Die Perspektive von Wasserstoff für die Transportindustrie

Fokus Wasserstoff - Beispiel H2-Mobilität im Straßengüterverkehr

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Facts and Figures

Global Footprint

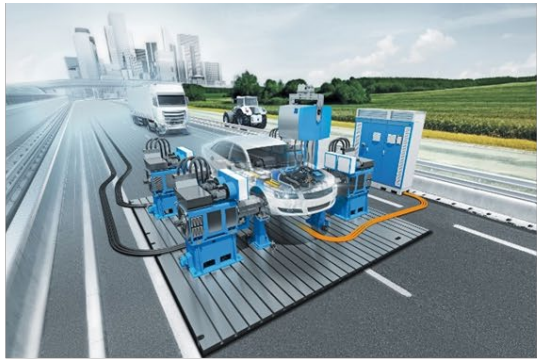
Represented in 26 countries

45 Affiliates divided over 93 locations

45 Global Tech and Engineering Centers (including Resident Offices)

ENGINEERING SERVICES

- Design and development services for all elements of ICE, HEV, BEV and FCEV powertrain systems
- System integration into vehicle, stationary or marine applications
- Supporting future technologies in areas such as ADAS and Autonomous Driving
- Technical and engineering centers around the globe



INSTRUMENTATION AND TEST SYSTEMS

- Advanced and accurate simulation and testing solutions for every aspect of the powertrain development process
- Seamless integration of the latest simulation, automation and testing technologies
- Pushing key tasks to the start of development

ADVANCED SIMULATION TECHNOLOGIES

- We are a proven partner in delivering efficiency gains with the help of virtualization
- Simulation solutions for all phases of the powertrain and vehicle development process
- High-definition insights into the behavior and interactions of components, systems and entire vehicles

