FPT INDUSTRIAL IN THE 2020S
ROUTES TO DECARBONIZATION

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Alternative Fuels Projects – Innovation

TRANSPORT ENERGY NETWORK
ON LINE WORKSHOP
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FPT INDUSTRIAL: A BRAND OF CNH INDUSTRIAL

CNH INDUSTRIAL

NYSE New York Stock Exchange

Borsa Italiana London Stock Exchange Group

12 BRANDS

28.1B$ REVENUES 2019

10 YEARS INDUSTRY LEADER DOW JONES SUSTAINABILITY INDICES

MEMBER OF Dow Jones Sustainability Indices In Collaboration with RobecoSAM

FPT POWERTRAIN TECHNOLOGIES

FPT INDUSTRIAL RESULTS IN 2019

FPT Industrial is a brand of CNH Industrial and a world leader in design, production and sale of industrial powertrains for on- and off-road vehicles, marine and power generation applications

4.1B$ REVENUES 2019

596 400 ENGINES PRODUCED

232 200 AXLES & TRANSMISSIONS PRODUCED

10 PLANTS AND 7 R&D CENTERS

73 DEALERS AND 800 SERVICE POINTS

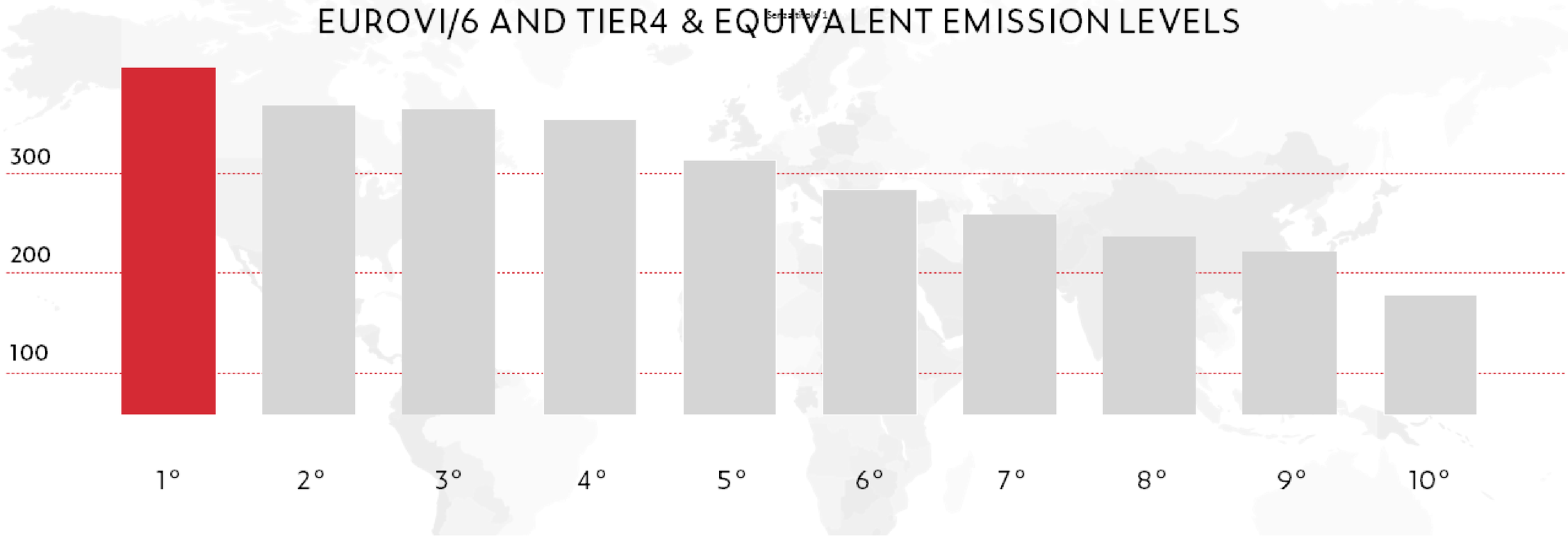
55.1% NON-CAPTIVE VOLUMES

MORE THAN 1 ENGINE PRODUCED EVERY MINUTE

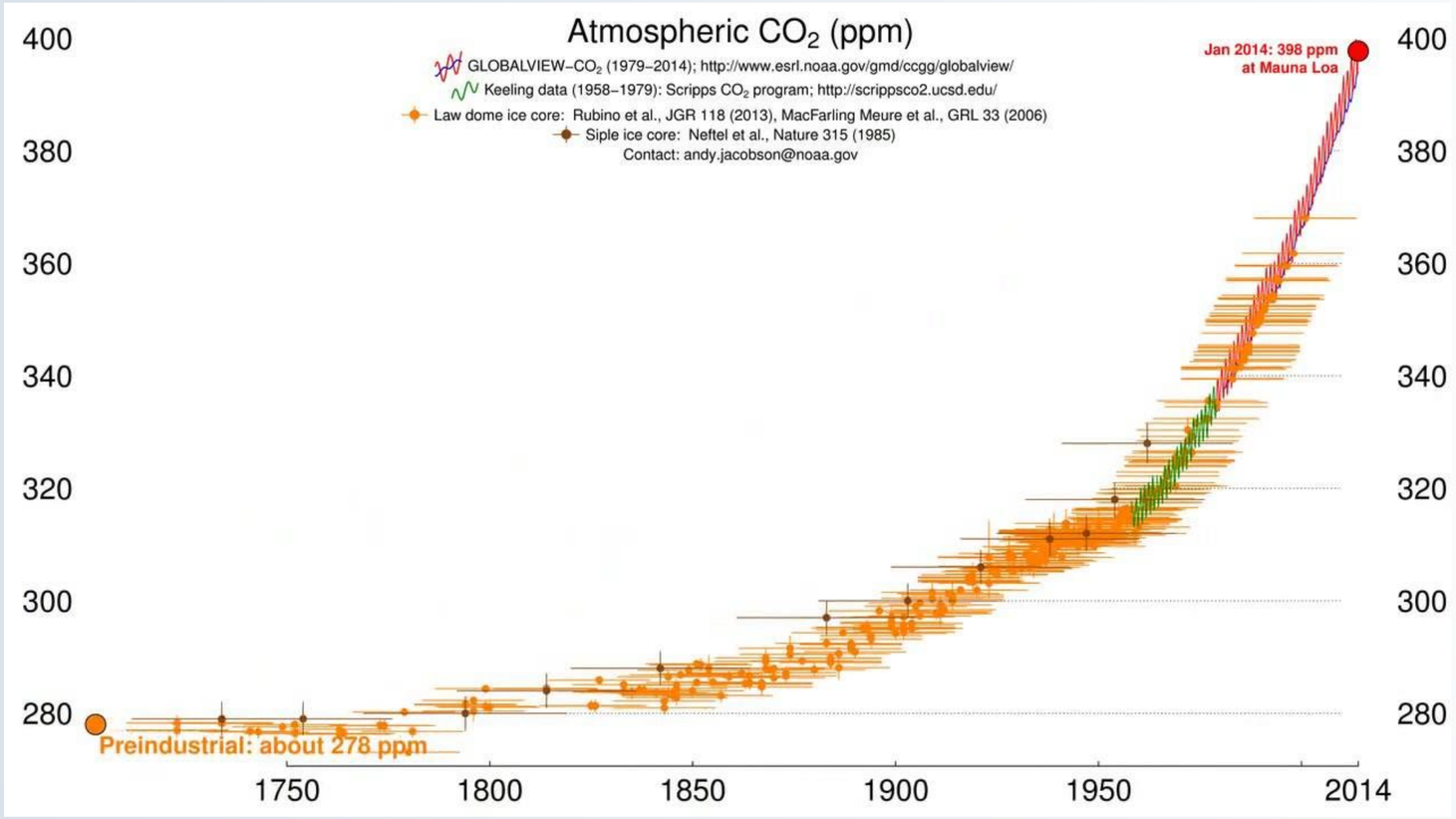
FPT POWERTRAIN TECHNOLOGIES

LOW-EMISSION ENGINES MANUFACTURERS (2019)

2.3 L - 20 L Diesel & alternative fuels



THE INEXORABLE GROWTH OF CO_2



- CO_2 CONCENTRATION SHOWS AN EXPONENTIAL GROWTH IN THE PAST 200 YEARS, NOW EXCEEDING 410PPM (THE HIGHEST LEVEL IN THE LAST 800 000 YEARS)

- THE INDUSTRIAL REVOLUTION ROUGHLY STARTED 200 YEARS AGO…DO YOU BELIEVE IN COINCIDENCE?

