ZEV DEFINITION – UPDATE

03 June 2022

acea

ACEA PROPOSAL – ADDED FLEXIBILITY

2017/2400 (CO2 Determination) 2nd amendment draft by EU-COM 30.09.2021:

"(15) 'zero emission heavy-duty vehicle' means 'zero emission heavy-duty vehicle' as defined in Article 3, point (11), of Regulation (EU) 2019/1242 of the European Parliament and of the Council;

2019/1242 (CO2 Limits) current legislative text:

(11) 'zero-emission heavy-duty vehicle' means either:

a) a pure electric vehicle or,

b) PEV, FCV and FCEV and H2 ICE if excempted according to (EC) 2017/2400, article 9 or,

c) any other motor vehicle pursuant to (EU)2018/858, article 3, that emits less than 1 gCO2/t-km or 1 gCO2/p-km as determined in accordance with Regulation (EC) 2017/2400, annex IV, Part 1, 2.3, or which emits less than 1 gCO2 /km as determined in accordance with Regulation (EC) No 715/2007 of the European Parliament and of the Council (16) and its implementing measures or,

d) a motor vehicle not belonging to categories a. & b. and whose emissions cannot be determined as per c., with a propulsion unit operated only with fuel with a carbon mass share of equal or less than 1%

VECTO PARAMETERS FOR C)

Fuel Properties

FuelType	Tanksystem	FuelDensity [kg/m3]	CO2 per FuelWeight [kgCo2/kgFuel]	NCV_stdEngine [kJ/kg]	NCV_stdVecto [kJ/kg]	Note
Diesel CI		836	3.13	42700	42700	
Ethanol CI		820	1.81	25700	25400	
Petrol PI		748	3.04	41500	41500	
Ethanol PI		786	2.10	29100	29300	
LPG PI			3.02	46000	46000	
NG PI	compressed		2.69	45100	48000	H-Gas
NG PI	liquefied		2.77	45100	49100	EU mix 2016/2030
H2 PI/CI	**L/C**	**R49**	**0.00**	**R49**	**R49**	**Gaseous**

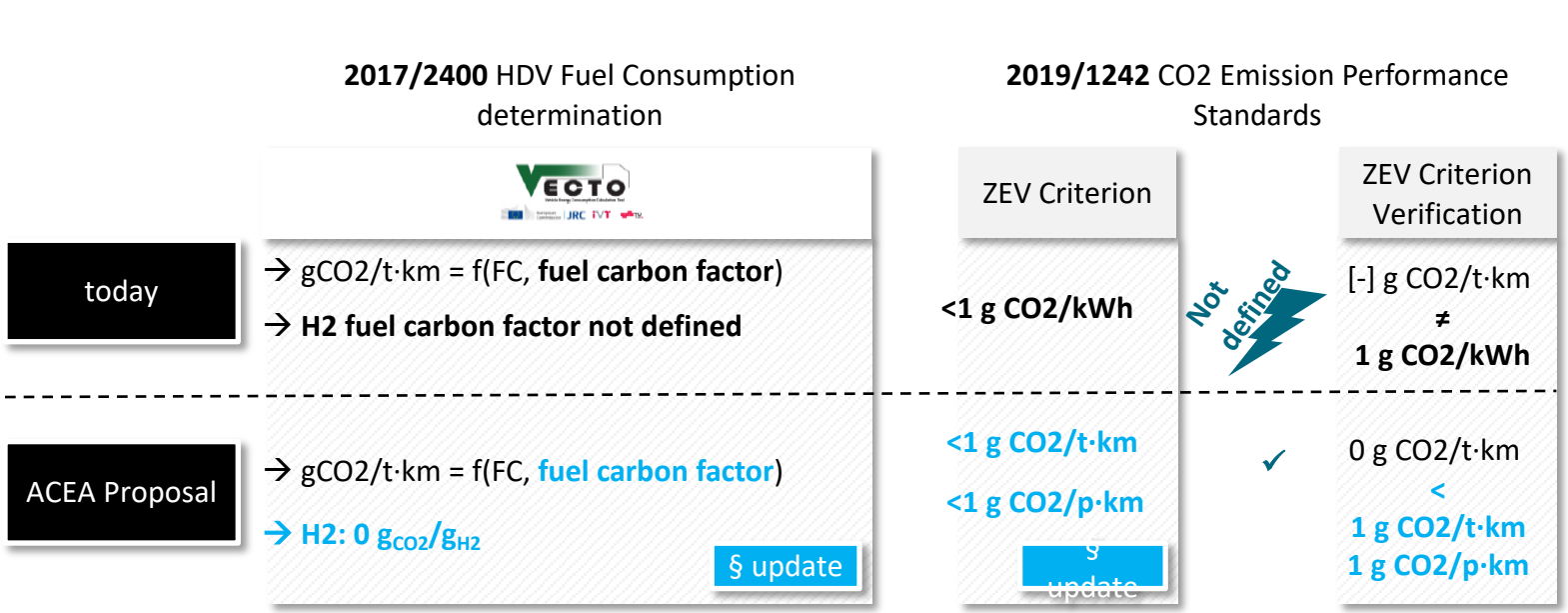
European market. The data was in the context of the study: Well-To-Wheels Analysis Of Future Automotive Fuels And Powertrains in the European Context – Heavy Duty vehicles (doi:10.2760/100379)

