

# Introduction

Herbert Wancura

Graz | June 27, 2017



INTERNATIONAL HYDRAIL CONFERENCE



## INTERNATIONAL HYDRAIL CONFERENCE



# HYDRAIL – The Clean & Green Alternative Machine ...are we there now?



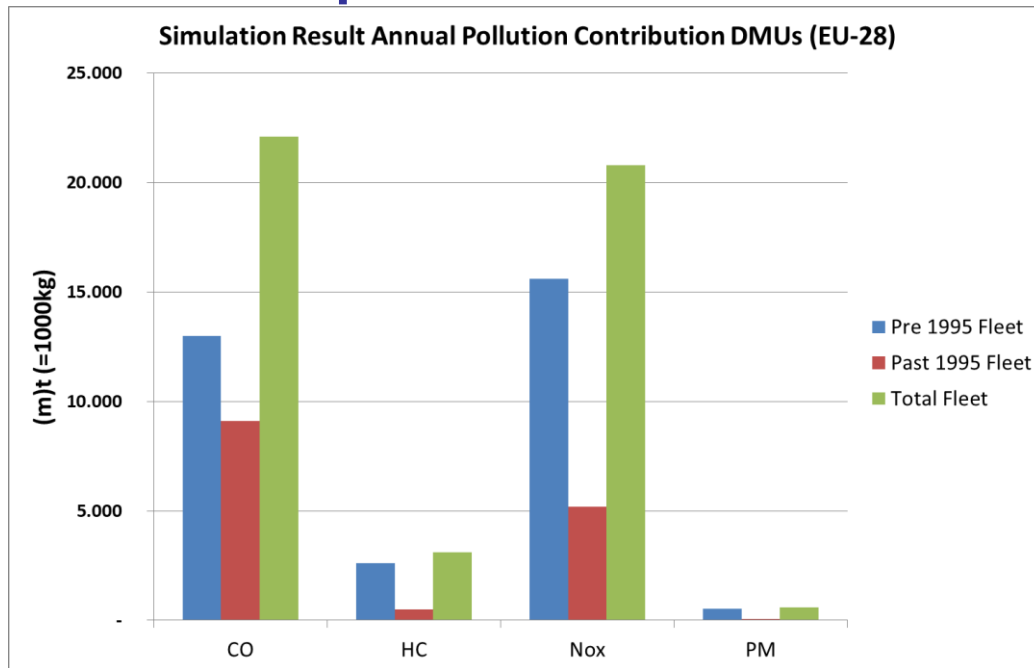
# Megatrends influencing rail

- Urbanization
- Economic efficiency
- Autonomous operation and IoT (Internet of Trains)
- Seamless mobility using ICT
- Decarbonization
- ....
- **Zero pollution mobility demand**





# The Gap to Zero Pollution Mobility



Note:

Numbers are based on current DMU fleet of EU-28 from railfaneurope.net resulting in a total of approx. 9600 units, with a media year of 1st operation 1995. Fleet age was translated into emission level according to diesel emission regulation,; for pre 1995 Eu non road engines Tier I/II of corresponding power classes, for past 1995 the 2004 regulation data for rail engines. Daily energy consumption was based on A. Hoffrichter, 2013 using a new DMU (Stadler GTW). Energy consumption was not varied according to model and age.



## Example – European Diesel Regulation

- Despite air quality issues and broad public debate on diesel, rail emissions will be stationary for nearly 30 years and significantly below HD Truck& Bus SOTA

Emission Component	Unit	HD Truck & Bus	Rail 2004 (Current)		Rail 2016 (Starting 2020)	
		EURO 6	DMU	Locomotive	DMU (RLR)	Locomotive (RLL)
CO	g/kWh	4,000	3,500	3,500	3,500	3,500
HC			0,190		0,190	
THC		0,160		4,000		4,000
NOx		0,460	2,000		2,000	
Particle Mass		0,010	0,025	0,025	0,015	0,025
Particle Count	#/kWh	$6 \times 10^{11}$	N/A	N/A	$1 \times 10^{12}$	N/A



## INTERNATIONAL HYDRAIL CONFERENCE

So clean appears not to be the main concern  
**WILL BEING GREEN BE?**



# Hydrail – Potential „Conventional“ Application Sectors

- (1) **Light rail** (with limits resulting from ‚light‘)
- (2) **Regional passenger transport** (daily operating distance <1000km)
- (3) **Road Switcher**
  - (1) „Pure“ shunts can be designed differently and may face phase-out by other technologies like last mile power units on main line locomotives
- (4) **Maintenance and construction**
- (5) ***„Mobile catenary“ units***



# How much „greening“ via hydrail?

- Regionally very different!
- In Europe, while nearly 50% of rail is non-electrified, only 20% of the total energy consumption comes from there.
- As very few rail operators produce their own energy, it is dependent on the overall energy shift and the will to pay for decarbonization!
- Which application sectors will make the change?



