



**fka**

CREATING IDEAS &  
DRIVING INNOVATIONS

# OPPORTUNITIES AND CHALLENGES FOR GREEN H<sub>2</sub>

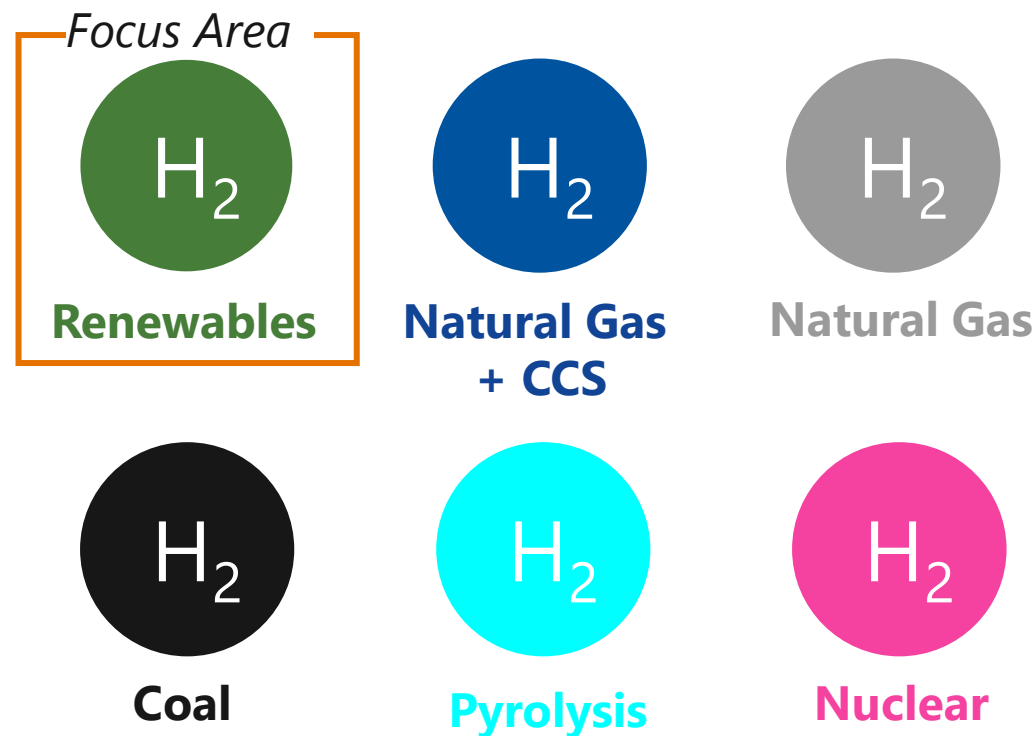
Michael Redhead  
Expert Automotive Regulations

