Shell Global Solutions

ADVANCED & FUTURE FUELS IN MOTORSPORT

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GLOBAL TECHNOLOGY MANAGER RACING FUELS

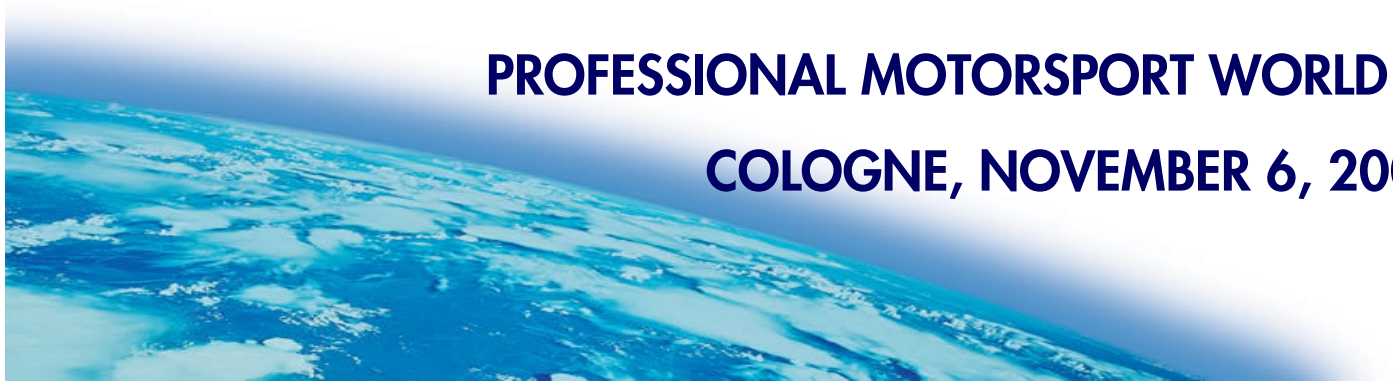
Shell Global Solutions Deutschland GmbH

Shell Global Solutions is a network of technology companies of the Shell Group

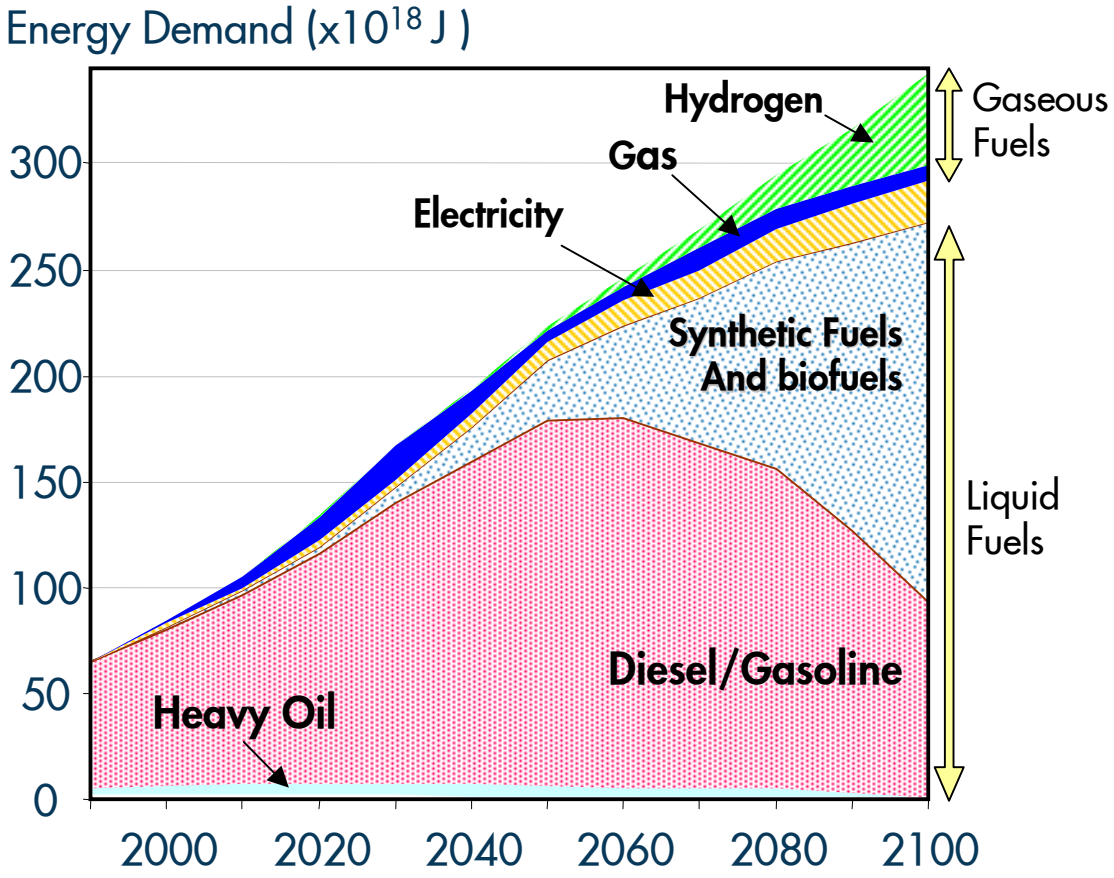
PERFORMANCE AND ENGINEERING FORUM

PROFESSIONAL MOTORSPORT WORLD EXPO 2007

COLOGNE, NOVEMBER 6, 2007



Forecast of automotive fuel demand



- Improved energy efficiency will be of prime importance
- Key selection criterion for alternative fuels ought to be cost effectiveness
- Bio Fuels are the only short term viable non-fossil fuel option
- Wealth of potential vehicle-fuel solutions
- Fossil fuels will dominate the market for the next decades
- Existing logistics for liquid fuels will benefit non-gaseous fuels

