

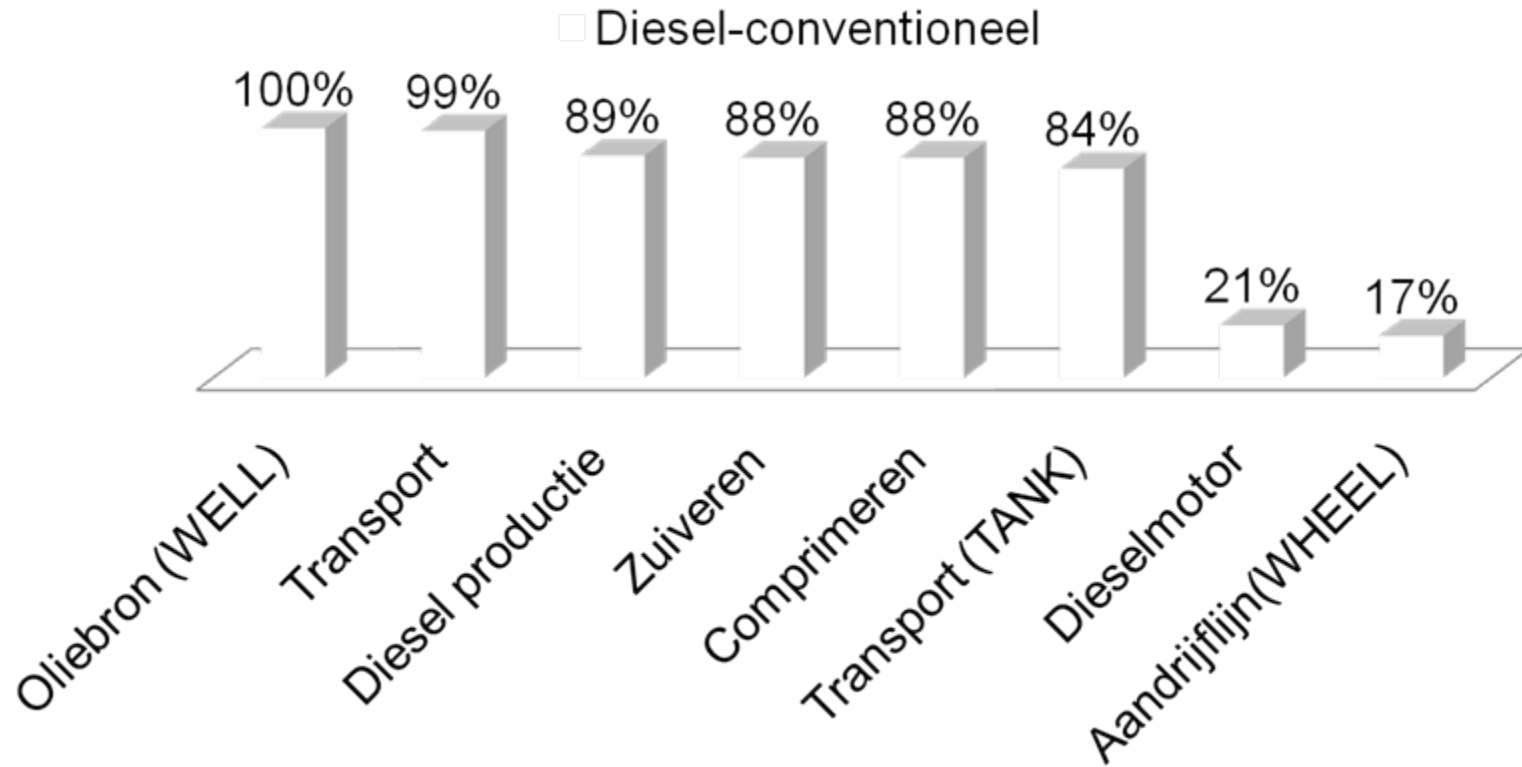
WELCOME



Presentatie Hytruck

Eric Beers

Well to Wheel efficiëncy

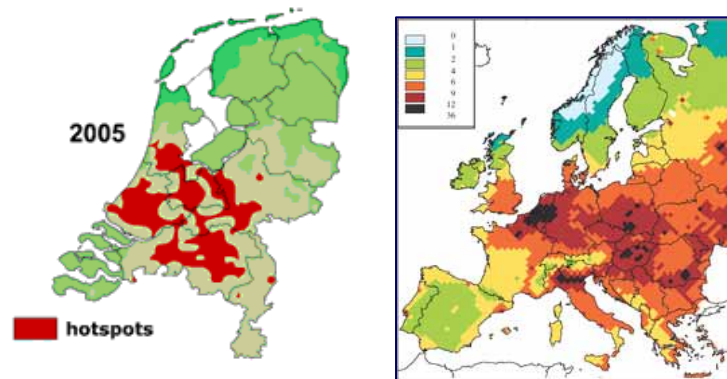




hydrogen future
experience NOW

Why

- Take our responsibility
- Use our experience and knowledge
- Stimulator of change processes
- Entrepreneurs
- Social responsibility
- Take care of climate and environment



