



Reducing Total Cost of Ownership through Innovation

Gary Kassen, Engineering Director – Hydraulics/Pneumatics

Burr Ridge, IL

October 19, 2017

Contains confidential proprietary and trade secrets information of CNH Industrial. Any use of this work without express written consent is strictly prohibited.

CNH Industrial – 2016 Sales \$23.7 B

~55% Off-Highway



Trucks



Buses and Coaches



Firefighting Equipment



Civil Protection and Defense Vehicles



Skid Steer Loaders



Crawler Excavators



Engines and Transmissions



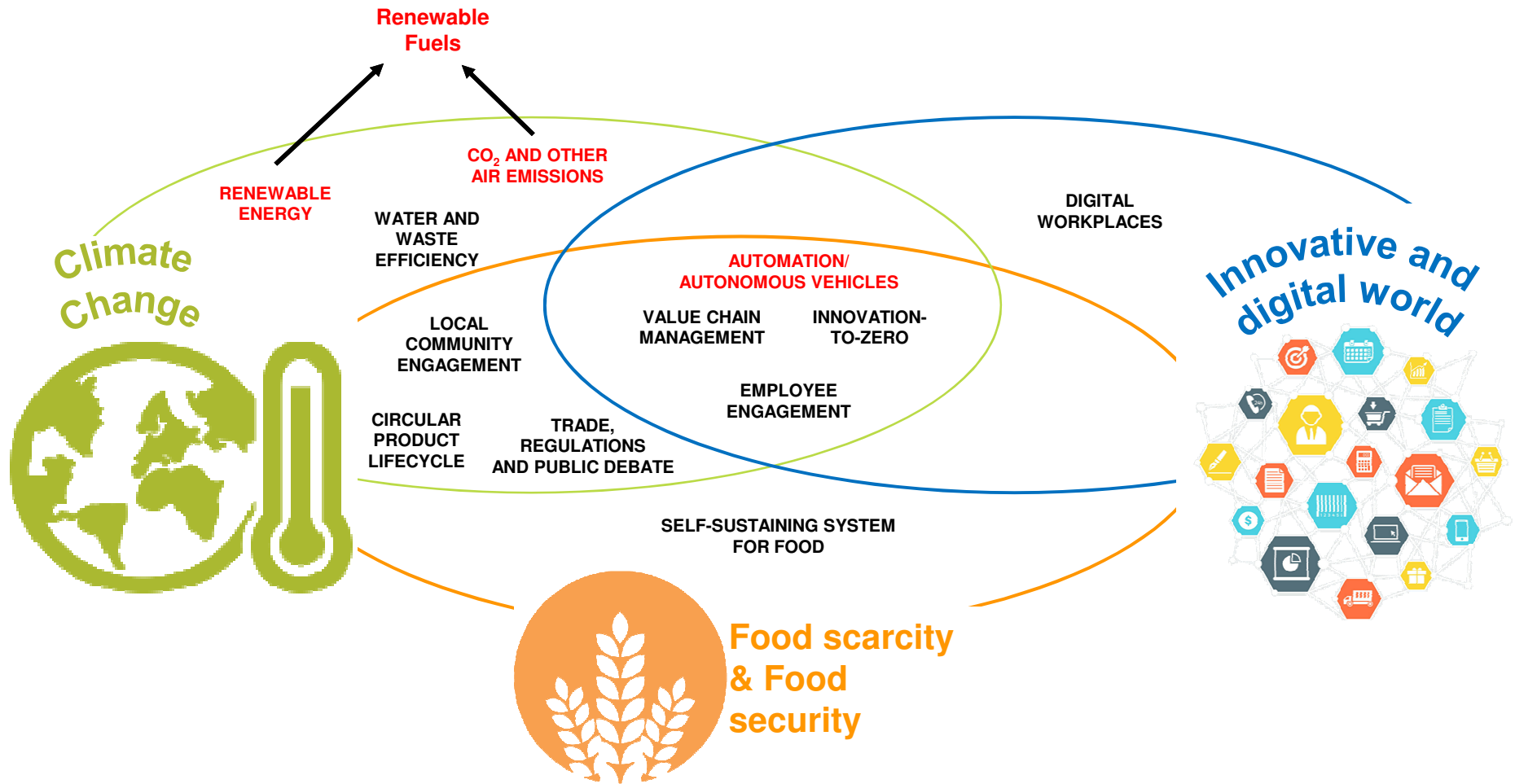
Tractors



Combines

Megatrends & Related Material Topics

Five-Time Leader in the Dow Jones Sustainability Indices



Source: CNH Industrial Sustainability Report, 2016

Reducing Total Cost of Ownership

Renewable fuels

- Methane
- Hydrogen

Automation

- Functions
- Autonomous



Methane Tractor



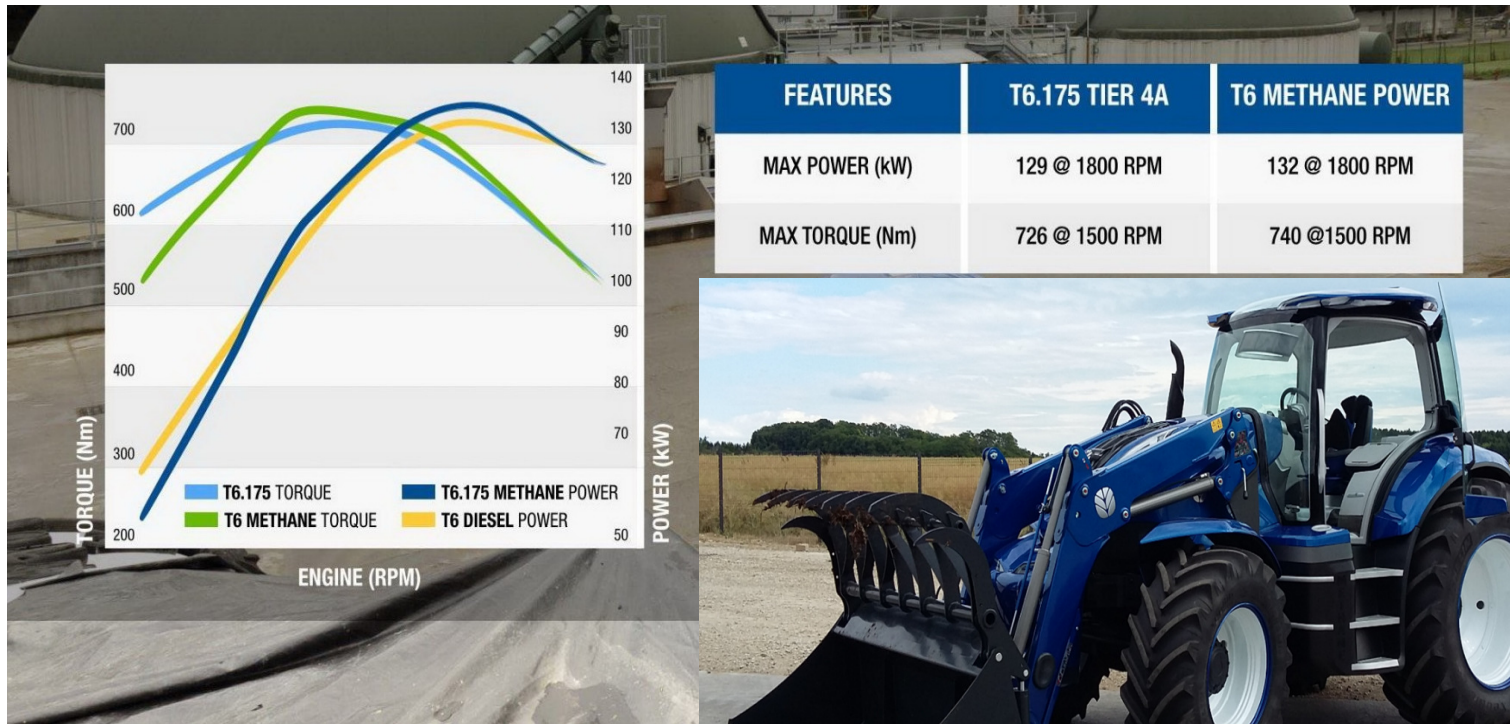
Hydrogen Fuel Cell Tractor



Autonomous Tractor

Methane Power Tractor

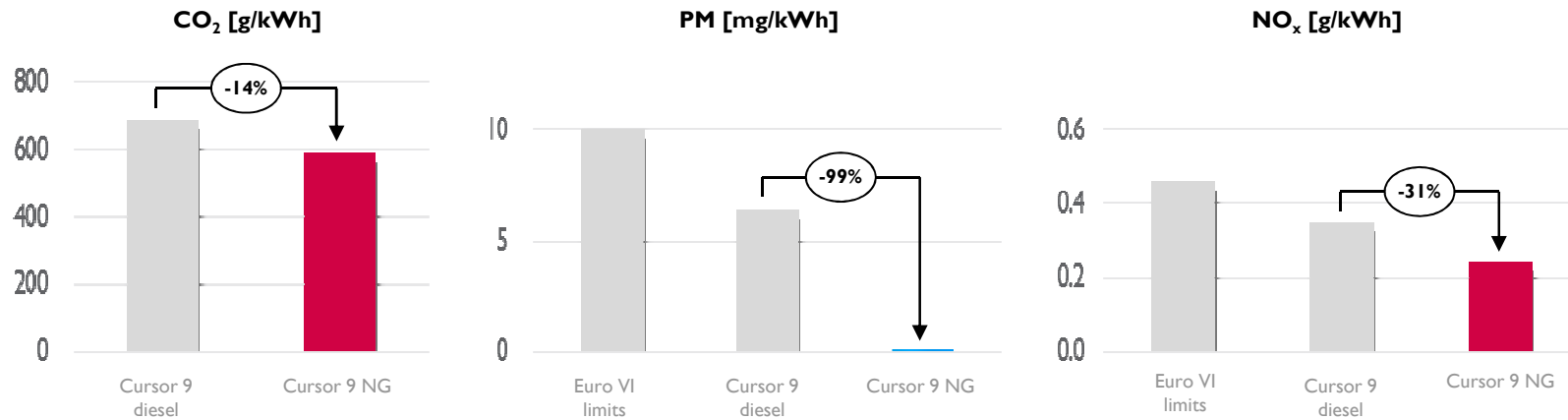
PERFORMANCE – TIER 4A T6.175 VS T6 METHANE POWER



