

5-Min Monthly Read

August 2021

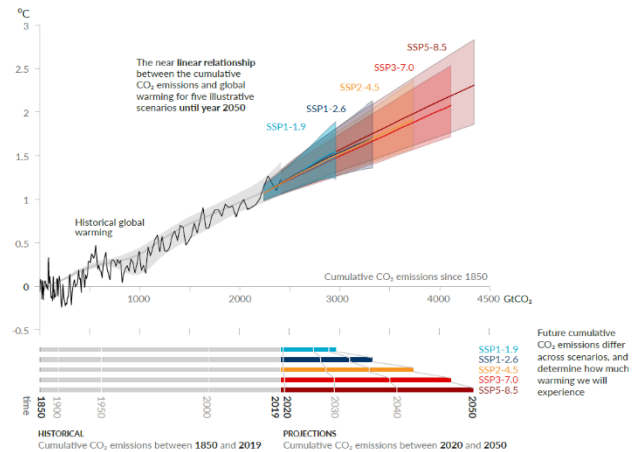
+ Upcoming events listed at the end

- The UN Intergovernmental Panel on Climate Change has published its updated and comprehensive assessment on global warming since the last publication in 2014. The report concludes that human activities have unequivocally led to an increase in surface temperatures and calls for rapid action to reduce greenhouse gas emissions. Of relevance to the transportation sector and the associated fuel consumption, the report highlights that emissions of CO₂, methane, nitrous oxides and black carbon have all led to the increase in global temperatures.

<https://www.ipcc.ch/report/ar6/wg1/>

Every tonne of CO₂ emissions adds to global warming

Global surface temperature increase since 1850-1900 (°C) as a function of cumulative CO₂ emissions (GtCO₂)



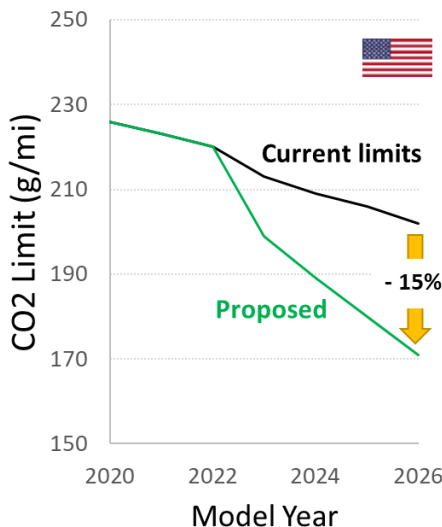
Regulatory Update

Significant changes are being proposed to CO₂ tailpipe limits in Europe and the US

- The European Union has proposed changes to the CO₂ tailpipe limits for light-duty vehicles as part of the “Fit for 55” package. For 2030, the targets are revised from 37.5% reduction to 55% reduction for passenger cars versus 2021 levels. For vans the revision is from 31% to 50%. Also proposed is a ban on the sale of any new light-duty gasoline or diesel vehicle beyond 2035. There will be inputs from stakeholders on this proposal and it needs to be ratified by member nations before it can be finalized.

https://ec.europa.eu/commission/presscorner/detail/en/IP_21_3541

- The EPA is revising the SAFE standards for tailpipe CO₂ emissions and fuel economy for model years 2023 – 2026. The revised CO₂ limits reduce by ~ 10% in 2023 and then ~5% each year through 2026, as compared to the ~ 1.7% reduction in the existing rule.



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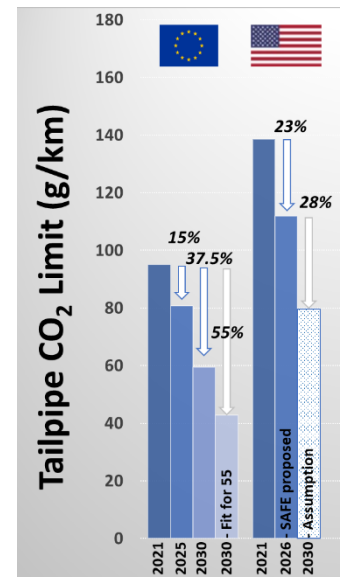
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<https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/>

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The impact of these tighter standards on the rate of EV/hybrid uptake remains to be quantified and depends on the details of other provisions and CO₂ credits banked by automakers.

