

ECO-MOBILITY 2020: SUSTAINABLE PROPULSION – FROM RESEARCH TO ROAD

Fuel Cell Technology for Heavy Duty Applications Made in Austria

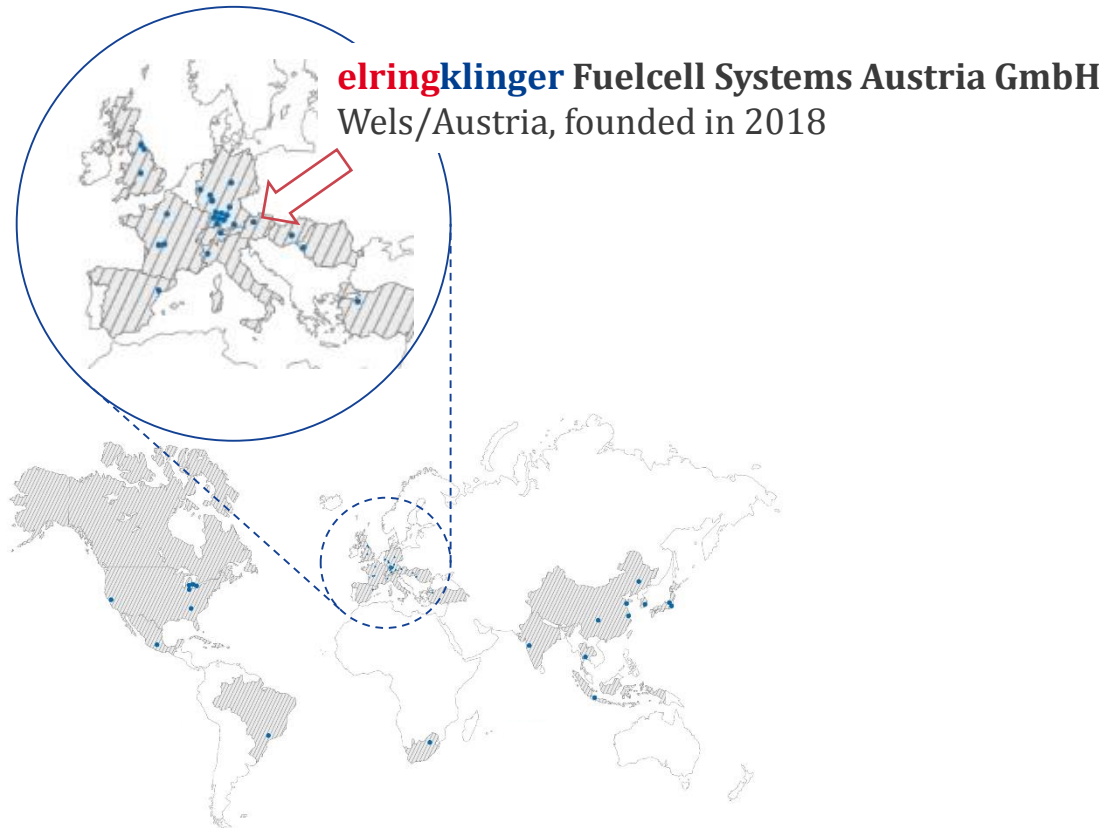


Dr. Ewald Wahlmüller, General Manager EKAT

Tech Gate Vienna, 19th Nov. 2020

FUEL CELL TECHNOLOGY FOR HEAVY DUTY APPLICATIONS MADE IN AUSTRIA

EK in a Nutshell



 Headquartered in **Dettingen/Erms**, close to Stuttgart

 Sales 2019: **EUR 1.727 mm**

 **45** locations

 **3.7%** EBIT margin pre PPA

 Family as a **strong anchor** shareholder

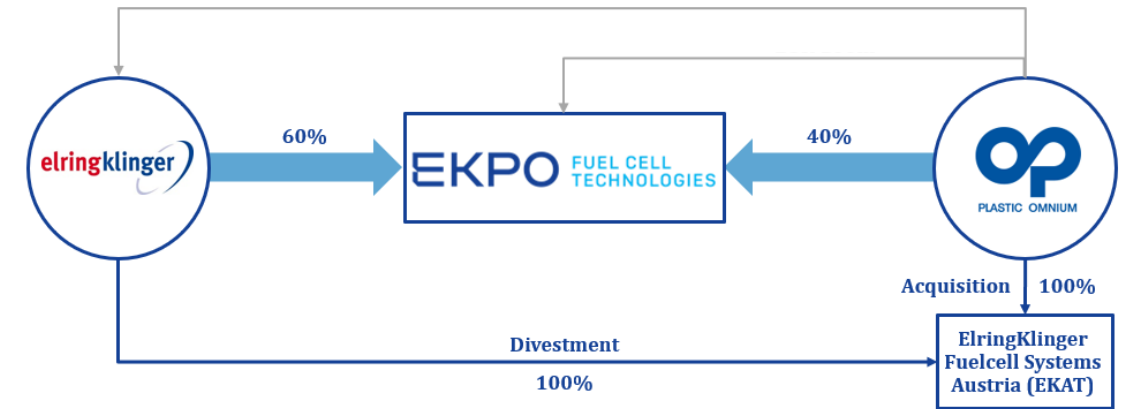
 More than **10.000** employees

 **+9%** CAGR since 2005

 founded **1879**



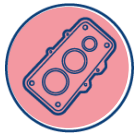
News