1948

Founded

11,000

Employees Worldwide

12%

Of Turnover Invested in Inhouse R&D

1.7BN€

Turnover 2019

65%

Engineers and Scientists

1,500

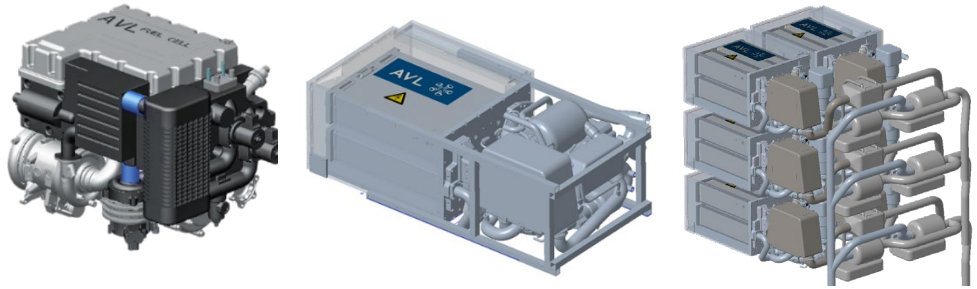
Granted Patents in Force

AVL Hydrogen & Fuel Cell

Public

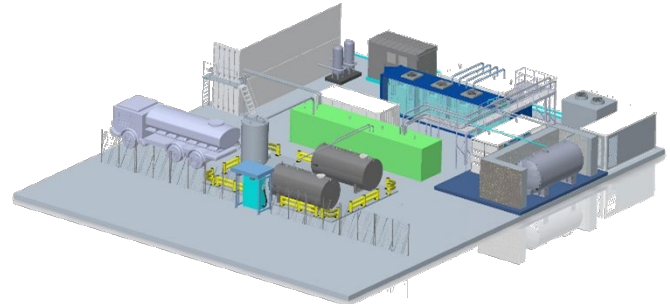
Hydrogen & Fuel Cell @AVL

Hydrogen Mobility



Fuel Cell Systems & Stacks for PC, CV, Rail and Marine

Synthetic Fuels & Chemicals



e-Fuel Production based on SOEC

Fuel flexible SOFC X-to-Power

SOEC based Power-to-X

Power Generation Hydrogen Production

AVL Fuel Cell Techcenters

Hydrogen & Fuel Cell Test & Development Center – Graz / Austria

AVL Fuel Cell Canada – Vancouver / Canada

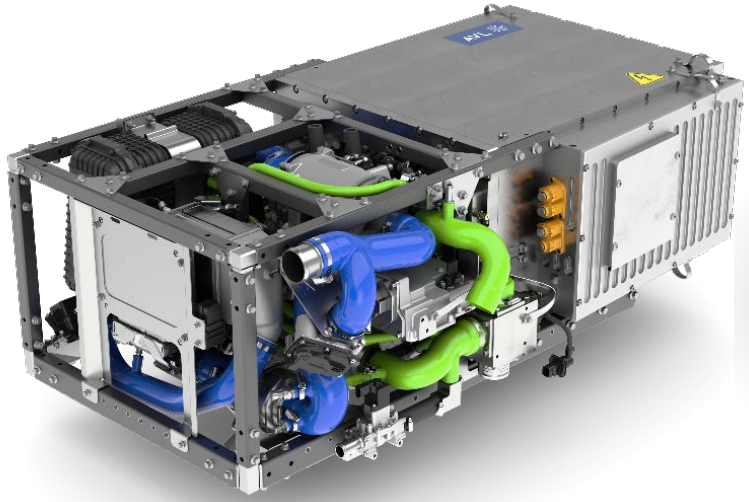
- H_2 & fuel cell development since 2002
- ~500 engineers in engineering, testing & simulation
- 3 H_2 & Fuel Cell Tech-Centers:
  - Graz, AT
  - Vancouver, CA
  - Kecskemet, HU