H2 needs to be introduced

VECTO Input for CNG/LNG Vehicles

Currently only the fuel type 'NG PI' for the engine certification is allowed according to Regulation (EU) 2017/2400. For LNG vehicles, therefore, the engine fuel type has to be set to 'NG PI' and at the vehicle level NgTankSystem has to be set to 'liquefied'. For CNG vehicles the same engine fuel type is provided but NgTankSystem has to be set to 'compressed'.

NECESSARY CHANGES FOR VECTO TOWARDS H2 AS FUEL



KEY TAKEAWAYS

- **H2 powered vehicles currently not reflected by VECTO. H2-fuel and fuel carbon factor to be added as "0"**
- **With H2 as "0", VECTO will calculate 0 g CO2/t·km [g CO2/p·km] based on FC simulation → ZEV criterion passes!**

ZEV DEFINITION - CURRENT

2017/2400 (CO2 Determination) 2nd amendment draft by EU-COM 30.09.2021:

"(15) 'zero emission heavy-duty vehicle' means 'zero emission heavy-duty vehicle' as defined in Article 3, point (11), of Regulation (EU) 2019/1242 of the European Parliament and of the Council;

2019/1242 (CO2 Limits) current legislative text:

(11) 'zero-emission heavy-duty vehicle' means a heavy-duty vehicle without an internal combustion engine, or with an internal combustion engine that emits less than 1 gCO2/kWh as determined in accordance with Regulation (EC) No 595/2009 and its implementing measures, or which emits less than 1 g CO 2 /km as determined in accordance with Regulation (EC) No 715/2007 of the European Parliament and of the Council (16) and its implementing measures;

(12) 'low-emission heavy-duty vehicle' means a heavy-duty vehicle, other than a zero-emission heavy-duty vehicle, with specific CO 2 emissions of less than half of the reference CO 2 emissions of all vehicles in the vehicle sub-group to which the heavy-duty vehicle belongs, as determined in accordance with point 2.3.3 of Annex I;

CONCLUSION - METRICS

Case	582/2011	2017/2400	R85	R49
BEV&HEV	1)	η, T_{loss}; 1)	P_{max}, P_{mean}	1)
FCELL	1)	Tbd.	Tbd.	1)
H2-ICE	1)	Tbd.	2)	Tbd.

1) Procedure to determine specific CO2 emission in g/kWh missing
2) Procedure to determine Power missing

Metrics to be measured	BEV	FCELL	H2-ICE
<1 g/kWh	-	-	✓

Metrics to be simulated	BEV	FCELL	H2-ICE
<1 g/tkm	✓	✓	✓

→ g/kWh currently referred to, but no determination in regulations implemented

→ g/tkm already defined for low emission hdv. Simulation of BEV coming in 2022, FCELL planned for 2025 and H2-ICE has to be implemented in Annex V (maybe together with 3rd amendment of 2017/2400 together with FCELL)

ANNEX III, 2. DEFINITIONS

(11) "Fuel cell" means an energy converter transforming chemical energy (input) into electrical energy (output) or vice versa.

(12) "Fuel cell vehicle" (FCV) means a vehicle equipped with a powertrain containing exclusively fuel cell(s) and electric machine(s) as propulsion energy converter(s).

(13) "Fuel cell hybrid vehicle" (FCHV) means a fuel cell vehicle equipped with a powertrain containing at least one fuel storage system and at least one rechargeable electric energy storage system as propulsion energy storage systems.

„Internal Combustion Engine“ not defined in 595/2009, 582/2011, R49 or 2018/858!