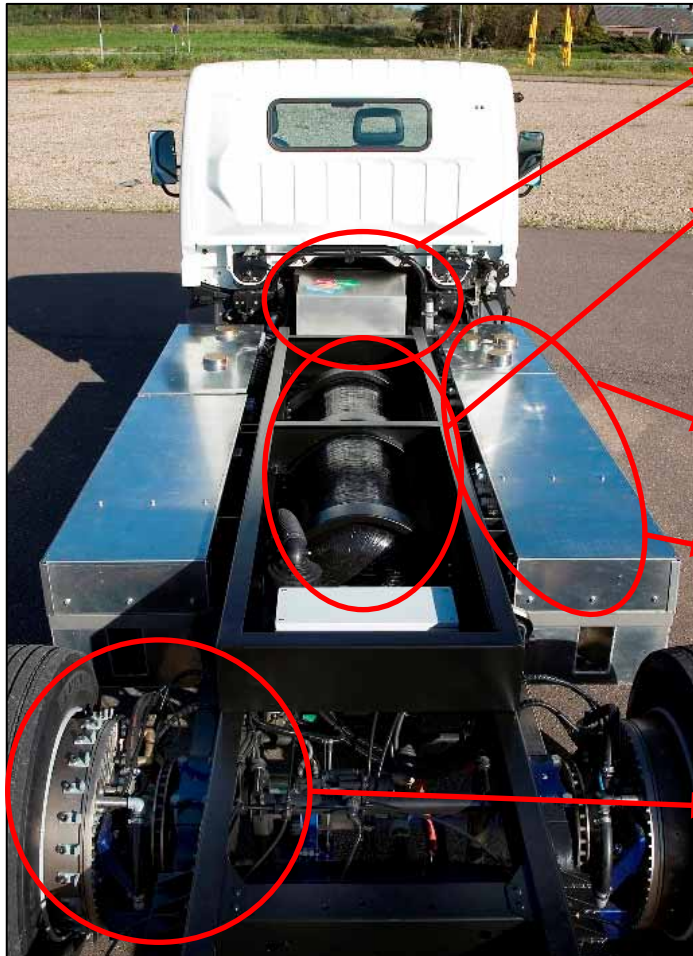
Solution

Hytruck



0-emissie truck for
regional & city transport

Hytruck



Fuel cell system

Hydrogen tank

Battery package

Electrical centre

Wheel engines

Who

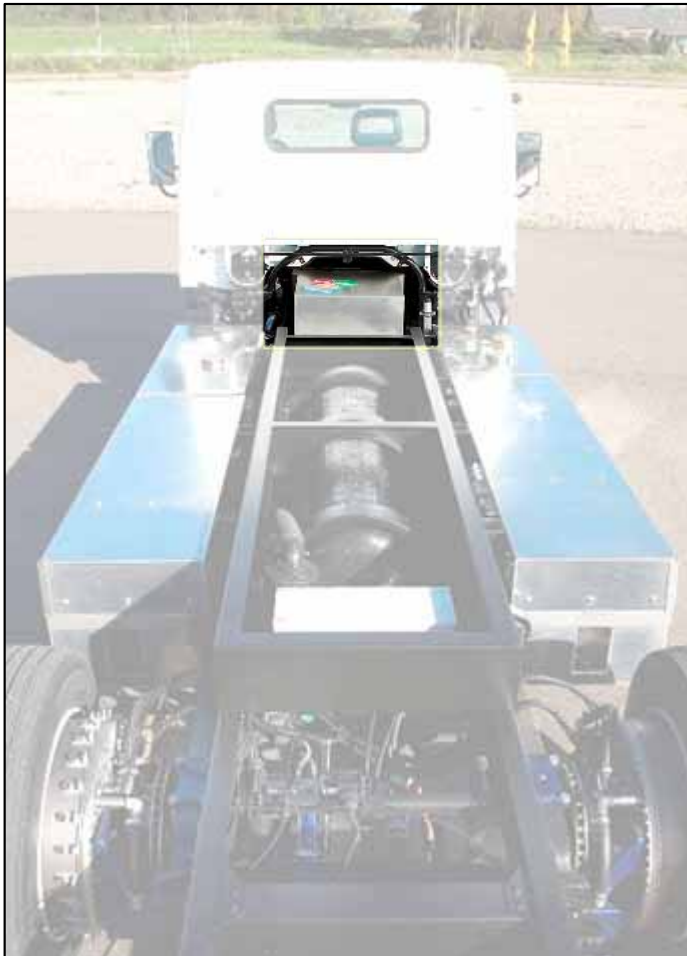
- NedStack Fuel Cell Technology



- Automotive system
- PEM Fuel cells
- Life length > 10.000 hours
- High efficiency 50-60%
- 4 kg/ KW (=>12 kg batt)

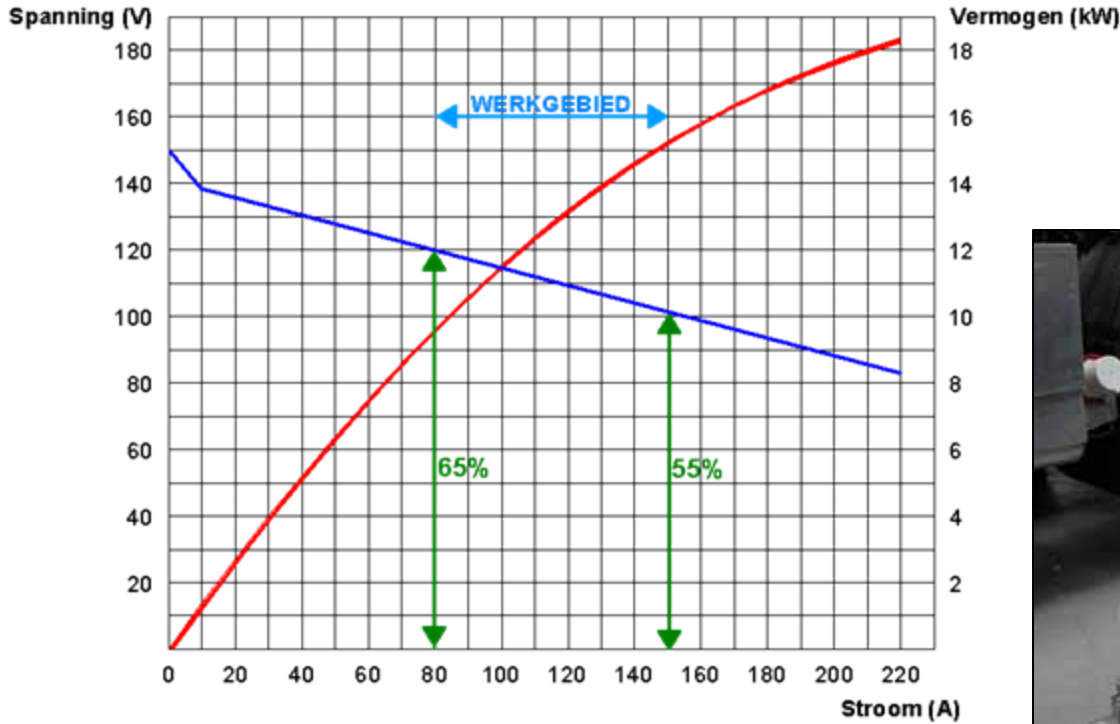


Fuel cell system

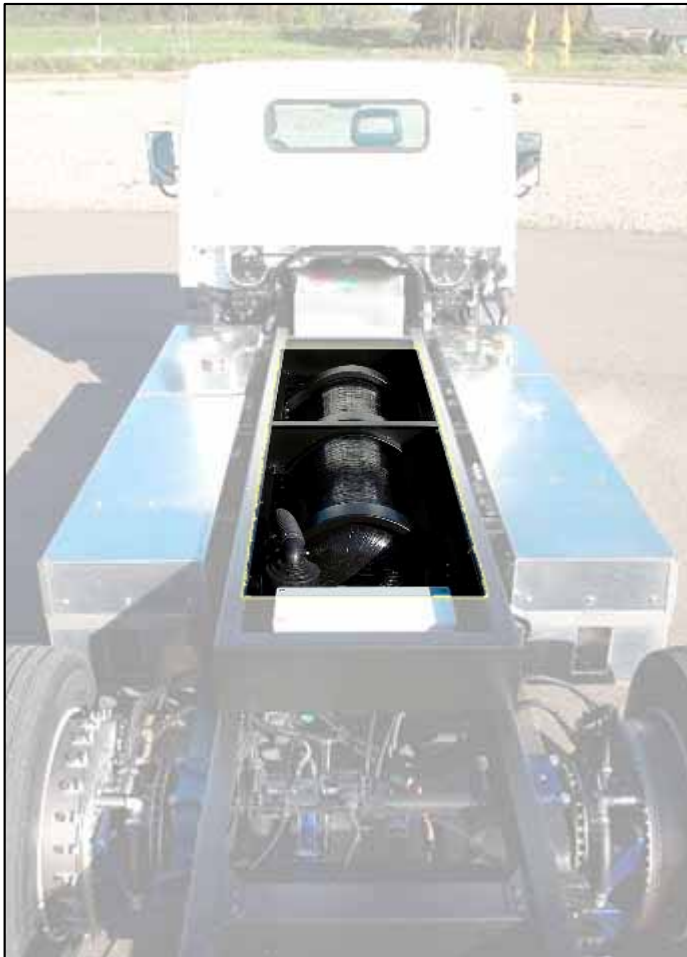


- PEM fuel cell
 - Low pressure (200 mbar)
 - performance 55-65%
- 9,5 – 15 kW continue
- 0-emission
- No noise

