



VOLVO
VOLVO GROUP

Vätgas

**Ett viktigt komplement för tunga
fossilfria vägtransporter**

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Energiforsk 2020-12-03

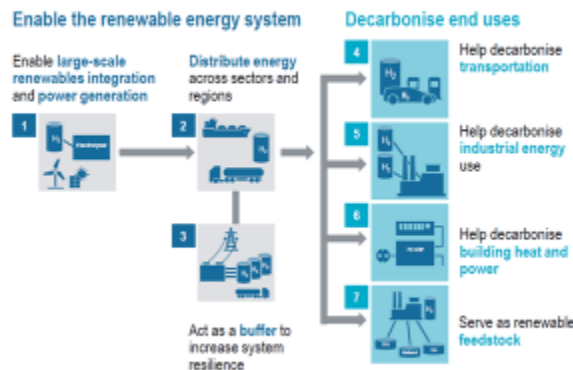
Why Hydrogen and why Fuel Cell Electric Vehicles?

EU target: “The first climate neutral continent by 2050”

- Increase efficiency in renewable power generation
- Large scale storage solution
- Decarbonize heavy industry, heating and chemical industry
- Decarbonise heavy road transport alongside battery electrification

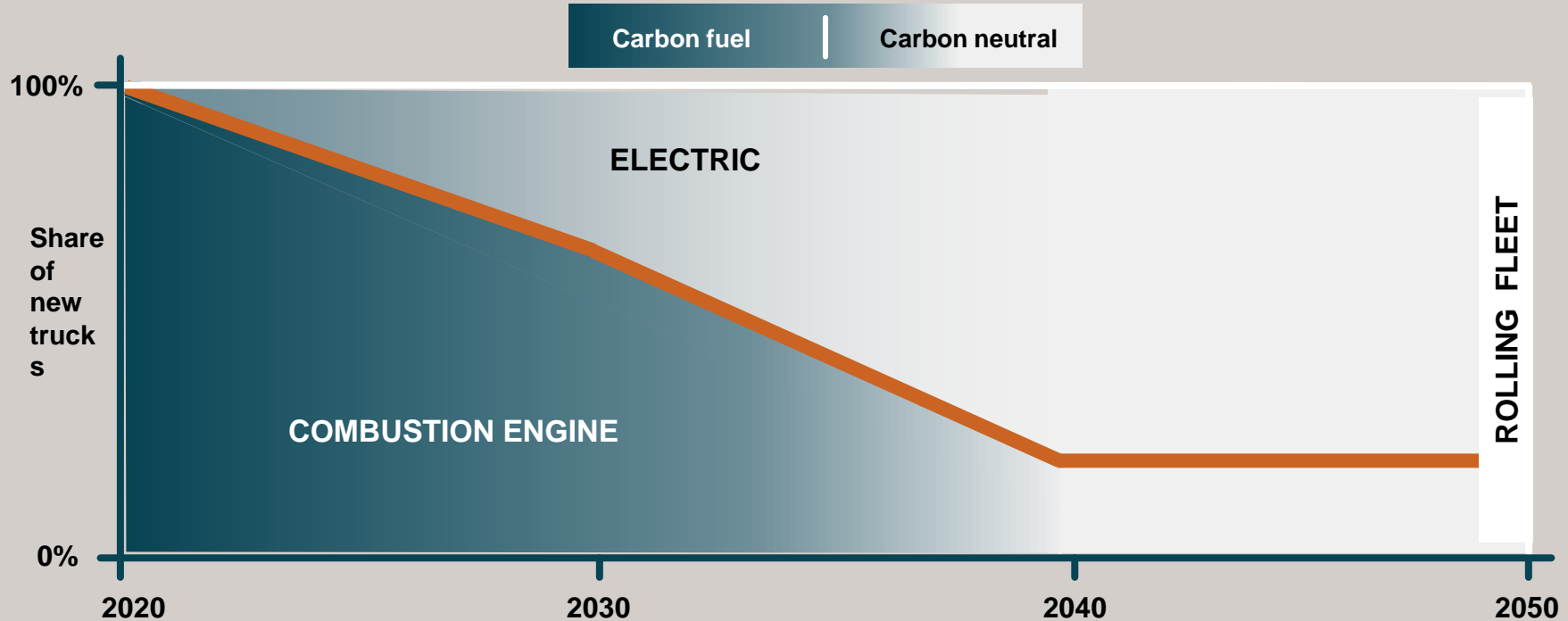


Hydrogen Will Play an Important Role in the Future Green Energy System

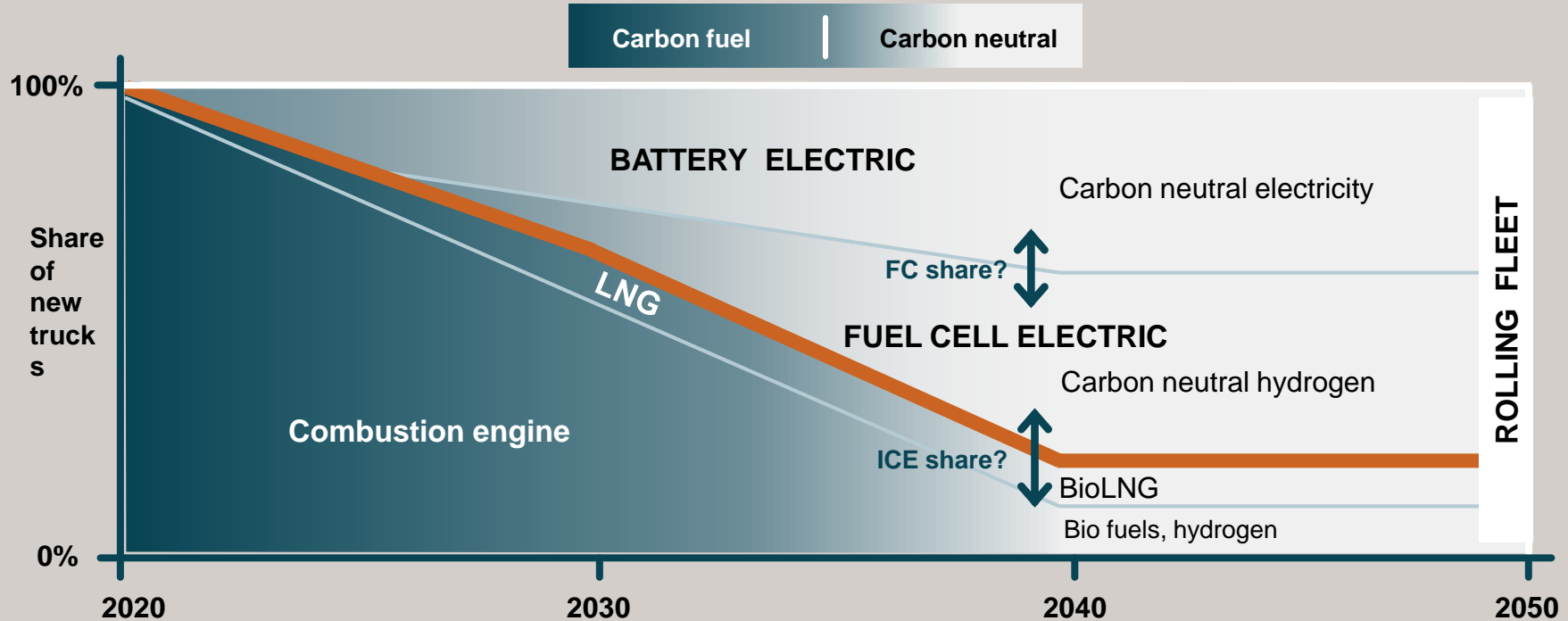


Source: island_barger_fuel_cells_and_hydrogen_for_green_energy_in_europe

100% fossil free Volvo Group vehicles from 2040

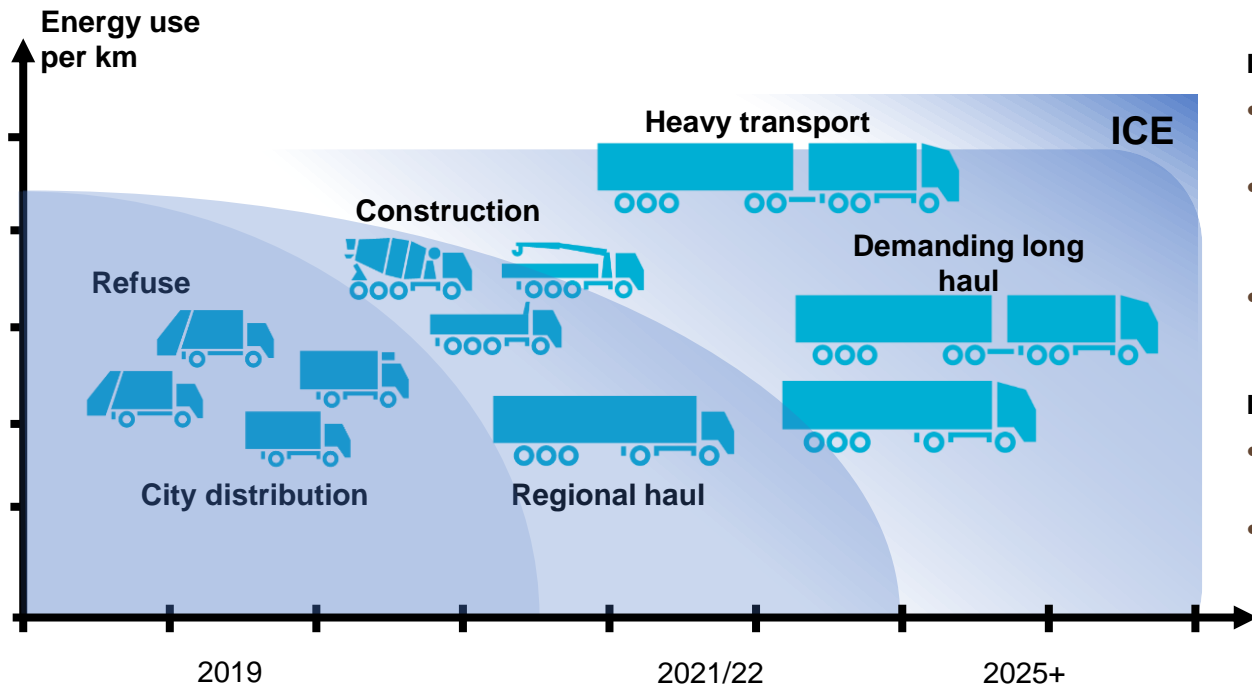


100% fossil free Volvo Group vehicles from 2040



Electric propulsion adapted to transport application

Policies, incentives and regulations need to support a selected mix of technologies and energies to meet the **EU target** “The first climate neutral continent by 2050”.



Infrastructure:

- First wave will mainly depend on home depot over-night charging
- Second wave will also depend on public and destination charging and hydrogen refueling stations
