MMM Energy

Methanol

Methanol + water

Hydrogen

Gas

Bringing Hydrogen closer

Feb 2023

Methanol to Hydrogen Technology

MMM Group

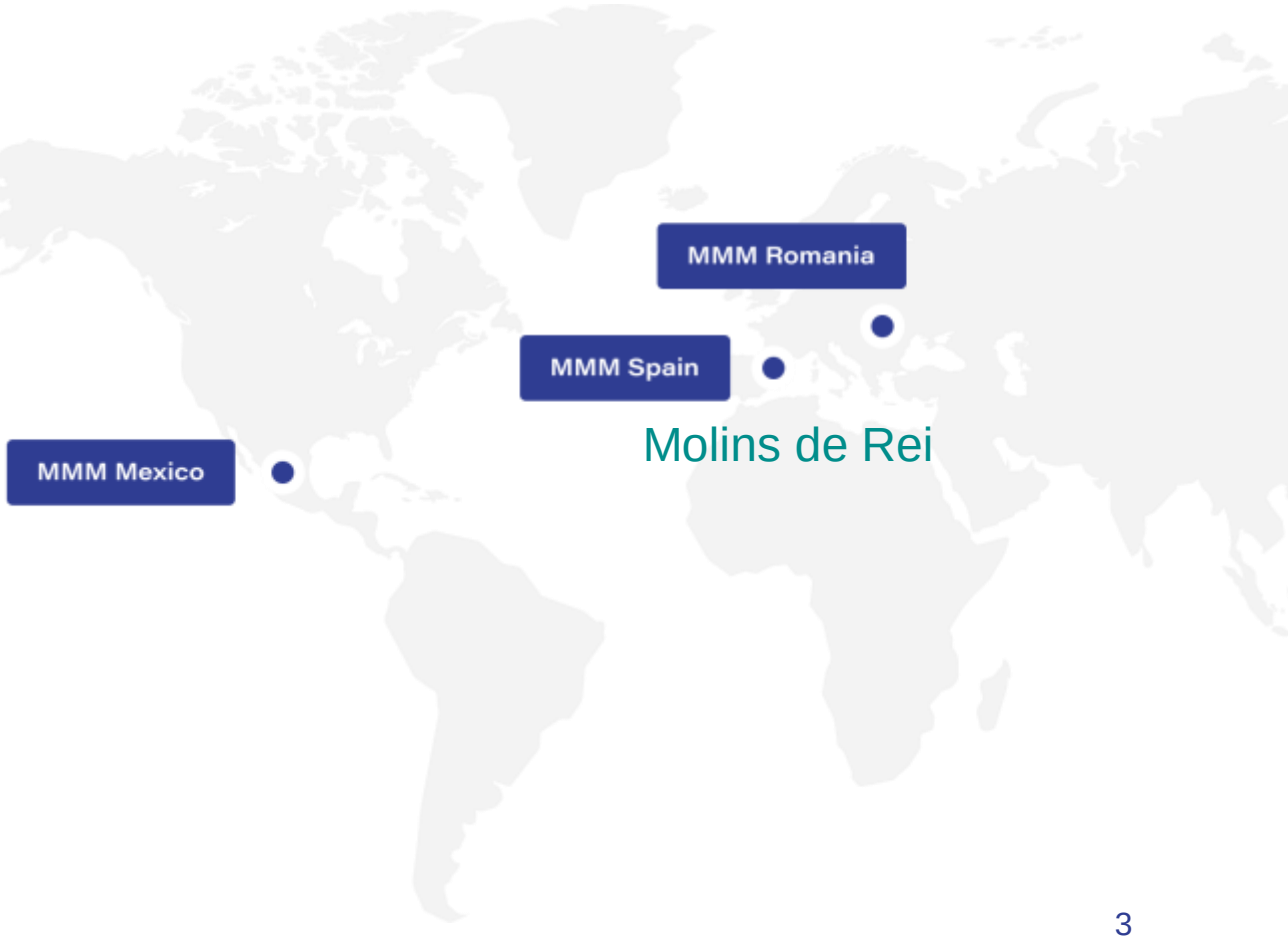
MMM is a business group that has specialized in the design, development and manufacturing of systems that integrate tubes for the automotive industry.

Our energy systems division focuses in several technologies to contribute in the decarbonization of our industry, providing mature and safety technology that can be deployed in a short period of time.

The high technical knowledge, the industrial experience and our company structure allows us to cope with the maximum speed the demands of our customers. We offer a quick response and an accessible, transparent and affordable customer treatment.

