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## Market Update

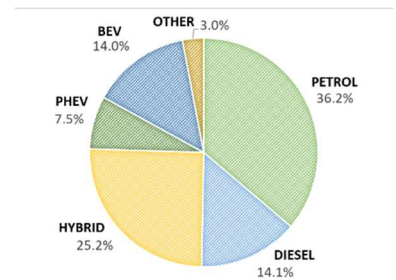
### UAW and “The Art of War”

Taking what has been described as strategies from Sun Tzu’s “The Art of War”, the United Auto Workers (UAW) union is close to reaching major deals with the big three automakers in the US – Ford, Stellantis and GM.

- The first agreement reached with [Ford](#) will increase wages by 25% and an increase in starting wage by 68%
- The second agreement with [Stellantis](#) provides an immediate 11% wage hike, and an overall increase in wages of 33%. It will also require the company to keep open two manufacturing locations in Michigan & Ohio, originally under threat of closure.
- The latest agreement with [GM](#) promises to increase wages by 25% through 2028, and starting wages by 70% compounded.

### One third of vehicles sold in Europe year-to-date were hybrids, 14% were BEVs

Over 8 million cars were registered in [Europe](#) in the first three quarters, representing a 17% year-to-date increase in sales. One in every three cars was an hybrid (conventional or plug-in). The share of battery electric vehicles was about the same as diesels.

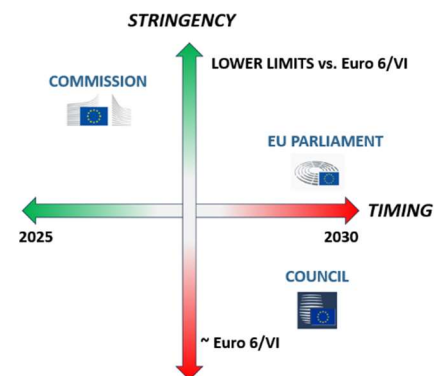


EVs are struggling in the US though. The total EV market (including PHEVs) was below 8% in Q3. GM announced that it has abandoned its plans to build 400,000 EVs through mid-2024 due to lower demand and higher costs (especially with the UAW strikes, see above).

## Regulations / Reports

### Euro 7

The EU Council and the EU Parliament have cast their votes on the stringency of Euro 7 emission regulations for light- and heavy-duty vehicles. Broadly, the Council voted for a “little/no change” compared to Euro 6, while the Parliament has voted in favor of some of the tighter regulations originally proposed by the EU Commission, but with somewhat relaxed boundary conditions. The next step will be trilogue discussions between the three agencies followed by (hopefully) a consensus. In any case, a delay in implementation compared to the original timing of 2025 for light-duty and 2027 for heavy-duty seems imminent. See here for details on the positions by the [Council](#) and [Parliament](#).



### European Council votes in favor of Commission heavy-duty CO<sub>2</sub> standards

The EU Council reached an [agreement](#) to support the revised CO<sub>2</sub> standards as proposed by the EU Commission. These standards will require a CO<sub>2</sub> reduction of 15% by 2025 (already in place), 45% by 2030, 65% by 2035, and 90% by 2040.

ZEV mandate for urban buses: A target of 85% ZEVs sales by 2030 and 100% by 2035 is set for urban buses. Inter-urban buses are exempt from this target. The CO2 emission threshold for a vehicle to be called a ZEV is made tighter compared to the Commission proposal but is still at a level which allows for internal combustion engines running on hydrogen.

The agreement calls on the Commission to review effectiveness of these standards and infrastructure readiness in 2027. The Commission will also have to assess the role of a carbon correction factor (CCF) which will reduce the CO2 emission targets based on the use of renewable fuels.

### RED III published

The European Union has set a revised binding renewable energy [target](#) of 42.5% - 45% by 2030 for overall energy consumption as part of the Renewable Energy Directive (RED III). In 2021, renewables accounted for 21.8% of the energy consumption, so this will call for nearly a doubling of renewable energy share by the end of this decade. The target has already undergone revisions from 32% to 40% in 2021 and is now revised further.

