



HRS 2.0: The Standardization of hydrogen refueling stations

presentation „Unternehmergespräche ENERGIE“ 14.09.2023



MAXIMATOR[®]
HYDROGEN



Maximator Hydrogen - Who We Are



MAXIMATOR
Advanced Technology



MAXIMATOR
Gas Solutions

MAXIMATOR
Hydrogen Inc.

TesTneT
Maximator GmbH

MAXIMATOR
HYDROGEN

- founded in 2019 as GmbH
- outsourcing of an existing division „Hydrogen“ from the Maximator GmbH
- dedicated technology development partner „Maximator Advanced Technologies“
- by planned 50 compression systems in 2023 we will be one of the top refueling station provider
- first serial Hydrogen refueling station provider with own developed Hydrogen compressor „made in Germany“
- nearly 200 highly qualified young motivated employees (08/2023)

Growing Up

MAXIMATOR®
Advanced Technology



2017

- Project Start Max Compression

2018

- Hanover fair: presentation of Max Compression Mockup

TesTneT
Maximator GmbH

MAXIMATOR®
Gas Solutions



2018

- Start of Max Compression Series Product
- Start of HRS Production



2019

- **Foundation Maximator Hydrogen GmbH**
- International market launch of Hydrogen Refueling Systems

Growing Up

MAXIMATOR[®] HYDROGEN

 **MAXIMATOR[®]
Hydrogen Inc.**


VERNCONEX



2020

- **Foundation Maximator Hydrogen Inc.**
California
- about 50 HRS projects
in California

- **Foundation Vernconex AG**
- about 40 HRS projects
in 2020

2021

- **Opening Production Plant Maximator Hydrogen GmbH**
- about 50 HRS projects
in 2021
- Project Start „Max Compression 2.0“

2021

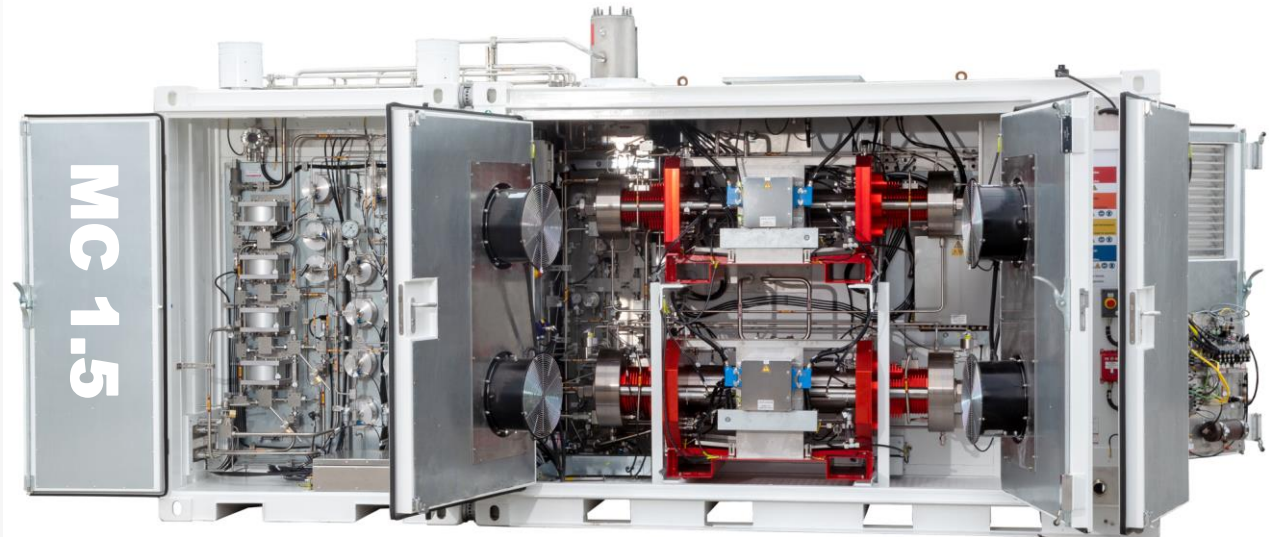
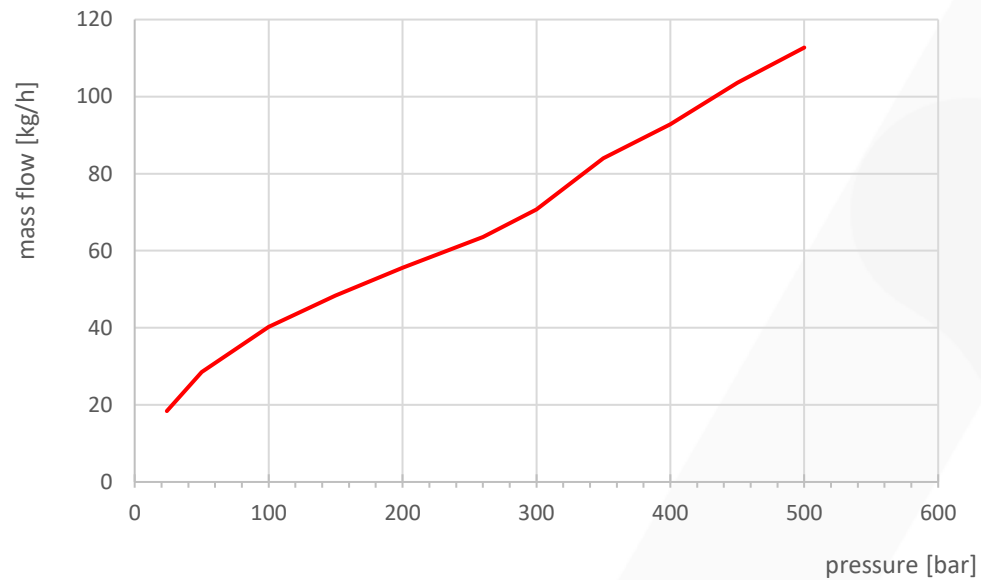
- Development of **MAX Compression 2.0 S & M**