ElringKlinger and Plastic Omnium create joint venture

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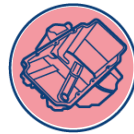
EK Divisions



Cylinder-head
gaskets



Sealing
Systems



Plastic
housing
modules



Shielding
systems



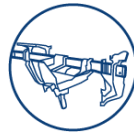
Aftermarket



Tooling
technology



PEM Fuel cells



Lightweight
plastic
components



Battery
technology



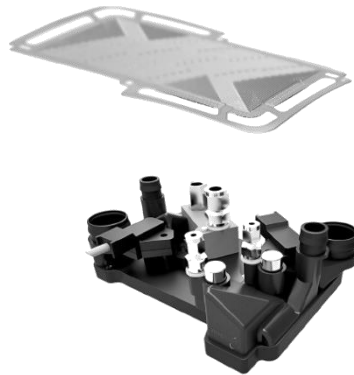
Electric
Drive Unit

FUEL CELL TECHNOLOGY FOR HEAVY DUTY APPLICATIONS MADE IN AUSTRIA

Competence in PEM Fuel Cell Technology

Conception → Engineering → Production

Components



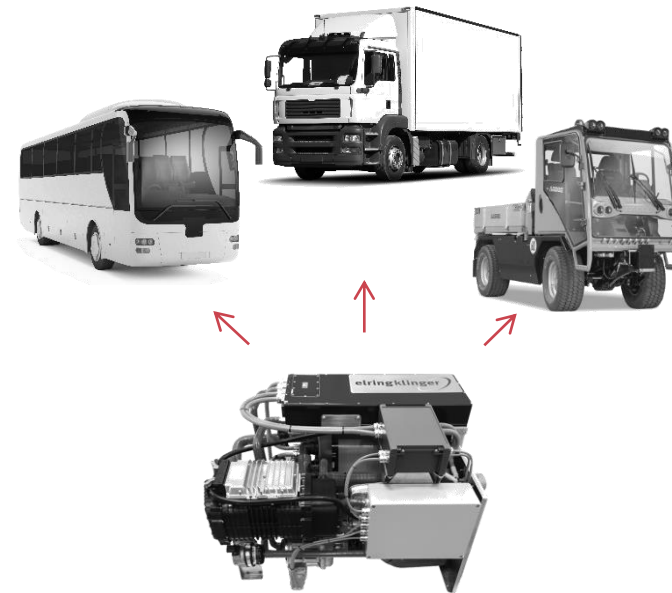
Metallic BPP
Endplates
Media Supply Units
Housings

