

Achieving Sustainable Transport with Fuel Cells Challenges and Solutions

A3PS Eco-Mobility 2021
Paths to a Climate-Neutral Mobility

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Today's Agenda

1 Fuel Cell Technology Roadmap

2 Importance of Renewable Hydrogen

3 Key Drivers for Fuel Cell Mobility



We Owe It to the Planet

It is our duty as an organization to contribute to the resolution of social, cultural and global issues – especially with regards to environmental protection, sustainability and global emission reduction.

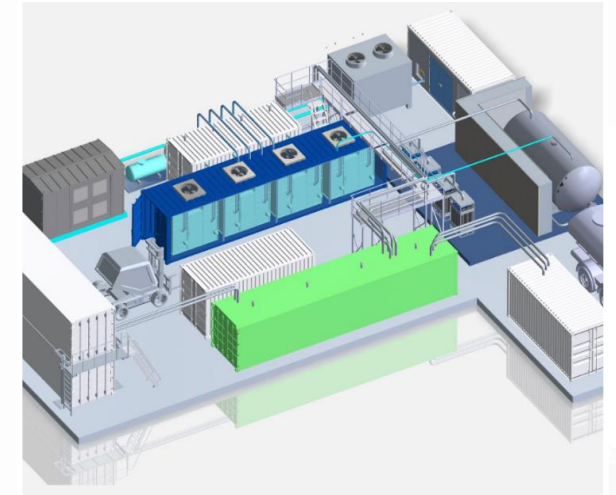
AVL Fuel Cell Technology Roadmap 2030+



PEM
H2 Mobility



SOFC
Power Generation

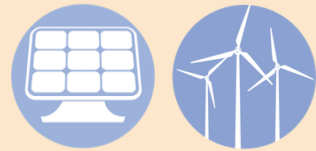


SOEC
E fuels & Reversible
Power

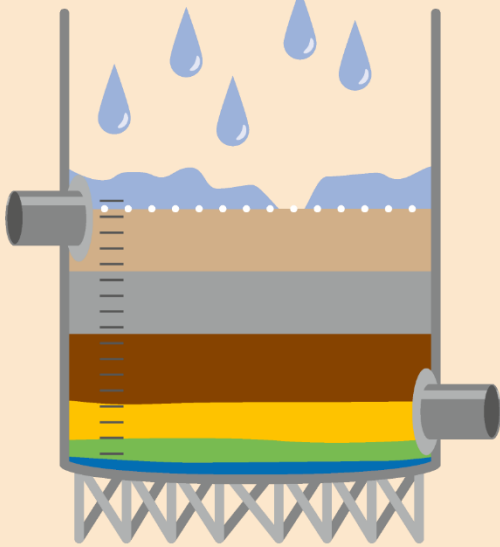
Energy Storage Metaphor: Water-Tower

2021

Fluctuating
Energy Supply



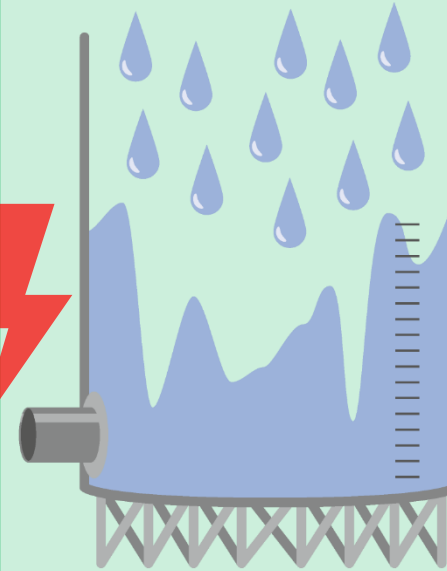
Predictable Energy