Methane Tractor debut at 2017 Farm Progress Show

Methane Advantages

Natural Gas / Bio-Methane Vs. diesel



Natural gas (fossil)
CO₂ -14%

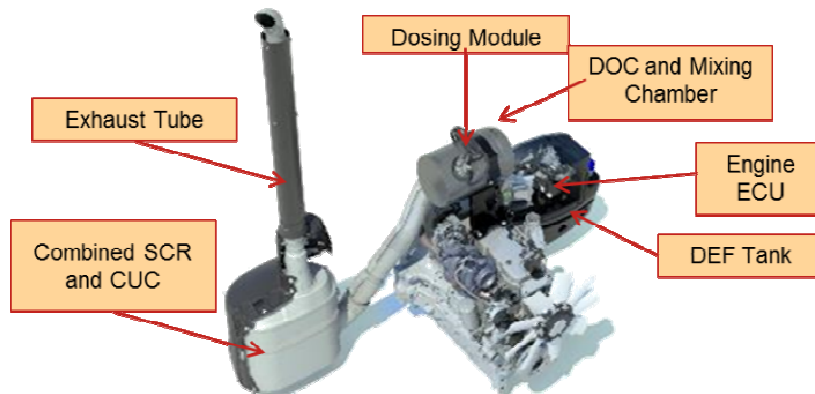


Bio-methane
CO₂ -100%

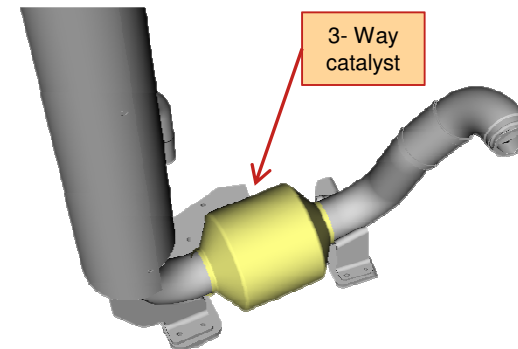
Significantly lower noise with Methane

ATS – Diesel Vs. CNG/LPG solution