- Third wave will require an increased international network of fast charging and hydrogen refueling stations

ICE:

- ICE will be needed for demanding heavy transport applications
- All ICE fuels needs to be carbon neutral

Fuel Cell Electric Vehicles

FCEV WELL SUITED FOR:

- High utilisation 24/7
- Heavy load
- Long range
- Operations in both remote and urban areas
- High energy consuming superstructures

KEY FEATURES

- Green - Fossil neutral
- Zero Tailpipe
- Close to zero WtW
- Very low LCA footprint
- Range 1.000 km between fillings
- Fast refueling – 15 min
- High flexibility
- Can operate with blue and green hydrogen – not grey!

INFRASTRUCTURE

- Require relatively limited infrastructure investments
- Global solution working independent of local energy availability
- Hydrogen will support the entire society transformation to zero
- Global and local players see investment opportunities
- Will encourage investments in green energy and make that profitable, resulting in lower electricity prices and faster journey to zero.

FCEV Applications



Long Haul



On road construction



Timber



Construction

Rough Cost Build up for Hydrogen Pump Price

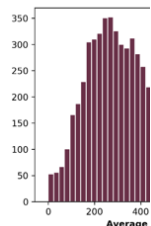
- Roadside windmills can avoid distribution cost and increase windmill profitability!
This will enable increased willingness to invest in green renewables.