Stack Test and Prototype Lab - Vancouver / Canada

AVL Fuel Cell Technology for Trucks

Stack

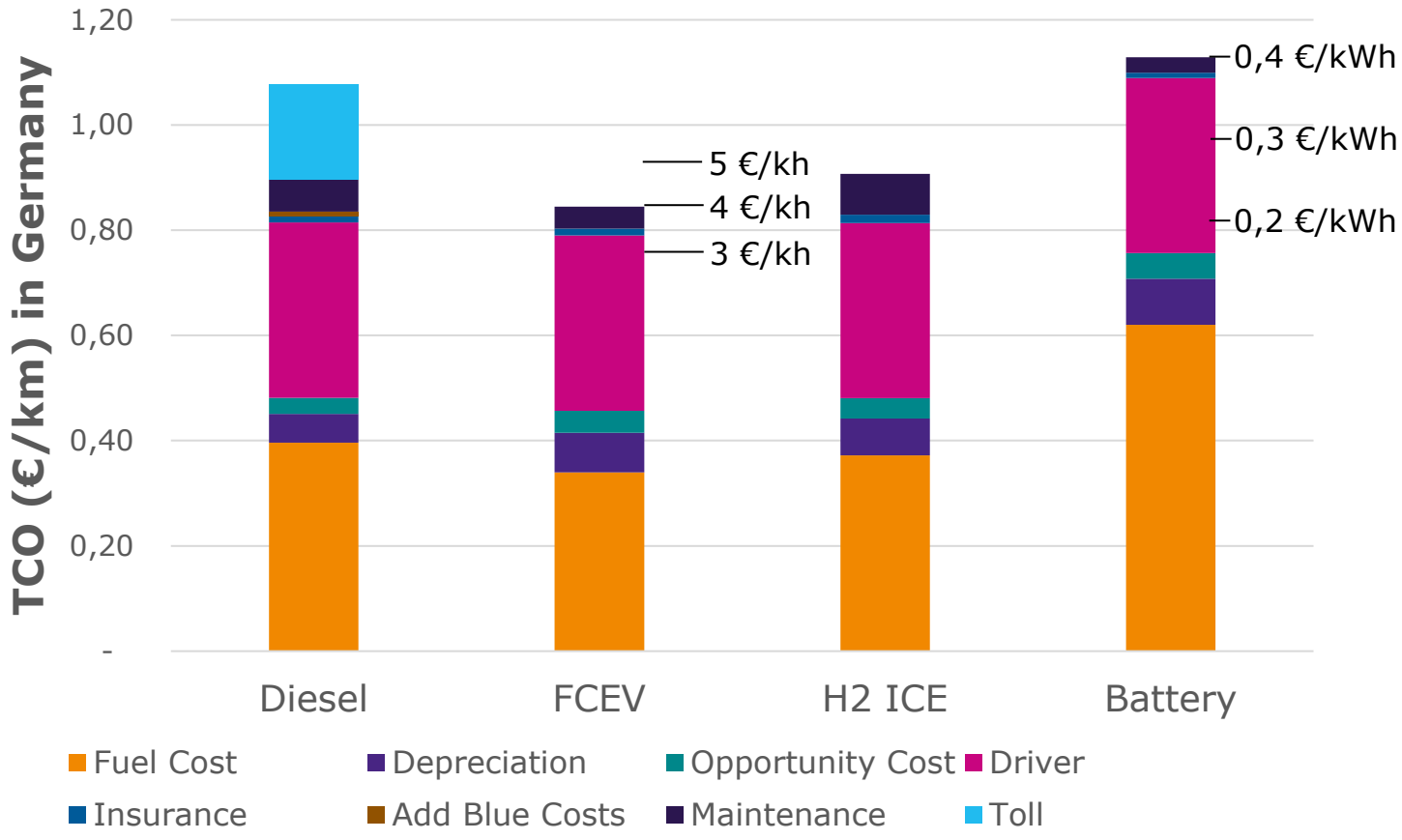
System



Vehicle

Why H_2 Fuel Cell Trucks?

TCO Comparison – 2030+



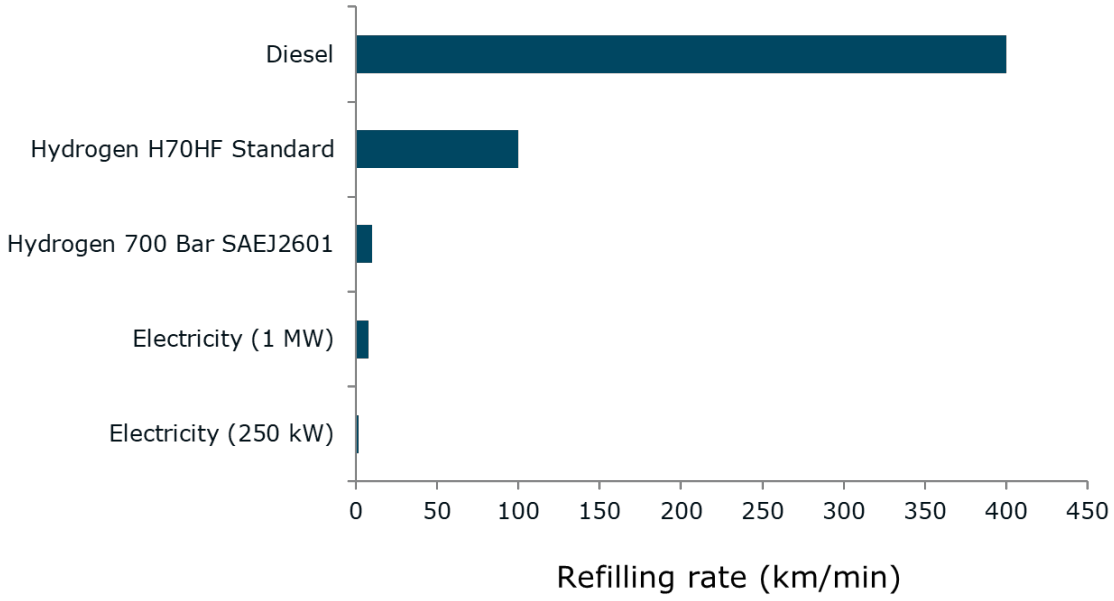
Assumptions

Parameter	Value
Range	800 km (600km BEV)
Consumption Diesel	33 L/100 km
Consumption FCEV	8,5 kg H2/100 km
Consumption H_2 ICE	9,3 kg H2/100 km
Consumption BEV	155 kWh/100 km
FC Cost	60 €/kW (high volume, 2030)
Battery Cost	80 €/kWh (high volume, 2030)
Tank System Cost	1.400 €/ 4 kg H2
H_2 ICE Powertrain Cost	23.000 €
Diesel Price	1,2 €/L
H_2 Price	4,0 €/kg
Electricity Price	0,4 €/kWh (3 MW Charger)
Diesel Toll Cost	18 €/ 100 km (Germany, EU VI)