2025

- about 100 HRS
projects in 2025

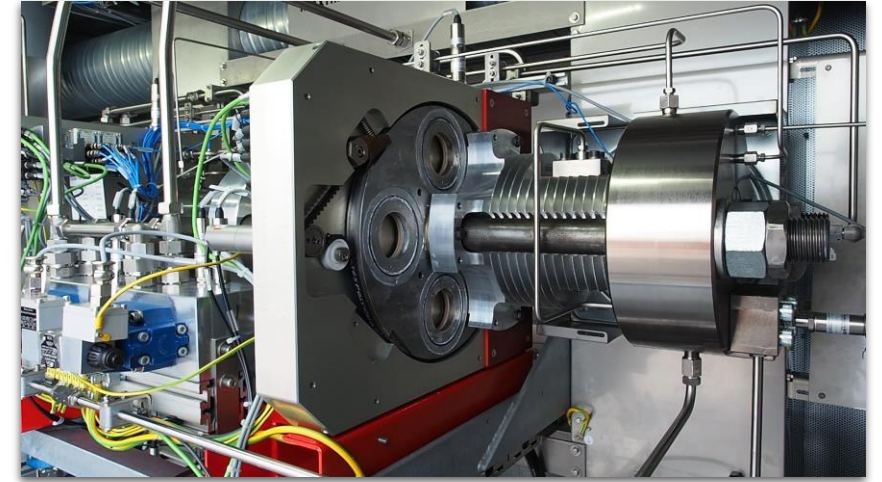
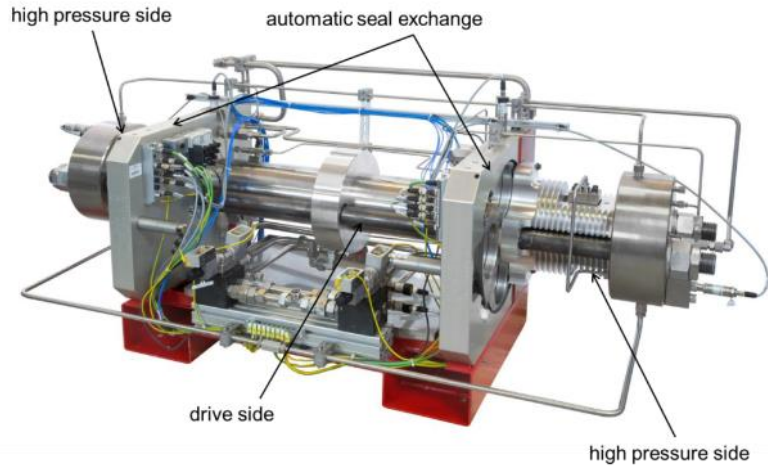
HRS - Core Technology MAX Compression