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ON ROAD LIGHT DUTY AND HEAVY DUTY FLEET CO_2 REDUCTION

Light Duty

- 2025: 15% CO_2 EMISSION REDUCTION COMPARED TO 2021 LEVELS
- 2030: 31% CO_2 EMISSION REDUCTION COMPARED TO 2021 LEVELS

- CO_2 MEASURED IN WLTC AS WELL AS REAL DRIVE MEASUREMENTS

Heavy Duty

- 2025: 15% CO_2 EMISSION REDUCTION COMPARED TO 2019 LEVELS
- 2030: 30% CO_2 EMISSION REDUCTION COMPARED TO 2019LEVELS

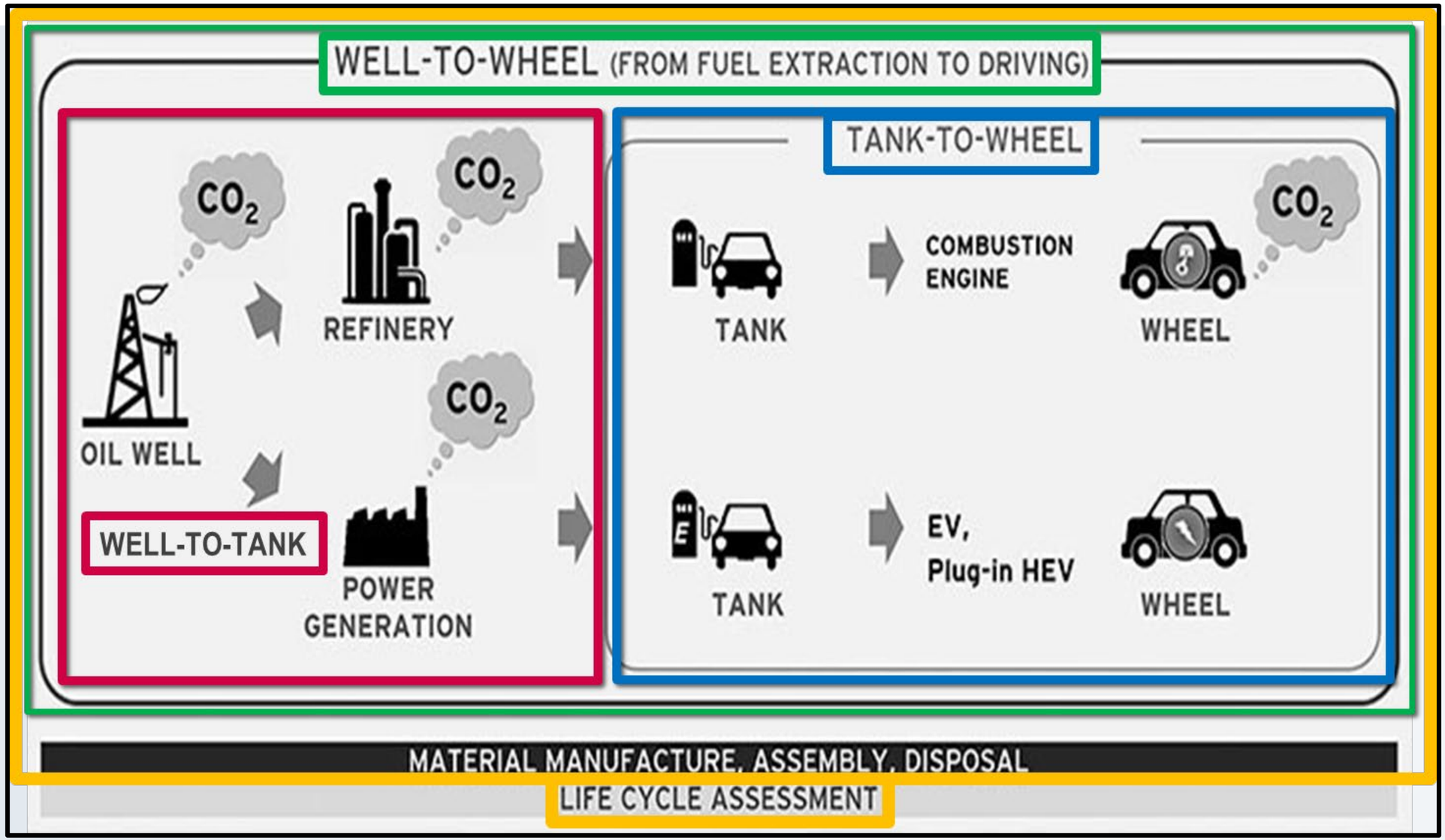
- CO_2 MEASURED BY VECTO SW BASED ON WHTC RESULTS, FUEL CONSUMPTION VALUES FROM ENGINE MAP AS WELL AS REAL DRIVE MEASUREMENTS