Stack-Modules



NM5 / NM5-evo
NM12 single / twin
NM9

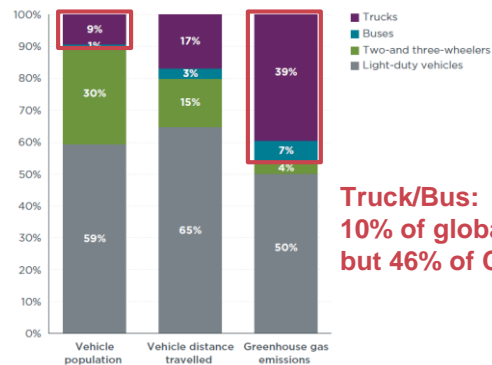
Fuel Cell Modules



FCM-NM5
FCM-NM12

HD Truck/Bus – Near-Term Market Opportunity

- **EU mass market** with ~100.000 u/a (25%) until 2030
- **Clear benefits of H2/FC** vs. battery and ICE
- **Positive BC (TCO) FC vs. Diesel** (<1,25x Diesel €/km @ 3€/kg H2) requires FC Module market price range of 600 to 800 €/kW
- **Positive BC @ HRS** achieved for ~10 trucks
- ZEV vehicle **supportive regulations already in place** (CH, NL) for 2025+
- **EK FC-Module development program is based on and carried out in cooperation with leading truck/bus OEMs** in Europe & Asia



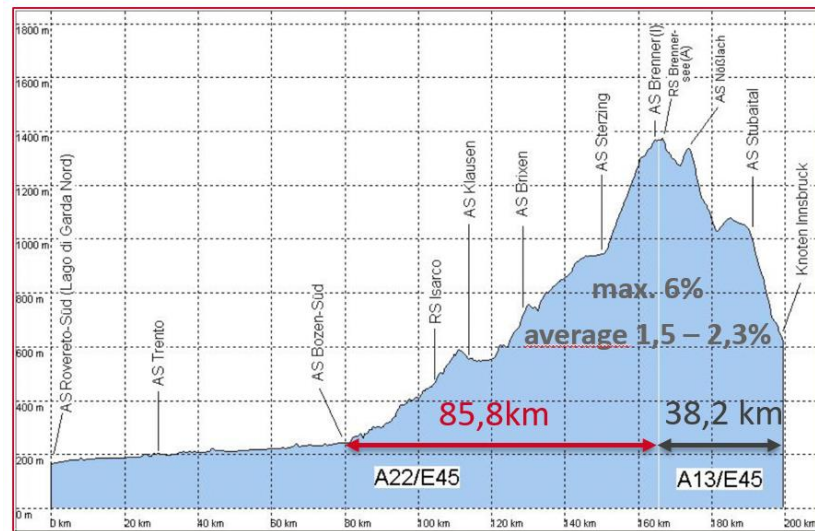
Truck/Bus:
10% of global vehicle stock
but 46% of CO2 emissions!



Source: Moutak M., Lutsey N., Hall D.: Transitioning to Zero-Emission Heavy Duty Freight Vehicles, White Paper, icct – The international council on clean transportation (www.theicct.org), Sept. 2017

HD Truck - Typical Use Cases

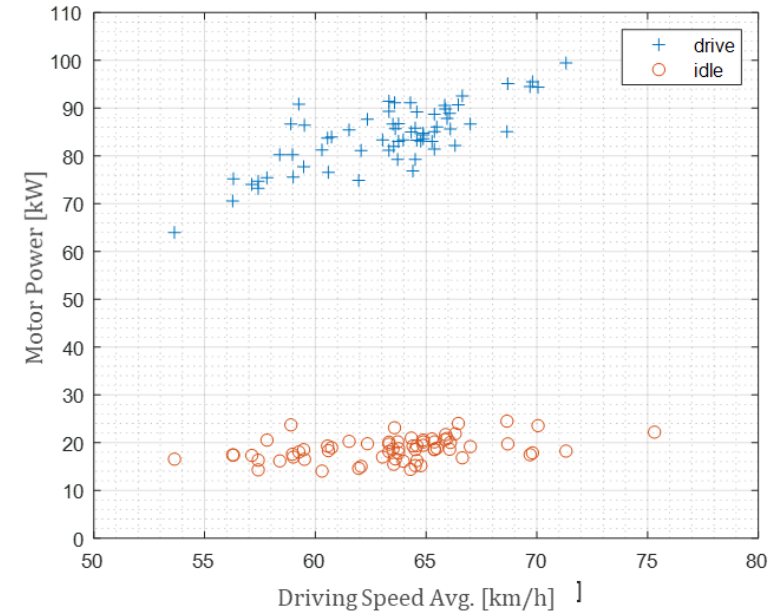
44t Truck on Brenner Pass



Source: WWW.ahph.de

Inclination	Required power @ v = 60 km/h	Required power @ v = 80 km/h
0%	101 kW	157 kW
2%	245 kW	349 kW
6%	532 kW	731 kW