Fuel cell system



Hydrogen tank

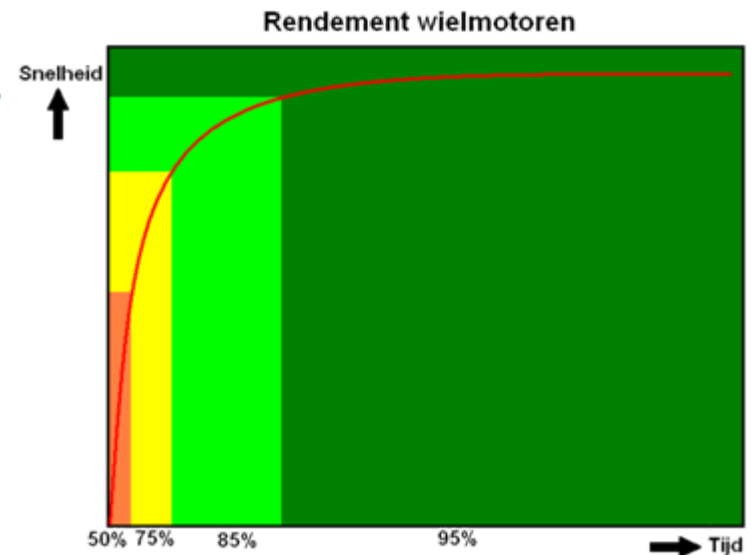


- Composite material
- 350 Bar
- 227 litre
- 5,8 kg H₂

- 400 km range

Who

- e-Traction
 - Wheel engines
 - No unnecessary gears
 - Very high efficiency
 - quiet
 - Battery package & BMS
 - Energy buffer
 - Storage of brake energy



Wheel engines



- 2 x 30 kW
- 2 x 2500 Nm
- 295/60R22,5”
- Regeneration brake energy
- High efficiency
- Quiet

Battery Pack



- 15 x 12,8V/130Ah
- Li-Ion phosphate
- 25kW continue
- 50kW max
- Storage brake energy
- charge via grid
 - Ca. 4 hour

Energy Management



- Monitoring of:
 - Fuel cell system
 - Wheel engines
 - Battery pack
- 12V-24V-100V-192V
- Battery chargers

Who

- Boudesteijn Bedrijfswagens
 - Initiative starter
 - Truck dealer
 - Transport company



boudesteijn



Driving resistant

- Rolling resistance:

$$F_R = \mu * F_N$$



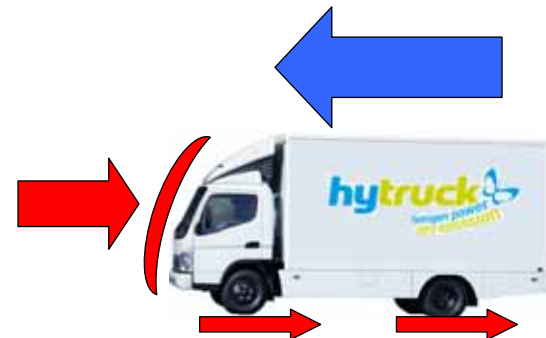
- Air resistance:

$$F_L = \frac{1}{2} * \rho_L * C_W * A * V^2$$



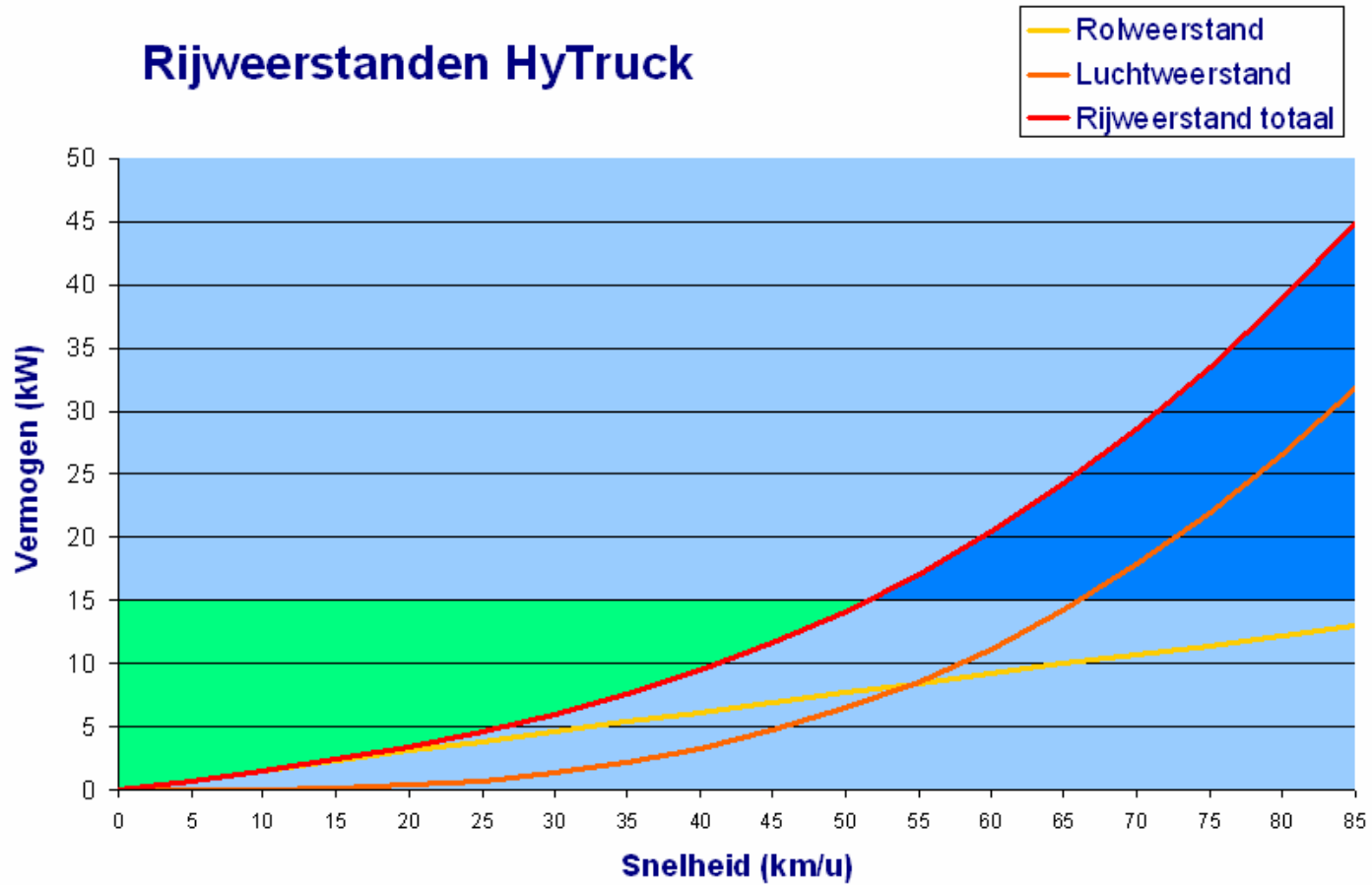
- Power needed:

$$P = (F_L + F_R) * V$$

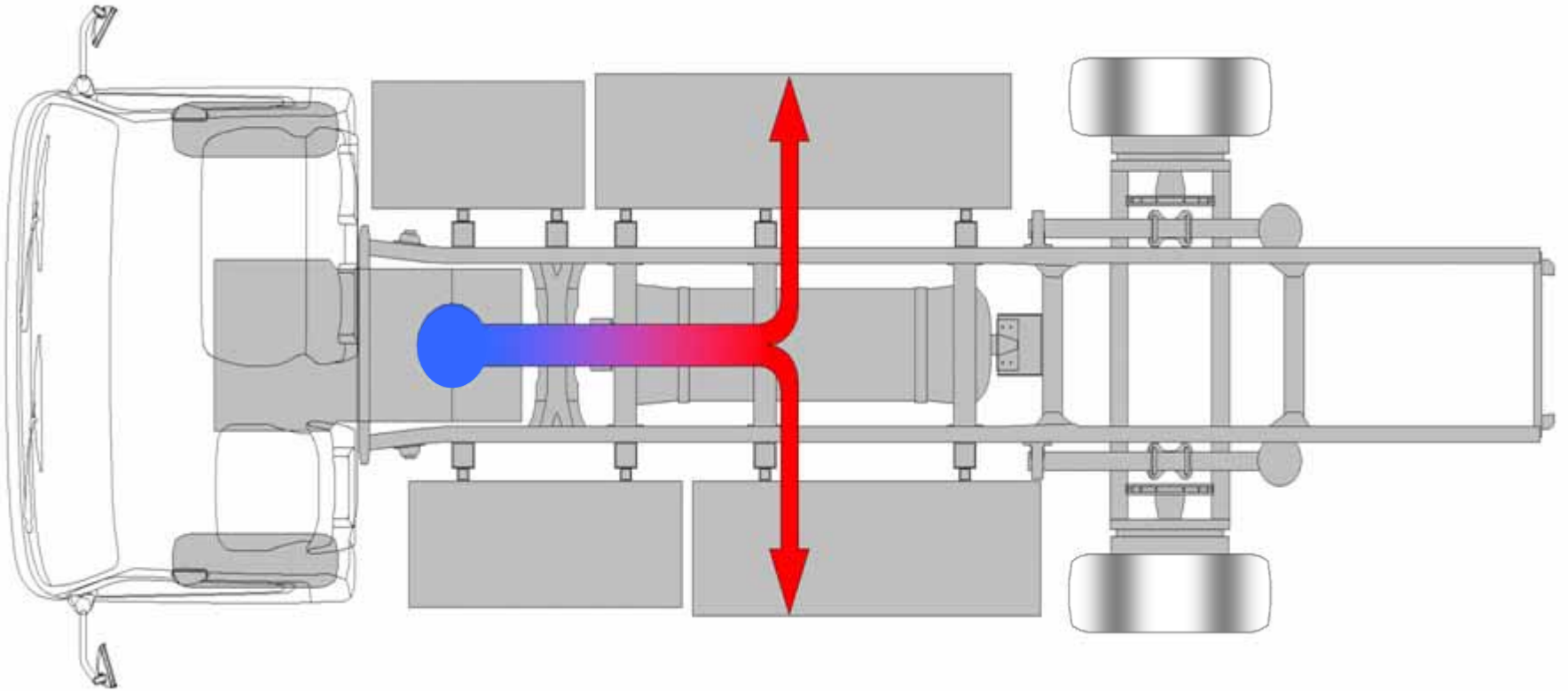


Power

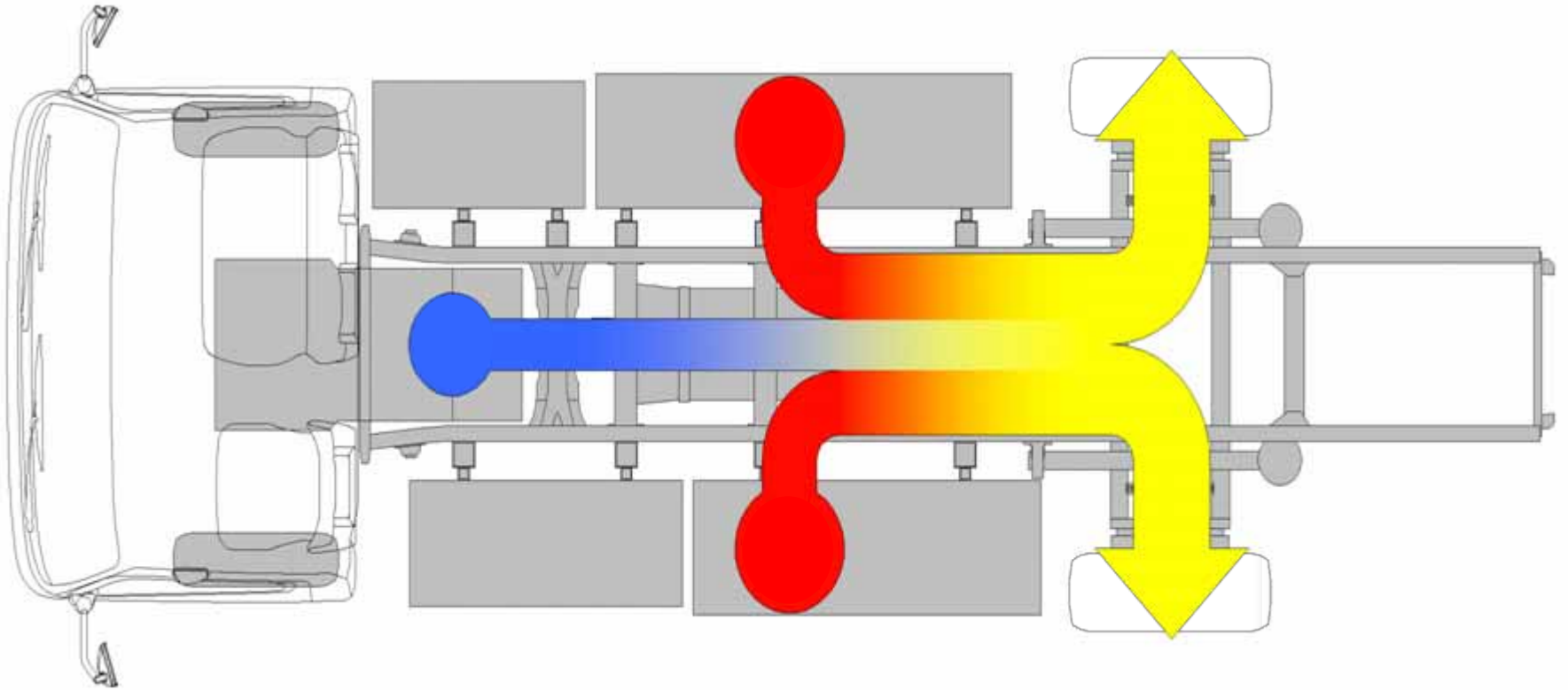
Rijweerstanden HyTruck