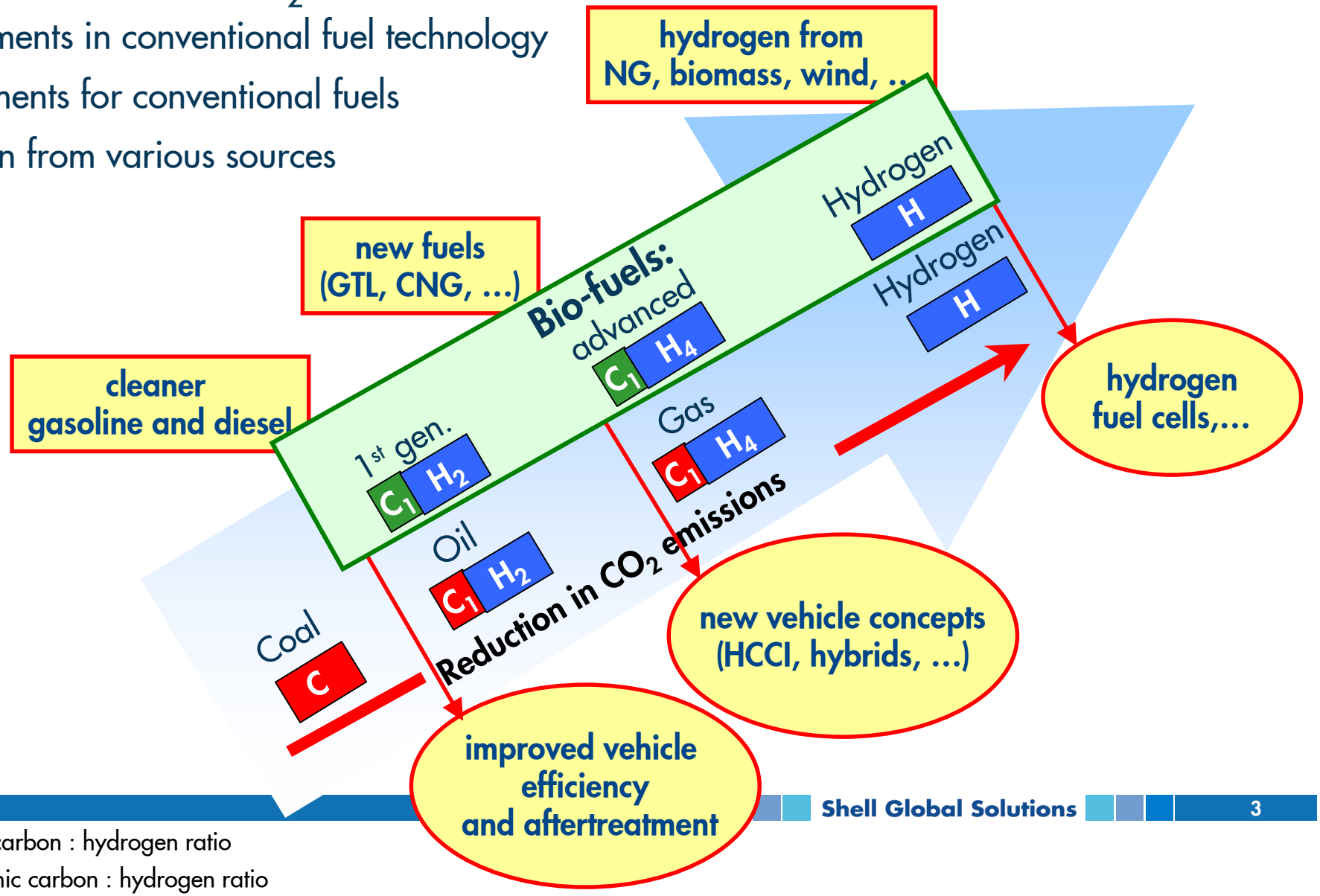
A future for new fuels - but fossil fuels still dominate

Source: WEC

Changes to automotive fuels are inevitable

"De-Carbonisation = CO_2 reduction to it's best"

1) Improvements in conventional fuel technology
2) Replacements for conventional fuels
3) Hydrogen from various sources



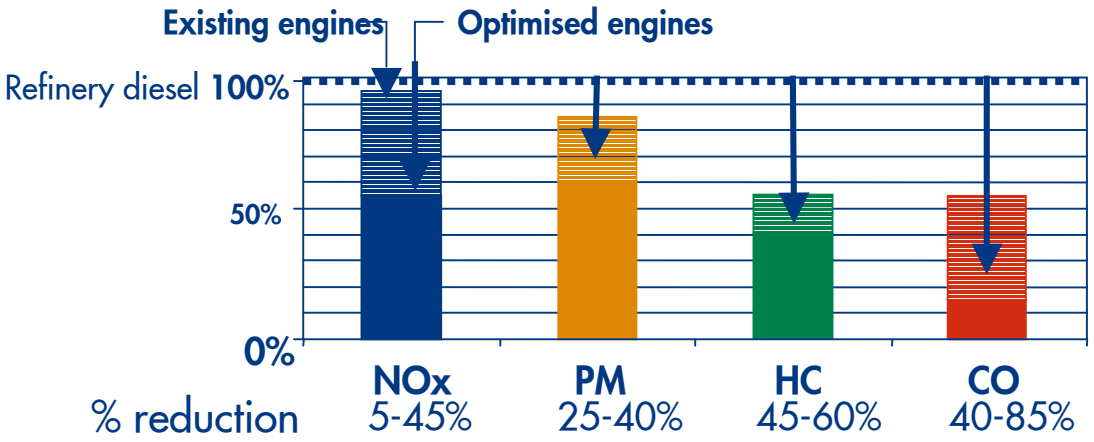
fossil carbon : hydrogen ratio

biogenic carbon : hydrogen ratio

GTL as an Option for More Oil Independency

- Cleaner-burning synthetic fuel made from natural gas
- Can be used in today's infrastructure and diesel vehicles
- Lower local emissions can help tackle air pollution in cities
- Lifecycle CO_2 from GTL system comparable with refinery system
- Identical products can be made from biomass (BTL) and coal (CTL)