Tier 4B Diesel ATS

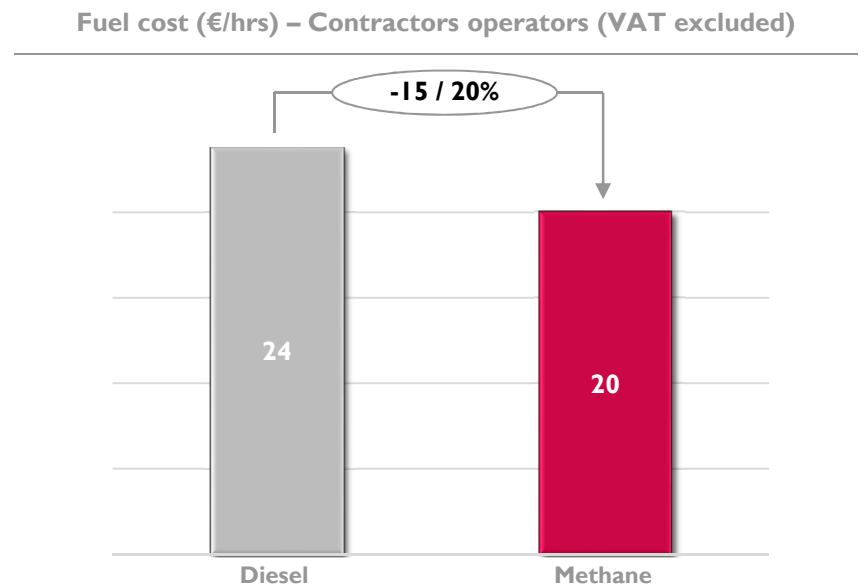
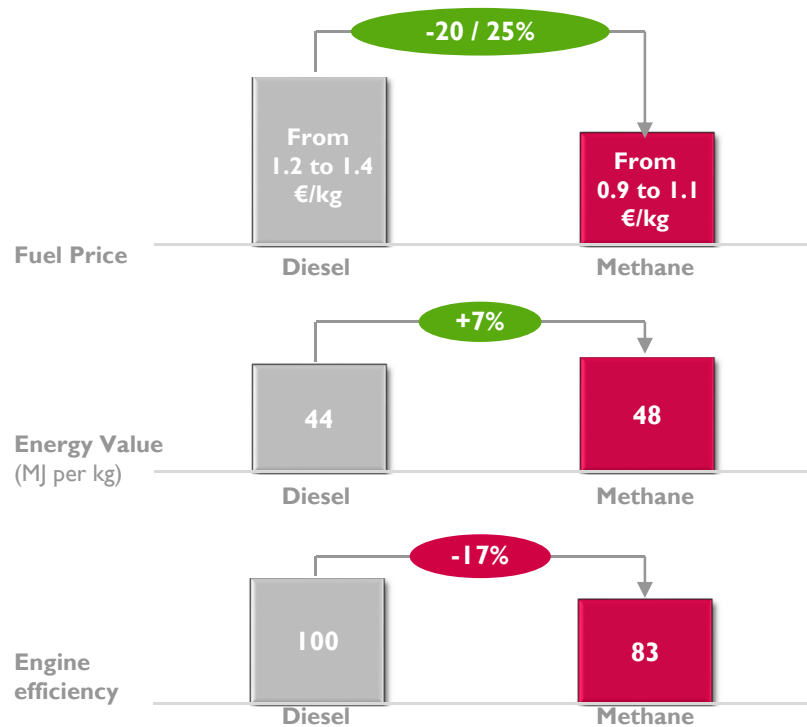


Tier 4B CNG/LPG ATS



ATS solution for CNG/LPG engines is ~90% smaller volume (ref. Tier4B)

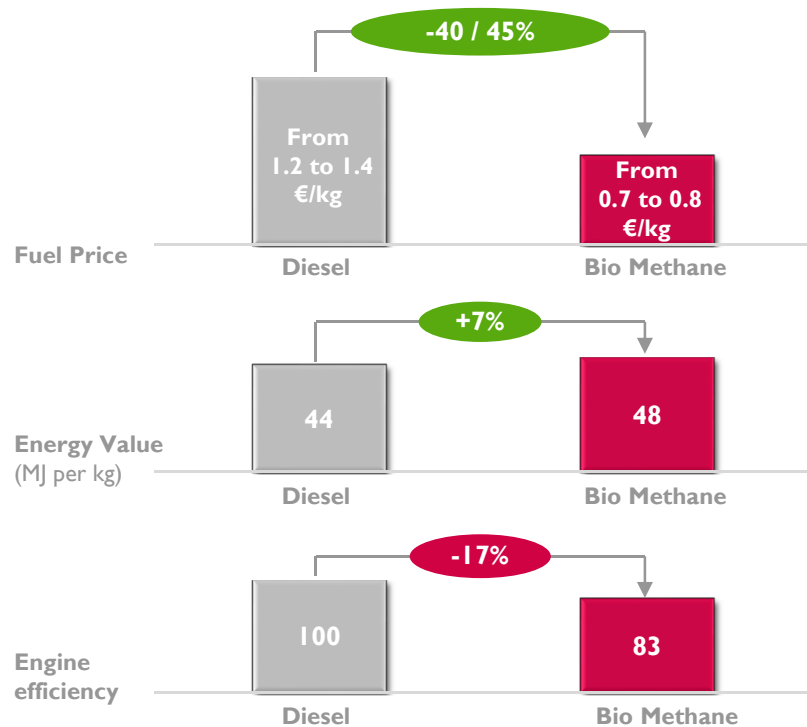
Total Cost of Ownership – Commercial filling station simulation