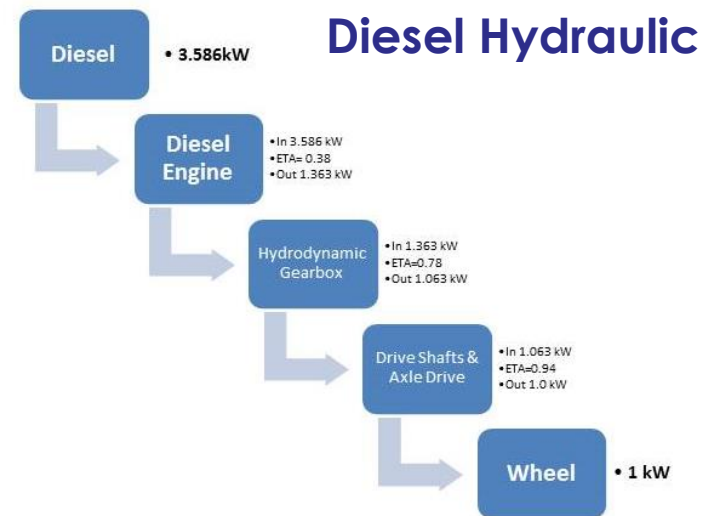
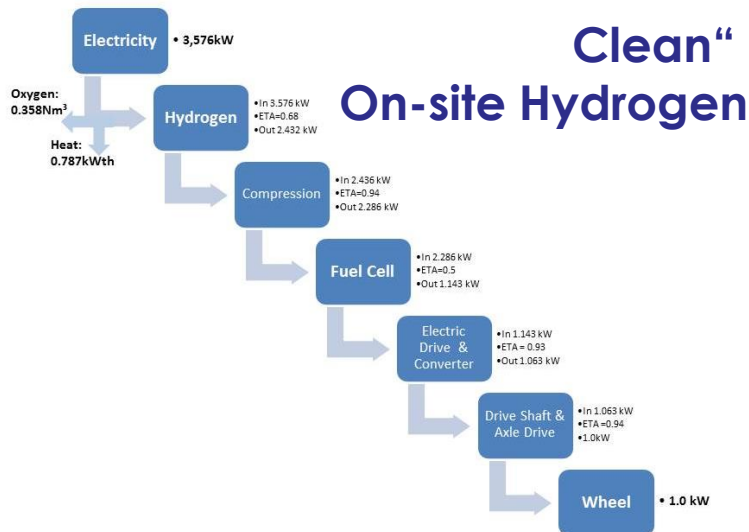


## Game changers?

- ZET- law modelled on California 1990 ZEV legislation?
- Low-cost decentralized hydrogen production enabling economic efficiency significantly better than diesel?
- Hydrogen transport and energy logistics service as a new business model for rail companies?
- People priorities and behaviour?
- „Completely new“ rail transport concepts?



# „Simplified“ Energy Cost Comparison



- **Electric Energy market (EEX)**
  - Phelix Day Base €/MWh 42.00
  - Off Peak I €/MWh 34.55
- Primary Energy Multiplier 3.576
- **1MWh Net Traction Energy Cost**
  - **€123.55 – 150.19**

- **Diesel price (Bulk, sulphur-free)**
  - € 420– 479/t
- Primary Energy Multiplier 3,586
  - 302kg Diesel/MWh net
- **1MWh Net Traction Energy Cost**
  - **€126.84 – 144.66**



# Action variables?

- Rapid and massive deployment of regional passenger transport solution via zero pollution tender requirements
- Fully harmonized hydrail homologation for Europe
- Integrated energy & transport strategy featuring hydrogen as synergy variable
- Rolling stock supplier industry to become much more active, e.g. joint large scale actions by FCH2-JU and Shift2 Rail



## Visions?

From my 2008 Hydrail Conference contribution....

### Alternative Light Rail Concepts – Powered by Fuel Cells?

- Individual Units are car like and could thus directly profit from automotive developments
- Consumers like the more private feel
- Vehicle Frequency control enables covering of peak periods while keeping short wait times (on demand) in low frequency times
- Speed > 70 km/h possible
- Driverless autonomous operation is easier since it uses 3<sup>rd</sup> dimension



Source: [www.coaster.at](http://www.coaster.at)



# Contact

**synergesis consult.ing**

Herbert Wancura

Puschweg 37

A-8053 Graz

Austria

Mobil: +43 (0) 676 848156 10

E-mail: [herbert.wancura@synergesis.eu](mailto:herbert.wancura@synergesis.eu)