Local emissions from GTL Fuel compared with conventional diesel

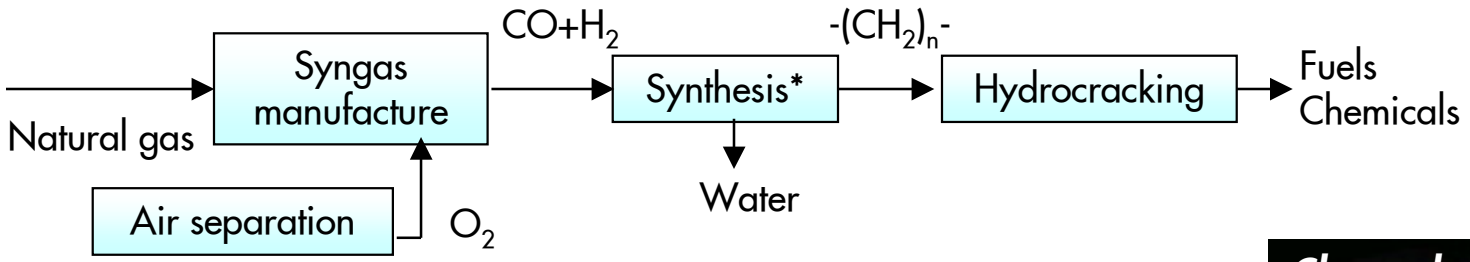


Source: ASFE

Emissions benefits vary depending on vehicle type and technology level
Emissions reductions for light duty diesel engines

Gas to Liquid (GTL) Fuels will play an important role in the future (mid & long term)

Simplified Process



Shell operates the worlds only commercial GTL plant of its type in Malaysia (operating since 1993)

GTL Fuels

Use Natural Gas feedstock to produce high quality products:

- Diesel, Kerosene, Base Oils & Chemicals

* Fischer-Tropsch Synthesis

Drivers for GTL Fuel - status

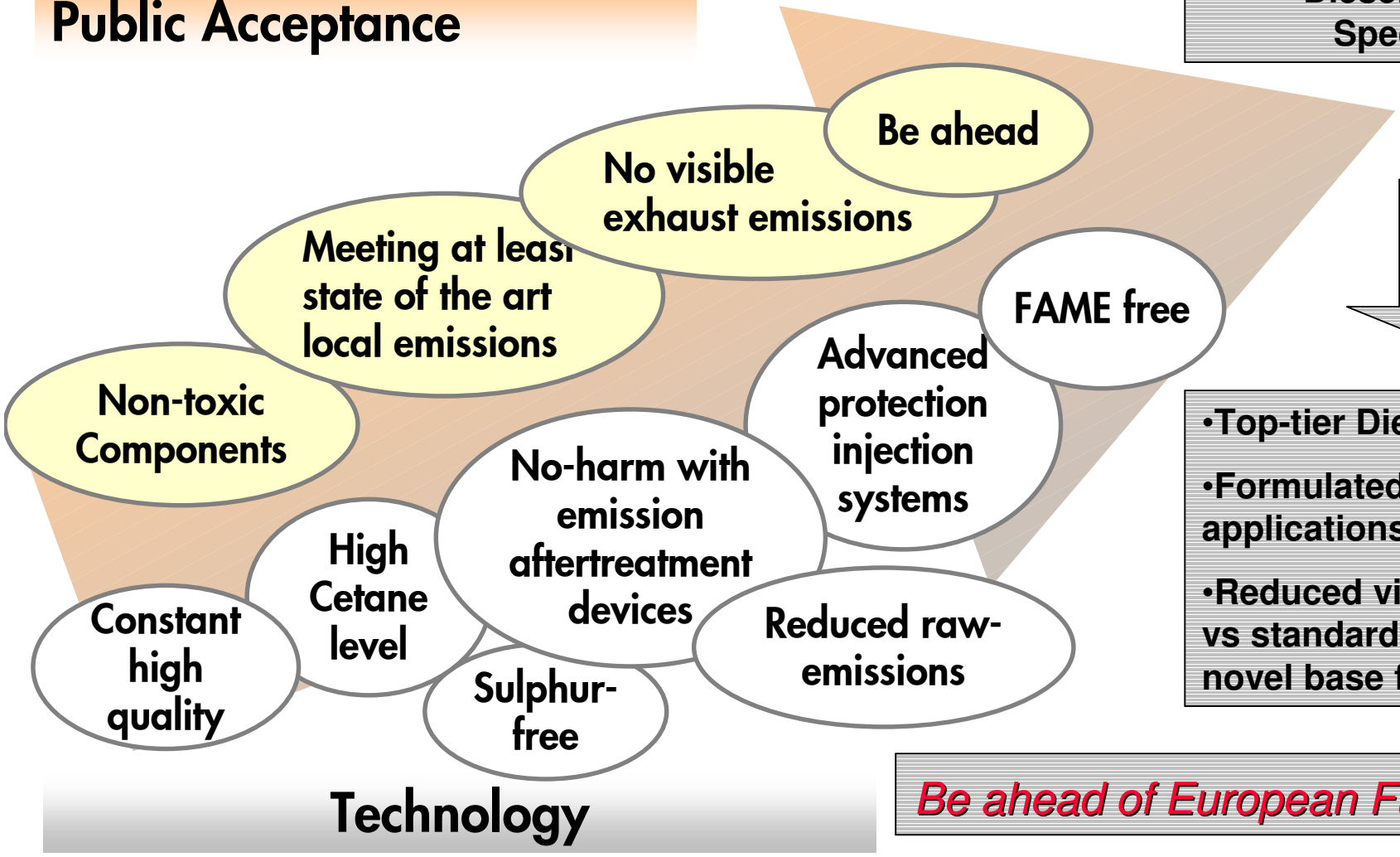
- GTL Fuels are marketed by Shell in V-Power Diesel
- In many markets a separate diesel distribution channel is required to accommodate specialised base fuel and additives