Specific to the transport sector, this calls for:

- (1) >29% of energy consumption to be met by renewables by 2030 and greenhouse gas intensity reduction of > 14.5% by 2030 through renewable fuels and electricity.
- (2) > 5.5% target for advanced biofuels and renewable fuels of non-biological origin (RFNBO, e.g. green H<sub>2</sub>) by 2030. There is a minimum requirement of 1% share of RFNBO within that target.

### Biden announces \$7B for hydrogen production

President Biden has [announced](#) \$7 billion in funding to launch seven regional clean hydrogen hubs across the US. These are expected to produce 3 million metric tons of H<sub>2</sub> annually, a third of the US 2030 production target and lowering CO2 emissions from hard-to-decarbonize sectors by ~ 25M tons, equivalent to emissions from 5.5M gasoline cars.

### CARB Tier 5 Off-Road Low NOx Workshop

California's Air Resources Board held another [workshop](#) on the upcoming Tier 5 regulations which aim to reduce NOx emissions from off-road machinery. A more detailed summary will be done later, here are some high-level changes noted compared to the previous workshops:

- Regulations will be phased in through a Tier 5 Interim and Tier 5 Final standard, starting 2029 through 2034.
  - Interim standards will not require CO<sub>2</sub>, idling standards or low load cycle (LLC) certification
- NOx limits reduced by 90% (vs Tier 4) for 56 – 560 kW engines, similar to on-road and previous workshops. But engines < 56 kW are pre-empted and will have no change in limits.
  - More stringent LLC standard for NOx : 0.1 g/kWh-hr

Criteria Standards

#### Proposed Tier 5 Criteria Standards (g/kW-hr)

Nonroad Transient Test Cycle (NRTC) and Steady-State/Ramped Modal Cycles (RMC)

Power Category	Implementation Period	NO <sub>x</sub> Interim	NO <sub>x</sub> Final	PM Interim	PM Final	NMHC* Final	CO
< 8 kW (< 11 HP)	2031-2033	6.0*	-	0.3	-	-	8.0
	2034 +	-	5.0*	-	0.2	-	
8 ≤ kW < 19 (11 ≤ HP < 25)	2031-2033	5.5*	-	0.2	-	-	6.6
	2034 +	-	4.0*	-	0.1	-	
19 ≤ kW < 56 (25 ≤ HP < 75)	2031-2033	3.7	-	0.015	-	0.19	5.0
	2034 +	-	2.5	-	0.008	-	
56 ≤ kW < 130 (75 ≤ HP < 175)	2031-2033	0.22	-	-	0.005	0.080 <sup>1</sup>	5.0
	2034 +	-	0.040	-	0.005	-	
130 ≤ kW ≤ 560 (175 ≤ HP ≤ 750)	2029-2032	0.22	-	-	0.005	0.080 <sup>1</sup>	3.5
	2033 +	-	0.040	-	0.005	-	
> 560 kW (Gen Sets) (> 750 HP)	2030-2033	0.50	-	0.015	-	0.080 <sup>1</sup>	3.5
	2034 +	-	0.35	-	0.008	-	
> 560 kW (Mobile) (> 750 HP)	2030-2033	3.5	-	-	-	0.19	3.5
	2034 +	-	3.0	-	0.040	-	

\* NMHC + NO<sub>x</sub> - Not applicable  
<sup>1</sup> The NMHC standard for lean-burn NG engine families remains at 0.19 g/kW-hr

- For engines > 560 kW, PM limit stringency increased to enforce DPFs. But NOx stringency reduced.
- N<sub>2</sub>O and CH<sub>4</sub> caps of 0.15 and 0.13 g/kW-hr, respectively
- CO<sub>2</sub> emissions: For 56 – 560 kW, a 6% reduced standard compared to baseline certification data. For engines < 56 and > 560 kW, capped at 80<sup>th</sup> percentile of emissions from Tier 4 final engines
- Zero-emission credit program proposed.
- No change to useful life and hourly warranty periods
- Use of biofuel blends for durability testing not required.

