Fuel Cell Vehicle Range and Hydrogen Use

Driving range and hydrogen use per 100 km of a fuel cell vehicle from usable hydrogen, system and drivetrain efficiencies and energy at the wheels.

Method: Tank-to-wheel energy chain of a fuel cell vehicle

Input parameters

Unit system: SI

Parameter	Value	Unit
Usable hydrogen on board	5.6000	kg
Fuel cell system efficiency (LHV)	52.000	%
Drivetrain efficiency (inverter, motor, gears)	88.000	%
Energy needed at the wheels per distance	130.00	Wh/km

Calculated results

Parameter	Value	Unit
Hydrogen energy on board (LHV)	186.58	kWh
Energy delivered to the wheels	85.381	kWh
Driving range	656.78	km
Hydrogen per 100 km (kg)	0.85265	
Tank-to-wheel efficiency	45.760	%

Notes for this case

• Range = m_H₂ × LHV × η_fc × η_dt / e_w, with the hydrogen lower heating value (about 120 MJ/kg, 33.3 kWh/kg). Real range also depends on auxiliaries, heating and cooling, and driving style.

Formula and method

$$R = \frac{m_{H_2} LHV \eta_{fc} \eta_{dt}}{e_w}$$

Variables

m_{H_2}	Usable hydrogen on board	kg
η_{fc}	Fuel cell system efficiency (LHV)	-
η_{dt}	Drivetrain efficiency (inverter, motor, gears)	-
e_w	Energy needed at the wheels per distance	J/m
E_{H_2}	Hydrogen energy on board (LHV)	J
E_w	Energy delivered to the wheels	J
R	Driving range	m
$m/100\,km$	Hydrogen per 100 km (kg)	-
$\eta_{tank-to-wheel}$	Tank-to-wheel efficiency	-

Method and standards

Vehicle energy chain.

Assumptions and limits

- Average efficiencies over a drive cycle.

References

Tank-to-wheel energy chain of a fuel cell vehicle

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/environmental/hydrogen-fuel-cells/fuel-cell-vehicle-range

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.