Shell V-Power Diesel

GTL Fuel is colourless, odourless, virtually free of sulphur and aromatics and has a high cetane number
GTL offers reduced local emissions and can be used in existing vehicles and distribution system

Drivers for an advanced Racing Diesel Fuel

Public Acceptance



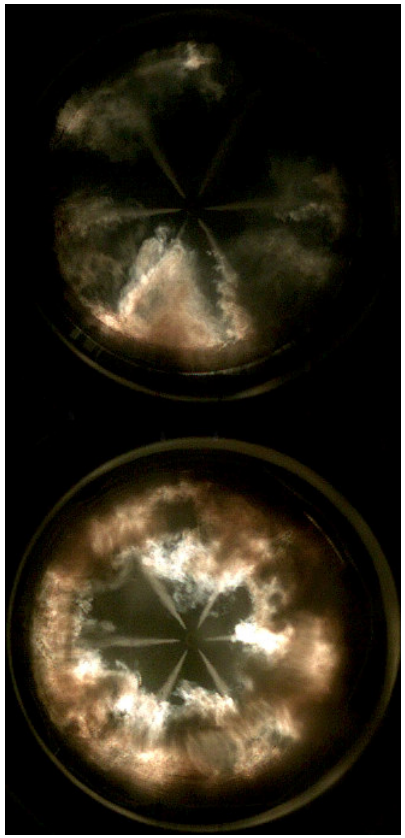
Technology

Diesel Race Fuel Specification

- Top-tier Diesel Fuel basis
- Formulated for motorsport applications
- Reduced visible emissions vs standard Diesel (using novel base fuels)

Be ahead of European Fuel Directives!

Fuel technology for performance diesel engines



POWER

- High fuel energy content
- Good driveability & smooth acceleration

EMISSIONS

- Reduced raw emissions
- 100 % control of engine out emissions
- Ideal conditions for after treatment devices
- Approval from after treatment suppliers

FUEL EFFICIENCY

- Enhanced combustion
- Ideal balance power / fuel consumption

RELIABILITY & DURABILITY

- Cleanliness of diesel injection system
- Advanced protection of diesel injection system
- Approval from injection system suppliers

24 Heures du Mans –18th June 2006

Motorsport history was made!

Shell V-Power Diesel fuel technology powered the Audi R10 TDI of Frank Biela, Marco Werner & Emanuele Pirro took a stunning victory by 4 laps….

- New **distance record** for the current circuit layout
- **380 laps** record in the 24 hours
- Equivalent of 5,187 km; almost the **entire distance of a Formula 1 season**
- Winning car's average speed was **over 215 kph**

Introduction to biofuels

- Made from biomass – plant matter or organic waste
- Generally produce less CO_2 over life-cycle compared to gasoline/diesel
- Vary by feedstock, manufacturing process, CO_2 production and cost
- Can be used in today's vehicles at low concentration blends with petrol/diesel
- Higher concentrations typically require modified vehicles
- Can contribute to increased energy security and economic development

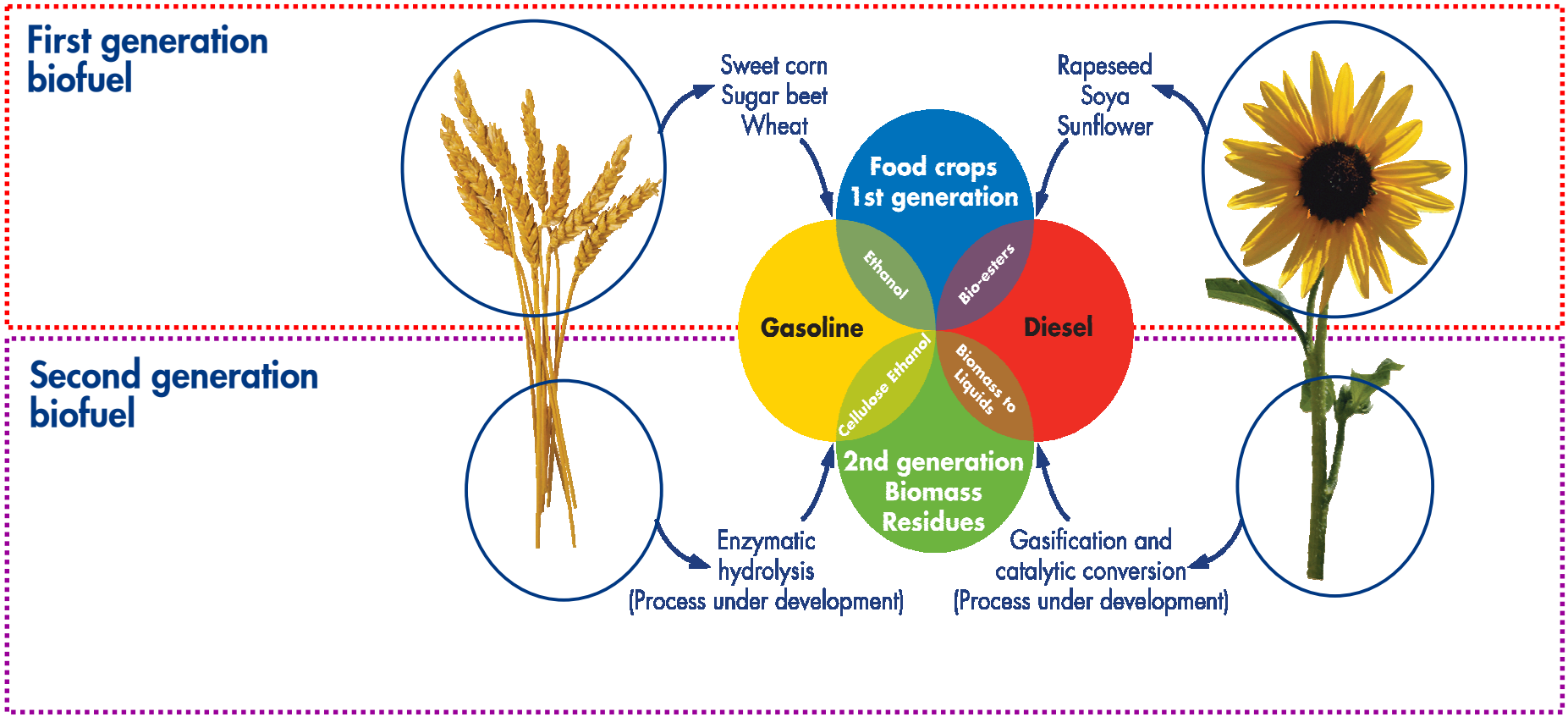
First generation biofuels
made from food crops
e.g. rapeseed, soyabeans