mass flow, depending on suction pressure, MC 1.5



picture left: attached MAX Flowtech "S", right: MAX Compression 1.5 75kW

HRS - Core Technology MAX Compression



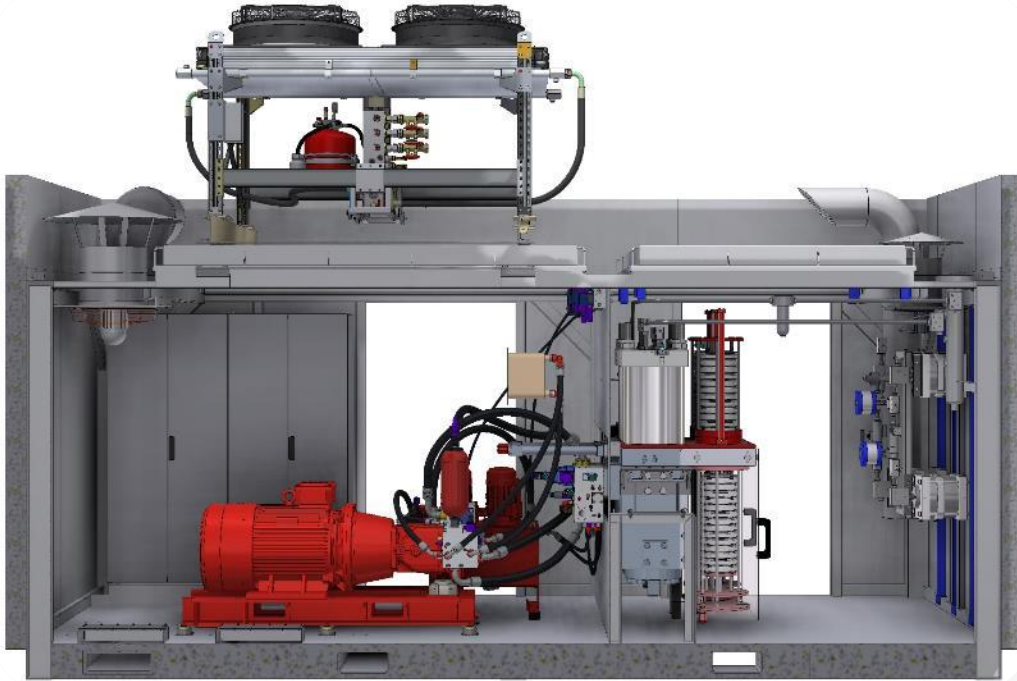
MAX Compression 1.5

- hydraulically driven 2-stage piston compressor
- supplies H₂ with up to 1000 bar
- clean and safe hydrogen compression
- unmatched service lifetime of seals and valves
- lowest maintenance costs with highest energy efficiency

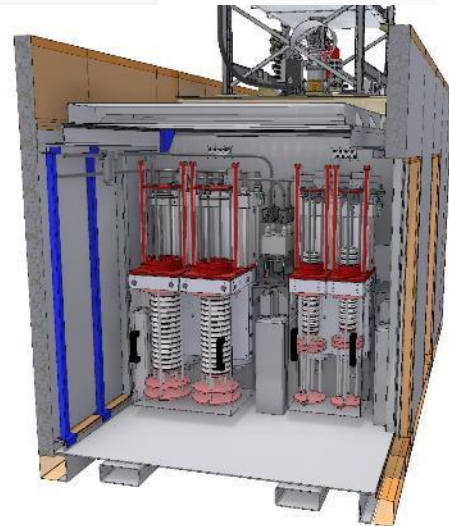
ASX (Automatic Seal Exchange)

- all MAX Compression units are equipped with the ASX function
- this function describes the automatic seal change of the Hydrogen high pressure seal
- unplanned downtime is reduced to a minimum
- seal change itself takes about 4 minutes per pressure converter compared to some working days for existing technology

MAX Compression 2.0 „S“



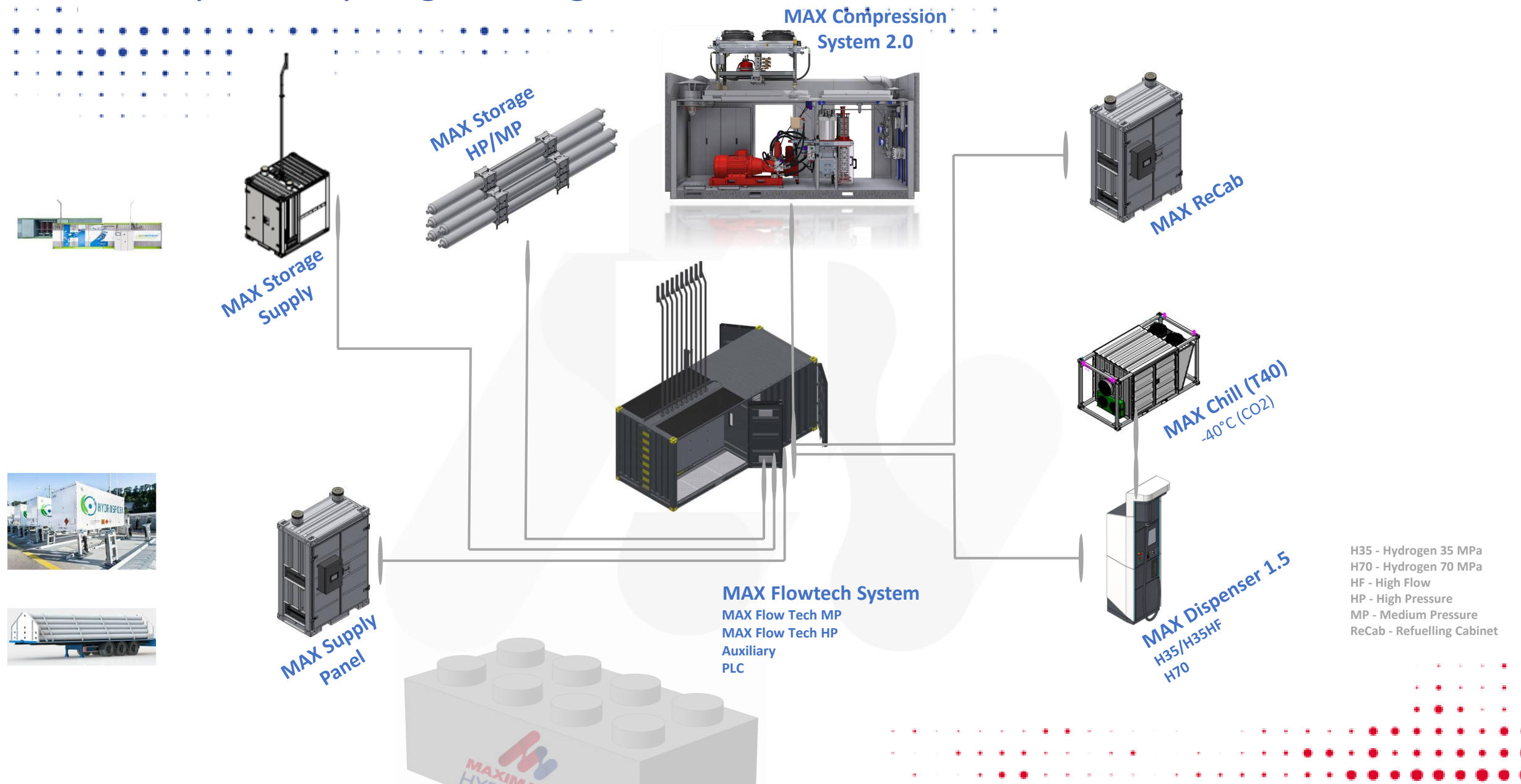
- Hydrogen inlet pressure range 15 - 600 bar
- Hydrogen outlet pressure range 15 - 950 bar (MAWP = 1050bar)
- delivery rate 25 - 110 kg/h
- footprint 6200 x 2485 mm
- stroke frequency of up to 1,5Hz due to mass balancing
- precise piston movement and deadspot optimization
- highly efficient water cooling
- reduced leakage possibilities due to straight design
- Automatic Seal Exchange (ASX)



