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Passenger cars sold in the US emit much higher particulates compared to very similar models in Europe, reports [Green Car Congress](#). European vehicles had a gasoline particulate filter (GPF), currently also being deployed in China. The US needs to update its particle mass standards to enforce GPFs.

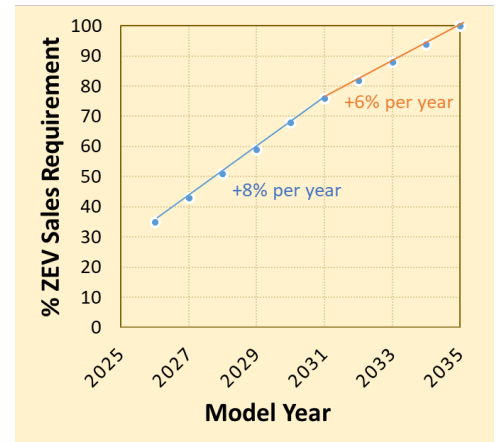
### Regulatory Update

#### California's Air Resources Board (CARB) Advanced Clean Cars II proposal

CARB has [published](#) the latest detailed proposal for the ACC 2.0 rule for light-duty vehicles. Key elements:

##### Electrification

- 100% new sales to be ZEVs and PHEVs by 2035, increasing at 8% per year from 2026 – 2031 and 6% thereafter.
- Change from “credit” to “value” system, with each EV compliant with technical requirements counting as one.
- Technical requirements for ZEVs beyond 2026: Range >150 miles, ≥5.76 kW on-board charger, capability for DC fast-charging, and compliance with battery durability and servicing requirements.
- PHEVs can only count up to 20% of ZEV requirements. Must be SULEV compliant and have > 50-mile range, > 40-mile on US06.
- Post MY 2026 EVs must monitor battery deterioration through a “state of health” monitor which correlates with usable energy. This will be displayed on the dashboard.
- Durability requirements include maintaining 80% of range for 10 years / 150,000 miles (as reference Tesla Model S & X vehicles have shown < 10% for vehicles driven to 200,000 miles).
- Environmental Justice provisions have been introduced. One allows manufacturers to earn an additional vehicle value of 0.5 if a ZEV is sold to disadvantaged communities at > 25% discount off MSRP. Another gives an additional 0.1 vehicle value for low cost EVs, priced ≤ \$20,275 for cars and ≤ \$26,670 for LD trucks.
- 14 other states have adopted the ZEV regulation. The proposal allows for pooling of up to 25% of ZEV requirements across these “section 177” states, but this reduces to 5% by 2030.



##### LEV Criteria Pollutant standards for ICE vehicles

- Beyond 2029, the ICE-only portion of the fleet must meet average SULEV30 limits. New Bins are added down to 15 mg/mi, while higher Bins of 125 and 160 will be removed.

- For NMOG+NOx, all vehicles will have to meet new stand-alone US06 standards (no certification against composite SFTP allowed). The limits are the same as FTP for most bins.
- For PM, the limit will be lowered from 6 mg/mi to 3 mg/mi for the US06 cycle.
- New standards proposed for shorter cold soaks. The current FTP limit applies for any soak durations > 3 hours, while new limits are established for 10 min to 3-hour soak duration.
- To address quick drive-away emissions, a new limit for NMOG + NOx is set with a reduced idle time of 8 sec on the FTP. Reduced idle time typically increases HC (and not NOx) and can be addressed by improved engine calibration, better injection systems and improved catalyst light-off.
- For SULEV30 PHEVs, a new NMOG + NOx limit of 100 mg/mi for high-powered cold start emissions, measured on cold-start US06 test.
- Class 2b and 3 medium-duty vehicles will be required to meet lower fleet averaged standards for NMOG + NOx. Like light-duty, ZEVs will not be counted in the fleet averaging. Also introduced are new in-use requirements based on PEMS measurements and analyzed using the moving average window (MAW) method. This is similar to the HD Low NOx regulation.