Supply



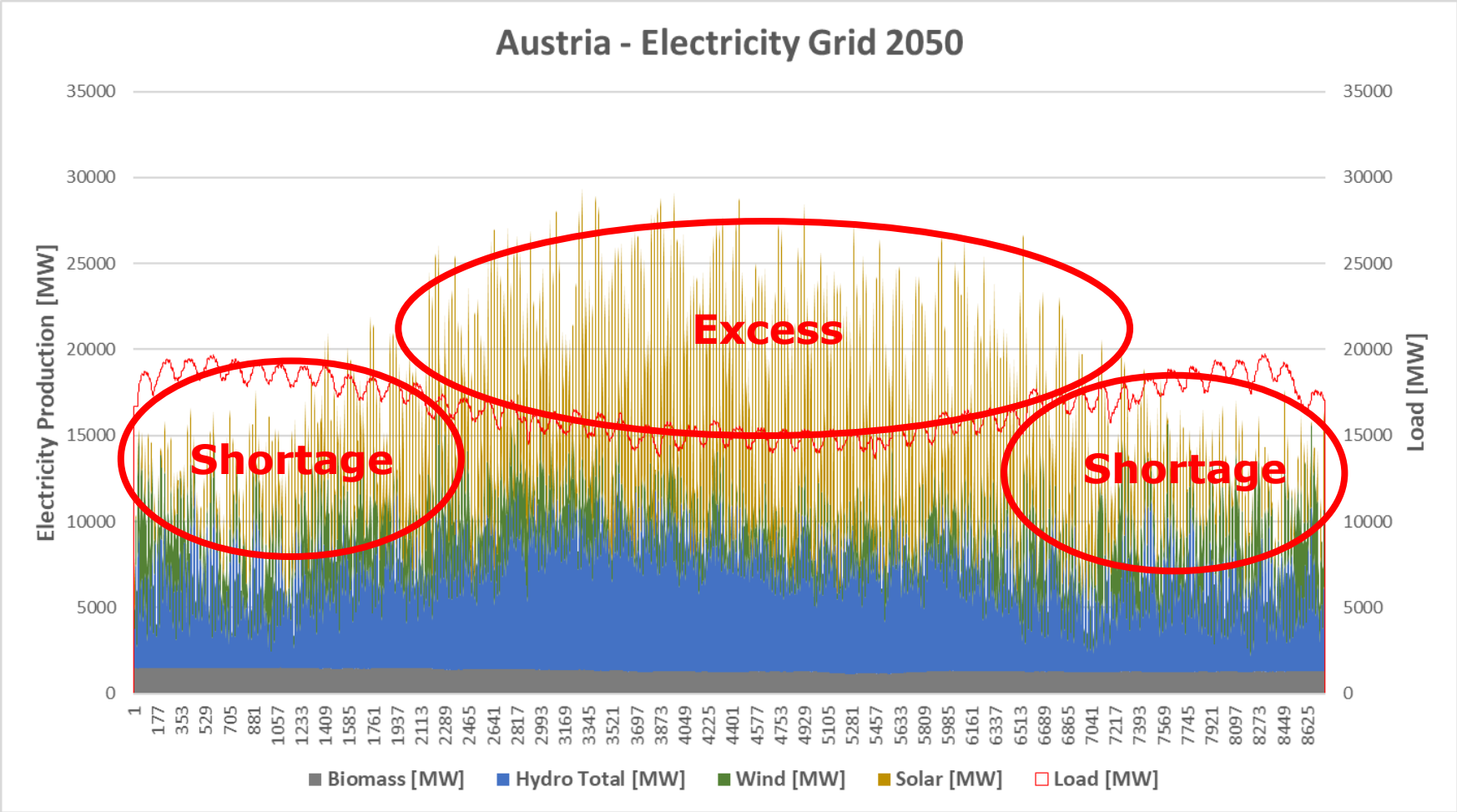
Energy Security
for end consumer

2050

Fluctuating
Energy Supply

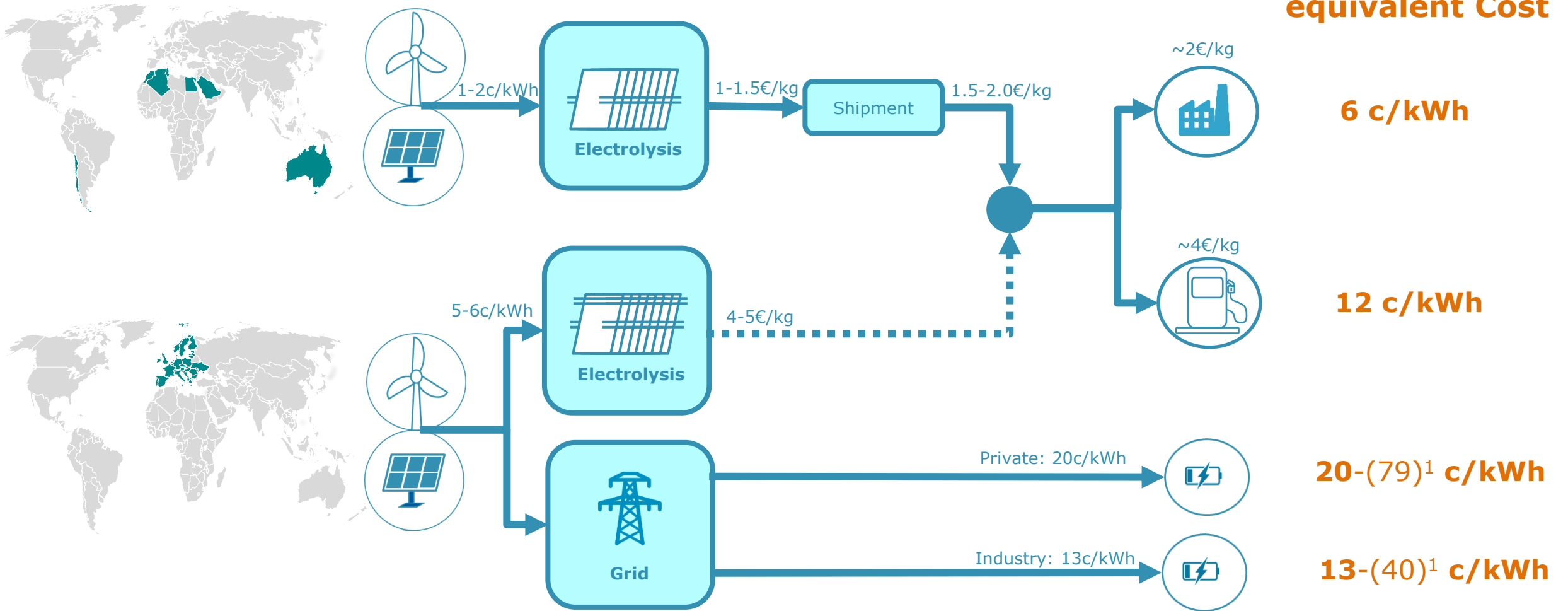


Austrian Energy Scenario 2050



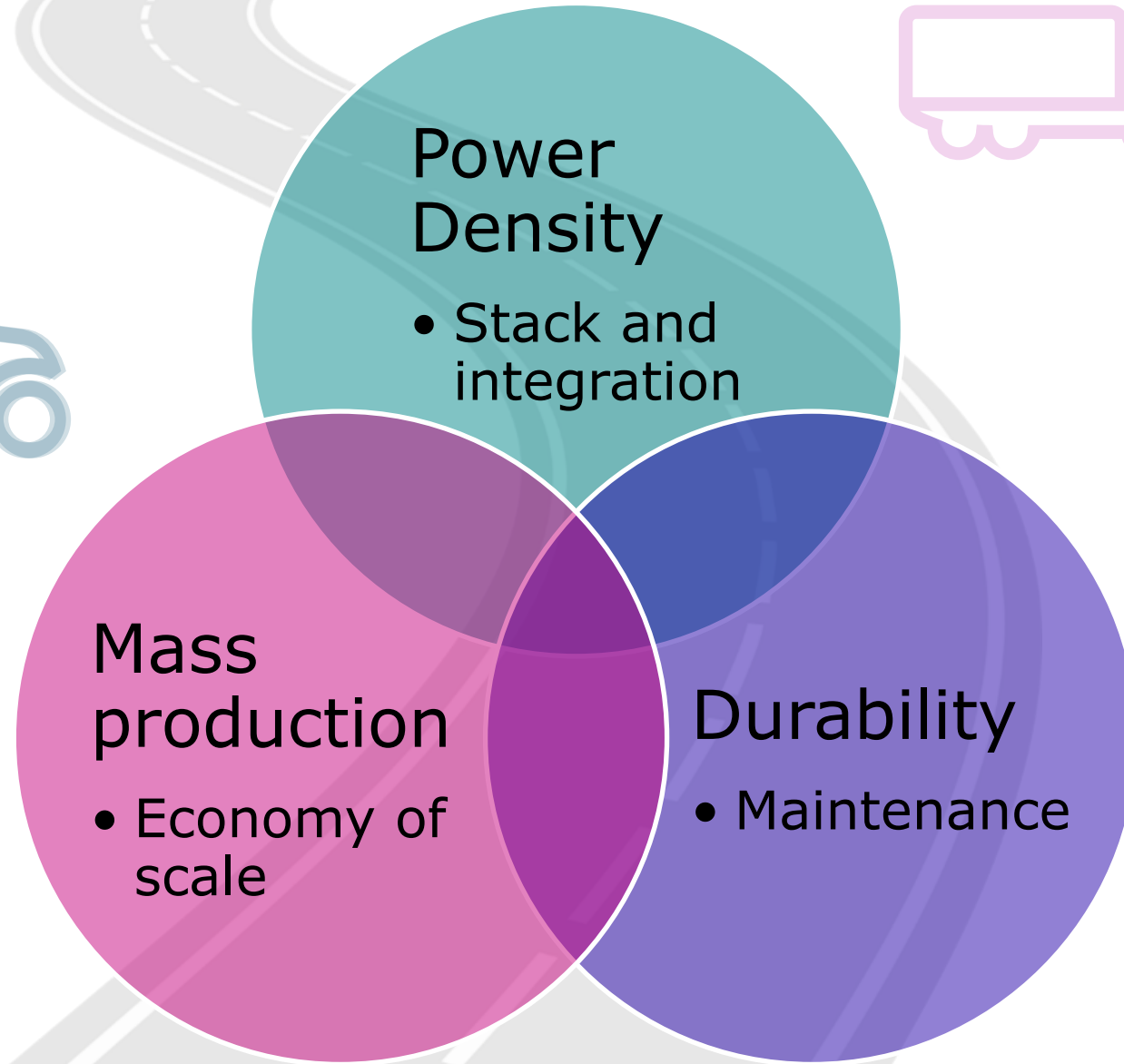
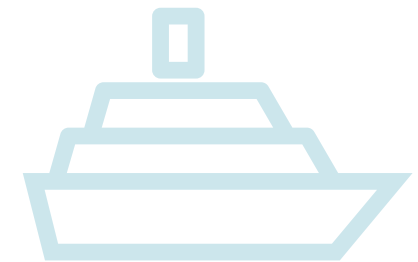
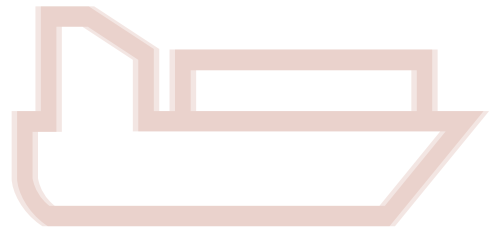
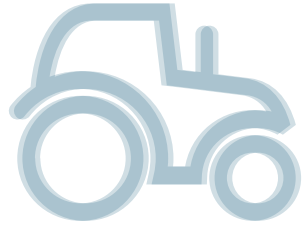
EE Potential: 118 TWh (IndustRiES Studie, 2019), weather scenario average of 2017,18,19