30t Delivery Truck Fleet (Diesel, 290kW)



Driving Power	70 - 90 kW
Idling Power Avg.	19 kW
Driving Time	44 - 88%
Stops per Day	5 - 9

EK Stack Platforms & Roadmap

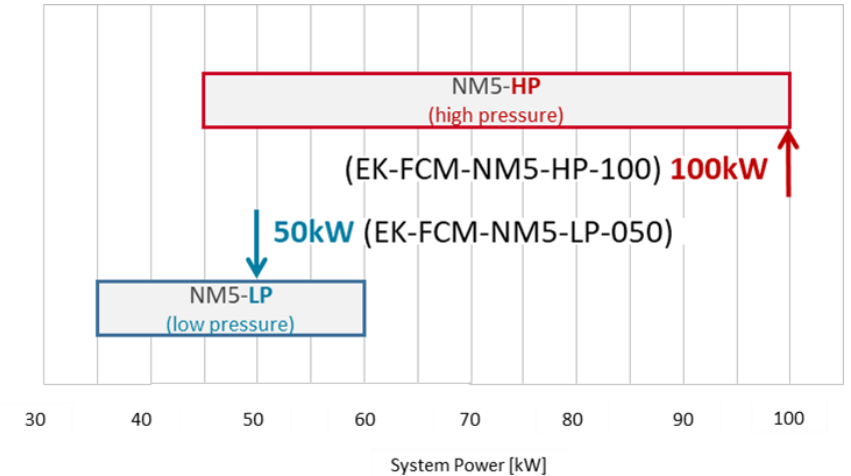
FCM-NM5

NM5	NM5-evo	NM12 twin	NM12 single	NM9
				
6 - 55 kW	15 - 73 kW	100 - >200 kW	60 - 125 kW	50 - 100 kW
up to 299 cells	up to 334 cells	up to 598 cells	up to 359 cells	up to 389 cells
Phased-out 2021	SOP 12/2021	SOP 12/2022	SOP 03/2023	SOP 2023

Modular FCM-NM5 Platform

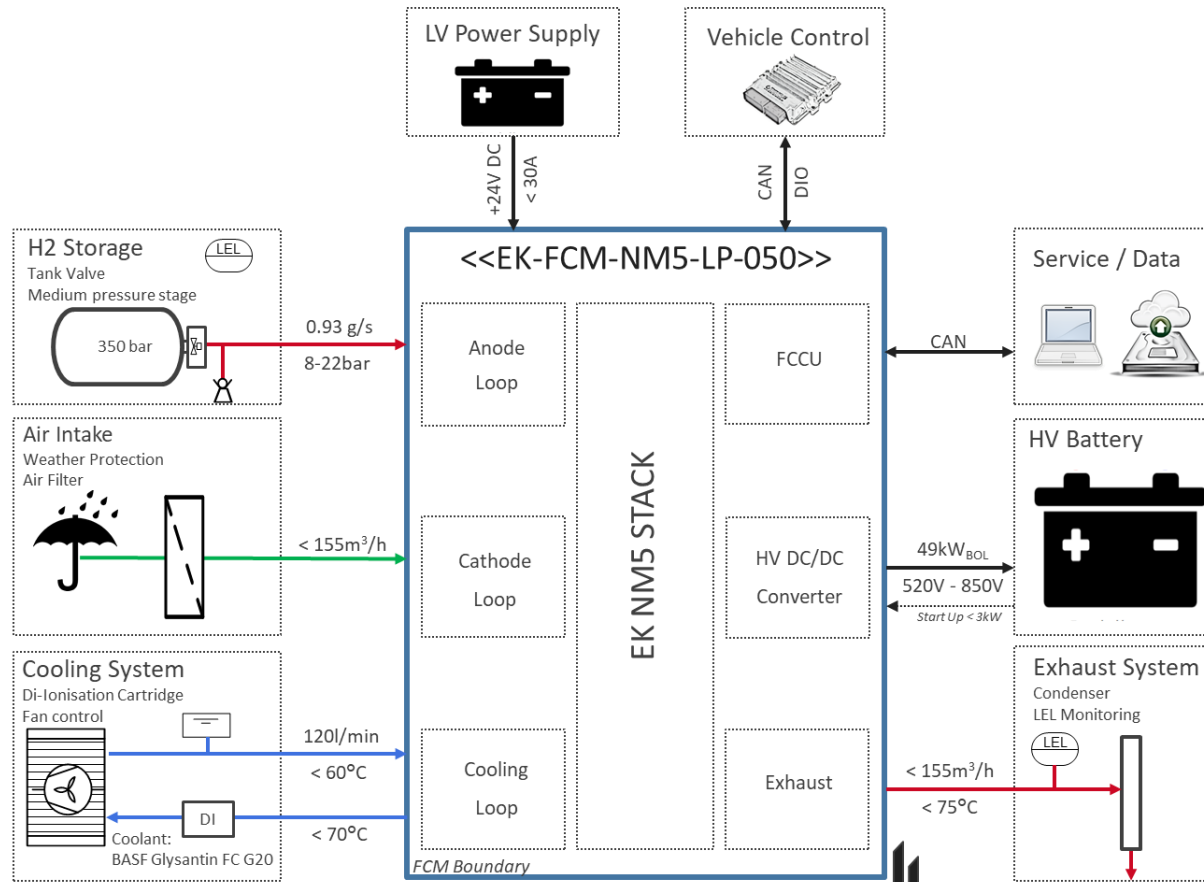
FCM Type	EK-FCM-NM5-LP-050
Module Configuration	NM5 – Double – Stack Low Pressure Cathode Integrated HV DC-DC
BOL Power [kW]	49
EOL Power [kW]	41
Output Voltage [V]	450 (520) - 850
Weight [kg]	< 200
Dimension / L x W x H [mm]	1000 x 700 x 330
Durability [hr]	>12.000
H2 consumption, nom. [g/s]	0,93
H2 Fuel Quality	ISO 14687-2, SAE J2719
Best System Efficiency [%]	56
Ambient [° C]	-25 to +40
IP Rating (min.)	54
High Temperature Cooling	≤ 60DegC, 120 l/min Glysantin FC G 20-00/50
LV Interface [VDC] / [ADC]	24 / < 30
Control Interface	CAN - fully ISO 11898-2/-5 compliant
Homologation	ECE-R 134, ECE-R 100, ECE-R 10