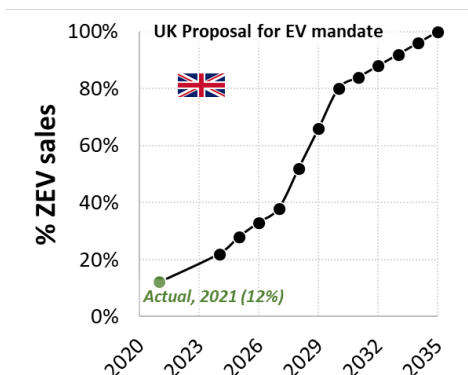
## Two EU Parliament Committee voted on technology neutral CO<sub>2</sub> regulations for passenger cars and vans

The European Parliament’s Committee on Industry, Research and Energy (ITRE) and Transport and Tourism (TRAN) voted on [amendments](#) to proposed CO<sub>2</sub> standards for new light-duty vehicles. While not a binding rule, amendments call for the Commission to develop a methodology for lifecycle accounting of CO<sub>2</sub> emissions, and adjusting the 100% CO<sub>2</sub> reduction target by 2035 to 90% to allow for other technologies (e.g. plug-ins, low carbon fuels) during the transition. There was no change proposed to the 2025 and 2030 CO<sub>2</sub> targets. The Committee on Environment, Public Health and Food Safety (ENVI) has yet to vote on these amendments and then these will be considered for a plenary vote at the EU Parliament.

### EXAMPLE AMENDMENT

... Commission needs, by 31 December 2023 at the latest, to draw up a harmonized methodology for reporting the carbon balance of the life-cycle of such vehicles ('manufacture – use – scrapping') and the energy consumption ('extraction / production – transportation – consumption' or 'Well-to-Tank') in order to obtain an overview and thus ensure consistency of the means brought to bear in pursuit of the Union's climate objectives. [...]

The term "zero-emission vehicle" is misleading, since the electricity production in many Member States is heavily dependent on fossil sources. The supply of alternative energy for transport will as a rule give rise to emissions, directly or indirectly.



### UK EV mandate

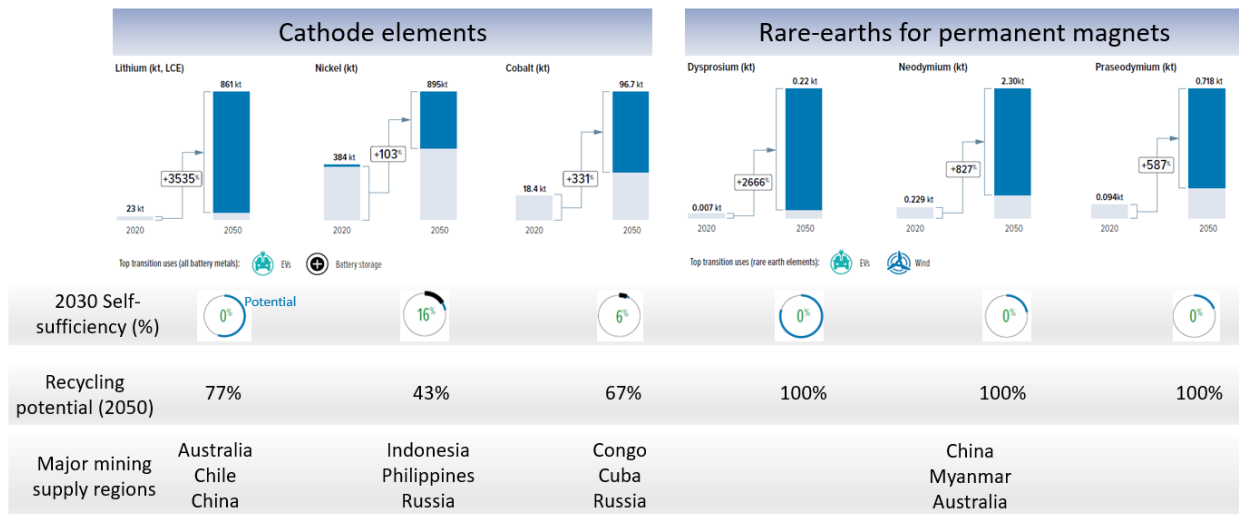
The UK is seeking feedback on a [technical consultation](#) which aims to set the first EV sales mandate, supporting the goal of 100% electrification by 2035. It notes that 12% of vehicle sales were full EVs in 2021 and that OEM public commitments of 100% ZEV sales by 2030 cover 60% of the UK market share. Note that both CA and UK are thinking of a third of sales to be electric by 2026 but the UK follows an S-curve unlike the linear one in CA. For vans, 2% of new sales were zero tailpipe emitting in 2020. A starting target of 8% in 2024 is being proposed, ramping to 100% by 2035.