MMM Group

During the more than 75 years since our foundation, MMM has been creating and establishing the essential values that have allowed us to maintain an outstanding position in the Automotive sector.



MMM Divisions

MMM Fluid

75 years of experience in Fluid conducting Systems for the Automotive Industry

Automobile Product Portfolio

MMM Energy

Contributing to reduce Climatic Change impact by providing new technologies to the Hydrogen Economy.

H_2 production by Green Methanol

CO_2 Capture

Power (H_2) to X (Gas & Fuel)

3DP by MMM

Accessing to customized productions opportunities through Additive Manufacturing

3D printing High performances materials

MMM Energy

H_2 Green Methanol REFORMER

Making Hydrogen a Reality

Why a Methanol REFORMER System

1. Climatic Change ⇢ Emissions Reduction ⇢ Mandatory driver push for Zero/Low Emission Vehicles
2. Heavy Duty / High Power Systems NOT supported by battery technology
3. Global Infrastructures for H_2 & BEV electric supply won´t be ready in the short & medium term
4. H_2 compress and transport is not efficient.
5. Liquid H_2 carriers → Produce sustainable energy where needed

Why a Methanol REFORMER System

Methanol + Water Reformer Reactor
$CH_3OH + H_2O = 3H_2 + CO_2$

→

Methanol To Hydrogen Generator (on-board/on-site) to feed Power PEMFCs

Why not?

Chemical Storage instead Physical Stored

Efficiency reason: H_2 is the lightest gas

Methanol instead of Ammonia

Safety reason: NH_3 is a poisonous gas & difficult to reform

Methanol instead of other biofuels

Mature Technology: CH_3OH is the simplest alcohol, easy to reform

Cost Competitive: CH_3OH is early available and cheap

Sustainable and Ethic = No food competition: Green CH3OH is made out of captured CO2 or biogas sources.

Methanol To Hydrogen Generator

Fields of opportunity

Methanol To Hydrogen Generator (on board/on site) are ideal to feed Power PEMFC

EU Market 2025

Medium Power

- Trucks / Coaches
- Trains / Trams
- Isolated Charging Stations (HRS & CCS)

Market 2030

Low Power

- Vehicles
- Light Mobility
- Isolated Power Units

Methanol to Hydrogen Technology

MMM Energy

Methanol REFORMER Solutions

Hydrogen generation capacity starts from 2,5 kW in the lower range to several MWs in the upper one, taking advantage of the scalability of our products.

- **Efficient**
- **Safe**
- **Mature Technology**
- **Cost Competitive**
- **Sustainable & Ethical**