Future Energy Prices (2030+)



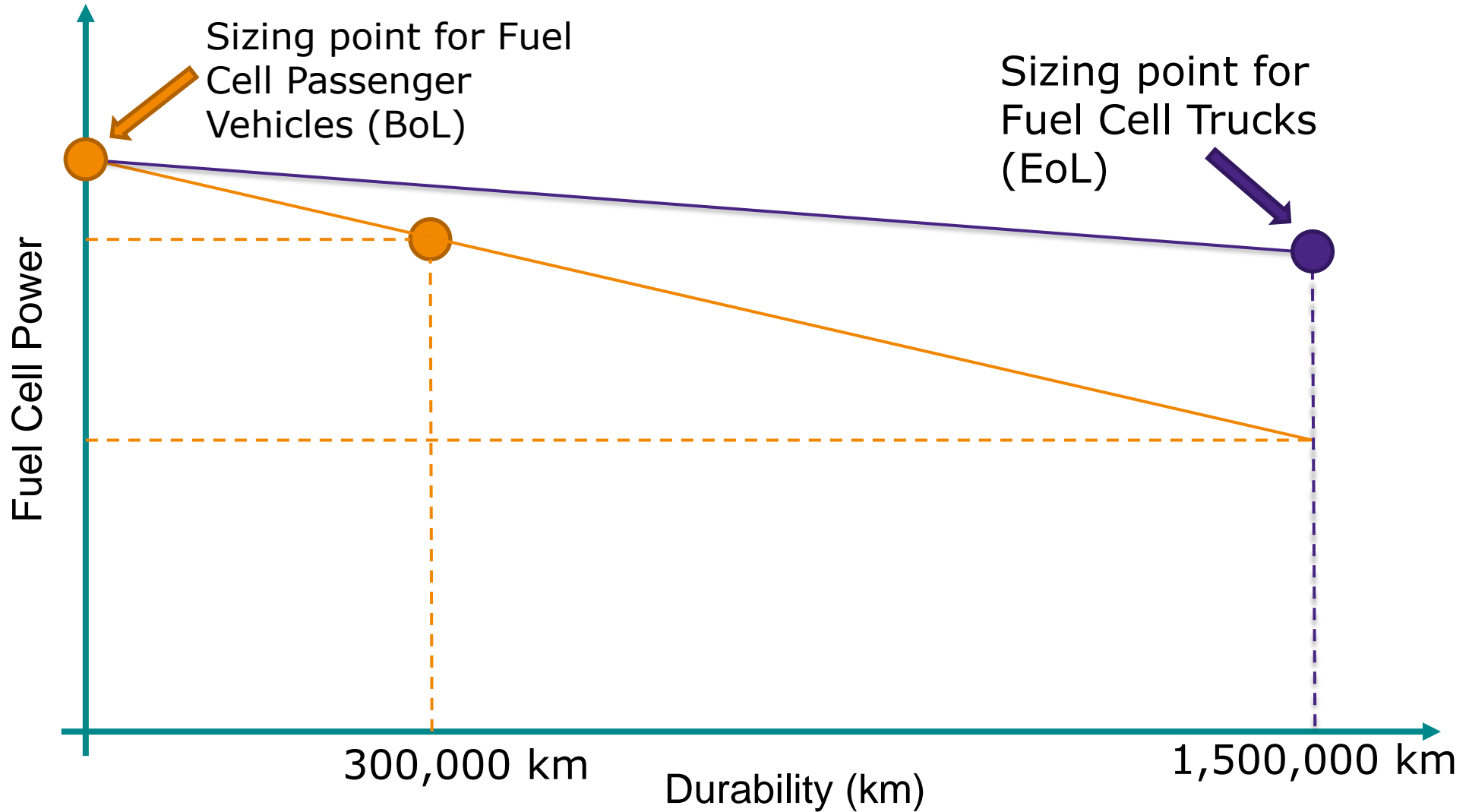
All prices in € or € cent

1...quick charging

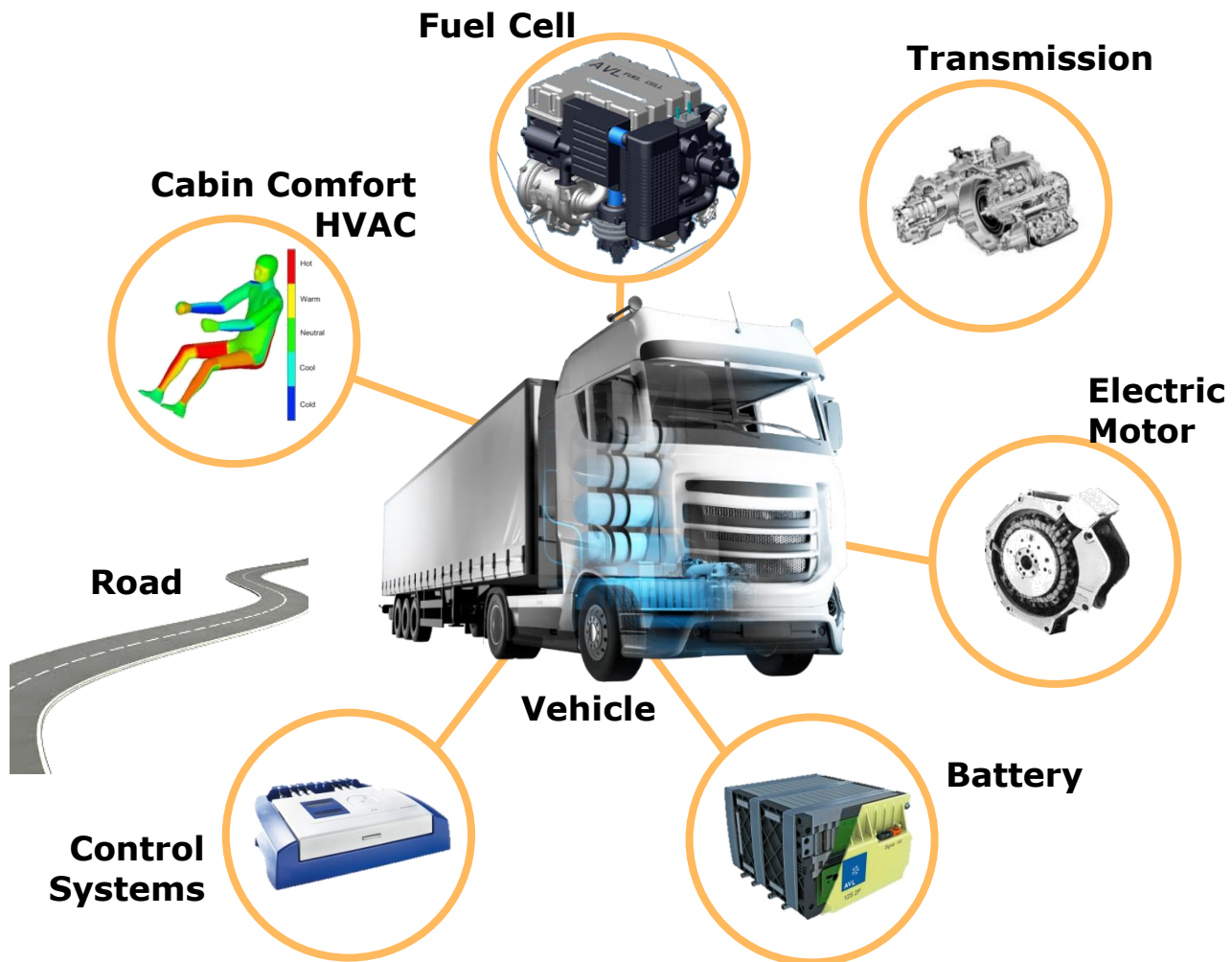


Key drivers for PEM mobility

Challenge: Degradation over time