IN BOTH CASES, ONLY WHAT HAPPENS DURING THE VEHICLE'S USE IS CONSIDERED → TANK-TO-WHEEL APPROACH

FPT
POWERTRAIN TECHNOLOGIES

LIFE CYCLE ASSESSMENT METHODOLOGY

- TANK-TO-WHEEL IS JUST A PART OF THE PICTURE AND IT IS BIASED AGAINST ICES
- WELL-TO-WHEEL IS A MORE COMPREHENSIVE APPROACH
- LIFE CYCLE ASSESSMENT (ANALYSIS) IS THE CORRECT TOOL TO COMPARE DIFFERENT POWERTRAIN SOLUTIONS



FPT POWERTRAIN TECHNOLOGIES

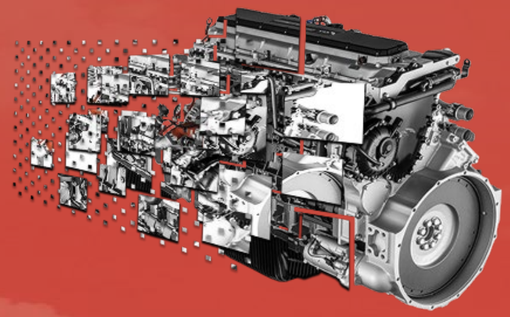
ONE CHALLENGE, SEVERAL SOLUTIONS

SUSTAINING LEADERSHIP IN DIESEL AND GAS WHILE INVESTING INTO NEW ZERO-EMISSION SOLUTIONS

EXCELLING IN DIESEL & NATURAL GAS ENGINES

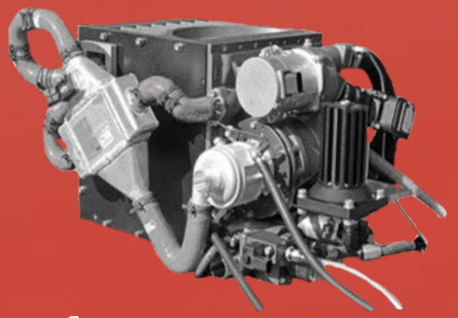
- INCREASE FUEL EFFICIENCY TO REDUCE CO_2

PIONEERING IN DISRUPTIVE TECH. INNOVATIONS



- CO_2 REDUCTION BY 30%

INTRODUCING ZERO-EMISSION PROPULSION SOLUTIONS



FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

- NO CO_2 EMISSION

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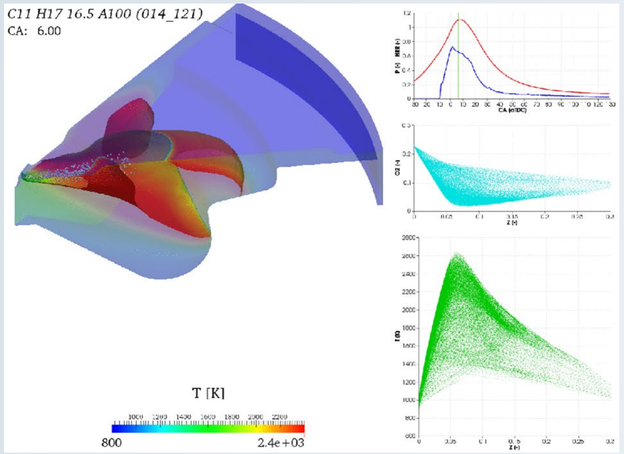
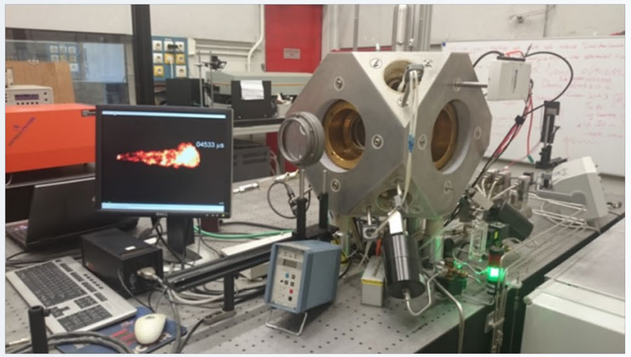
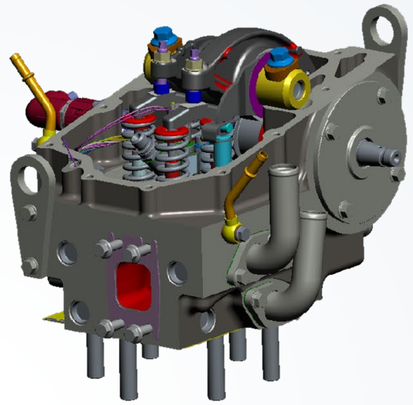
DIESEL AND NATURAL GAS ENGINES: FOCUS ON COMBUSTION







