Green Propulsion A Technologies for a Greener Mobility

www.greenpropulsion.be

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The first car to overpass 100 km/h is Electric, driven by the Belgian Camille Jenatzy The first patent for an Hybrid Propulsion System was registered in Liège by Henri Pieper



Alternative fossil fuels (LPG, CNG)

- Adaptation to ICE
 - Great hopes from good fuel characteristics...
 - Low polluting emissions, low CO₂
 - ...but rare dedicated engines
 - Real CO, HC emissions of dual-fuel engines?
 - Poor efficiency, no significant CO₂ improvement
- Onboard CNG storage
 - High pressure for low range
- LPG, a side product to oil
- New natural gas sources
- Expected market share: high





Biofuels (ethanol, rapeseed,...)

- Ethanol for petrol ICE
 - E85 for race cars
 - Flexfuel mix for road vehicles: total freedom
- Rapeseed oil for Diesel ICE
 - Additional fuel pre-heating
- Onboard storage
 - Lower density, higher volume
- Developed countries:
 - Limited production capacity
 - Questionable CO₂ efficiency
- Major ethics issues in developing countries
- Expected market share: low





Electric drive

- Performing AC machines now available...
 Compact, liquid cooled: 13 kg for 85 kW
- ...and batteries demonstrate solid progress
 - Li-polymer: up to 250 km range
 - Working on safety, reliability and life
- Various types of electric powerplants
 - Real emissions?
 - What about nuclear wastes?
- Limited power for final user
 - Fast charge: around 1h
- Expected market share: low





Fuel cells

• PEM fuel cell $-H_2 + O_2 \rightarrow e^- + H_2O$





- Hydrogen production
 - Water electrolysis: electricity consumption
 - Natural gas reforming: CO₂ emissions
- Tough competition from these upstream energies
- Expected market share: very low



Autonomous full hybrids

- Micro, mild, full hybrids
- Downsized engine
 - Average needed power
 - Lower mechanical losses: higher efficiency
- Regenerative braking
- Fuel tanking only
- Fuel consumption
 - Lower in cities
 - Unchanged on highway
- Poor ZEV range
- Expected market share: high





Plug-in hybrids

- Combining the best of both worlds
 - Electric drive
 - No emission, silent in cities
 - Low cost main energy: night electricity
 - Thermal drive
 - Unlimited range
 - Performances
 - 0 to 100 km/h: 4,0s
 - CO2: <45 g/km
- Currently higher cost
- Expected market share: high



GP, an independent technology leader...



1998: Parallel plug-in hybrid moving lab



2002: Parallel plug-in hybrid (Volkswagen): 60 gCO₂/km



AutoMixte[®] 1.0 combined plug-in hybrid : 85g CO₂/km



Electric superkart: 0 to 100 km/h in 3.5 s



AutoMixte $^{\mbox{\tiny B}}$ 2.1 urban bus: -25 to -40% CO₂



Powerhybrid[®]: 100 kW petrol + 120 kW electric



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Creating a market for alternative technology

- Supranational authorities (ISO, Europe,...)
 - Implementing a "Well to Wheel" methodology
 - Define sustainable second-generation biofuels
 - Define realistic electric powerplants emissions
 - Define heavy duty testing methodology
- National authorities
 - Include social cost of emissions
 - From annual vehicle taxes to a fossil carbon tax /litre
 - Paving the way: buying cleaner vehicles today
- Local authorities
 - ZEV-only zones for inner cities or historic centres



Salvation by the technology only?

- ±30% CO₂ economy?
 - From 1400 kg 4-seater cars back to 1000 kg
 - From 4-seater down to 2-seater to transport 1 person
- ±50% CO₂ economy?
 Car pooling
- ±100% CO₂ economy?
 - Teleworking, videoconference
 - Suppress unnecessary meetings