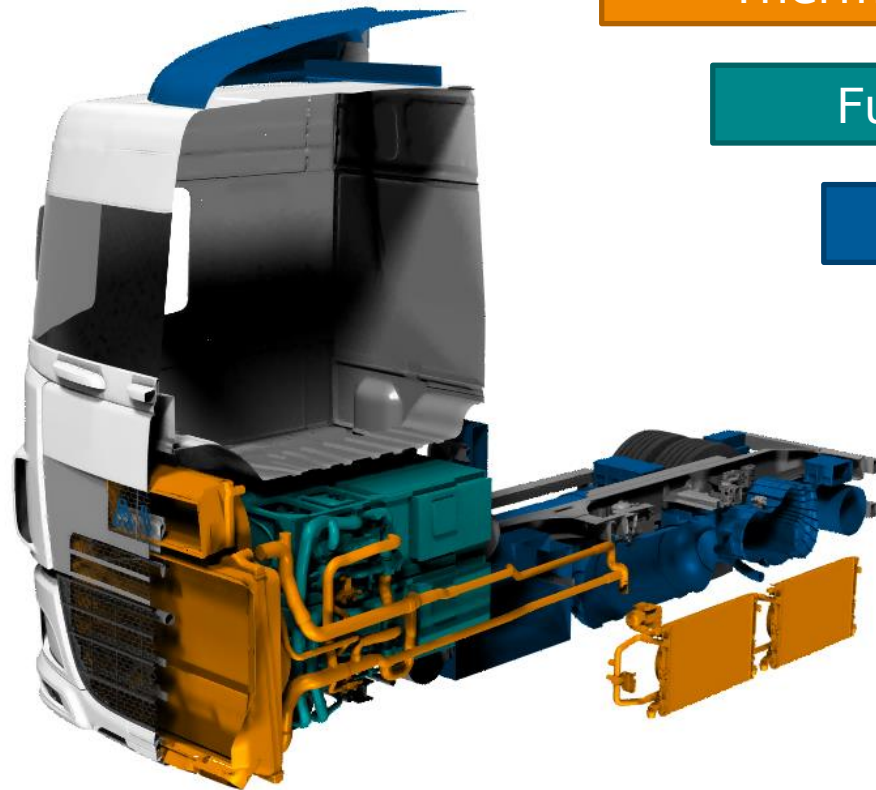
Challenge: Cooling



Contributions of Thermal Management

- Impact on energy efficiency and driving range
- FC system requires sophisticated coolant temperature control