FPT is putting a strong focus on understanding of the combustion process

- Supporting fundamental research into combustion process
- Working with Universities and Research Centres to develop state-of-the-art simulation methodologies to optimize combustion chamber shape and air motion
- Use of single cylinder engine testing to investigate novel combustion regimes

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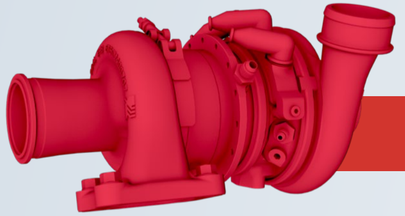
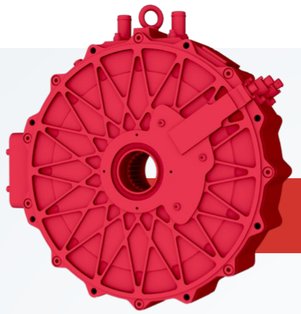
DIESEL AND NATURAL GAS ENGINES: MILD HYBRIDIZATION



E-TURBOCHARGER

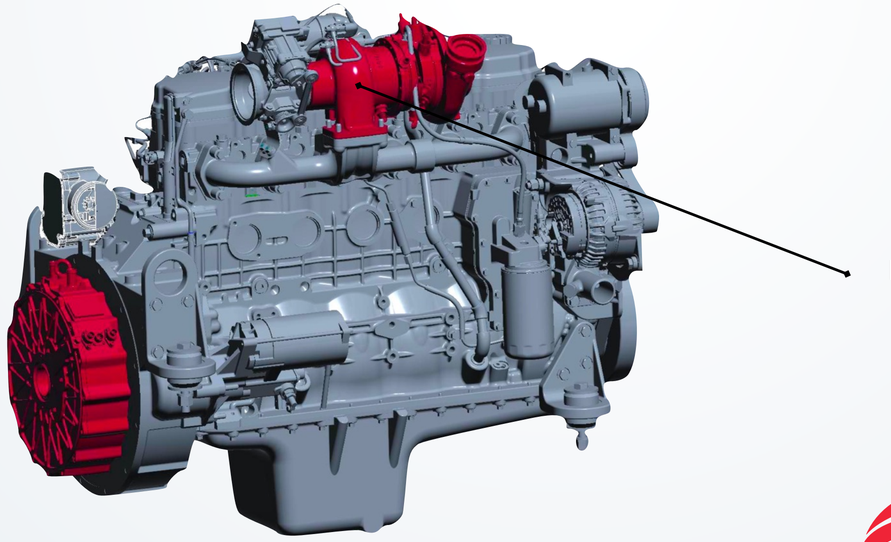
	Low Voltage	High Voltage
Max power	Up to 25kW peak, 17.5kW continuous	Rule of thumb: ~10% of engine power
Voltage	48V	400-800V
E-machine efficiency		97%



E-FLYWHEEL

	Low Voltage	High Voltage
Max power	Up to 20kW	Up to 80kW
Voltage	48V	400-800V
E-machine efficiency		≥ 95%

- E-TURBOCHARGER HARVESTS THERMAL ENERGY AND PRODUCES ELECTRICAL ENERGY WHICH IS FED BACK IN THE ENGINE VIA THE E-FLYWHEEL