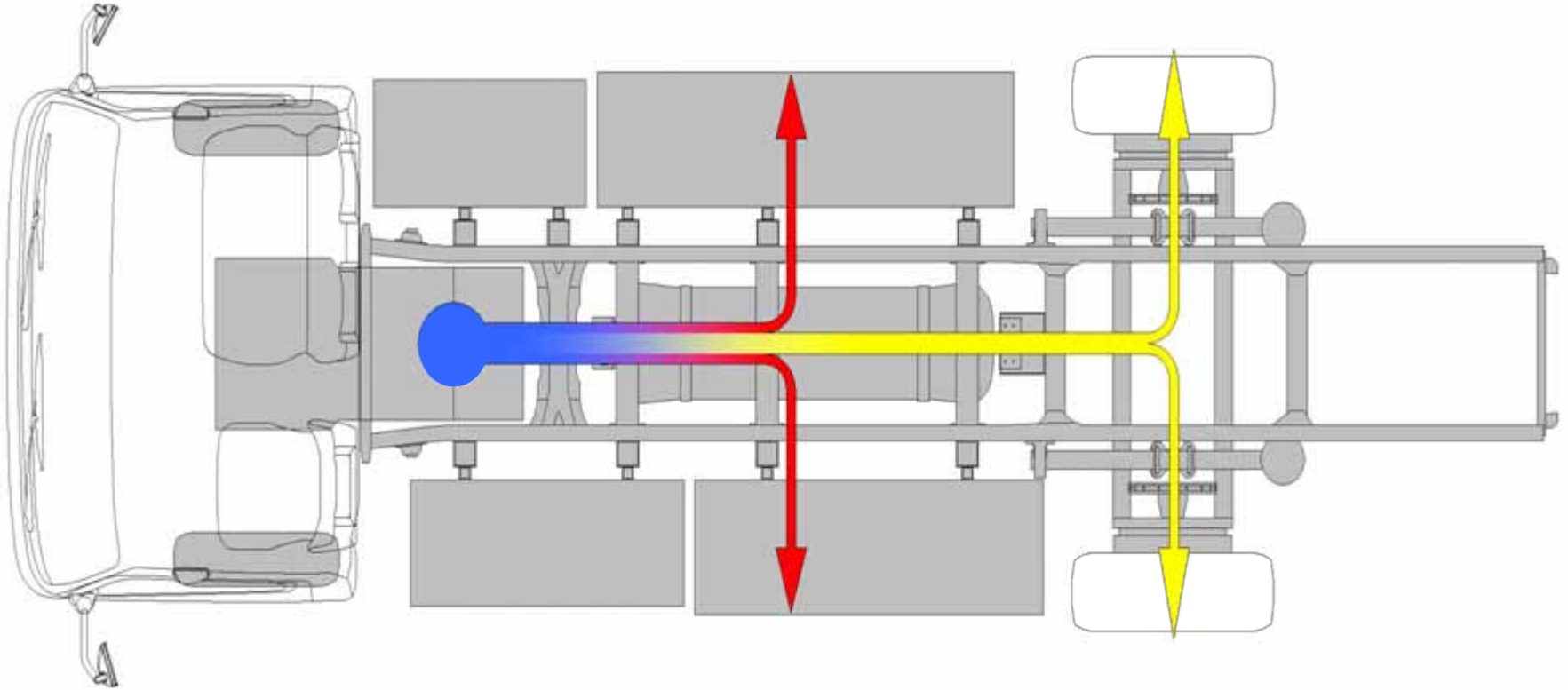
Stand still



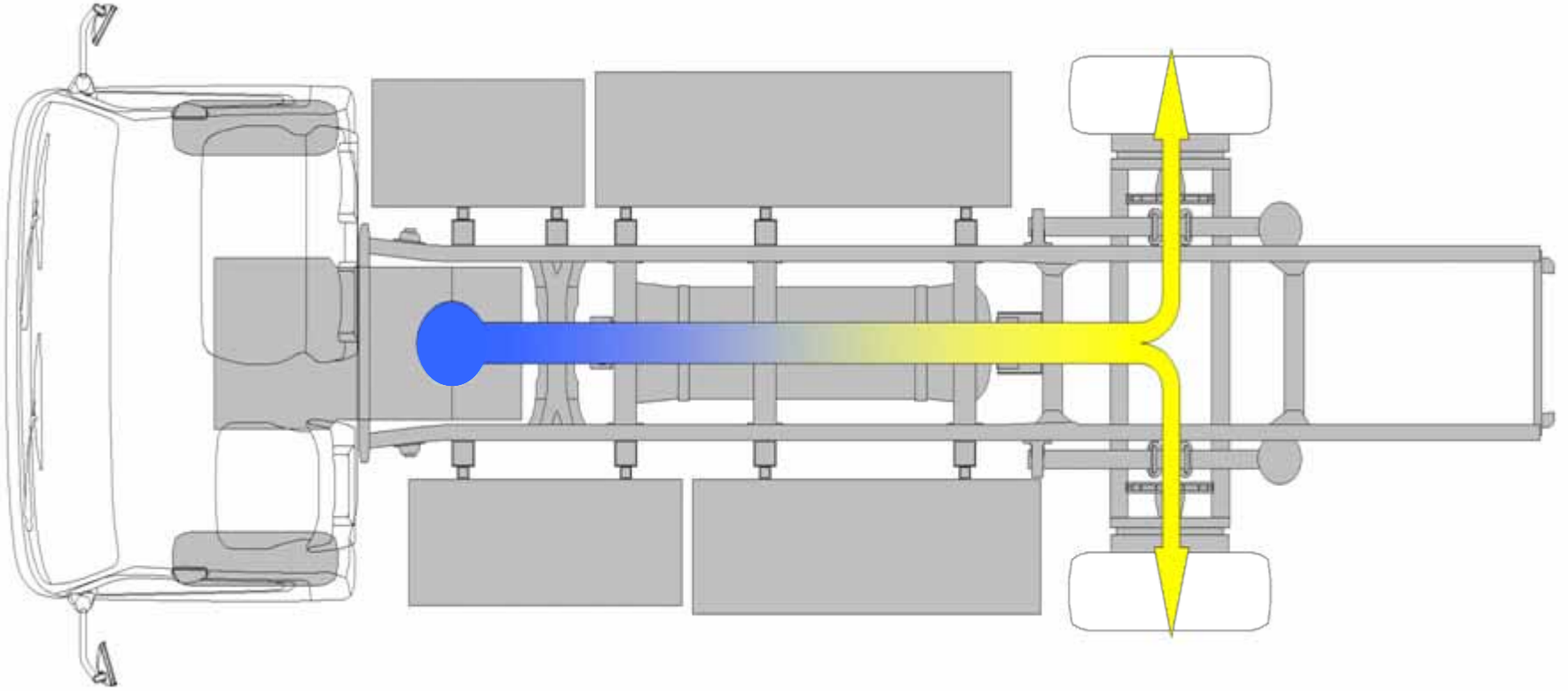
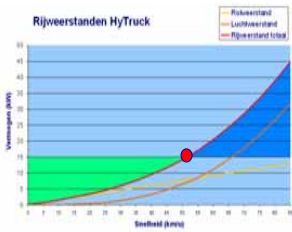
Acceleration