[Hydrogen + Fuel Cells EUROPE @ Hannovermesse 2022 - YouTube](#)

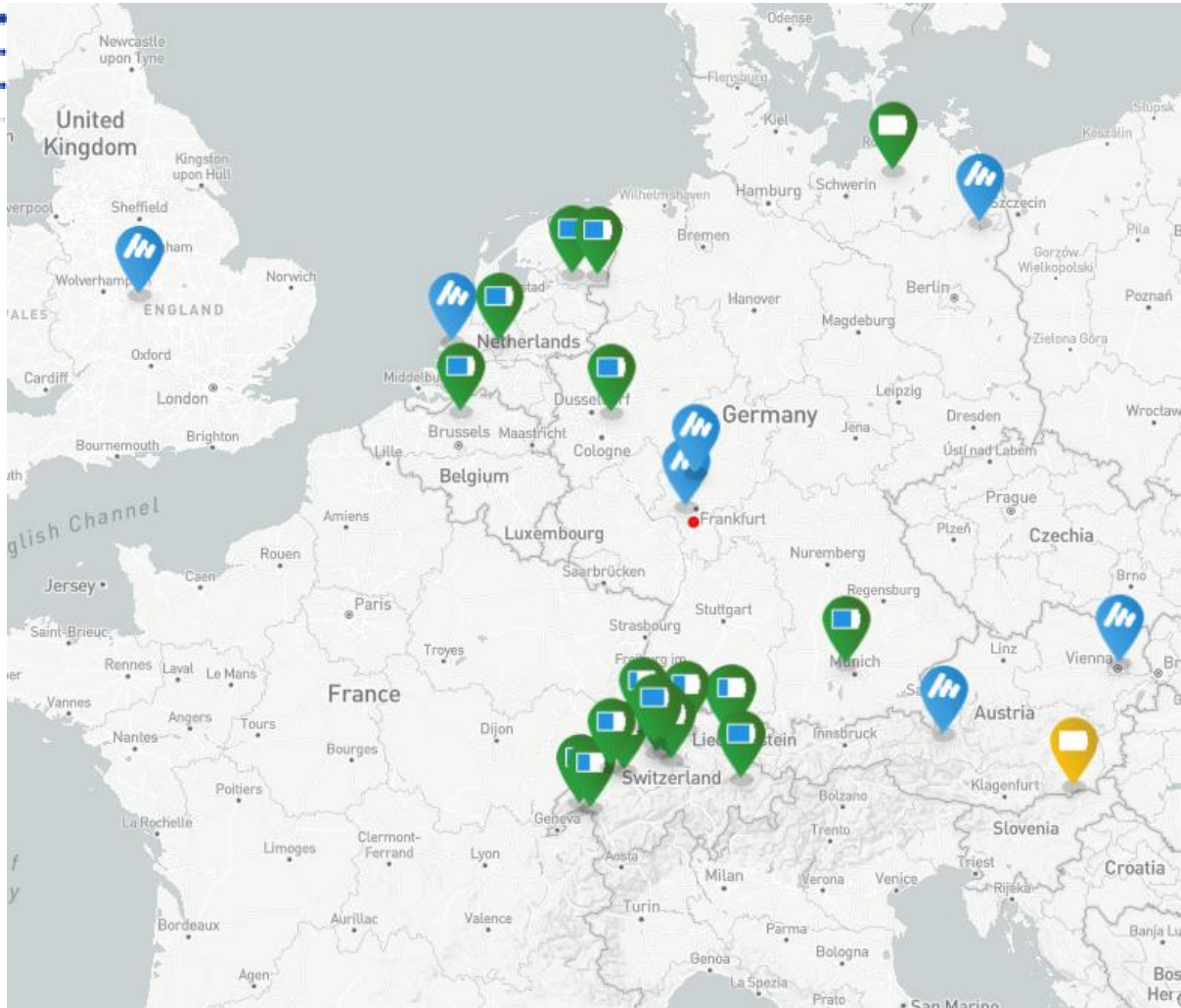
[\[DE\] Bosch Rexroth & Maximator Hydrogen: Innovative Lösungen für Wasserstofftankstellen - YouTube](#)