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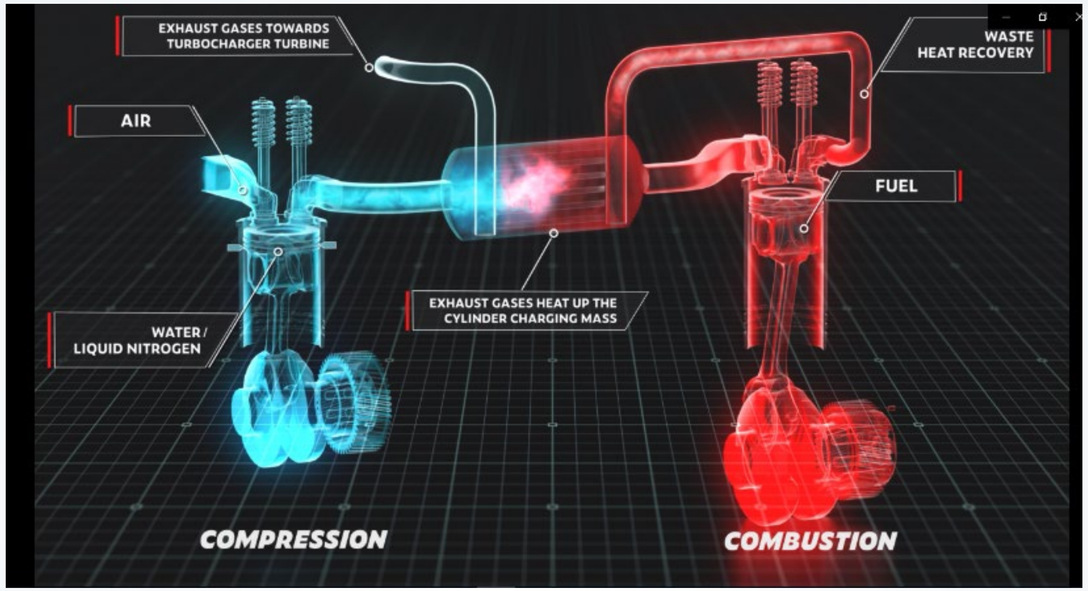
DISRUPTIVE ENGINE TECHNOLOGY

DOLPHIN N2



- FPT ACQUIRED DOLPHIN AT THE END OF 2019
- DOLPHIN: A SPIN-OUT COMPANY FROM RICARDO, SPECIALIZED IN AN INNOVATIVE INTERNAL COMBUSTION ENGINE TECHNOLOGY
- APPLIED ON ICES AS ALTERNATIVES TO FULL ELECTRIFICATION. ACHIEVE CO_2 TARGET WITH ZERO OR MINIMUM HYBRIDIZATION CONTENTS

FPT POWERTRAIN TECHNOLOGIES

ZERO- EMISSION PROPULSION SOLUTIONS

NIKOLA™

- CNH Industrial and Nikola formed a technological partnership in September 2019 to enable a faster introduction of heavy-duty battery-powered and fuel-cell powered vehicles
- Both vehicles will employ FPT's e-axle
- First BEVs will be delivered to key Customers in Q4/2021; FCVs will follow in 2023

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ZERO- EMISSION PROPULSION SOLUTIONS

- FPT and Microvast formed a technological partnership in November 2019
- This partnership will enable FPT to design and assembly in-house high-voltage battery packs
- Insource the battery production

- FPT acquired Potenza in March 2020
- Potenza: A UK company specialized in the design and development of electric and hybrid electric powertrain systems
- Insource e-PWT hardware production (e-Motors and Power electronic) and software development (Battery Management System).

BIOFUELS: 1ST AND 2ND GENERATION (AND FURTHER…)

Evolution pathway of biofuels

Type	Example	No competition with		
		Food	Land use*	Biomass**
1st generation: Conversion / use of sugar, starch and oil	■ Ethanol from sugar beet and wheat ■ FAME ■ HVO	✗	✗	✗
2nd generation: Conversion of cellulose	■ Biogas from corn straw ■ Diesel from wood	✓	✗	✗
2nd generation: Conversion of cellulose on basis of residual via algae / bacteria / yeast	■ Ethanol from straw ■ Diesel from straw ■ Diesel from residual wood	✓	✓	✗
3rd generation	■ E-Fuels ■ E-Gas ■ Ethanol	✓	✓	✓

- ALTERNATIVE FUELS MAY PLAY AN IMPORTANT ROLE IN REDUCING WTT EMISSIONS
- THEY ALSO ALLOW TO EXPLOIT EXISTING INFRASTRUCTURE FOR FUEL DISTRIBUTION AND EXISTING PRODUCTS (ENGINES/VEHICLES)
- ADVANCED ALTERNATIVE FUELS (2ND GENERATION BIOFUELS, E-FUELS) ARE SUPPORTED BY THE EU (RENEWABLE ENERGY DIRECTIVE)

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WHY NATURAL GAS?