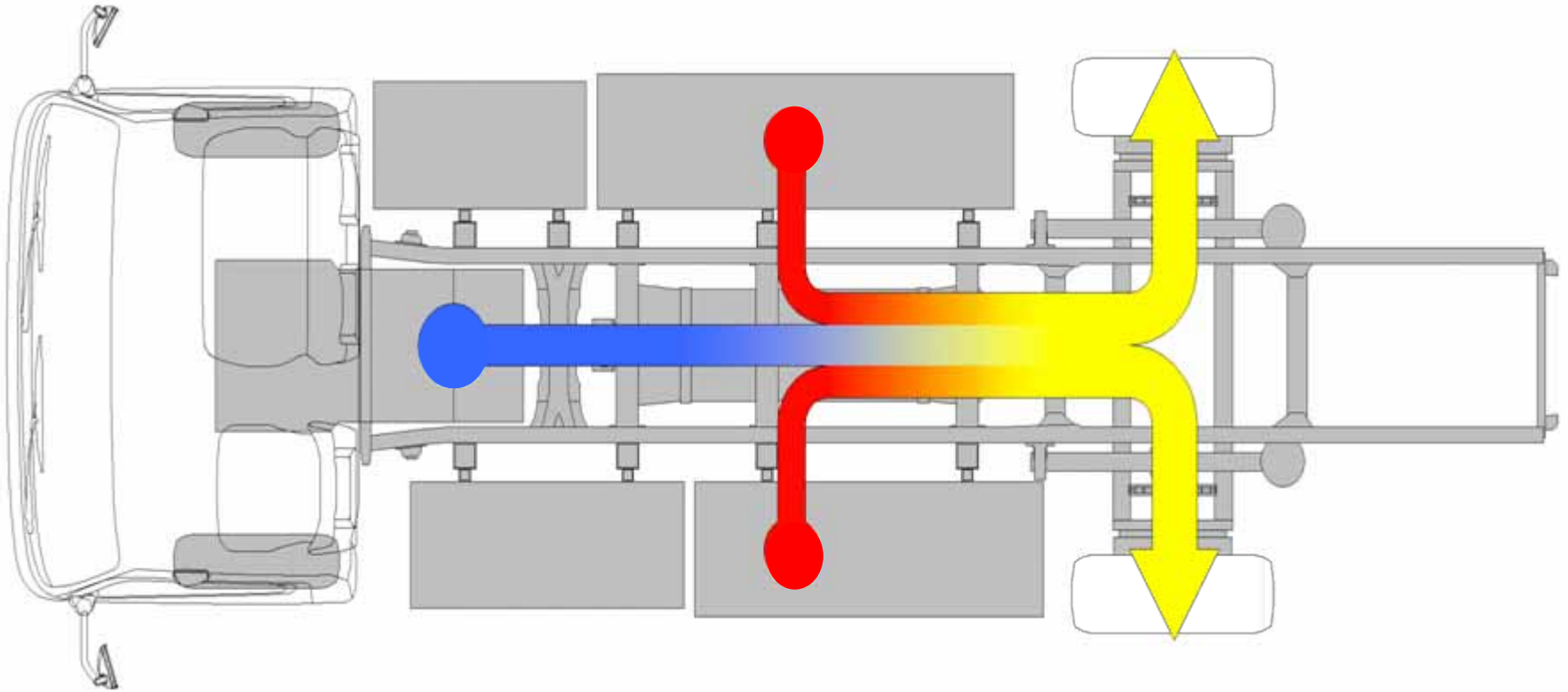
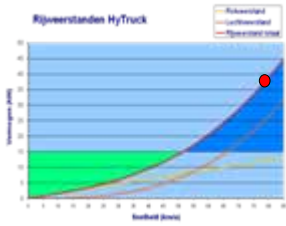
Low speed



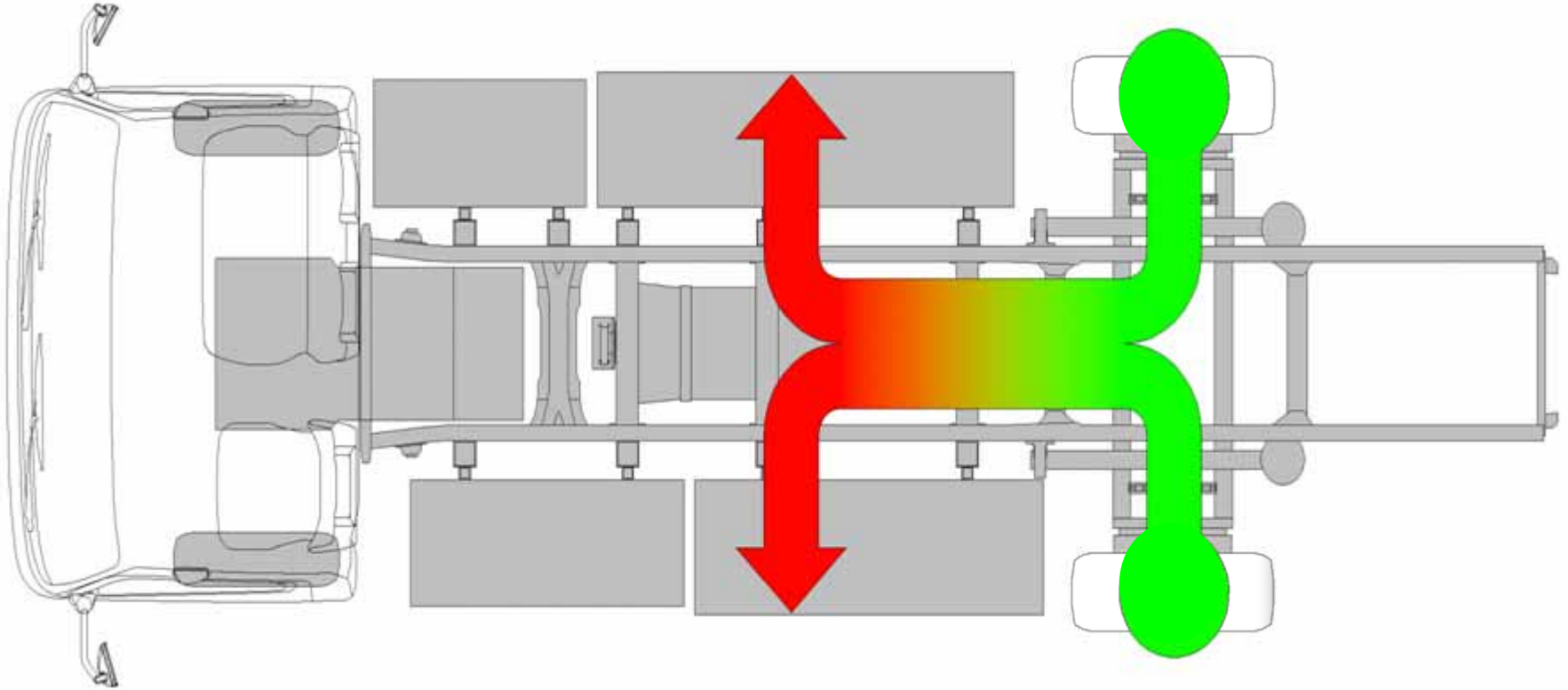
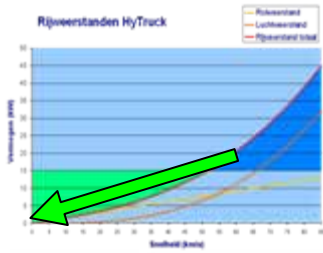
Average speed