Here are a few details worth noting:

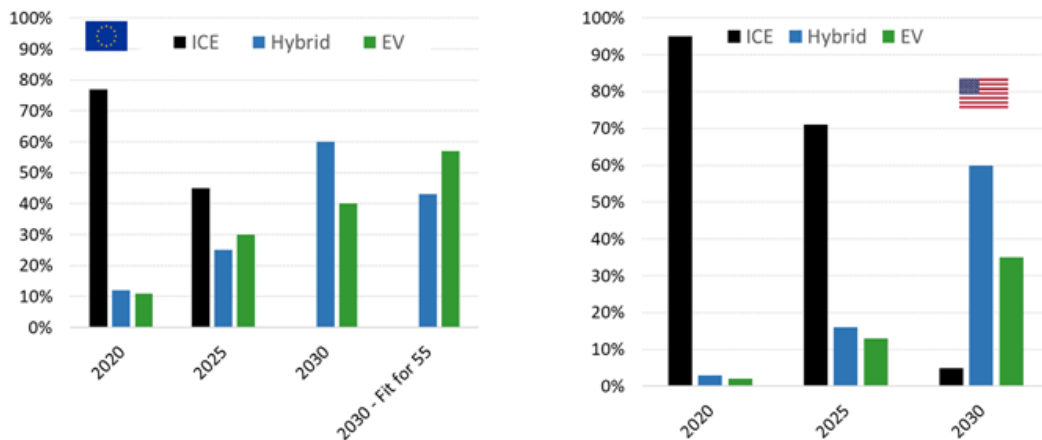


- Multiplier incentives for electric, plug-in electric, and fuel cell vehicles will be extended through 2025. Each EV can be counted as 2 vehicles in 2024 and 1.75 in 2025, towards the CO₂ targets.
- Incentives for hybridization of full-size pick-up trucks will be reinstated through MY 2025
- EVs will be considered as emitting 0 g/mi CO₂ and there will be no accounting of upstream CO₂ emissions.

<https://www.epa.gov/regulations-emissions-vehicles-and-engines/proposed-rule-revise-existing-national-ghg-emissions>

Implications for powertrain mix and electrification

Simple calculations based on recent fleet averaged CO₂ tailpipe numbers show that meeting the new targets will require a 50 – 55% pure EV share (of new sales) in Europe and ~ 35% share in the US. Note also that almost all the remaining ICEs will have to be hybrids of some form (mild, full, plug-in).



Raw material considerations for batteries

Assuming that China reaches 30% EV penetration by 2030, battery capacity to meet the above scenario is ~ 2TWh for light-duty vehicles alone (globally). *Note that this does not include electrification of two-wheelers, heavy-duty trucks and buses or off-road equipment.* Per a recent Bloomberg report, the current commissioned capacity for Li-ion batteries is ~ 586 GWh, while 822 GWh is under construction and 1.2 TWh additional capacity is announced. It suggests that on paper, the planned battery supply or ~ 2.6 TWh could meet demand, but more information is needed on whether raw materials will be available to meet the battery needs in the given timeframe.

<https://www.bloomberg.com/news/articles/2021-08-09/at-least-two-thirds-of-global-car-sales-will-be-electric-by-2040>

One recent paper on lithium highlights this issue. The authors conclude that for supply to keep up with demand there must be robust Li recycling, vehicle-to-grid integration and also limiting of the growth of vehicle stock (currently projected at 3 billion by 2050, up from a billion today).

<https://www.nature.com/articles/s41467-020-18402-y>

What about charging?

The ICCT published a report this month on the charging infrastructure needs and used 36% market share in the US by 2030, consistent with our calculations. The report concludes that sustaining this growth will require a 27% year-over-year increase in the number of public and workplace chargers.

<https://theicct.org/sites/default/files/publications/charging-up-america-jul2021.pdf>

- The UK has submitted a plan to electrify the transportation sector. In addition to the previously announced ban of new hybrid passenger cars by 2035 (pure ICEs by 2030), the new document also states a target ban on ICE powered light goods vehicles < 3.5 tons by 2030, heavy goods vehicles 3.5 – 26 tons by 2035 and heavy goods vehicles > 26 tons by 2040, or sooner if a faster transition seems possible. The document notes that these targets are subject to further

consultation. In the meantime, 10% ethanol fuel will be mandated starting next month (Sept 2021) and the plan also calls for an increase in renewable and low carbon fuels in the coming years.

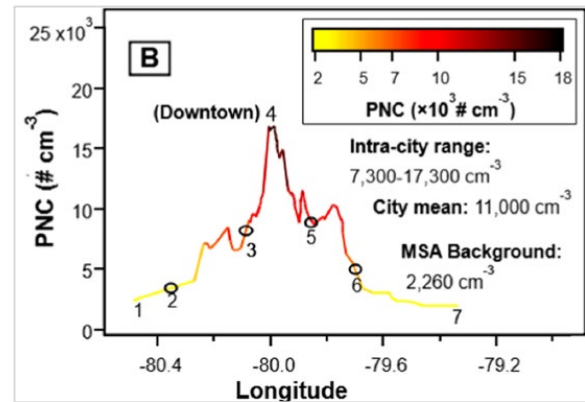
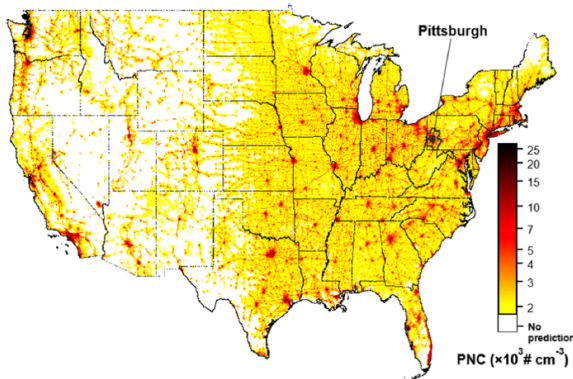
<https://www.gov.uk/government/publications/transport-decarbonisation-plan>

- Ultra-low sulfur (< 10 ppm) gasoline will be available in Australia starting end of 2024. This hopefully helps with the introduction of Euro 6 level regulations in the country.