For a long-haul application, a FC powertrain has the lowest TCO when compared to other zero emission powertrains

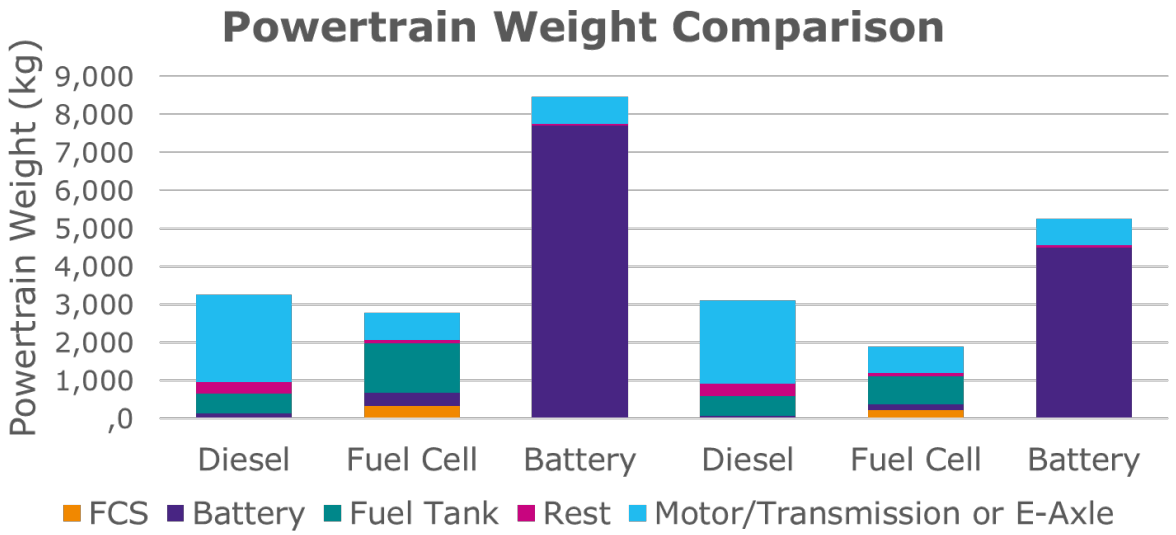
Technology Advantages

Refilling Time



Refilling to full range in 15-20min

Payload



3-5t higher payload

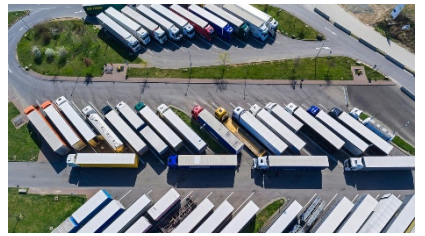
Use Case Fuel Cell vs. Battery

800-1000km | Refill 20min | Full range or overnight stop

- Payload as diesel
- Refill in 20min to full range
- Full flexibility like diesel
- No infrastructure requirements (e.g. overnight charging)