- NG ENGINES FOR HDV HAVE BEEN ON THE MARKET FOR THE PAST 20 YEARS
- THE PERFORMANCE AND DURABILITY OF NG ENGINES AND VEHICLES ARE COMPARABLE TO DIESEL COUNTERPARTS
- THE DISTRIBUTION NETWORK IS WIDESPREAD AND IT IS GROWING
- NG IS CONSIDERED BY THE EU A STRATEGIC FUEL TO REDUCE DEPENDENCE ON OIL

- NG CAN BE OBTAINED FROM RENEWABLE SOURCES (AGRICULTURAL WASTE, LANDFILLS)
  NOT IN COMPETITION WITH FOOD
- CO_2 REDUCTION CAN EXCEED 100% WHEN BIOMETHANE IS PRODUCED FROM PARTICULAR SOURCES (E.G. WET MANURE)

BIOMETHANE FOR TRANSPORT*			
Biomethane production system	**Technological options**	**Typical greenhouse gas emission savings**	**Default greenhouse gas emission savings**
Wet manure	Open digestate, no off-gas combustion	117%	72%
	Open digestate, off-gas combustion	133%	94%
	Close digestate, no off-gas combustion	190%	179%
	Close digestate, off-gas combustion	206%	202%

Source: RENEWABLE ENERGY DIRECTIVE

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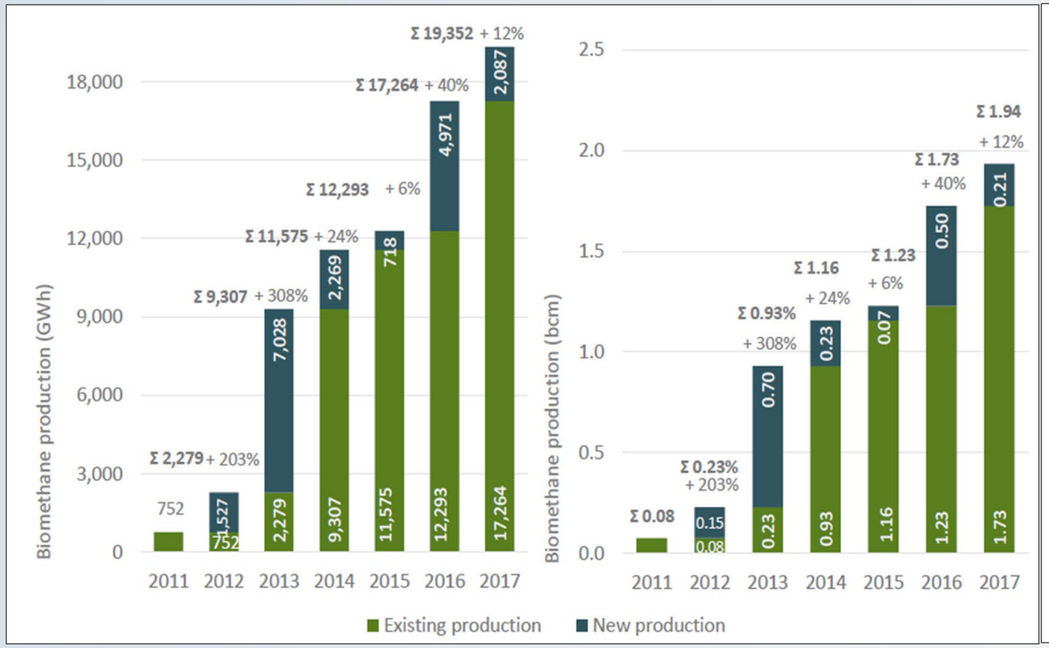
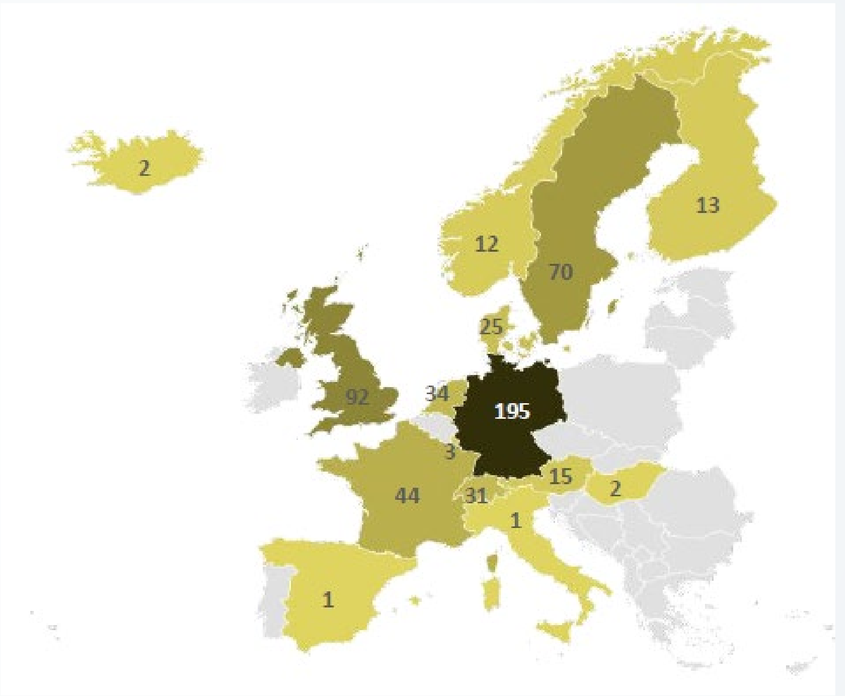
BIOMETHANE: A GROWING RESOURCE