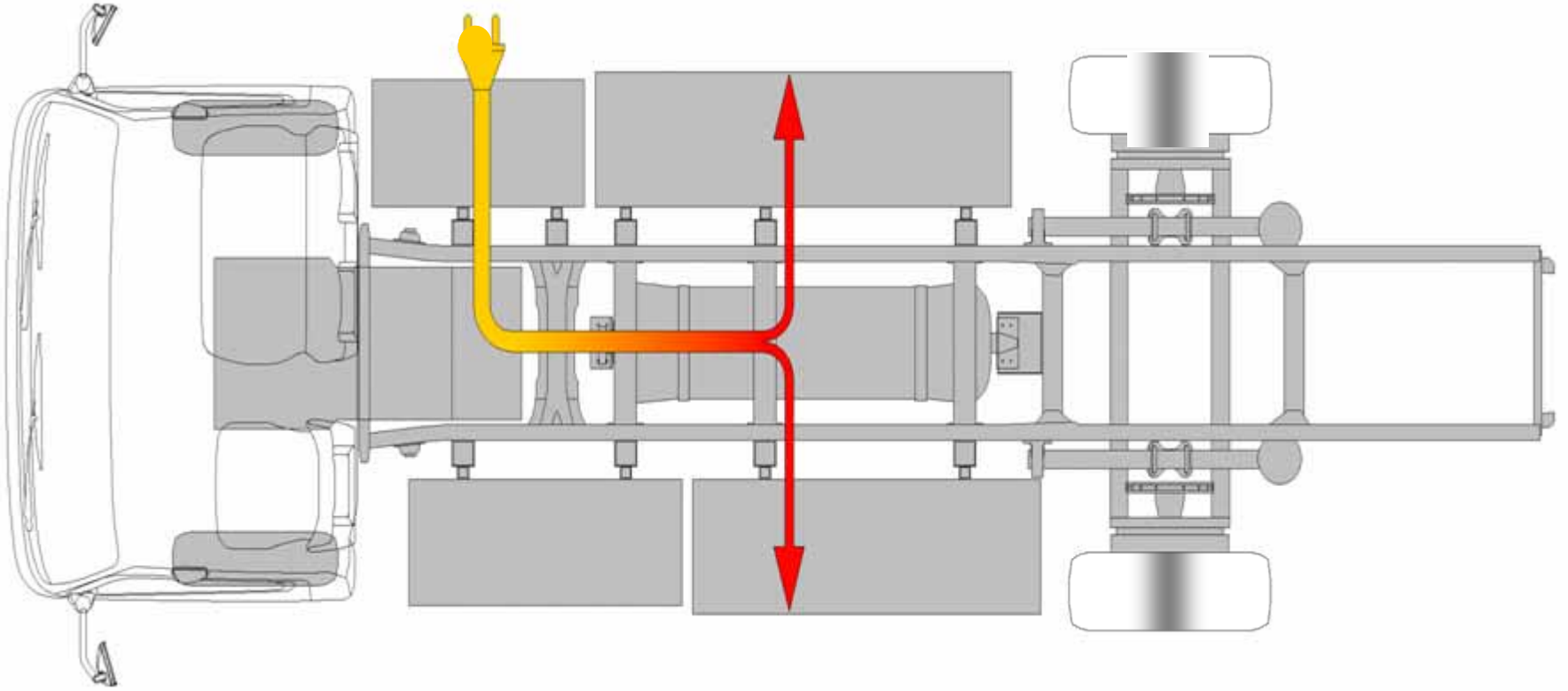
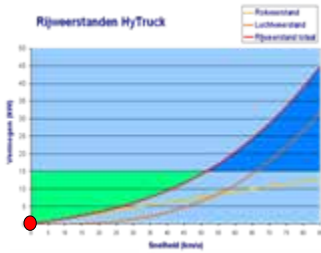
High speed