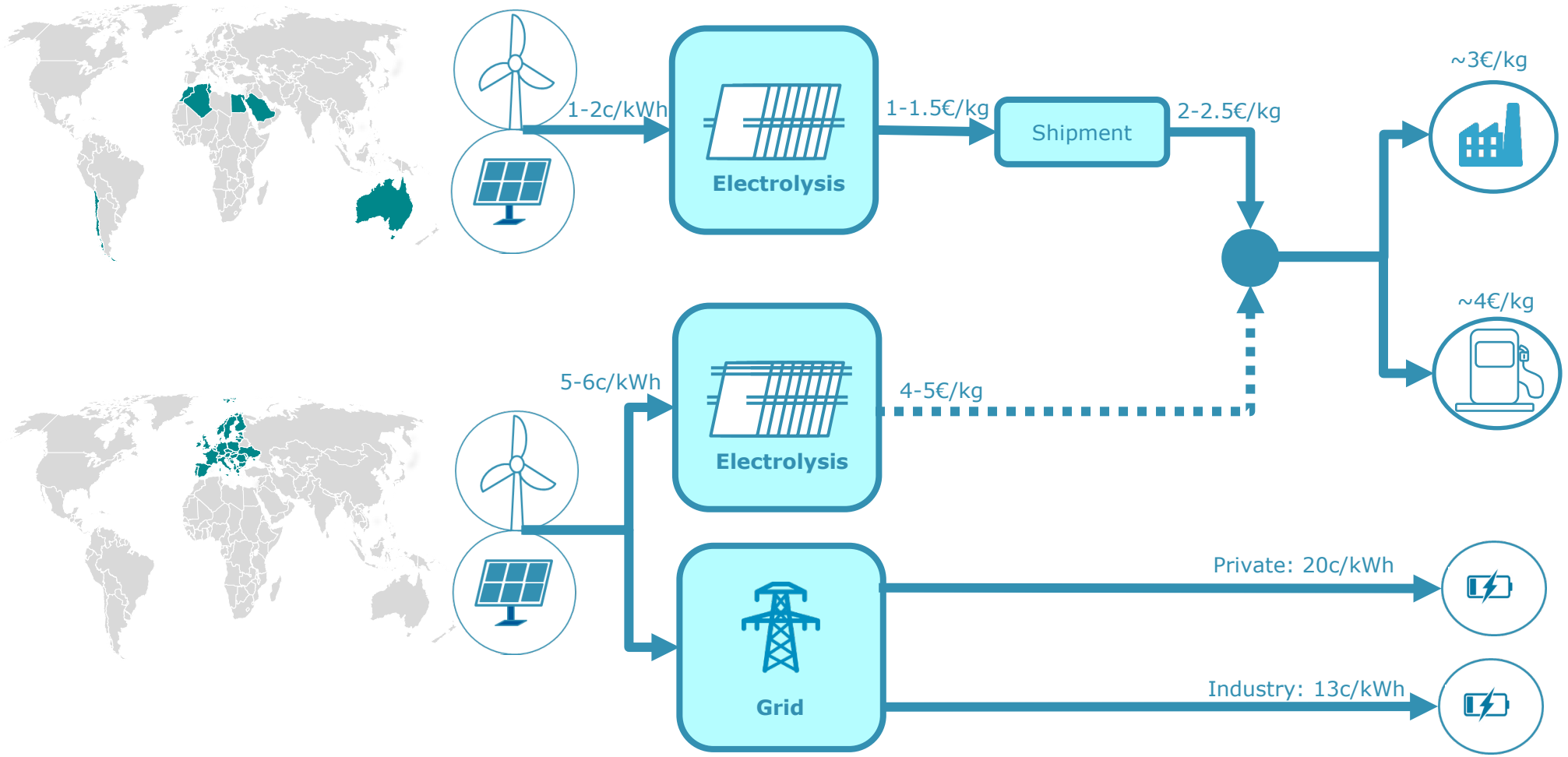
Max. 500 km | MW quick charge | Max. 500 km | Overnight quick charge

- Payload 3-5to lower
- Max. range ~500km
- 2-4 MW quick charge during day
- ~100kW quick charge overnight



50 charging spots
125MW peak power
~40-50Mio€ investment
Charging cost ~40c/kWh
Low utilization!

Future Energy Prices (2030+)