- THE QUANTITY OF BIOMETHANE PRODUCED IN THE EU HAS GROWN BY NEARLY 2500% BETWEEN 2011 AND 2017 AND THE TREND IS ONGOING
- BIOMETHANE IS PRODUCED IN THE MAJORITY OF THE EU COUNTRIES

Source: EBA STATISTICAL REPORT 2018

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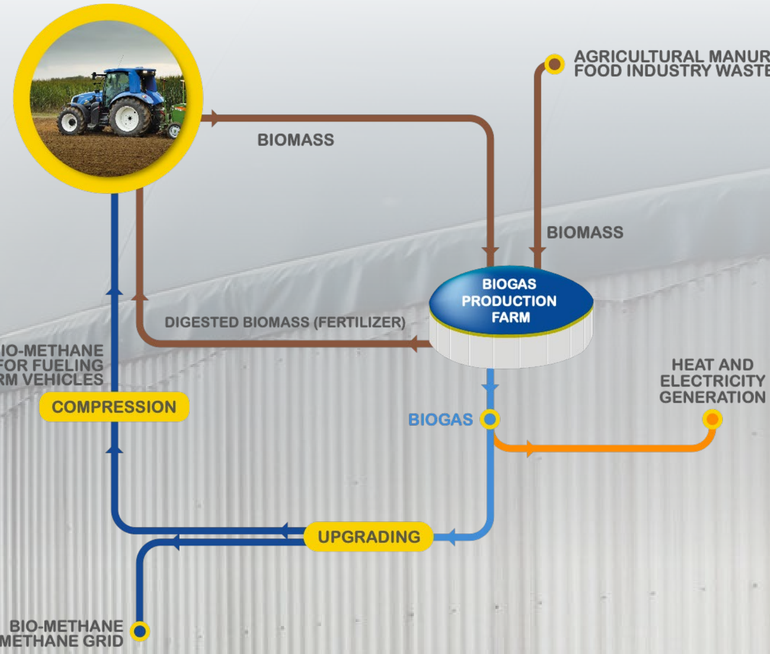
I HAVE A DREAM

ENERGY INDEPENDENT FARM

A CIRCULAR ECONOMY MAY BE ESTABLISHED, (ALMOST) CARBON NEUTRAL

- BIOGAS CAN BE USED AS IT IS FOR PRODUCTION OF ELECTRICAL ENERGY AND/OR HEAT
- BIOGAS CAN ALSO BE PURIFIED TO BECOME BIOMETHANE (METHANE > 95%)
- FPT NG ENGINES CAN RUN ON BIOMETHANE WITHOUT ANY MODIFICATIONS



METHANE POWER

FPT POWERTRAIN TECHNOLOGIES

CONCLUSIONS

- There is not only one way or technology to go to reduce CO_2 emissions. **Diversification is necessary to match applications and missions**
- Increasing efficiency of internal combustion engines, both traditional and with disruptive technology, is one of the solutions, in particular for long haul heavy transport
- Electrification: the process is here and it is gaining momentum though many hurdles are still on the way
- Renewable fuels (diesel fuel, natural gas) are an efficient way to strongly reduce WtW emissions and remove further CO_2 introduction
- FPT Industrial is working to have a portfolio ready to meet each of our Customer's needs in the next decade

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THANK YOU FOR YOUR ATTENTION!

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