5-Min Monthly Read

July 2022

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Regulatory Update

US Senate Democrats agree on historic spending for climate and clean energy investments

The "Inflation Reduction Act of 2022" will invests $369 billion for climate and energy initiatives. The Senate will vote on this legislation in early August, after which it heads to the House for approval. Some clean air provisions:

Electric vehicles

- Tax credits for electric vehicles and charging infrastructure through 2032
  - $7,500 tax credit for purchase of new electric vehicle (EV) and $4,000 for a used EV. Eligibility cap of first 200,000 EVs sold per manufacturer (which excluded Tesla and GM) is removed.
  - To be eligible for tax credits, starting 2024 the vehicle will require at least 40% value of battery critical minerals to be processed in a country which has free trade agreement with the US. The requirement increases to 80% starting 2027. *This may be a difficult requirement to meet.*
  - A new up-to 30% credit (max. $40,000) for commercial plug-in chargeable and fuel cell vehicles
  - 30% credit for charging/refueling stations
- $3 billion funding for the US Postal Service to purchase EVs and install charging infrastructure.
- $1 billion funding for zero tailpipe emitting Class 6/7 trucks, transit and school buses

Clean Energy / Climate

- Tax credits for manufacturing of batteries, wind & solar equipment, and for clean H2 production
- $27 billion for a "Greenhouse Gas Reduction Fund" to finance clean energy technologies especially in disadvantaged communities (environmental justice)
- Tax credits for carbon capture @ $180/ton for direct air capture with storage and $130/ton for enhanced oil recovery. For other (non-direct-air) CO_2 capture projects get credits of $60 – 85 / ton.

Pollution control

- Funding for EPA: $5 billion to provide grants for combating climate pollution, and $3 billion to reduce pollution and climate threats in low-income communities.
- ~$0.5 billion funding to reduce diesel emissions, address air pollution, boost air quality monitoring
- Methane emissions reduction: ~ $1.5B in incentives for mitigation and monitoring from natural gas systems and conventional wells. Fees for excess methane emissions starting at $900/ton in 2024.

Fuels

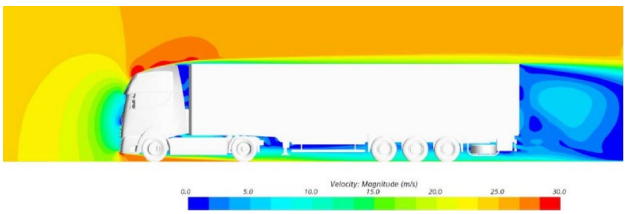
- Funding for EPA to develop renewable fuel standard

- Extension of $1/gallon tax credit for biodiesel and renewable diesel through 2024
- Tax credits worth 60 cents/kg to $3/kg of clean H2 production depending on other requirements

Euro 6e starts September 2023

The EU Commission voted in favor of adding another step to tighter emission standards for light-duty vehicles. Euro 6e will lower the conformity factors for NOx from 1.43 to 1.1 and for particle number (PN) from 1.5 to 1.34. (CFs are the allowance for on-road emission measurements relative to laboratory measurements). The new standards start September 2023 and are in effect through end of 2027, with the end date likely revised when Euro 7 is officially announced.

EU first-ever CFD-based heavy-duty trailer regulations published



The European Commission has published the first trailer regulations for O3 and O4 category vehicles, requiring the use of a standardized CFD (computational fluid dynamics) tool developed to assess impact of aerodynamic drag and tire rolling resistance on CO2 emissions.

Special Issue on Euro 7/VII

Continuing on CFD above, an open-access article published in Transport Engineering by Convergent Science and Argonne National Lab discusses the role of CFD towards better design of engines and after-treatment systems for Euro 7/VII. Other articles are being published on the theme of Euro 7/VII in the same issue and include:

(1) An assessment of the benefits of Euro 7/VII by the ICCT (~ 38,000 premature deaths avoided)

(2) A summary of Euro 7/VII compliant after-treatment system including an electrically heated catalyst, published by AECC and FEV