- Off grid production possible – Low investments – Short time to market
- Will be able to compete with huge scale imported Hydrogen from Middle East



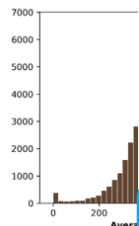
Where to build charging & H₂ infrastructure & how many?

We know fleet daily mileages, where and when frequent stops occur and for how long

Regional



Inter regional



Publicly accessible charging & filling stations adapted for trucks					
Station type	Currently available	EU		SWEDEN***	
		2025	2030	2025	2030
AC/DC <100 kW		20 000	200 000	3 000	15 000
DC >100 kW	< 10	4 000	50 000	500	2 400
DC 350 kW	0	11 000	20 000	100	400
DC >500 kW	0	2 000	20 000	10	400
H2 compr. & liquified	16*	> 50**	> 500**	5	50
LNG/bioLNG	250	> 750	> 1 500	30	50

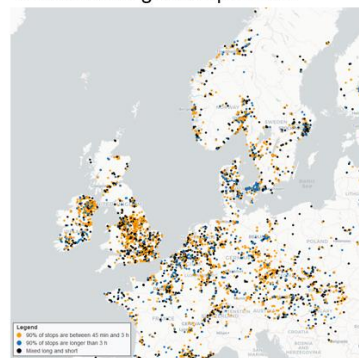
Number of charging and filling stations in accordance with ACEA position

* For buses, 350 bar

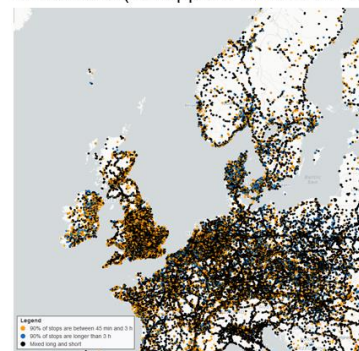
** Hydrogen Europe estimate a need of 100 H2 stations 2025 and 1 000 H2 stations 2030

*** Volvo Group internal estimate

Vehicles in regional operation



All vehicles (EU approx. 45 000 HD trucks)



Source: ACEA Position Paper:
Charging and re-fueling infrastructure
required for heavy-duty vehicles,
March 2020.

THE GLOBAL ELECTRIC LINEUP



Volvo FE Electric Volvo FM Electric Volvo FH Electric Volvo VNR Electric Volvo FMX Electric Volvo FL Electric

TACK!