concept of a hydrogen filling station 2.0



H35 - Hydrogen 35 MPa
H70 - Hydrogen 70 MPa
HF - High Flow
HP - High Pressure
MP - Medium Pressure
ReCab - Refuelling Cabinet

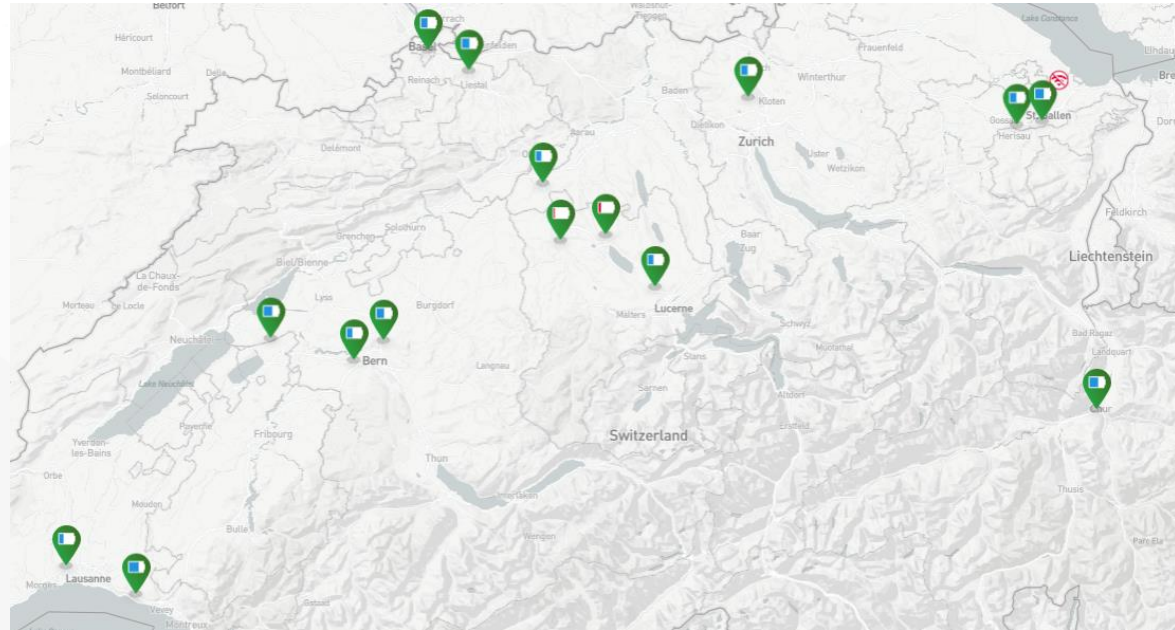
Where our stations are already...



	Unit	2020	2021	2022	2023 YTD
Refuelled mass	kg	13.729	226.681	355.170	253.520
Average mass per refueling	kg	9,86	9,1	8,78	9,47
Number of refuelings	-	1.393	24.911	40.460	26.784
Average duration	min	05:05	04:50	05:13	05:47
Max refueled mass	kg	31,85	32,51	33,78	33,38
Max daily throughput	kg/d ay	407	1346	1771	1875

