon. The actual reduction will be calculated using the SAF-GREET 2024 model. For corn ethanol-to-jet, a greenhouse gas reduction credit is provided if certain USDA recommended Climate Smart Agriculture CSA practices (no-till, cover crop, and enhanced efficiency fertilizer) are used.

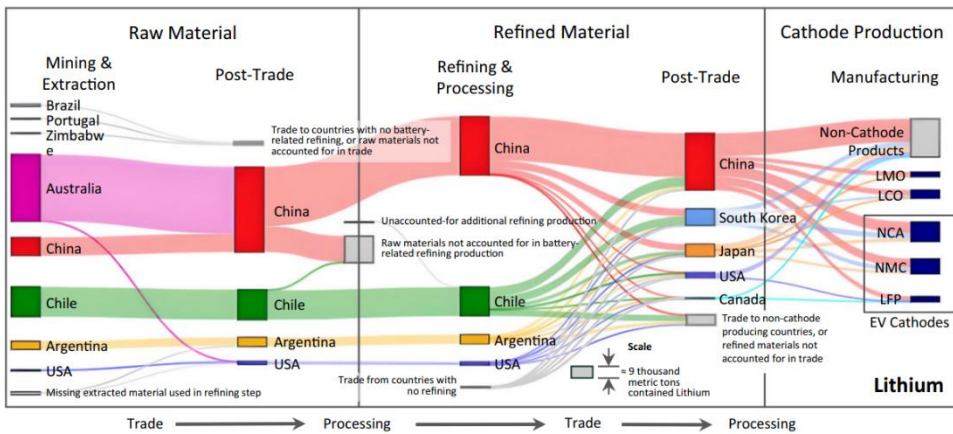
Field testing of hybrid truck for mining

When you think of hybridization, you don’t typically picture a 220-ton mining truck. Cummins, in partnership with a Chinese mining truck manufacturer NHL, is [testing](#) exactly that, in the field. The hybrid QSK50 engine allows downsizing from 2,500 to 2,000 hp and can potentially reduce fuel consumption by 30%.

Cost of making one fuel cell truck? Over a million dollars

The case for increasing ZEV truck sales – such as those targeted by the EPA GHG Phase 3 rule – rests on lower total cost of ownership and availability or recharging / refueling infrastructure. For hydrogen fuel cells, both are still very challenging. According to [Nikola](#), the direct cost of manufacturing one fuel cell electric truck in Q4 2023 was \$679,000, which increases to \$1.26M when adding fixed costs. In Q1 2024, Nikola [sold](#) 43 fuel cell trucks. Earlier this year, Nikola opened its first ever H₂ refueling station, with \$58.2M in grants from public funds.





Battery material vulnerabilities

A paper published in [Nature Communications](#) by researchers at the Carnegie Mellon University has quantified vulnerabilities of battery supply chain for NMC and LFP cathode materials. The paper provides a good overview of the material flows and regional shares, and the dominance of China.

Conferences



The annual SAE WCX was held in Detroit and covered all aspects of transport decarbonization through parallel sessions, an exhibition floor, and a ride & drive event. [Download](#) presentations made at the kick-off sessions on emissions and sustainability. And here is a good summary of the conference by [DieselNet](#).

Here are some upcoming conferences to consider attending –

DOE Hydrogen Program Annual Merit Review, May 6 – 9, Arlington, Virginia

[Home | Hydrogen Program Annual Merit Review & Peer Evaluation Meeting \(energy.gov\)](#)

Emissions Analytics Off-Highway Powertrain and Fuels USA 2024, May 8-9, Irvine, California

<https://conferences.emissionsanalytics.com/offhighway-us/index.html>

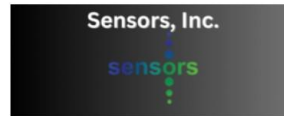
Advanced Clean Transportation Expo, May 20 – 23, 2024, Las Vegas

[Advanced Clean Transportation \(ACT\) Expo | May 20-23, 2024 \(actexpo.com\)](#)

DOE Vehicle Technologies Office Annual Merit Review, June 3 – 6, Arlington, Virginia

[Vehicle Technologies Annual Merit Review | Department of Energy](#)

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