ANNEX III, APPENDIX 1, TABLE 1

Appendix 1

Vehicle technologies for which the obligations laid down in Article 9(1), first subparagraph, do not apply, as provided in that subparagraph

Table 1

Vehicle technology category	*Criteria for exemption*	*Input parameter value in accordance with Table 5 of this Annex*
Fuel cell vehicle	The vehicle is either a fuel cell vehicle or a fuel cell hybrid vehicle in accordance with point 2 (12) or (13) of this Annex.	"FCV Article 9 exempted"
ICE operated with hydrogen	The vehicle is equipped with an ICE that is capable of running on hydrogen fuel.	"H2 ICE Article 9 exempted"
Dual-fuel	Dual-fuel vehicles of types of types 1B, 2B and 3B as defined in Article 2(53), 2(55) and 2(56) of Regulation (EU) No 582/2011	"Dual-fuel vehicle Article 9 exempted"
HEV	Vehicles are exempted in case at least one of the following criteria apply: – The vehicle is equipped with multiple EMs which are not placed at the same connection point in the drivetrain in accordance with point 10.1.2 of this Annex. – The vehicle is equipped with multiple EMs which are placed at the same connection point in the drivetrain in accordance with point 10.1.2 of this Annex but do not have exactly identical specifications (i.e. the same component certificate). This criterion shall not apply in case the vehicle is equipped with an IHPC Type 1. – The vehicle has a powertrain architecture other than P1 to P4, S2 to S4, S-IEPC in accordance with point 10.1.3 of this Annex or other than IHPC Type 1.	"HEV Article 9 exempted"
PEV	Vehicles are exempted in case at least one of the following criteria apply: – The vehicle is equipped with multiple EMs which are not placed at the same connection point in the drivetrain in accordance with point 10.1.2 of this Annex. – The vehicle is equipped with multiple EMs which are placed at the same connection point in the drivetrain in accordance with point 10.1.2 of this Annex but do not have exactly identical specifications (i.e. the same component certificate). This criterion shall not apply in case the vehicle is equipped with an IEPC. – The vehicle has a powertrain architecture other than E2 to E4 or E-IEPC in accordance with point 10.1.3 of this Annex.	"PEV Article 9 exempted"
Multiple permanently mechanically independent powertrains	The vehicle is equipped with more than one powertrain where each powertrain is propelling different wheel axle(s) of the vehicle and where different powertrains can under no circumstances be mechanically connected. In this regard hydraulically driven axles shall, in accordance with point 5(a) of this Annex, be treated as non-driven axles and shall thus not be counted as an independent powertrain.	"Multiple powertrains Article 9 exempted"
In-motion charging	The vehicle is equipped with means for conductive or inductive supply of electric energy to the vehicle in motion, which is at least partly directly used for vehicle propulsion and optionally for charging a REESS.	"In-motion charging Article 9 exempted"
Non-electric hybrid vehicles	The vehicle is a HV but not a HEV in accordance with point 2 (26) and (27) of this Annex.	"HV Article 9 exempted"

CVD - DEFINITIONS

(5) 'zero-emission heavy duty vehicle' means a clean vehicle as defined in point 4(b) of this Article without an internal combustion engine, or with an internal combustion engine that emits less than 1 g CO_2/kWh as measured in accordance with Regulation (EC) No 595/2009 of the European Parliament and of the Council (3) and its implementing measures, or that emits less than 1 g CO_2/km as measured in accordance with Regulation (EC) No 715/2007 of the European Parliament and of the Council (4) and its implementing measures.

NOT SCOPE OF ZERO-EMISSION-HEAVY-DUTY-VEHICLE

- Carbon fueled Hybrid powertrain vehicles
- Carbon-fueled FCELL vehicles
- Carbon fueled other powertrain vehilces such as Stirling Engines

Due to the VECTO internal conversion factor of gCO2/gFuel for e.g. hydrogen or ethanol referring to JEC database, all propulsion-fuel concpets shall be treated fair (shall get respectively CO2 emissions or not).
A fuel such as ethanol will lead to higher CO2 emissions simulated than 1 g/tkm

CURRENT ACEA PROPOSAL ON PURE ELECTRIC VEHICLES FOR 2017/2400

“(40) ‘pure electric vehicle’ means a motor vehicle pursuant to (EU)2018/858, article 3, equipped with a powertrain containing exclusively electric
machines as propulsion energy converters and exclusively rechargeable electric energy storage systems as propulsion energy storage systems or alternatively any other directly connection from the power network such as catenary systems, rails etc., providing the propulsion energy to the motor vehicle.

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