Wasserstoffökosystem Schweiz

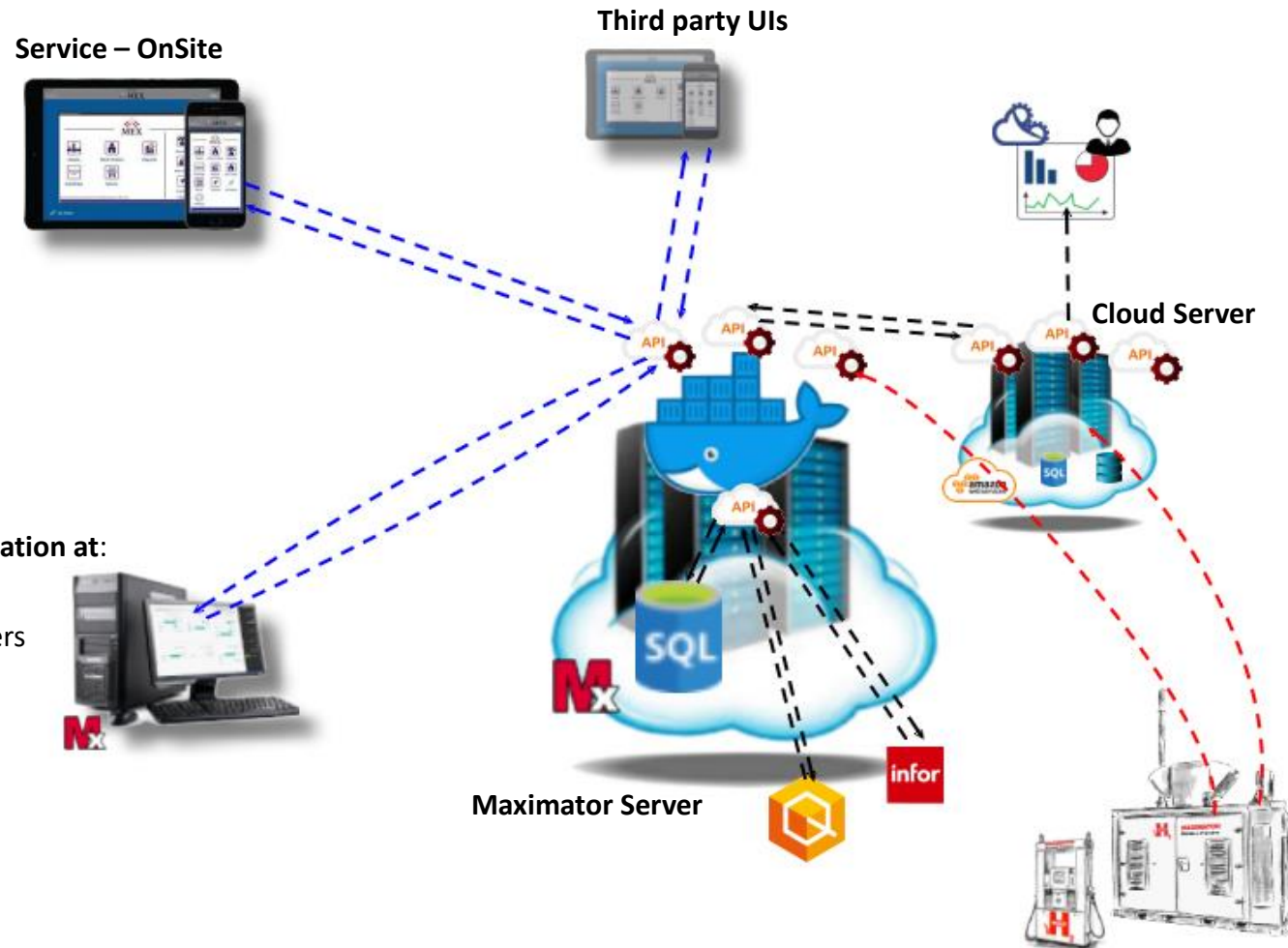
Betankungen	
Betankte Menge gesamt	662.790 kg
Betankte Menge 700 bar	54.300 kg
Betankte Menge 350 bar	608.490 kg
Anzahl Betankungen	65.928
Anzahl Betankungen 700 bar	23.709
Anzahl Betankungen 350 bar	42.219
Betankungsmenge pro Tag	742 kg



PKW: 4.200.000 km
NFZ: 7.600.000 km

CO2 Reduktion: 3.300.000 kgCO2

Software architecture



in-house workstation at:

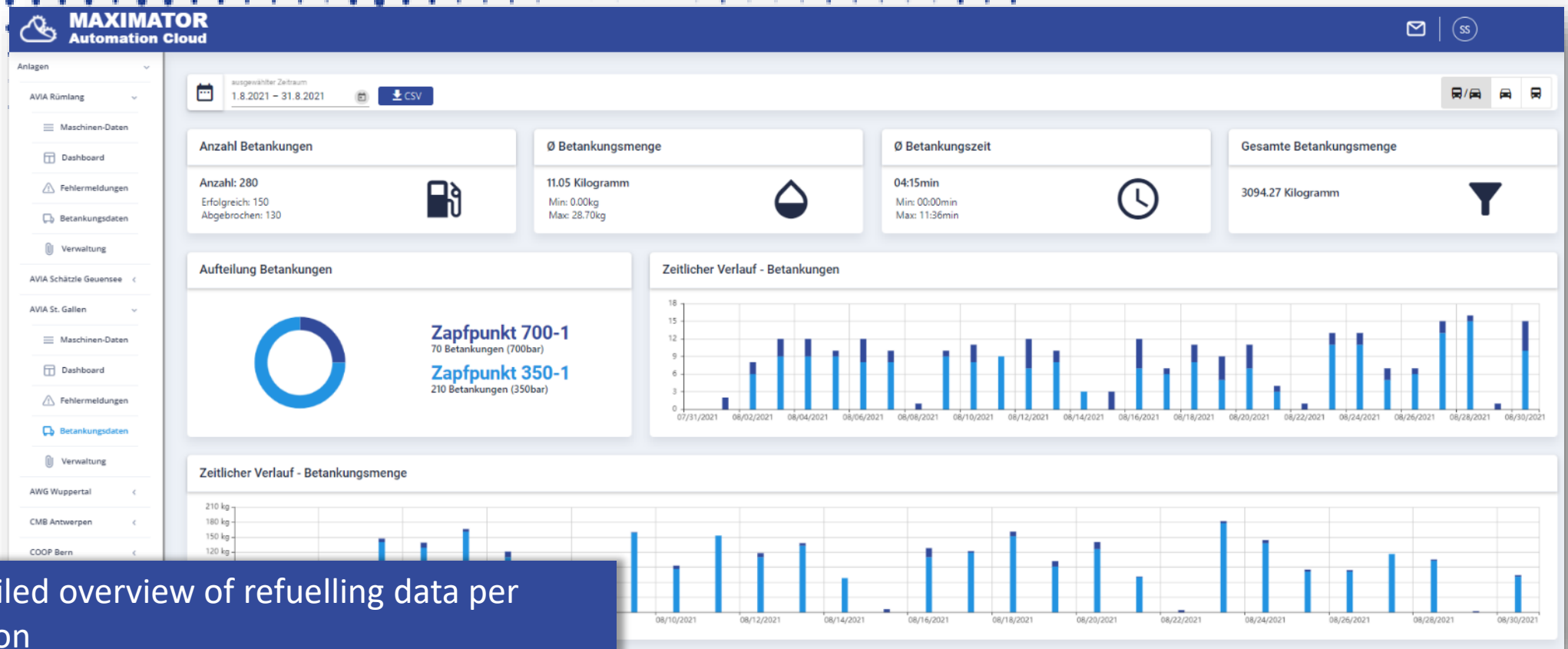
- MAXIMATOR
- Servicepartners
- Customers



Full Maintenance Service		Healthy Reports
Help Desk und Support		Online Zugriff
Erreichbarkeit 24/7		Statusüberwachung



Cloud Dashboard



- detailed overview of refuelling data per station
- report and export function
- filtering by refuelling type and dispenser

HRS – References





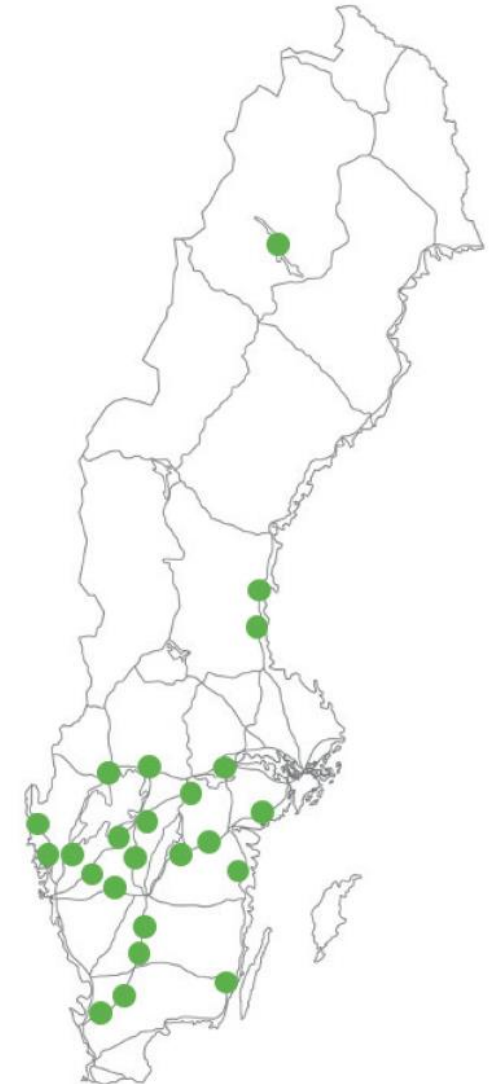
Expansion of the world's densest network of hydrogen refueling stations in Sweden

Maximator Hydrogen supports Hydri in the Swedish H2 infrastructure network expansion with innovative H2 solutions

Hydri – formerly REH2 – and Maximator Hydrogen are working together on the strategic expansion of a nationwide green H2 infrastructure for heavy trucks with the world's densest network of hydrogen refueling stations in Sweden. The first refueling station is scheduled to be delivered in the beginning of 2024, with another 23 stations to follow on a monthly cycle.

With Rasta, Sweden's largest service station chain for trucks is also part of the cooperation. 23 of the 24 hydrogen refueling stations will be built at their sites. The rest areas are strategically located along Sweden's major highways, making them an important building block in expanding hydrogen mobility for trucks and promoting zero-emission transportation in the country.

„Maximator Hydrogen offers us a complete turnkey package for our stations and, just like us, is committed to long-term cooperation. Both are key requirements for us to be successful in introducing a green H2 infrastructure in Sweden,“ said Christoffer Lofström of Hydri.