# In future, a trend towards green H<sub>2</sub> can be derived for multiple use cases

## Trends

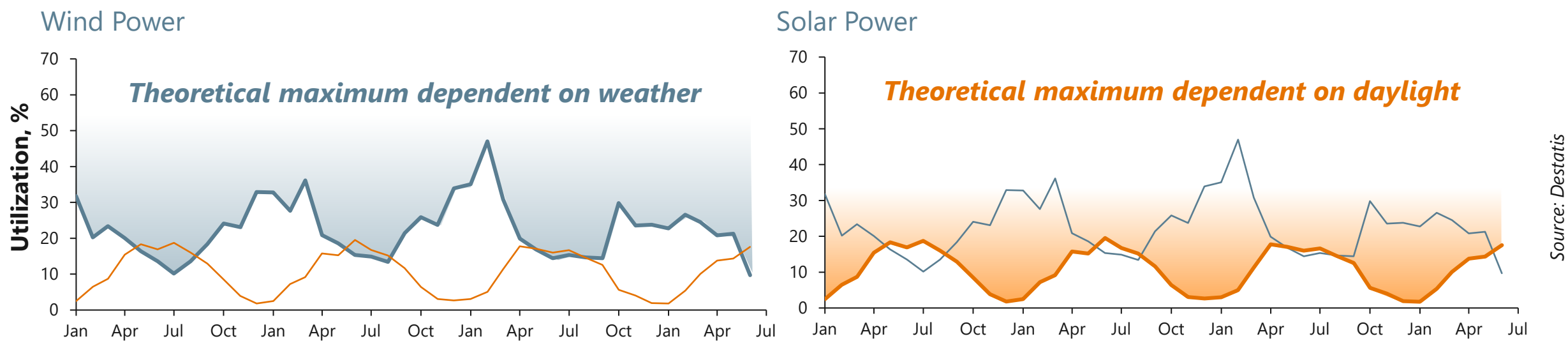


## Production Pathways







- Hydrogen can be obtained from a number of different sources, with varying emissions
- Development expected for **green H<sub>2</sub>** especially from **renewable sources**

# Installed renewable capacity could be fully utilized to increase green H<sub>2</sub> production



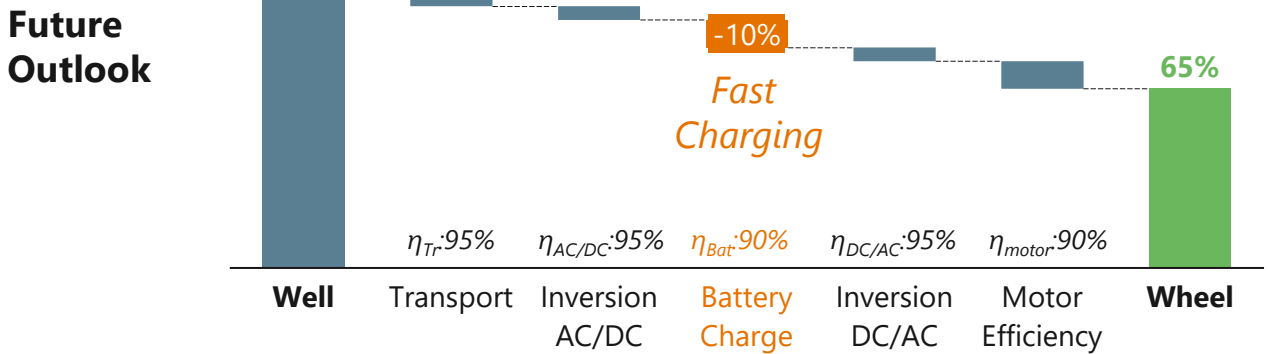
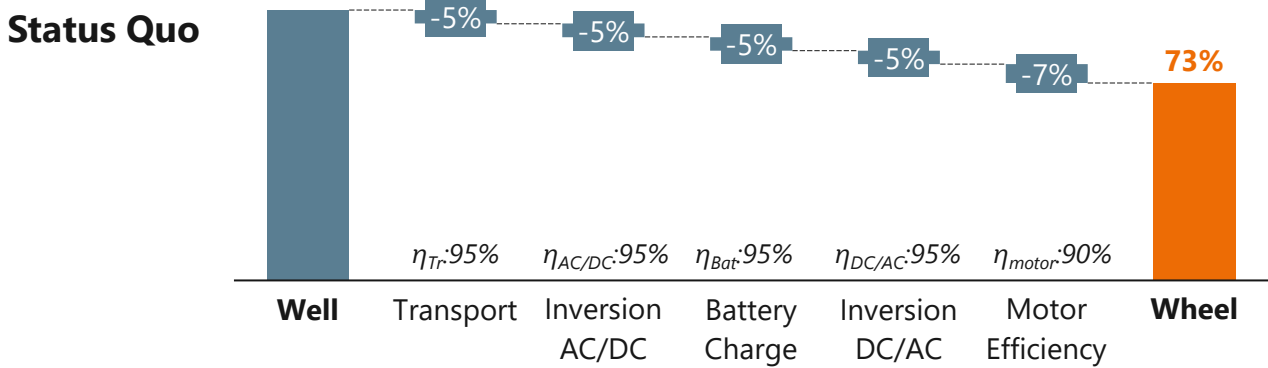
- **Already installed** infrastructure required for peak demand could be used to generate H<sub>2</sub> when idle
- Higher utilization rates result in production of an **additional energy carrier**