- Needs-based cooling/heating and auxiliary controls
- Impact on system durability
- Improved energy efficiency

Challenge: Integration



Thermal System

Fuel Cell System

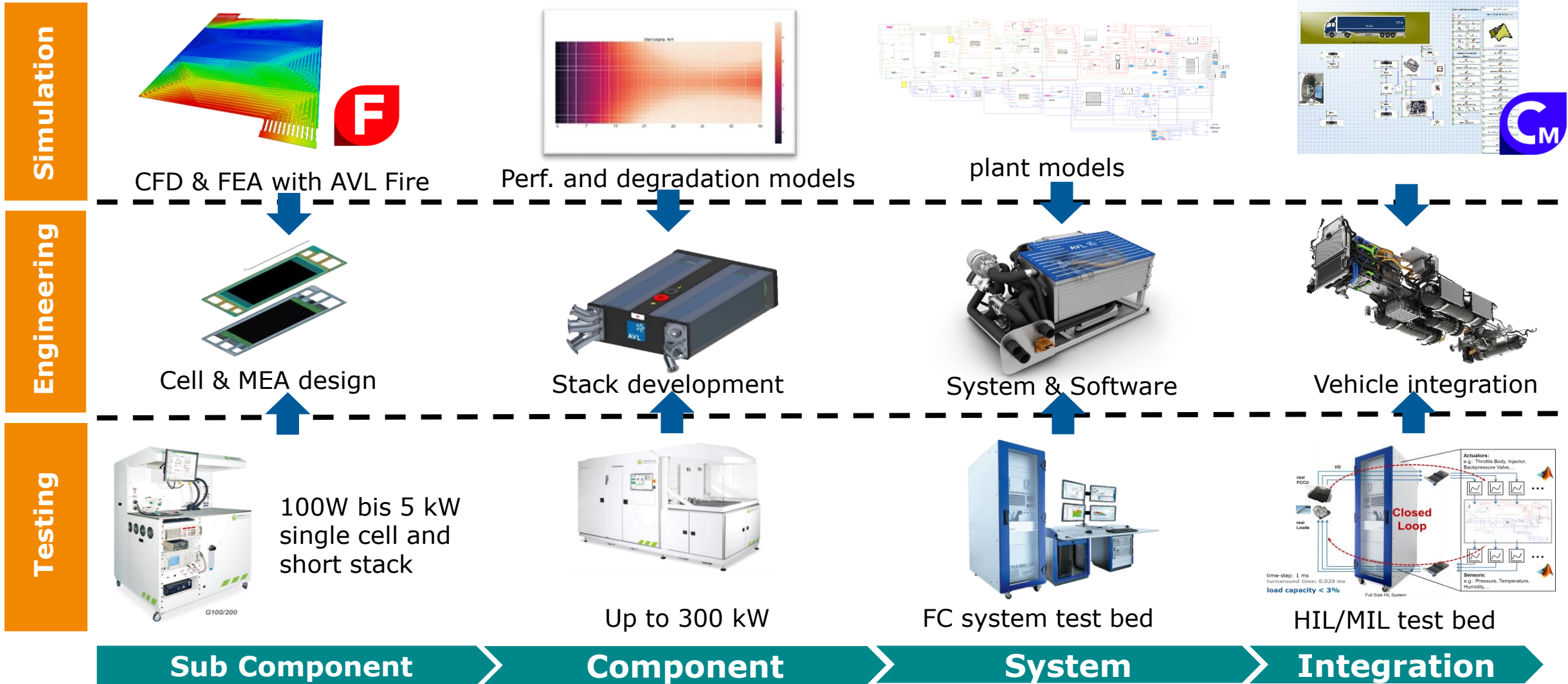
Powertrain/Tank/EE/...