Herausforderungen und Lösungen bei der Wasserstoffadoption und die Transformation der Industrie

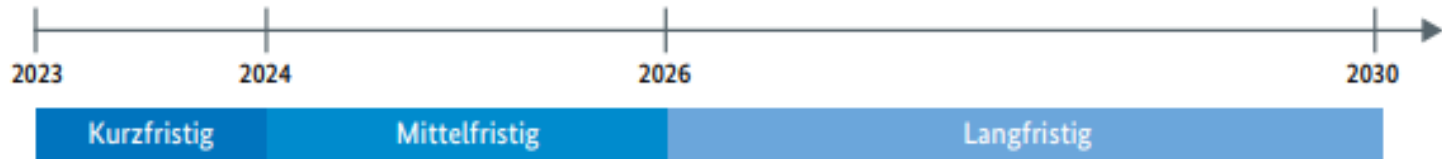
Handlungsfelder der NWS-Fortschreibung

1. Verfügbarkeit von ausreichend Wasserstoff sicherstellen

2. Wasserstoffinfrastruktur ausbauen

3. Wasserstoffanwendungen etablieren (Industrie, Verkehr, Strom, Wärme)

4. Gute Rahmenbedingungen schaffen



Die Herausforderungen der Wasserstoffadoption sind real, können aber durch kollaborative Anstrengungen und Innovationen überwunden werden, um die Industrie zu revolutionieren.

Innovation und Zukunftsprognosen von Maximator Hydrogen im Kontext der Mobilität

↑ Änderung des Bundesfernstraßenmautgesetzes im Kabinett beschlossen

PRESEMITTEILUNG

054/2023

Änderung des Bundesfernstraßenmautgesetzes im Kabinett beschlossen

Im Einzelnen:

Zum 1. Dezember 2023 soll ein CO₂-Aufschlag in Höhe von 200 Euro pro Tonne CO₂ eingeführt werden. Emissionsfreie Lkw werden bis Ende 2025 von der Maut befreit. Anschließend werden lediglich 25 Prozent des regulären Mautteilsatzes für die Infrastrukturkosten erhoben – zuzüglich der Mautteilsätze für Lärm und Luftverschmutzung.

Im Vergleich die Mautkosten für 150.000 Kilometer auf Bundesfernstraßen mit einem Diesel-Fahrzeug (Daimler Actros; Euro 6 Diesel; >18t bis 3 Achsen, 1360 g CO₂/km) und einem Wasserstoff-Fahrzeug:

- Diesel-Lkw aktuell: 0,18€/km → 21.600€
- Diesel-Lkw ab 01.12.2023: 0,18€/km + 0,27€/km → 68.000€
- Wasserstoff-Lkw bis 31.12.2025: 0€/km → 0€
- Wasserstoff-Lkw ab 01.01.2026: 0,074€/km → 11.083€

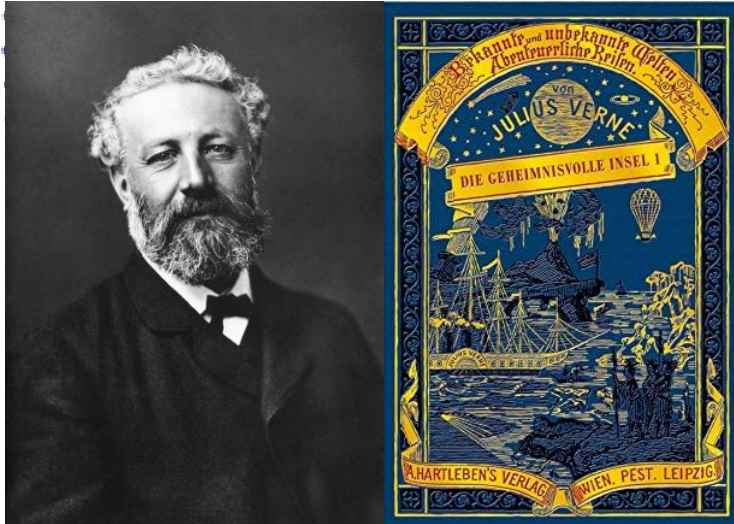
Ende 2023 gekauft und 3 Jahre betrieben:

Wasserstoff-Lkw: 11.083€

Diesel-Lkw: 204.000€

DELTA: 192.917€

Wasserstoffmobilität spielt eine zentrale Rolle im Bereich Transport von Gütern und Personen bei Tagesreichweiten von über 200 km und bei PKW im Bereich der Oberklasse und SUV`s
Übergangsweise spielt der Verbrennungsmotor on-road und off-road als Brückentechnologie eine zentrale Rolle



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1874

Jules Verne

L'île mystérieuse / The mysterious island

“Water is the coal of the future. Tomorrow's energy is water that has been broken down by electricity. The thus decomposed elements of water, hydrogen and oxygen, will secure the energy supply of the earth for the indefinite future. “

„Wasser ist die Kohle der Zukunft. Die Energie von morgen ist Wasser, das durch Strom aufgespalten wurde. Die so zersetzten Elemente, Wasserstoff und Sauerstoff werden die Energieversorgung der Erde auf unbestimmte Zeit sichern.“



Take the chance to be part of a movement that is changing the mobility landscape forever.



MAXIMATOR[®]
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Join hydrogen mobility and leave a positive footprint for generations to come.