## Market Update – Focus on battery raw material constraints

In a recent earnings call, Elon Musk called lithium a “fundamental limiting factor” in EV adoption. Nearly half of Tesla vehicles in Q1 used LFP battery packs, which do not require Ni, Mn and cost ~ 30% less relative to NMC pack cost of ~ \$130 /kWh today. But these still require lithium.

Several studies are pointing out the challenge of meeting the raw materials demand in the medium-term (~ 2030) and point to the need for increased recycling.

- [Roland Berger](#) estimates BEV share of light vehicles to increase to 52% in Europe, 29% in N. America and 38% in China by 2030. To support this transition, the Li-ion battery demand is projected to increase globally from 363 GWh today to >3,000 GWh in 2030 (~ 8.5X) of which ~90% demand comes from the transportation sector. That translates to roughly 75 gigafactories required in the rest of this decade.
- [Benchmark Minerals](#) estimates that battery capacity is growing at twice the speed of Li raw material supply. Based on industry announcements, it projects that global Li-ion capacity could reach 4,200 TWh by 2030 (greater than the demand estimated above). However, it cautions that only a quarter of the production will come from Tier 1 suppliers qualified to supply to automakers outside China.
- [Eurometaux](#), an association of non-ferrous metals producers and recyclers in Europe, published a study on the outlook of supply-demand of metals required for the clean energy transition in Europe. The study finds that the demand for lithium will increase by > 3500% by 2050, while that of rare earths by ~600 – 2500%. There is no domestic mining in Europe, so that the region will have to rely on imports for raw materials and significantly increase recycling capacity. Read [here](#) for a summary on our website.



## Technology Update

### H<sub>2</sub> High-P Direct Injection Demonstrated on Truck

Westport Fuel Systems [unveiled](#) their H<sub>2</sub> high-P direct injection (HPDI) fuel system and are demonstrating it on a truck. Originally designed to operate with natural gas, the new system can now operate with H<sub>2</sub> and deliver up to 98% reduction in tank-to-wheel CO<sub>2</sub>. Of course, the benefit in terms of GHG reduction will be tied to the carbon intensity of the H<sub>2</sub> fuel itself. The system is currently added to a 13L 6-cylinder engine, specified to deliver 20% higher power and torque than the base diesel and 5 – 10% improved thermal efficiency.

## **SAE WCX Summary**

In case you missed it, look up a [summary](#) of the SAE WCX conference on DieselNet. The Corning annual review is also discussed, you can download a copy of the slides [here](#).

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## ***Don't miss these upcoming events ...***

**Vehicle efficiency, electrification and emissions conference and Expo, June 8<sup>th</sup> – 9<sup>th</sup>, Troy MI and online**  
<https://gamcinc.com/conferences/emissions/>

**DOE Annual Merit Review, June 21-23, Washington D.C and online**  
<https://www.energy.gov/eere/vehicles/vehicle-technologies-annual-merit-review>

**CO2 Reduction for Transportation Systems Conference, June 21<sup>st</sup> – 22<sup>nd</sup>, Turin, Italy**  
<https://conferences.ata.it/>

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