Energy equivalent Cost

9 c/kWh

12 c/kWh

20-(79)[1] **c/kWh**

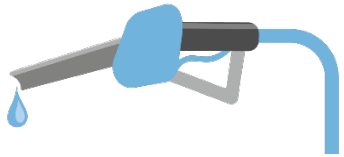
13-(40)[1] **c/kWh**

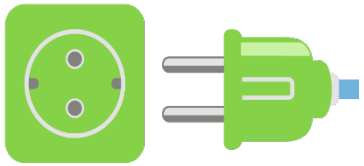
All prices in € or € cent

1…quick charging

Austrian Energy Scenario 2050

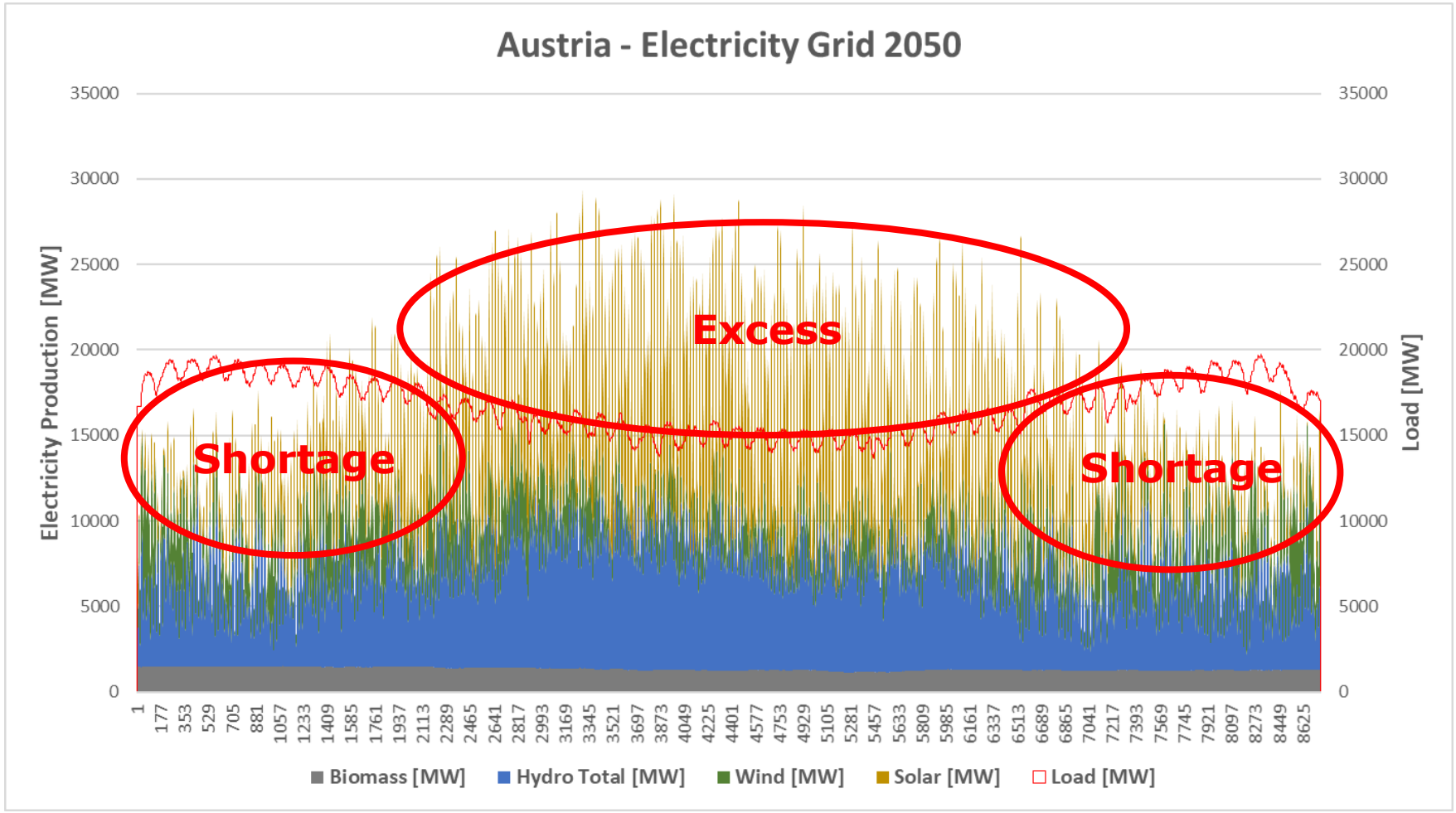
All values in TWh





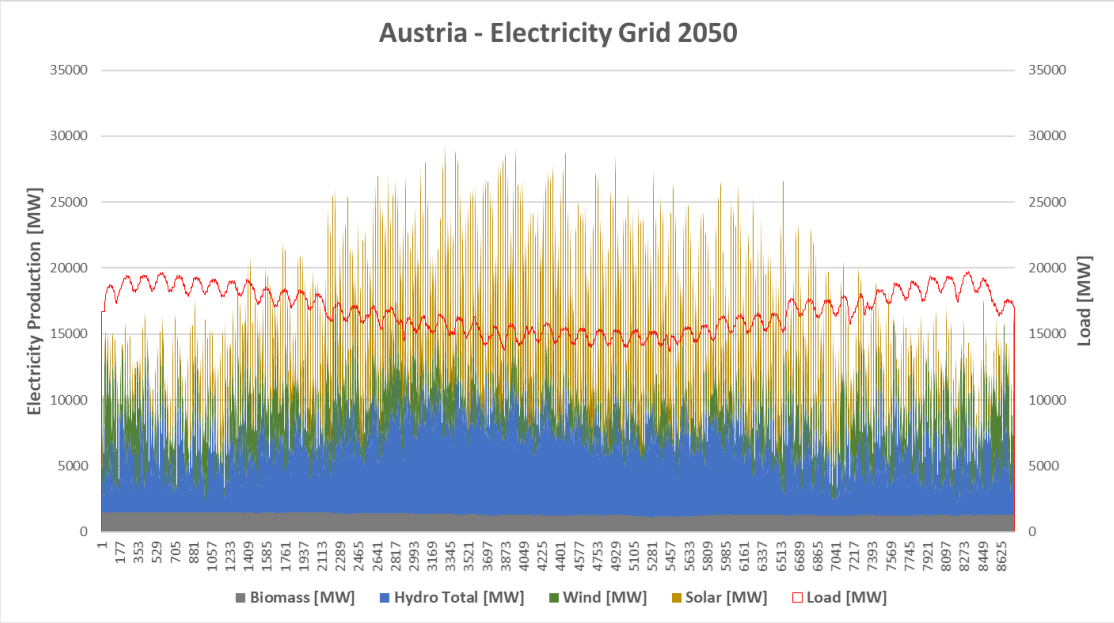
Mobility	Diesel PC	33,4	51,4	16,1	
	Gasoline PC	18,0			
	Truck Light	6,8	37,6	3,4	
	Truck Heavy	12,0		7,7	22,1
	Truck Transit	18,8		11,0	
	Other Mobility	13,4		3,2	10
	Total	102,4		41,4	10
Heating	Gas	10,9	26,3	4,0	
	Oil	15,4		5,6	9,6
Industry	Gas	39,6	48,1	15,8	20
	Oil	8,5		4,3	20,1
Total			**176,9**		**71,1** **30**

Austrian Energy Scenario 2050



EE Potential: 118 TWh (IndustRiES Studie, 2019), weather scenario average of 2017,18,19

Austrian Energy Scenario 2050 - Conclusions



Austrian Energy Scenario 2050 (AVL):

- EE: 118 TWh
- Total Load: 147 TWh (incl. losses)
- Shortage: **40 TWh!**
- Access: 11 TWh (2240h)
- Shortage (on balance): 29 TWh
- Measures:
  1. import of electricity (difficult - shortage mainly in winter months of 30 TWh)
  2. **H_2 Import or Storage**
     - Industry & mobility ~30 TWh
