

TECHNOLOGY DETAILS

Technology: **Hydrogen fuel cell electric vehicle**
Sub-technology: **Molten Carbonate**

Value chain: Shipping
Sub-sector or technology: Vehicle/aircraft/vessel and components
Sector: Transport
Demand/Supply/Infrastructure: Demand

TRL 2023: 7

According to IEA criteria, the TRL of this technology in 2021 was: **7**
For carbon capture, the TRL is 6

TECHNOLOGY DESCRIPTION

High-temperature (600-700C) molten carbonate fuel cells are more applicable for systems that run for extended periods of time without frequent start and stop cycles. They have found application in distributed power generation applications. The high-temperature allows them to operate with a variety of primary fuels with a reformer, thus offering simplified operation on fossil and renewable fuels.

They can have large modules (up to 500 kW of power) and have a good lifetime (on the order of 50,000 hours). Their typical electrical efficiency is around 50% and this can be optimized to 85% with heat recovery (source: <http://www.dnvgl.com/maritime/publications/alternative-fuel-assessment-download.html>).

Further improvements in power density may be required to facilitate the use of MCFCs for larger vessels.

KEY COUNTRIES

Europe, Japan, USA (MCFC supplier)

PROTOTYPE OR DEMONSTRATION PLANS, DEDICATED INVESTMENTS, LEADING INITIATIVES

MCFC fuel cells are being developed and tested:

- Large prototype tested on-board the offshore supply vessel "Viking Lady" <https://www.wartsila.com/marine/customer-segments/references/offshore/viking-lady>
- MC-WAP Project (Fincantieri), MCFC fuelled by diesel <https://emsa.europa.eu/publications/reports/item/2921-emsa-study-on-the-use-of-fuel-cells-in-shipping.html>

DEPLOYMENT TARGETS

None.

COST REDUCTION TARGETS

None.

RELEVANT PARAMETERS

Temperature (°C)	600-700 C
Efficiency (kWh/kg)	~ 50% (LHV) electrical
System cost (€/MW)	\$2,400-\$5,500/ kW installed
Cell lifetime (h)	50,000
Temperature resistance materials	Corrosion resistance at 600-700C

Based on expert input:

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