Note: technical data subject to change

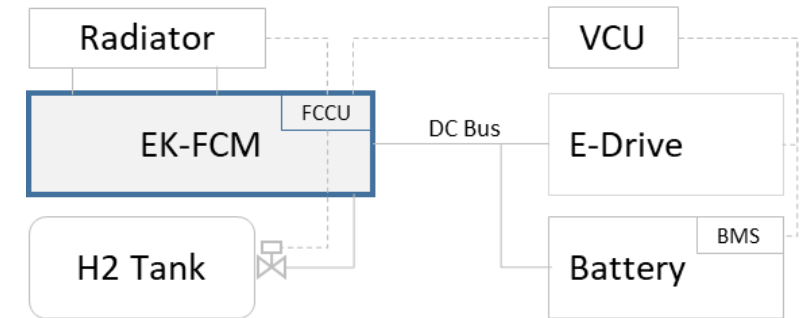


EK-FCM-NM5-LP-050
with integrated HV DC-DC

FCM Concept & Vehicle Integration



EK-FCM Platform Concept & Interfaces



EK-FCM Vehicle Integration Concept

- **Objectives:** 16 FC Trucks (26t/44t) end-customer demonstration incl. HRS
- **Results:** >2 mio km day-to-day driving of FC trucks providing data base for EU business case

Coordination, dissemination, analysis



Belgian deployment



French deployment



German deployment



Swiss deployment



Summary & Outlook

- Fuel cell technology is very fast progressing in all key parameters like power density, efficiency, lifetime and also costs
- Fuel Cell technology benefits from EKs proven automotive production technologies and quality
- A modular Fuel Cell system concept simplifies vehicle integration but also supports reduced costs and time-to-market
- More HD vehicle fleet demonstrations also in Austria(!) are required to identify early business models and spark market uptake



THANK YOU

Experience
mobility – Drive the
future.



Agenda

- ElringKlinger in a Nutshell / Divisions
- Competence in PEM Fuel Cell Technology
- HD Truck - Typical Use Cases
- EK Stack Platforms & Roadmap
- EK FCM-NM5 Platform
- H2Haul Project
- Summary & Outlook