

# VANHOOL | Fuel Cell

**Fuel cell Electric Bus :  
It works and it's ready !**



Jeff Madura – Director of Public Sector Sales, North America

# INTRODUCTION VAN HOOL

- 70 Years Bus Experience
- Family owned and managed
- Export 90% of our products Worldwide
- 4,900 Employees in two production facilities with the latest addition in Morristown Tennessee (Under Construction)
- 1,200 Output Buses and Coaches yearly
- 4,000 Industrial vehicles yearly
- Flexibility in Design and Market requirements
- Innovator in technologies







# HISTORY

More than 70 years





## ZERO EMISSION SOLUTIONS

With regard to solutions for zero-emission, Van Hool is technology neutral, thus **all solutions are being developed.**

Trolley solutions (IMC battery)



Battery electric solutions



Fuel cell electric solutions







# FUEL CELL BUS REFERENCE PROJECTS

131  
FC buses  
sold





## PHYSICS DRIVING THE SOLUTION

Hydrogen has most potential to become the disruptive technology driving large scale zero-emission deployment.

### It is physics driving the solution

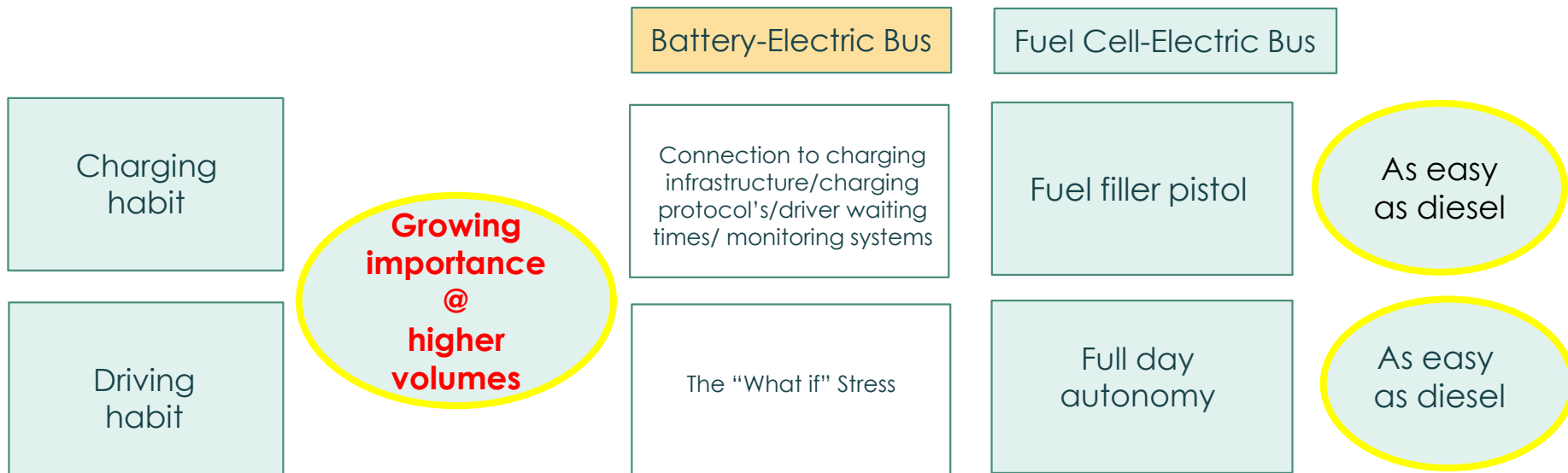
		Battery-Electric Bus	Fuel Cell-Electric Bus	
Usable energy on the bus	Energy density H2 = 33 kWh/kg	250 kWh	600 kWh Assume 5 stacks H2:(36 kg useable H2 or 1.200 kWh) x 50% efficiency	X 2.4 MORE
Time to charge	H2 = Gas/liquid	1 hour Assume 250 kW of charging power	7 minutes Standard filling	X 8.5 FASTER











## HABITS DRIVING THE ACCEPTANCE

Hydrogen has the potential to become the most disruptive technology being accepted by society.