<https://www.reuters.com/business/energy/australia-prop-up-its-last-two-refineries-with-up-179-bl-2021-05-16/>

Technology Update

- A recent publication highlights the issue with ultra-fine particulates in the US, which are not explicitly regulated via PN standards as in Europe and China. The study highlights that there are “hot-spots” across the country, often associated with urban centers with high population and that the PN concentration can vary significantly across the country exhibiting large urban-rural, inter- and intra-city contrasts. Picture on right shows the distribution in Pittsburgh ranging from 7,300 – 17,300 particles/cm³. This also has implications for environmental justice, as disadvantaged communities are disproportionately exposed to high particulate emissions.



<https://doi.org/10.1021/acs.est.1c03237>

- A summary of the advanced combustion engine and emissions related project updates presented at the recent DOE Annual Merit Review has been posted on DieselNet/

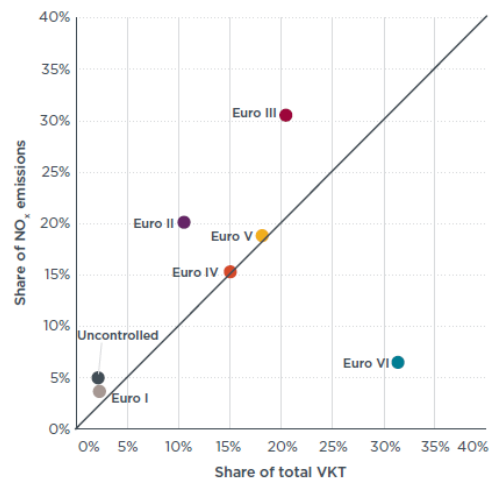
<https://dieselnet.com/news/2021/07amr.php>

For the SuperTruck 2 program, which is entering its final year, many of the participants have reported nearing the 55% brake thermal efficiency target. Here is a summary of that portion.

<https://mobilitynotes.com/supertruck-ii-update-notes-from-the-2021-doe-annual-merit-review/>

- The International Council on Clean Transportation (ICCT) has published a report quantifying the benefits of adopting advanced NOx and filter-enforcing regulations, coupled with accelerated fleet renewal policies in G20 nations. The report highlights that emissions from older vehicles certified to ~ Euro III – V levels contributing most to NOx and particulate emissions from the fleet, while modern Euro VI vehicles are relatively very clean. Adopting upcoming regulations (Euro VII / US Low NOx) combined with retiring older vehicles can reduce NOx and PM emissions by ~ 90% by 2040.

<https://theicct.org/publications/g20-hdv-impacts-jul2021>



- A review article provides a nice summary of the ongoing development and opportunities for catalyst improvements to address improved catalytic activity and platinum group metal (PGM) reduction. Examples include single-atom catalysts and core-shell catalysts, which yield improved activity through better dispersion, and are aiming for 90% conversion at exhaust temperature as low as 150 °C (a DOE challenge).
NATURE COMMUNICATIONS | <https://doi.org/10.1038/s41467-021-21152-0>
- In Europe, Mercedes-Benz will be offering a full electric heavy-duty truck, the eActros, starting this Fall. The truck will have a maximum range of up to 400 km with a 420-kWh battery pack which can go from 20% to 80% charge in a little over an hour using 160 kW, 400 A DC charging.

<https://www.daimler.com/products/trucks/mercedes-benz/eactros.html>

Don't miss these upcoming events ...

18th SAE BRASIL Mobility Forum, Aug. 18-19, 2021, online

<https://saebrasil.org.br/eventos/18o-forum-sae-brasil-da-mobilidade-secao-parana-e-santa-catarina/>

15th International Conference on Engines & Vehicles, Capri, Napoli (Italy) Sept. 12-16, 2021

<https://www.sae-na.it/>

SAE COMVEC, 2021, September 14-16, 2021, Rosemont, IL or online

https://www.sae.org/attend/comvec?utm_source=google&utm_campaign=WCX21-0023

FISITA 2021 World Congress, September 14-16, 2021, online

<https://go.fisita.com/fisita2021>

SAE Powertrains, Fuels & Lubricants Digital Summit, September 28-30, 2021, online

https://www.sae.org/attend/pfl?utm_source=google&utm_campaign=WCX21-0023

Symposium on International Automotive Technology (SIAT) 2021, Pune, India, 29th September – 1st October

<https://siat.araiindia.com/>

See here for recent conference summaries and to mark your calendar for future conferences:

<https://mobilitynotes.com/home/tech-updates/summaries-conferences-technical-papers/>