Second generation biofuels
made from agriculture /forestry residues e.g. straw, woodchips

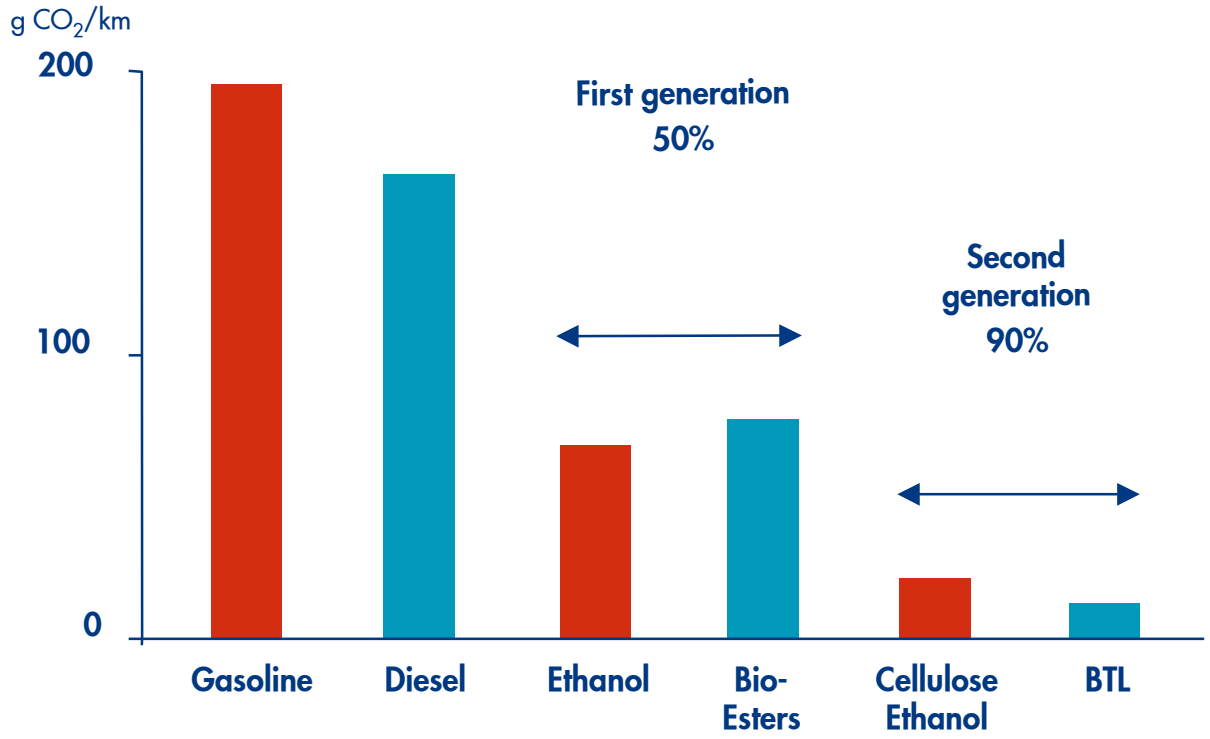
Challenges / limitations:

- Lower energy density
- Typically more expensive
- Sustainability issues (first generation biofuels)

Shell has invested in leading biotechnology companies to help commercialise second generation biofuels



Second generation biofuels offer significant reductions in W2W CO_2 production

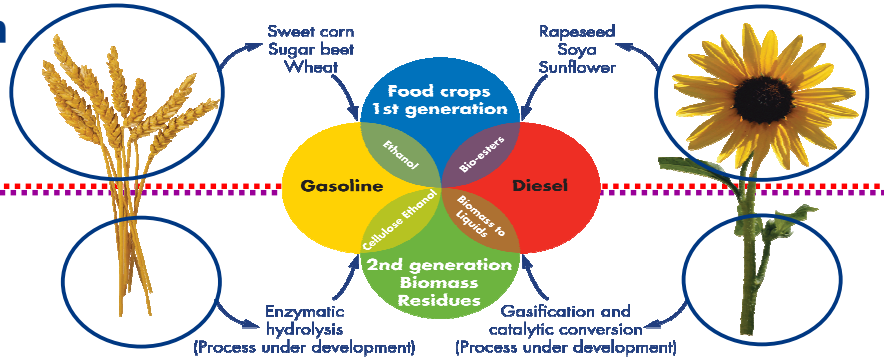


Source: EUCAR/CONCAWE/ JRC Well to Wheels Study, 2006

Biofuels

First generation biofuel

Second generation biofuel



Potential benefits of second gen. biofuels:

- Greater CO_2 reductions (~90%)
- Improved performance
- Lower costs
- More acceptable feedstocks (non food)

…however not available in large scale commercial quantities for 5-10 years.