**WHY? It's habits will be “driving” the acceptance of the solution!**



# FUEL CELL BUS DEVELOPMENT ROADMAP

Time >	2005-06	2007	2008-09	2011	2012-15	2016+
Series	1. gen. USA 2-axle	1. gen. Europe 3-axle	2. gen. USA. 2-axle	CHIC	High VLOCity HyTransit Cologne	3EMotion JIVE
1						
2						
3						
4						
5				2. gen. Europe 3-axle		
6				3. gen. Europe 3-axle	3. gen. Europe 2-axle	
Number Buses	5	16	1	5	22	82

- 13 years of building experience
- Running over several development phases
- Small scale projects
- Highly supported by FCH JU



## Standardised technical definition for Low Floor City Bus

- **Flat Urban Service Line**  
24 kWh traction battery and 85 kW hydrogen fuel stack
- **Regional and hilly City Service Line**  
36 kWh traction battery and 85kW hydrogen fuel stack

## Standardised service concept

- Spare parts management
- Dedicated service technicians
- SLA contracts with main suppliers

## Standardised documentation

- Manuals, service documents
- Training packages





## FUEL CELL BUS SERIES PRODUCTION





## INAUGURATION AT UITP STOCKHOLM

Inauguration of the first fuel cell bus for  
RVK Cologne

First fuel-cell bus of a 35 bus order

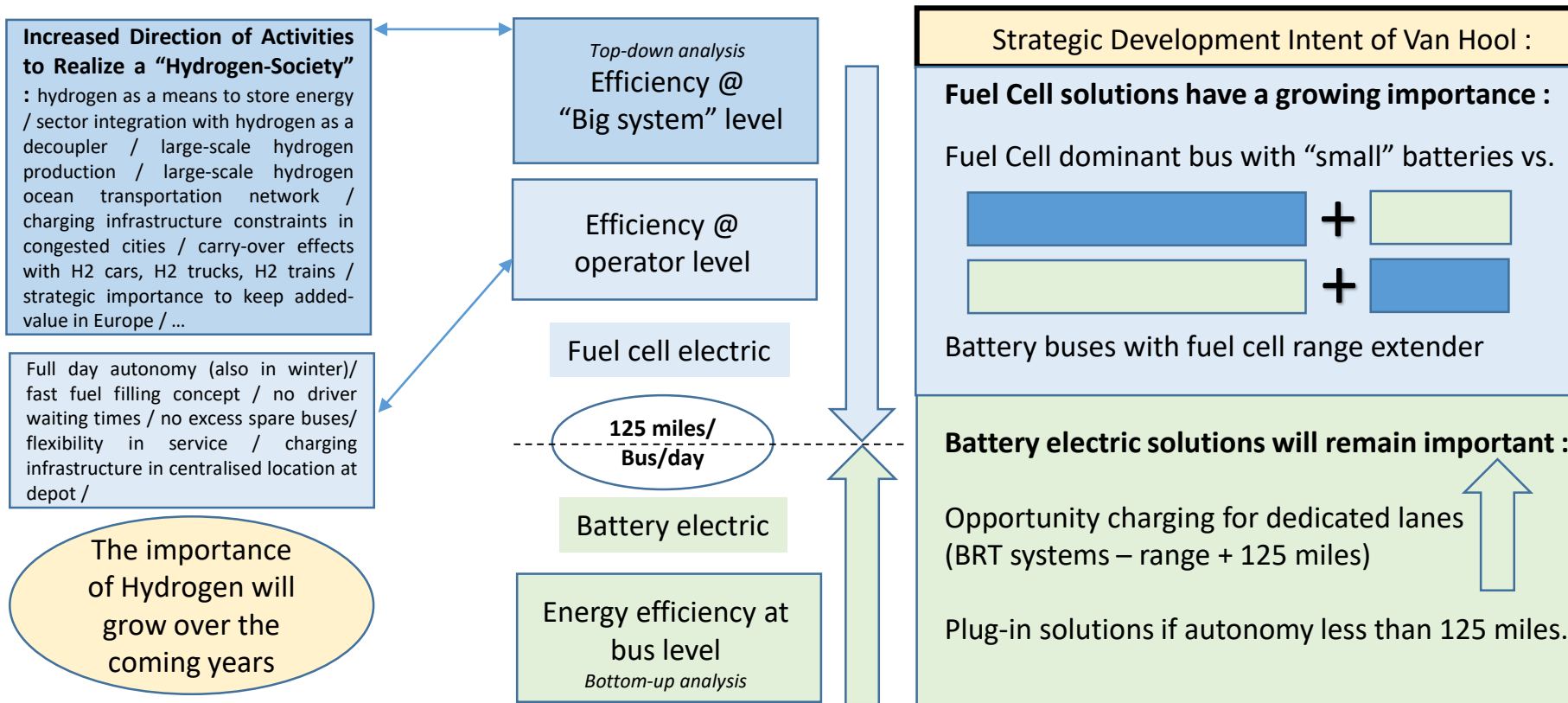
First bus produced in a standardized  
series of buses at Van Hool

Current capacity of fuel cell bus  
production line : 2.5 buses/week.





# STRATEGIC DEVELOPMENT FUEL CELL BUS





Thank you, Just think.....

During this presentation 2 Hydrogen  
Fuel cell buses have been refuelled !