Chassis/Frame/...

Challenges that come to mind:

- Max. cooling capacity for FCS
- Airflow through dense packaging
- Large battery due to recuperation capacity required

AVL product and service portfolio Fuel Cell



Solution: Modular Fuel Cell System Integration



		
System Efficiency	+	-
Power Density	-	+
Weight	-	+
Modularity / Fail Safe	+	-
Durability	+	-
Component Availability	++	-

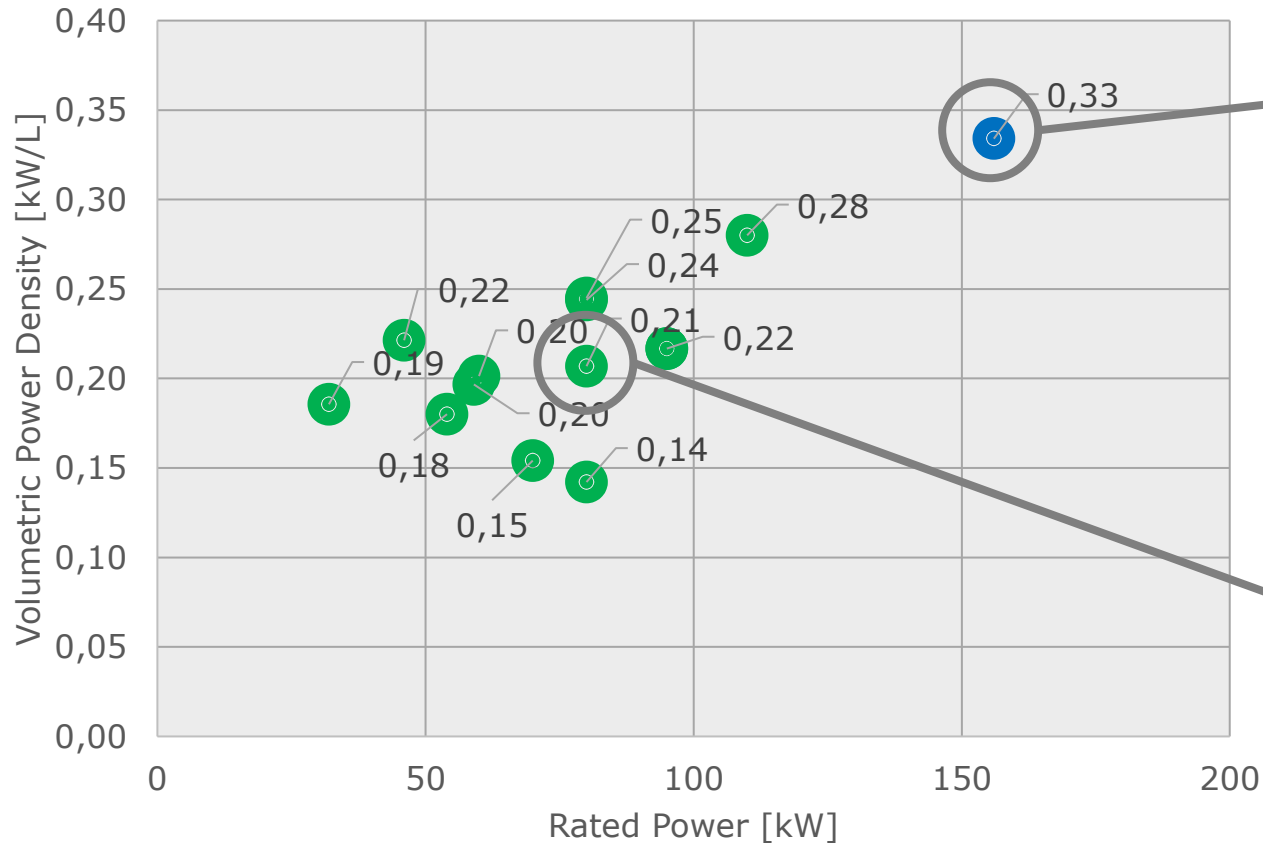
HyTRUCK Project

- Development and optimization of a modular PEM system concept for trucks
- Development of operating strategies
- Consortium led by AVL