Ethanol 2nd Generation

Iogen use non-food biomass to produce ethanol for blending into conventional gasoline to reduce CO_2 emissions.

IOGEN® CORPORATION

Simplified Process

- hemi-cellulose
- cellulose
- lignin

Pre-treatment → Hydrolysis → C5+C6 sugars

Enzyme production → Enzymes

Lignin → Steam generation

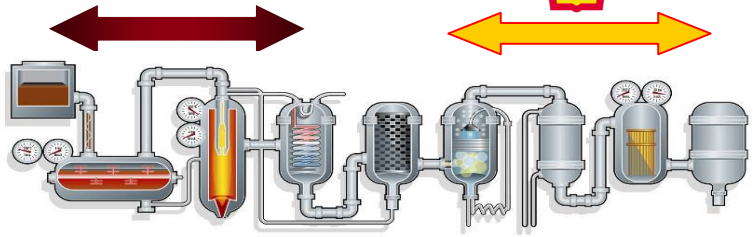
Standard bio-ethanol production steps

Bio Mass to Liquid (BTL) as 2nd Generation

Shell is working with CHOREN to develop commercially available high quality bio-component for diesel using a Biomass to Liquid process.

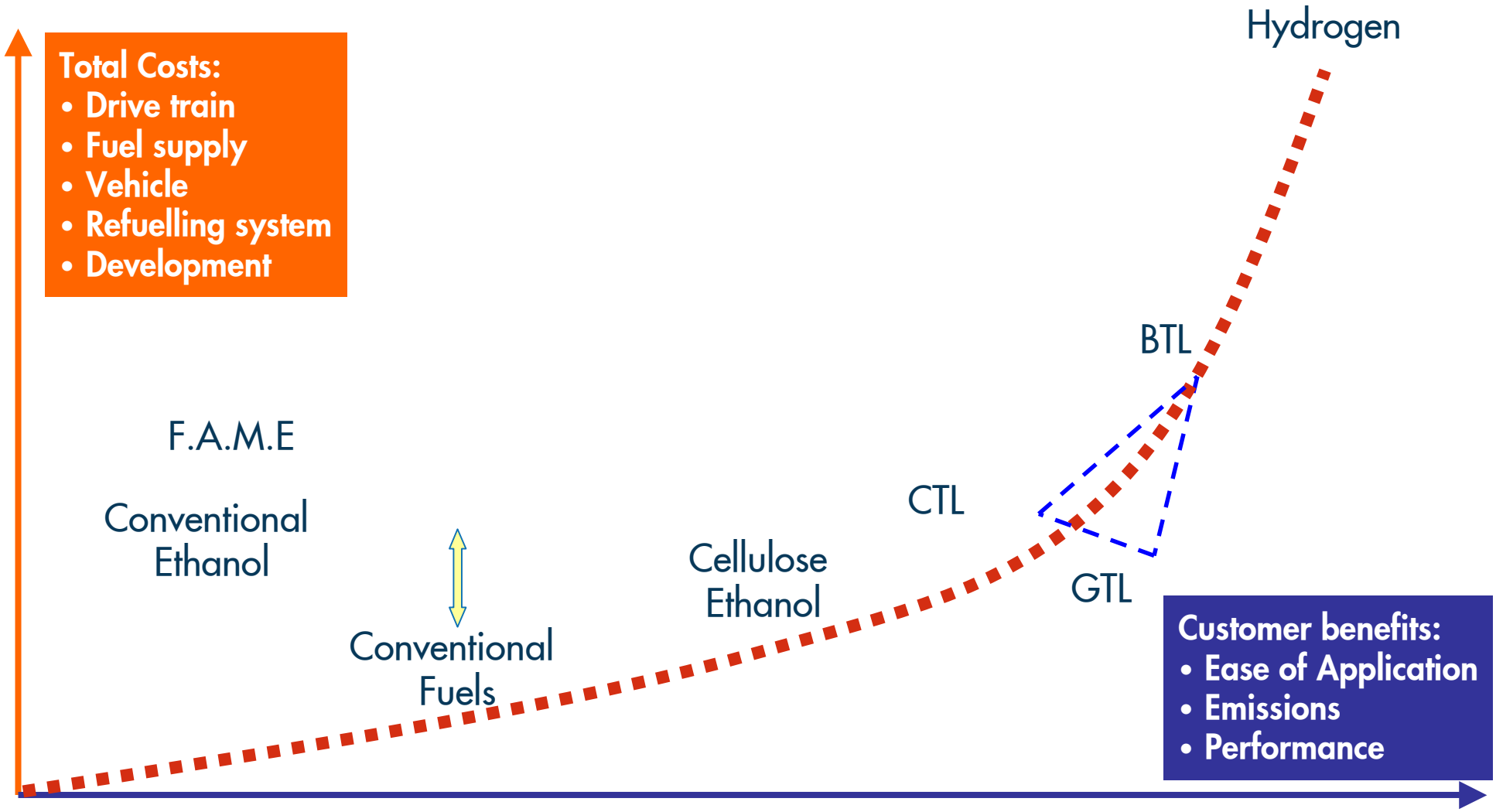
CHOREN INDUSTRIES

The Carbo-V® BTL Process



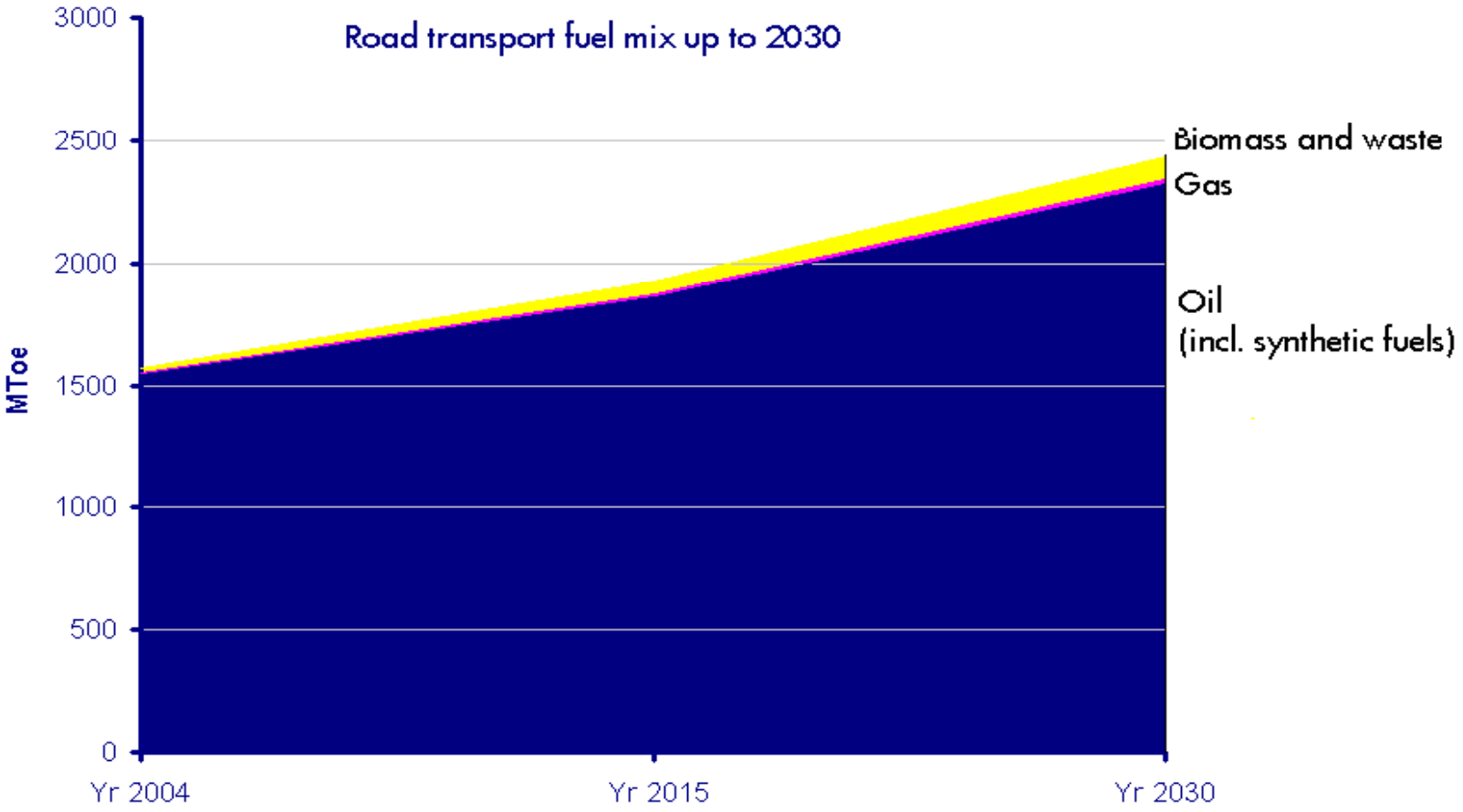
3 phase gasification | Gas Treatment | F-T Synthesis hydrocracking

Alternative fuel – current assessment of costs & benefits



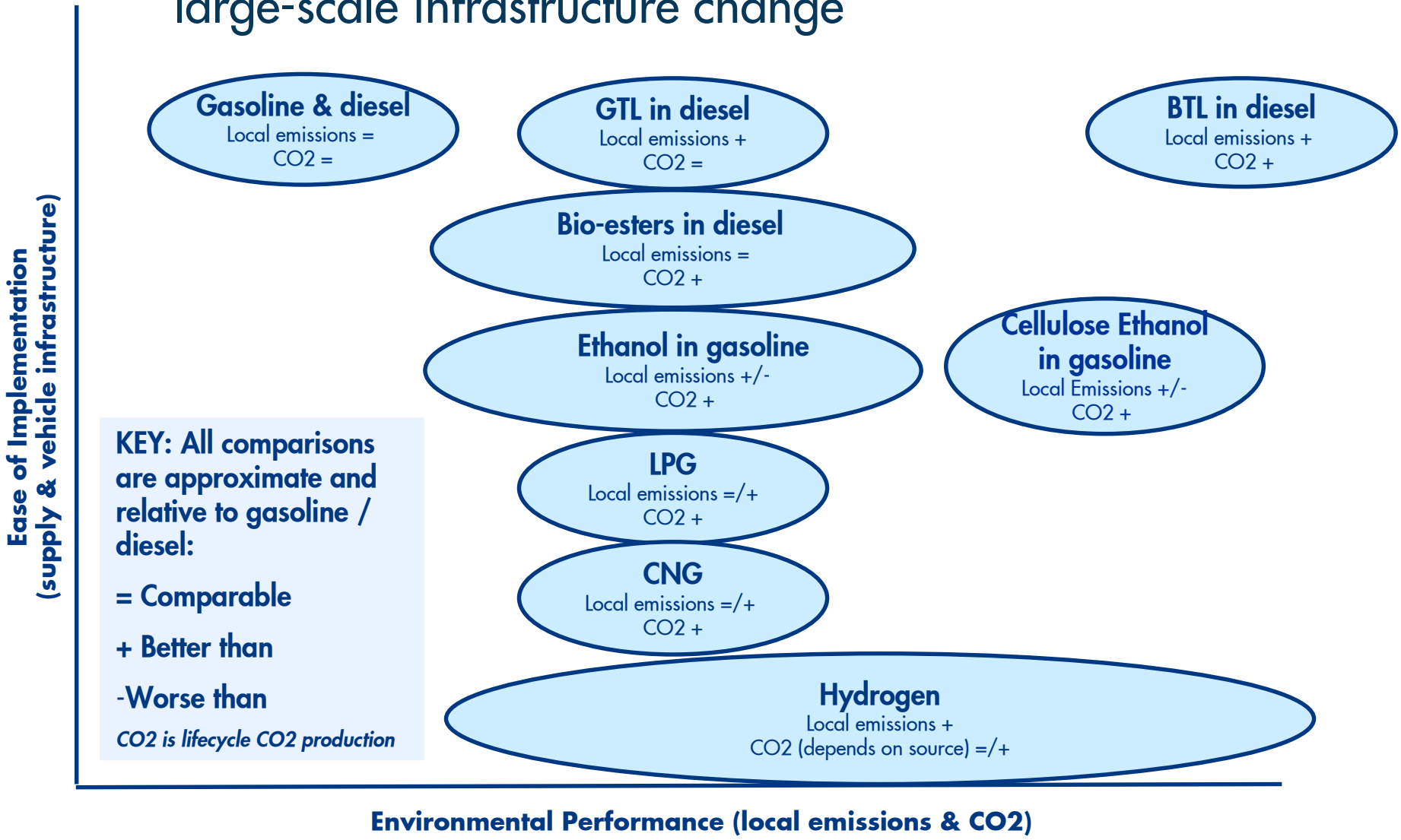
Biofuels – the solution?

