Liquid fuels perspective on ultra low carbon vehicles

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The evolving global energy market

Population forecast:
- 9 bn people by 2050
- 20–64 age group (5bn) - accounts for ~95% of motorisation
- Income inequality in the developing world limits vehicle ownership levels
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**Vehicle parc** forecast:
- By region, with India & China broken out
- Vehicle parc doubles by 2050
- China and India account for ~30% of global vehicle parc in 2050
What are the challenges for fuels?

Three key drivers of sustainable mobility solutions

- Air quality – particularly in developing markets
- Energy diversification and supply security
- Climate change

Economics & customer preference set the pathway
The importance of liquid fuels and efficiency

Liquid fuels are hard to beat…
The importance of liquid fuels and efficiency

Liquid fuels are hard to beat...

...and engine efficiency & alternatives play a significant role

Energy Density of Storage

Transportation Energy demand in 2050

Current Demand

Potential Rise in Demand by 2050

Efficiency

Substitution

Potential Hydrocarbon Demand in 2050

Energy density by mass (MJ/kg)

Energy density by volume (MJ/L)
The four technology race...

- 1) Reduced WTW CO₂ through advanced engine technology
The four technology race...

2) Reduced WTW CO₂ through hybrid technology

Based on a medium size car example
3) Reduced WTW CO₂ through BEV technology (incl. power generation source)

Based on a medium size car example, BEV Battery costs assumed at €300/kWh
The four technology race...

- 4) Reduced WTW CO₂ through application of biofuels

Biofuels from a sustainable, low carbon source such as switchgrass could offer similar WTW CO₂ reduction as BEVs from a decarbonised grid.
Where are we today…?

WTW CO₂ per km (g)

Purchase Cost above Conventional Gasoline Option (Euros/Dollars)

- Oil
- Gas
- Nuclear, Hydro/Wind/Sol, Fossil/CCS

Battery Electric Vehicles—Electricity from Coal

E85

Sustainable Low Carbon Biofuels — E85

Increasing Vehicle Efficiency [ICE & Hybridisation]

Toyota 2010 Prius

Battery costs assumed at €300/kWh

Biofuel source: C=Corn, S=Sugarcane, M=Miscanthus
What is needed for fuels?

- Produced from domestic, renewable resources in high volume and reasonable cost.
- Use in existing vehicles and existing infrastructure.
- Offer good value to consumers.
- Meet the evolving demands of vehicles.
BP plays a role in all areas…

Oil + Gas + Wind + Solar + Biofuels
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Thank you