Solution: Power density

Benchmark - Power Density of Fuel Cell Systems



AVL 155kW Gen0 HyTruck System

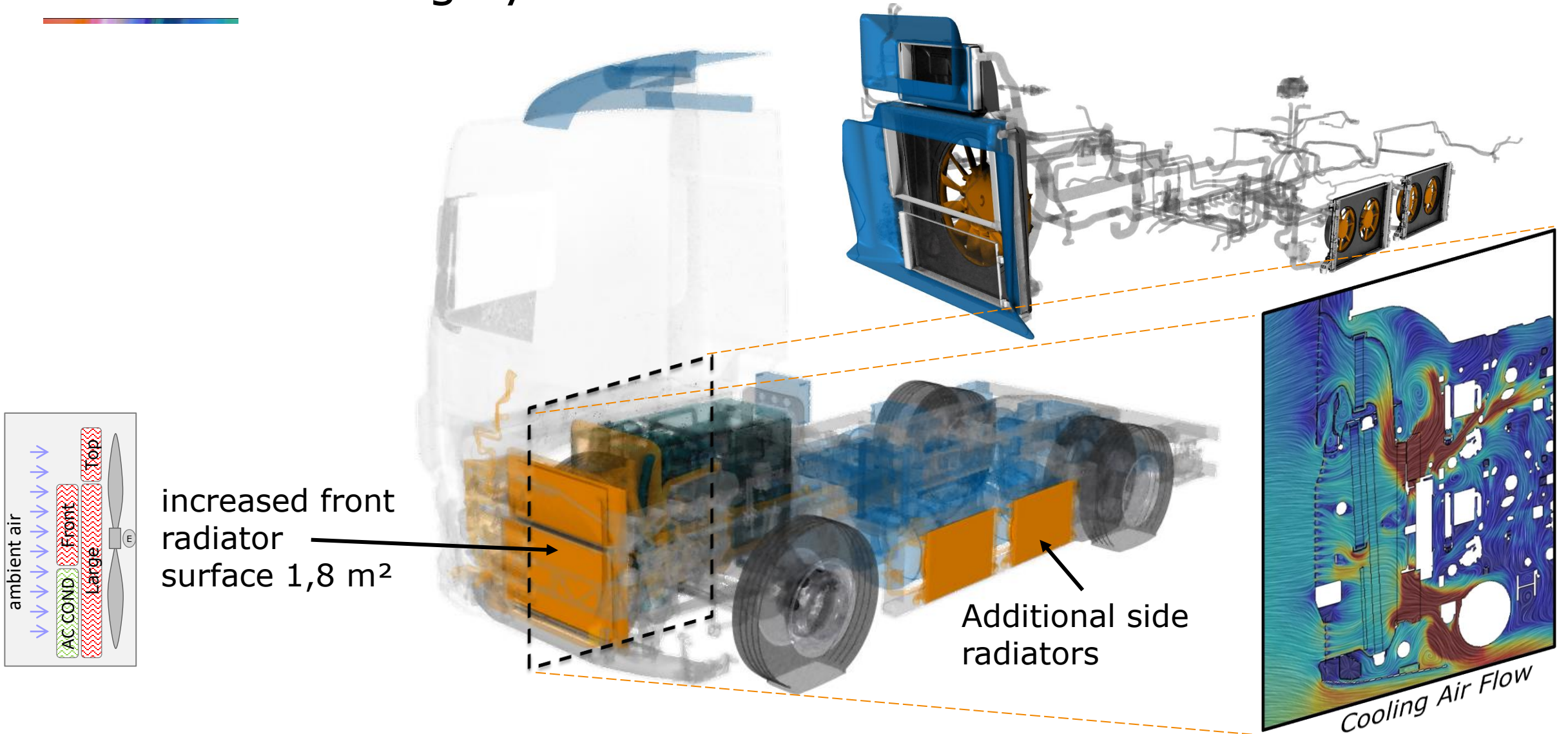
40% improved power density



Global OEM

**AVL PEM Technology has the highest power density and best durability trade-off in the market!
Power Density is the #1 leverage to low cost!**

Solution: Cooling system simulation



Summary and conclusions



AVL Mainstream Fuel Cell Technology Roadmap focuses on PEMFC for Mobility and SOFC/SOEC for Power Generation and E fuels

Operation of hydrogen powered powertrains will be price competitive compared to battery electric powertrains

Major challenges introducing Fuel Cells are energy storage and security, degradation over time, cooling and integration

Thank you



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