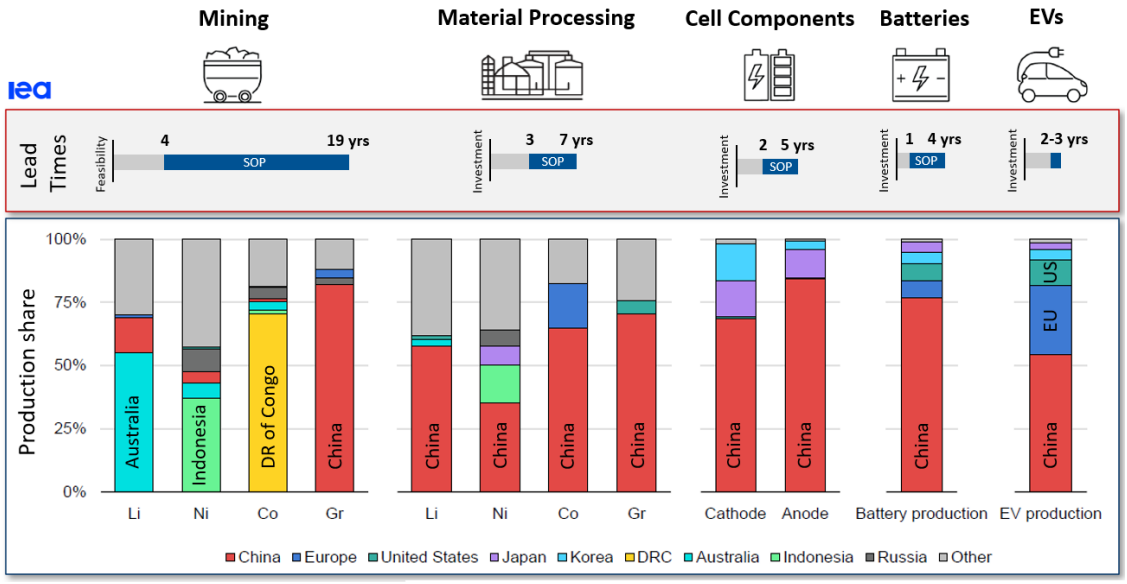
(3) Ultra-low NOx after-treatment for diesels using simulations, published by Punch Torino and Powertech Engg.

More articles will be published in the coming weeks, including one from Corning on the use of advanced substrates and filters for the upcoming standards.

Electrification / Batteries

Report highlights regional concentration of global battery electric vehicle supply chain

Tying the EV tax credits in the US to use of domestic mineral and battery production aims to address the dependence of the supply chain on few countries, especially China. A recent report by the International Energy Agency (IEA) quantified the share of current production of battery materials and components across various countries. Clearly, China is dominating much of the supply chain and EV market. Of the 340 GWh of battery demand in 2021, China accounted for 200 GWh. Also highlighted is that raw material availability is the key bottleneck in the supply chain today, with potential lead times of over a decade for mining of lithium and nickel from feasibility to production.

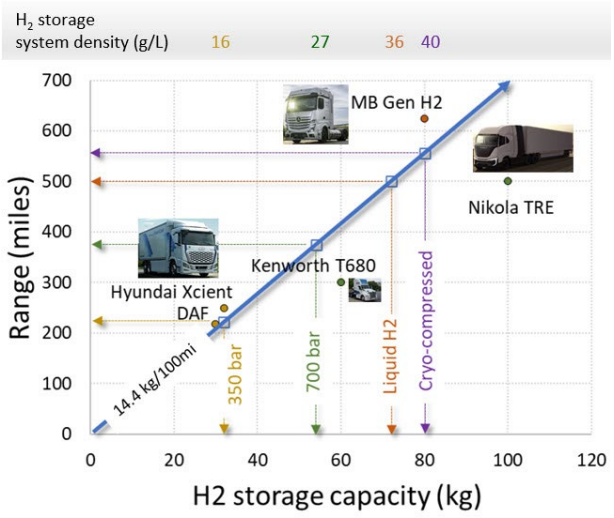


The average pure electric battery was 55 kWh in 2021. LPF (Li iron phosphate) chemistry is making a resurgence and made up 15% of the batteries, mainly for heavy-duty use.

Overview of fuel cell tractor-trailer technologies

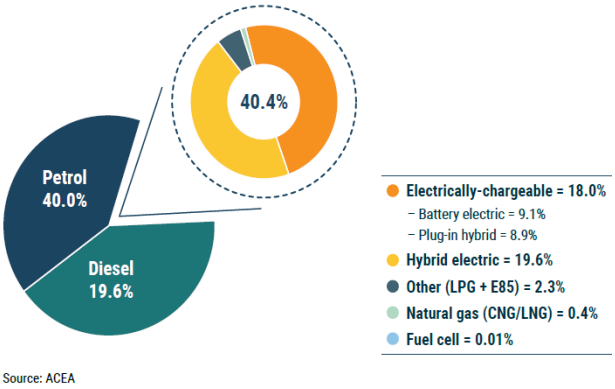
A recent working paper by the ICCT provides a good overview of the status of hydrogen fuel cell technologies with application to heavy-duty trucks.

Using that as a starting point, we have analyzed the H2 requirements to support conversion of long-haul trucks to fuel cell electrics. Briefly, 25% of the long-haul (Class 7-8) fleet conversion in the US to fuel cell electrics will require a doubling of the entire H2 demand of the US today, and for that H2 to be green, would require a doubling of the entire renewable electricity generation.



Progress in EU on electrification of light-duty vehicles

ACEA has published its annual report tracking the progress made towards reducing tailpipe CO_2 emissions. In 2021, battery electric and plug-in hybrid passenger car sales were ~ 9% (of new sales) each, while almost one in every 5 vehicles sold was a hybrid. The charging infrastructure was identified as falling short of requirements: almost half of the total charging points are currently located in only 2 countries (Netherlands and Germany).