Methanol REFORMER Technology

Low Power
S-Series Hydrogen Generator
From 2,5 to 10 KWh

Medium Power
L/M Series Hydrogen Generator
From 130 – 150 KWh

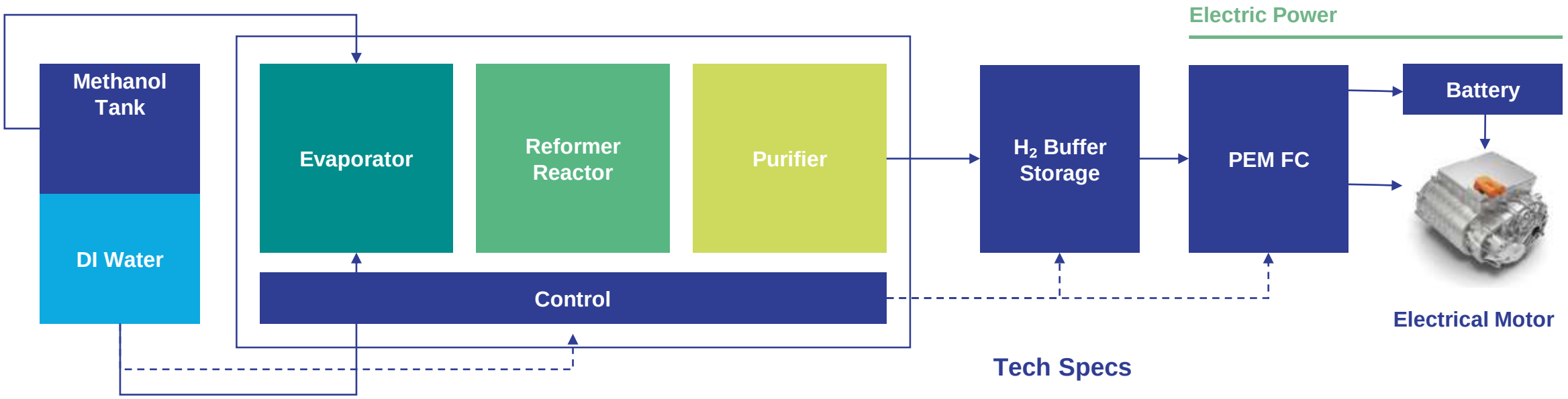
Advantages

- Hydrogen purity reaches 99.97%
- Reduced Noise and Pollution.
- Feedstock MeOH (63%) + H_2O (37%) → Low CO_2 emissions (-28 %).
- No harmful gas emissions.
- Low Cost of Hydrogen
- Substitutes compressed H2 or Cryogenics storage
- Scalable for large Hydrogen Deployments
- Long running time
- Limited Power Requirements
- Reduced and simple Maintenance

Medium Power REFORMER System

MMM side

Customer side



Tech Specs

- Size: 2.000 x 990 x 1524 mm
- Weight : 1.450 Kg
- H2 Flow: 9,75 Kg/h Steady state FC 150 KW/h.
- Purity: 99,97 with <0,2 ppm CO ISO 14687.
- Feedstock: 2,1 L/min MeOH + DI Water.

Technology validated in real conditions

Methanol REFORMER System

Immediate application for Sustainable Quick Charge BEV

+

+

Reformer
Methanol to Hydrogen

Fuel Cell
Hydrogen to Electricity

Why REFORMER System

for EV (CCS – BEV)

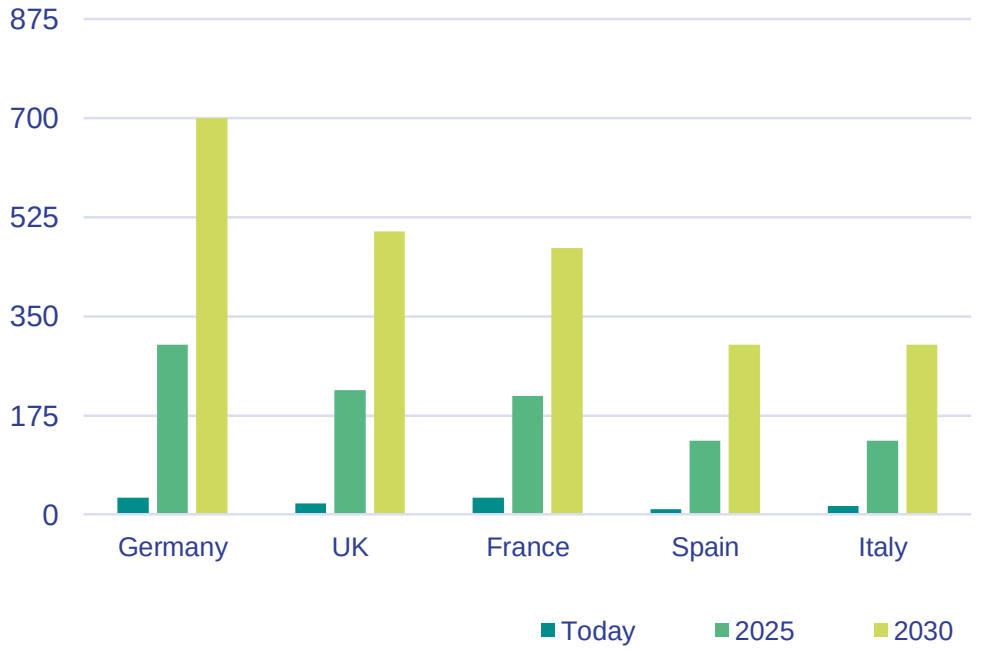
CCS and Ultra Fast CCS Chargers for BEV

- Rapid charging requires from 150 kW to 350 kW per charger
  It is, 1 to 2 MW at each site. Not supported by grid
- Grid infrastructure cost ranges from 30-40k €/MW. Years to have approvals
- Fast/Efficient way: Methanol > Uncompressed hydrogen

Hydrogen Refueling Stations (HRS)

- Isolated & Remote HRS stations
- Back-up for H_2 production systems requiring 24/7 working time

1.3 million public chargers in 2025 and 2.9 million in 2030



Transportenvironment.org (2021)

Thank you for **your** attention

Contact MMM Energy Systems engineering team
for a technical and economic proposal.

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