     - Grid balancing ~52 TWh (34 TWh electricity)
     - Seasonal storage ~6 TWh electricity

Not enough electricity available for all applications →
Direct use of H_2 in trucks more efficient and more economically viable

H_2 Technology in Austria

Public

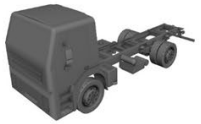
H_2 Trucks for Austria

MAGNA

WORTHINGTON INDUSTRIES

rosenbauer

MAN Assembly Plant

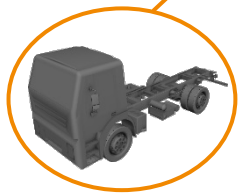


Undisclosed company planning fuel cell assembly plant in AT

AVL

+ manufacturing partner

H_2 Mobility Austria



Trucks made in Austria

Trucks operated in Austria

H_2 made in Austria

HYUNDAI IVECO HYZON DAIMLER MAN VOLVO TOYOTA RENAULT STELLANTIS

Green jobs, demand for green hydrogen, make H_2 stations to a business case, CO_2 reduction,...

Summary

Fuel Cell / H_2 will dominate the long-haul weight limited heavy duty truck segment

Battery will play an important role in volume limited short and medium range

Hydrogen will become a commodity type renewable energy carrier

Austria needs to act!
Strategy – Deployment Projects – Global supply chain

Thank you

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