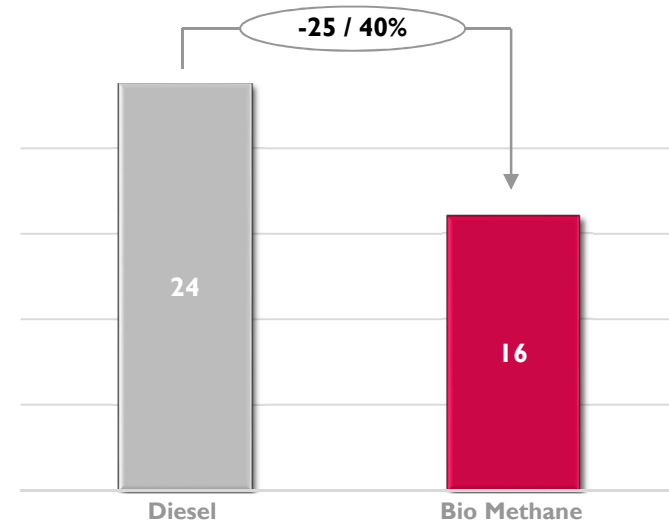
Fuel Consumption: Diesel: 27L/hrs - Methane: 25 kg/hrs
Engine Efficiency: Diesel: 45% - Methane: 37.5 (average field data)
Reference Yearly Usage: 1500 hrs/year
Pump Price: average price across IT/FR/UK/DE/ES/PO/NL

Not considering urea usage (2% saving) and the elimination of potential fuel theft, the Methane tractor could achieve more than €5500 per year savings compared to a diesel powered tractor

Total Cost of Ownership – Energy Independent Farm simulation



Fuel cost (€/hrs) – Contractors operators (VAT excluded)



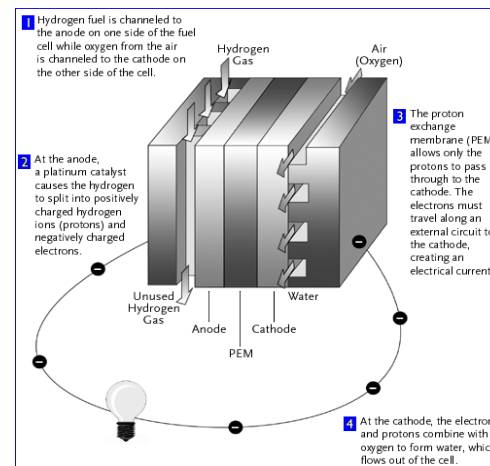
Fuel Consumption: Diesel: 27L/hrs - Bio Methane: 25 kg/hrs
Engine Efficiency: Diesel: 45% - Bio Methane: 37.5 (average field data)
Reference Yearly Usage: 1500 hrs/year
Pump Price: average price across IT/FR/UK/DE/ES/PO/NL

Not considering urea usage (2% saving) and the elimination of potential fuel theft, the Methane tractor could achieve more than €13,000 per year savings compared to a diesel powered tractor