Braking



Parking





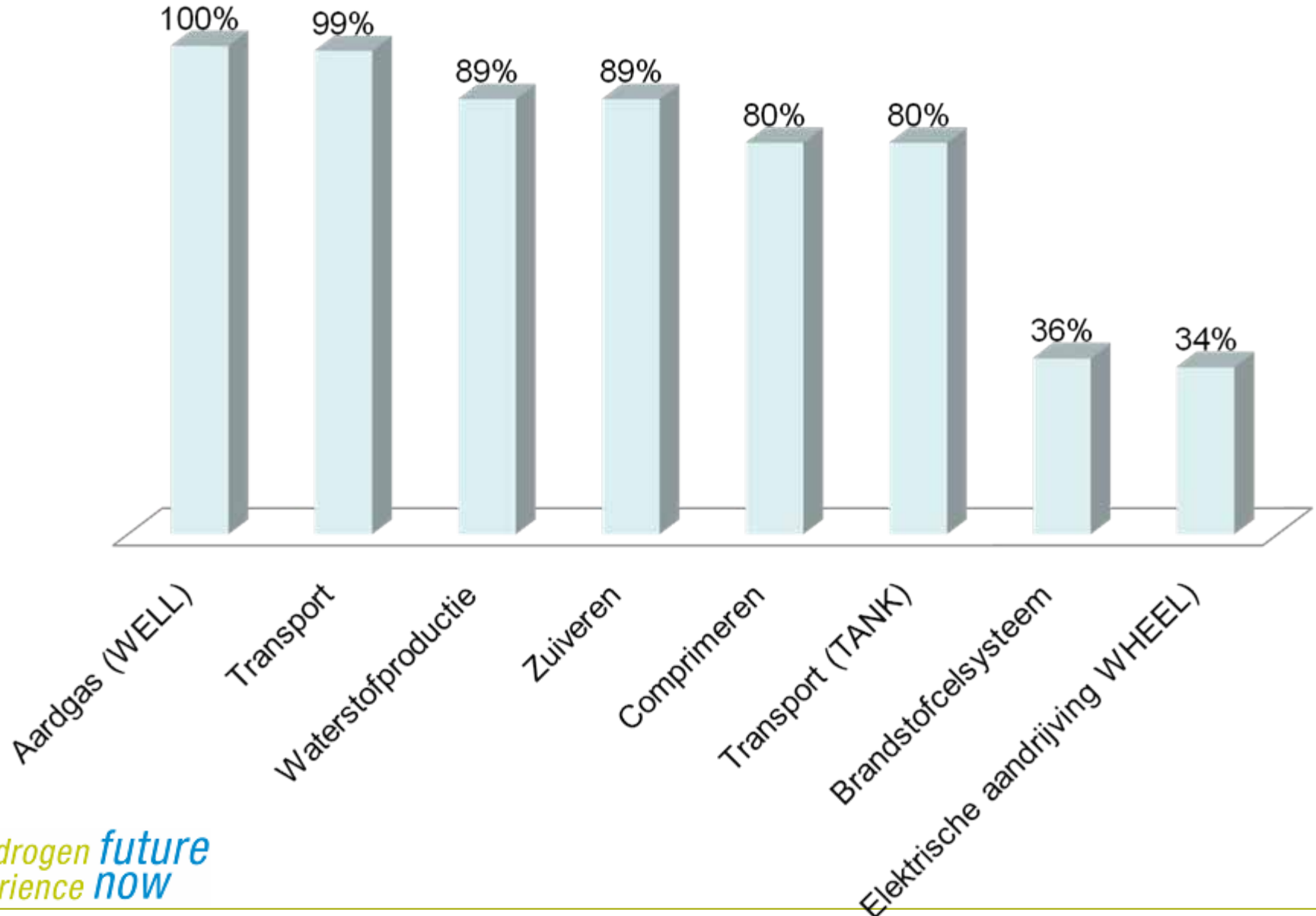
hydrogen future
experience NOW

Boardcomputer



Well to Wheel efficiency

■ Brandstofcel-elektrisch



Energy saving

	<i>Hytruck</i>	<i>Diesel</i>
• Fuel cell	45-55 %	
• Diesel engine (stationary – max power)		0-35 %
• Drive line (electro vs. gearbox)	50-95 %	20-85 %
• Battery package (storage energy)	95 %	
• Regeneration	100-125 %	
• Total	21-65%	0-30%
<i>avarage</i>	43%	15%

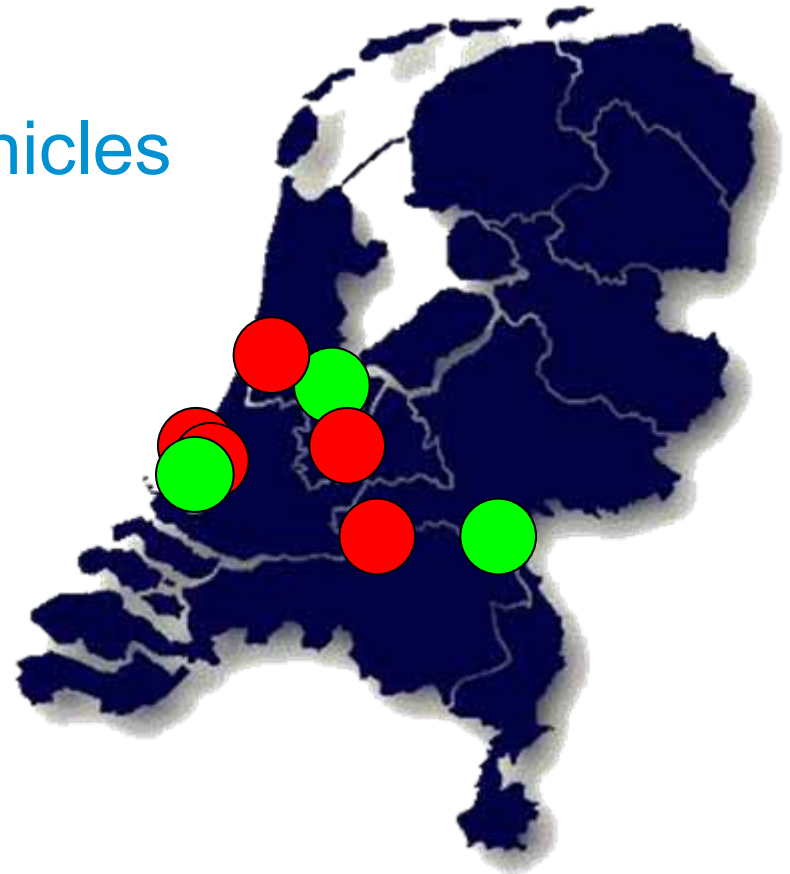
Energy saving

	<i>Hytruck</i>	<i>Conventioneel</i>
• Av. consumption	1kg/65km	1L/5,5km
• Heat value	139 MJ/kg	37,5 MJ/L
• 50.000km	113 GJ	340 GJ

-66%!

Fuel station

- Range
 - 400 km (city distribution)
- Number of hydrogen vehicles
 - Chicken-egg
- Focus on larger cities
 - Triangle
A'dam-R'dam-Arnhem



Phase 1

Demo

2007 & 2008

- Subsidy SenterNovem
- Concept: building & testing
- Practical experience (technical)
- Breakeven points (commercial)

Phase 2

Launching Customers

2009

- Production of 5 – 10 trucks
 - Preparation of series production
 - Price calculation of the series production
- Win customer interest for both community and private use
- Focus on zero emission

Phase 3

Series production

Cost price development:

- Series production

- Phase 1 € 1.900.000
- Phase 2 € 500.000
- Series max. factor 3

Hytruck demo

Launching customers

Breakeven !!

»



Disadvantages

- New technology
- Limited tank possibilities
- High pre-series costs
- Limited extra weight (<500kg)

Advantages

- 0-emission
- 'normal' 7,5 ton's truck
- Highest possible efficiency
- Quiet city transport
- Low number of moving parts
- Green image
- Absolute unique concept (world wide!)

Future over 10 years

- What does this development means for the transport branches ?
- And for the makes and dealers?
- Repair and maintenance?
- Battery v.s. Fuel Cell
- H2 production alternatives

Thank you for your attention



hydrogen future
experience NOW