Potential use cases

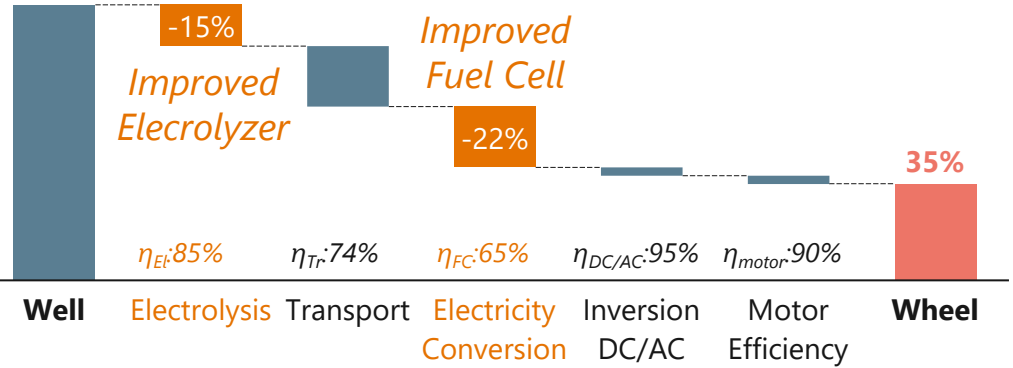
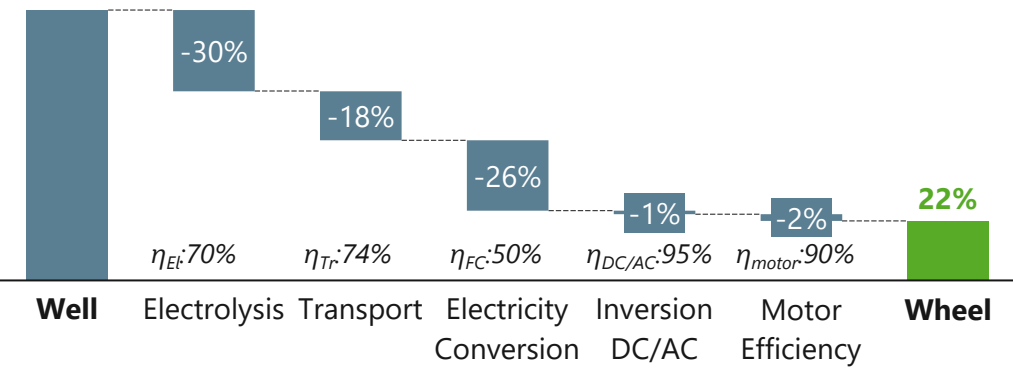
 <p><b>Industry</b></p> <ul style="list-style-type: none"><li>▪ Steel Production</li></ul>	 <p><b>Transport</b></p> <ul style="list-style-type: none"><li>▪ FCEV vs BEV</li></ul>	 <p><b>Energy Generation</b></p> <ul style="list-style-type: none"><li>▪ Large fuel Cells</li></ul>	 <p><b>Buildings</b></p> <ul style="list-style-type: none"><li>▪ Comb. Heat/Power</li></ul>
--	---	---	---