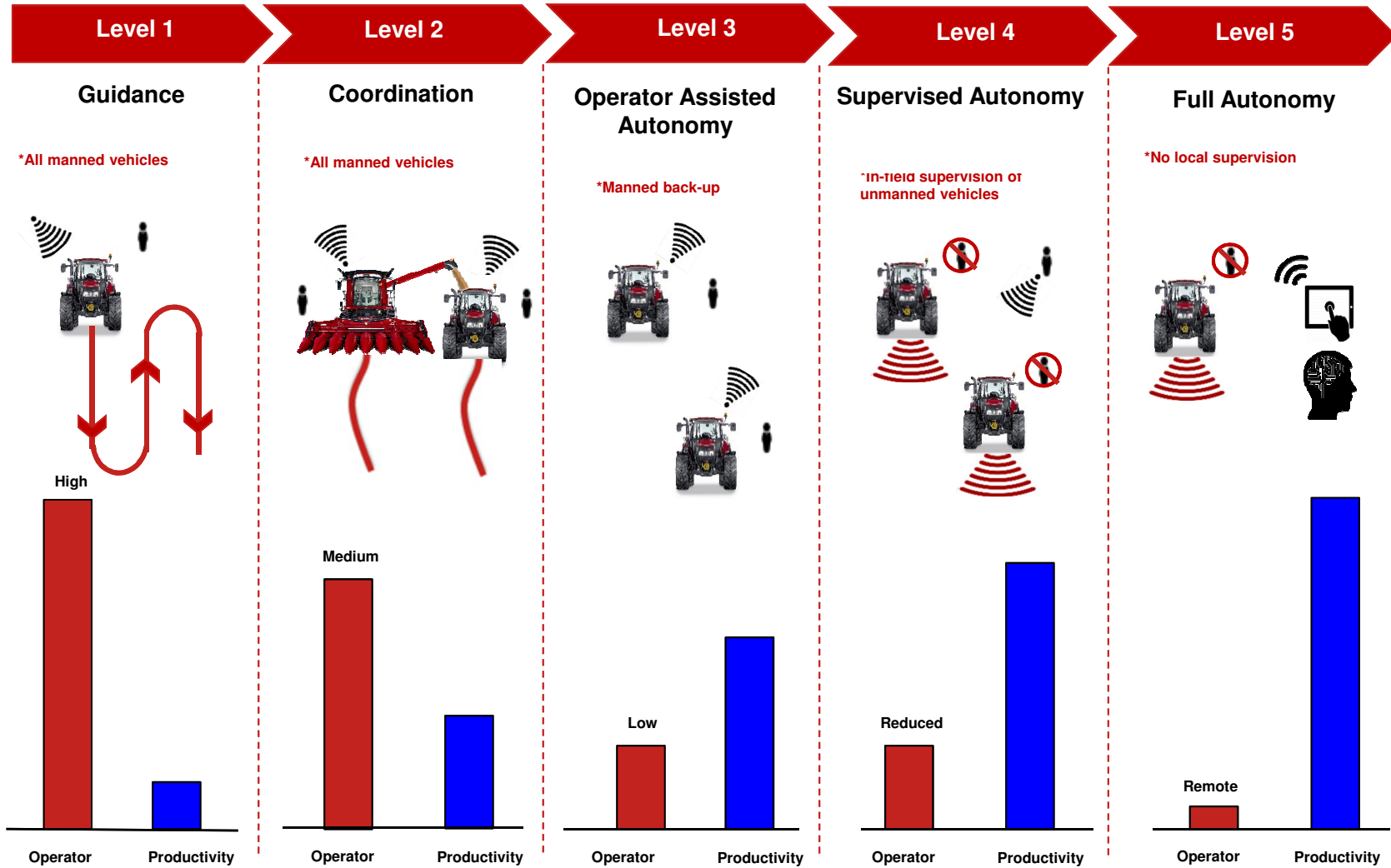
Hydrogen Fuel Cell – New Holland T6

Background:

- Splits hydrogen gas (H₂) molecule to produce electricity
- Zero emissions
- Lower noise
- High efficiency (150% of diesel)
- Fuel cells are currently expensive but cost could drop dramatically if widely used in automotive
- Limited distribution infrastructure (H₂) but could be produced locally on farms
- Requires tanks for pressurized hydrogen fuel (790 bar currently being used in automotive)



Autonomy – Operator Input vs. Productivity



Note: There are many other tangible and intangible benefits – Agronomic, Economic, Safety, etc.

Challenges to Autonomy

■ Legal



- Limited rules and compliance framework
- Impact on insurance business

■ Technology adoption



- Need to educate people
- Find the right technology costs



■ Human Vs Machine

- Up to which level do we want the machine to take the decisions?



■ Safety

- More safety directives
- System security



■ Small Scale Farming

- Lack of competitiveness
- Adapt machine sizes

Fluid Power Challenges

- Renewable Fuels – require more space
 - Improve efficiency
 - Reduce parasitic losses
 - Reduce size of components
- Automation
 - E-braking and E-steering
 - Higher level of functional safety

Reducing Total Cost of Ownership - Summary

Technology

- Renewable fuels
 - Methane
 - Hydrogen

- Automation
 - Functions
 - Autonomous

Benefit

- Lower fuel costs
- Lower emissions
- Lower noise

- Higher productivity
- Reduced required skill
- Lower cost