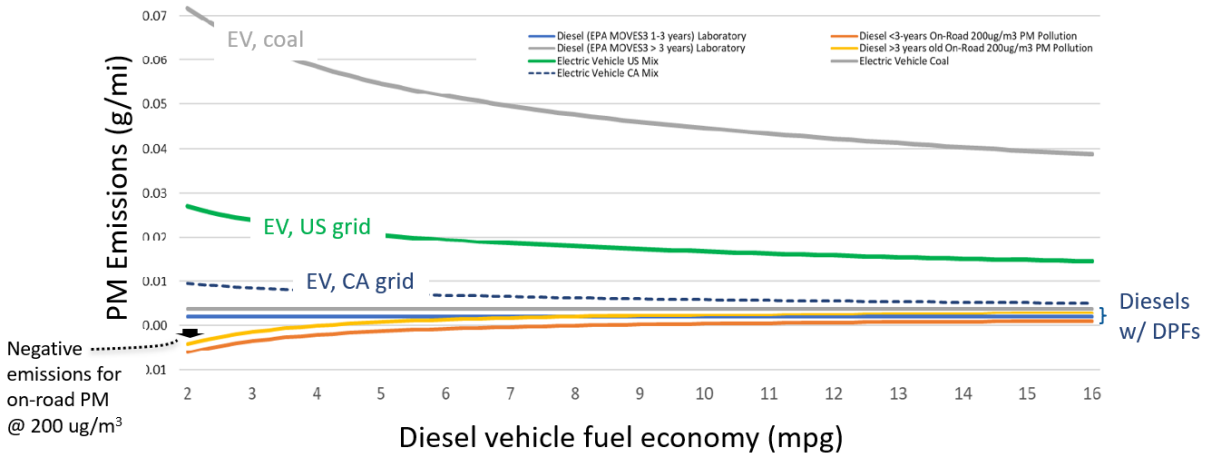


Source: ACEA

Clean Diesels

Analysis shows replacing older diesels with newer technologies more effective pathway for cleaner transport

A study published by Diesel Technology Forum and done by Stillwater Associates concluded that replacing older Class 7-8 trucks with the latest diesel technology is a faster and more cost effective path for GHG and criteria pollutant reductions. Almost 50% of long-haul trucks today are pre-2007 (without filters). Replacing them with new trucks will eliminate > 99% PM at a fraction of the cost required for fleet electrification. Replacing the older trucks with post-2027 low NOx trucks provide a faster way to reduce NOx as through electrification. Assuming a California-grid, electric trucks were projected to provide greater cumulative GHG emission reductions over this decade (1.5M tons vs. 1.15 M tons via clean diesels), but with a much higher cost. Highest GHG reductions could be achieved when pairing the diesels with renewable fuel. (Note: the study assumes rapid replacement with new diesels vs. end-of-life replacement through ~ the end of this decade with electrics through incentives).



SuperTruck II – All participants on track to meet the 55% BTE and 2X freight efficiency goals

Presentations from the DOE Annual Merit Review held in June 2022 are now available for download. Participants showed the latest progress on the SuperTruck II program, aimed at improving the efficiency of diesel engines for long-haul use. The program concludes this year, and all 5 teams demonstrated pathways to achieve 55% BTE using a combination of improved combustion, air handling and waste heat recovery. Some also achieved this while meeting the ultra-low NOx emission targets set by California (even though that was not the target).

		Daimler	Volvo	Cummins / Peterbilt	Navistar	PACCAR / Kenworth
Engine design & combustion	Piston / cylinder	Optimized piston bowl Thermal barrier coating	Wave pistons Thermal barrier coating	Low heat transfer Reduced friction	Optimized cylinder bowl Cylinder deactivation	Long stroke Thermal barrier coating
	CR	High CR	23:1		High CR	
Air handling	Boost	2-stage turbo	Optimized turbo	High eff. turbo	High eff. turbo	2-stage turbo.
	EGR	2 stage c-EGR	48V EGR pump			48V EGR pump
	Miller	✓	✓ (LIVC)			
WHR		Exhaust & EGR	Exhaust & coolant 48V e-WHR	Coolant, EGR & exhaust Dual HP & LP loop	+3.6% BTE demonstrated	Exh. & coolant
A/T		cc-SCR	6 – 14% lower NOx with new fuels Short DPF/SCR, EHC	Dual loop EGR On-engine DOC/DPF	cc-SCR: 0.15 g/bhp-h demonstrated	cc-SCR 2027 UL NOx demonstrated
Power -train		48V mild hybrid	48V, ISG, 14kWh Li-ion battery	48V mild hybrid	High-V battery E-accessories	48V mild hybrid E-hoteling

Don't miss these upcoming events …

International congress on Catalysis and Automotive Pollution CAPoC12, August 29th – 31st, Brussels, Belgium
https://capoc.ulb.ac.be/

SAE Powertrains, Fuels & Lubricants Meeting, September 6th – 8th, Krakow, Poland
https://www.sae.org/attend/pfl

Thiesel, September 13th – 16th, València, Spain
https://www.cmt.upv.es/#/thiesel2022

SAE COMVEC, 2021, September 20th – 22nd, Indianapolis IL
https://www.sae.org/attend/comvec