## H<sub>2</sub> and Renewable fuels

### Ethanol for marine engines

Ethanol made from sugarcane boasts an especially lower carbon footprint as compared to that made from corn (the former predominant in Brazil and the latter in the US, for example). A research program has been announced with Raizen, the world’s largest producer of sugarcane ethanol, and maritime transportation leader Wartsila, to explore ethanol-based engines for marine applications. Both first- and second-generation ethanol will be tested – second generation involves the use of plant waste and is greener but relatively scarce today. The [project](#) expects to reduce CO<sub>2</sub> emissions by as much as 80% at well-to-wake level.

### Shell – Cummins long haul truck demonstration on RNG

A concept truck – called “Starship” – equipped with a Cummins X15N natural gas engine and powered by renewable natural gas (RNG) made by Shell, [successfully](#) performed a 840-mile run while carrying a full load (gross vehicle weight of 80,000 lbs.) The results were monitored by the North American Council for Freight Efficiency (NACFE) and showed a 2.54 times better freight efficiency assessed on a ton-miles per gallon basis compared to the average diesel truck. The truck had other fuel efficiency enhancing technologies such as lightweighting, low aerodynamic drag, and low rolling resistance tires as have been demonstrated in the SuperTruck2 program.

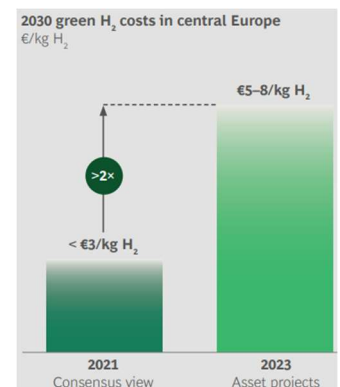


Image: Shell

### BCG Report provides status of Green H<sub>2</sub> cost and drivers in Europe

A [report](#) from the Boston Consulting Group raises a red flag on an increase in the anticipated cost of producing green H<sub>2</sub> by the end of the decade in Europe. While the consensus a couple of years ago was that H<sub>2</sub> costs will drop to below €3/kg by 2030, new estimates now point to a cost between €5-8/kg.

The report also provides a sensitivity analysis of the cost to the important factors : green electricity price is the main one, which also points to the possibility of increased competition from other places with more availability of renewable energy. Other factors such as electrolyzer capacity utilization and efficiency also play a role, along with the continued need for investment in infrastructure. There is currently a chicken-and-egg problem, where H<sub>2</sub> off-takers are not willing to sign up for over 5-year contracts given the likely decrease in price in coming years.



## Conference Summaries

### SAE COMVEC™ 2023, Sep 19 – 21, 2023

“An electric truck is not a toothbrush” – this pithy comment is a good summary of the conference held recently at Schaumburg, Illinois, where panelists across several sessions grappled with the questions facing the commercial vehicle industry on decarbonization topics such as electrification, infrastructure, renewable fuels, policies. One key takeaway was the enormity of the challenge and the need to pursue all technologies at hand. Download a [summary](#) of the conference.

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### Consider attending ...

#### Life-Cycle Analysis for Transportation Symposium, Nov 16<sup>th</sup> – 17<sup>th</sup>, 2023, San Antonio

<https://www.swri.org/event/life-cycle-analysis-transportation-symposium>

### And here’s something for while you are driving –

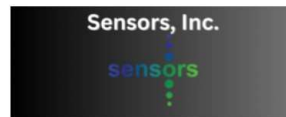
Consider tuning in to this [podcast](#) by Brandon Bartneck, where leaders from across the transportation industry are interviewed on a broad range of topics. A couple of examples to consider as a starting point -

[#169](#) – Dakota Semler | Xos – Electric Trucks, Charging Infrastructure & Fleet Electrification

[#144](#) – Matt Leuck | Neste – Renewable Diesel & The Critical Task of Decarbonizing the Internal Combustion Engine

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