Biofuels are expected to play an increasing role in the fuel mix



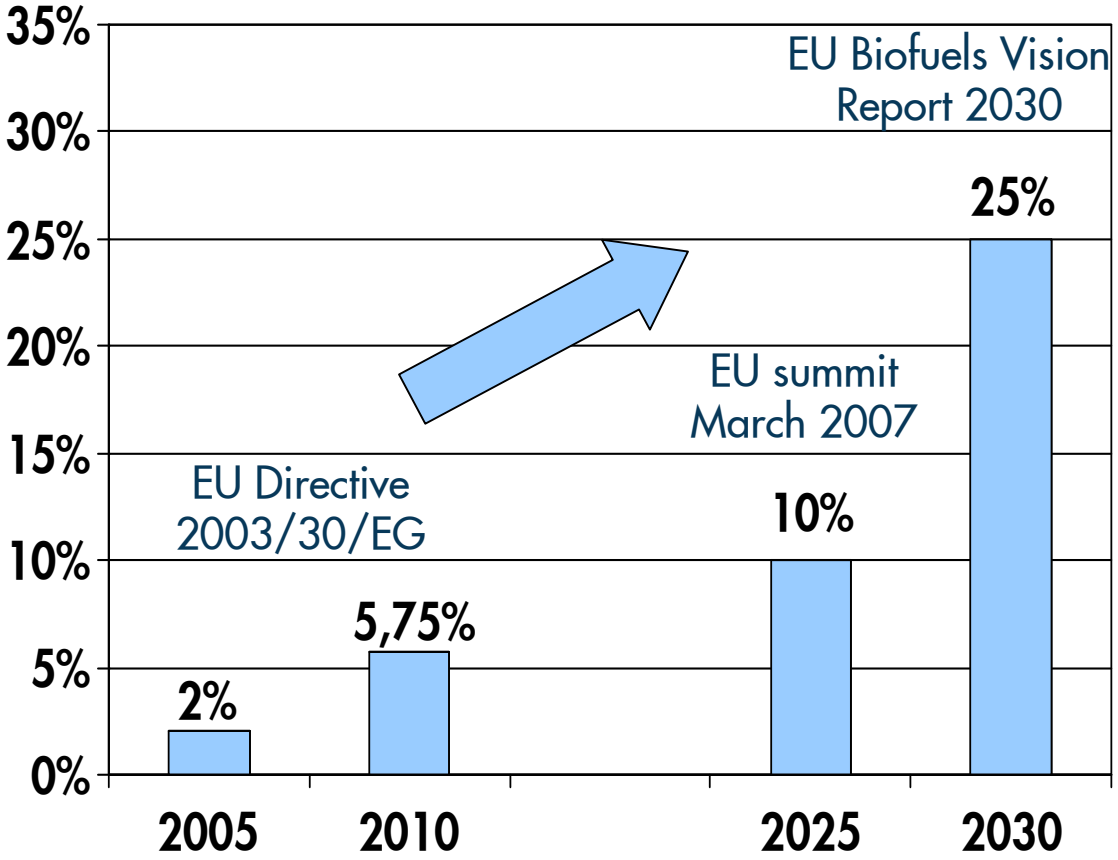
Source: International Energy Agency, 2006

Biofuels can offer environmental benefits without large-scale infrastructure change



EU-25 Biofuel Targets and Implications

Biofuel Share in Transport



- Strong growth required
- Need for high quality biofuels for easy implementation in existing fleets
- Need for use of wide range of bio feedstocks

Source: European Commission

Summary

- Conventional fuels from crude oil will further dominate over the next 20 years
- CO2 reduction, emissions, sustainability and energy efficiency, are the core drivers for future fuels, also for racing fuels
- Diesel racing will further grow, as providing a significant contribution to energy efficient racing
- GTL has a major role to demonstrate synthetic fuel benefits and acts as a bridge to advanced bio components as BTL
- Advanced bio-components incorporated in racing fuels can demonstrate technical opportunities and trends
- Shell is investing in technologies and partnerships and is a leader in future fuel technology, backed up by our technical cooperation in Motorsport.
- What we learn on the track is used to improve and create new fuels for the road to the benefit of the 20 mln+ drivers every day who fill up at Shell