# Currently, BEV is more efficient in the transport sector

## Battery Electric Vehicle (BEV)



## Fuel Cell Electric Vehicle (FCEV)



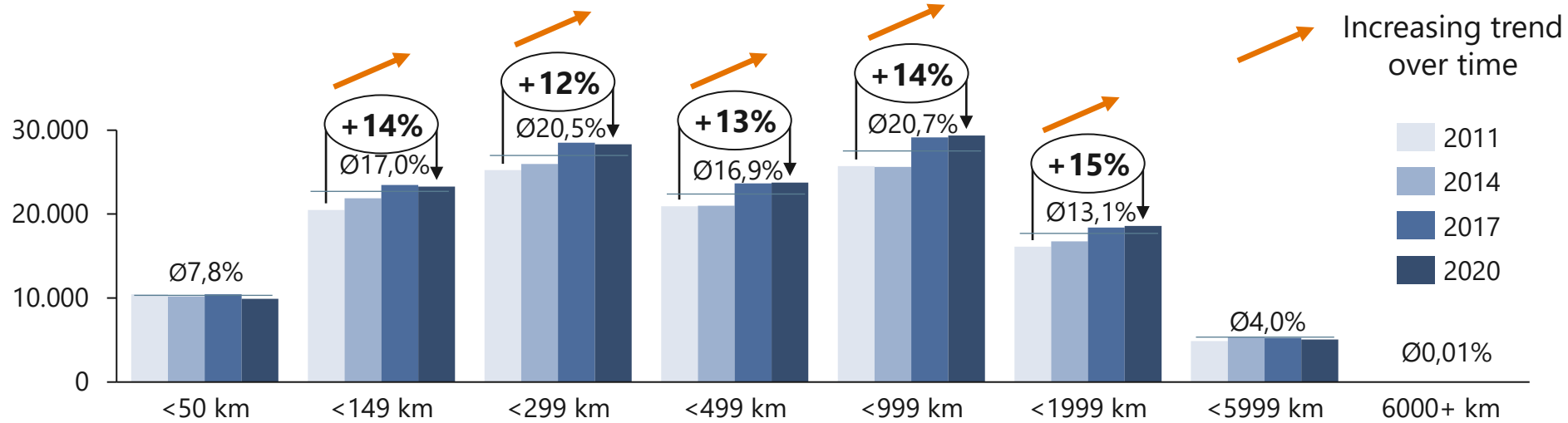
- In future, the **best case** scenario for **FCEV** is still less efficient than the **worst case** scenario for **BEV**
- **Well to wheel efficiency** for **BEV** is generally **higher**, however **further criteria** also have to be considered

Source: Transport and Environment (Belgium)



# From a fleet perspective, the mix of alternative drivetrain technologies must follow a strategic approach

Vehicle Kilometers (EU)



## Single Tank Trips: BEV

- Range: 150 – 300 km
- Frequent charging

## Multi Tank Trips: FCEV

- Range: 200 – 500 km
- Moderate charging
- Range: 300 – 800 km
- Infrequent charging

## Further Considerations

### Pattern of use:

- Vehicle “downtime”
- Charging Speed

### Temperature Sensitivity:

- Cold start for FCEV
- Restricted electron flow of BEV

- Balance of Plant
- Recycling
- Life Cycle Analysis

Source: Eurostat

- Due to a **rising demand** in transportation worldwide, **growth** is expected in both **long** and **short haul trips**
- **BEV** and **FCEV** can cover **distinct use cases** and have to be **considered** in the **fleet composition**

# Summary and Typical Questions for Businesses

## Summary

- » Existing grid infrastructure could be used to create additional green hydrogen
- » Hydrogen is not as energetically efficient as BEV, but has other strong characteristics (e.g. high range, simpler recycling)
- » Technologies for and efficiencies of FCEV and BEV are improving over time

## Potential Questions for Businesses

- » Which technology mix is best for my fleet or application?
  - **Strategic Portfolio Assessment**
  - **CO<sub>2</sub> Compliance Strategies and Footprint**
- » How do the components within my system need to be dimensioned?
  - **Assessment, Evaluation, Balance of Plant**
- » Which products or business areas are likely to be most affected by these technologies?
  - **Market Assessment and Strategy**
- » Which end of life considerations need to be taken into account?
  - **Life Cycle Analysis (LCA)**

# Michael Redhead

fka GmbH  
Steinbachstraße 7  
52074 Aachen  
Germany

phone +49 241 8861 134  
e-mail michael.redhead@fka.de  
web www.fka.de



CREATING IDEAS & DRIVING INNOVATIONS





CREATING IDEAS &  
DRIVING INNOVATIONS



THANK YOU FOR YOUR  
ATTENTION