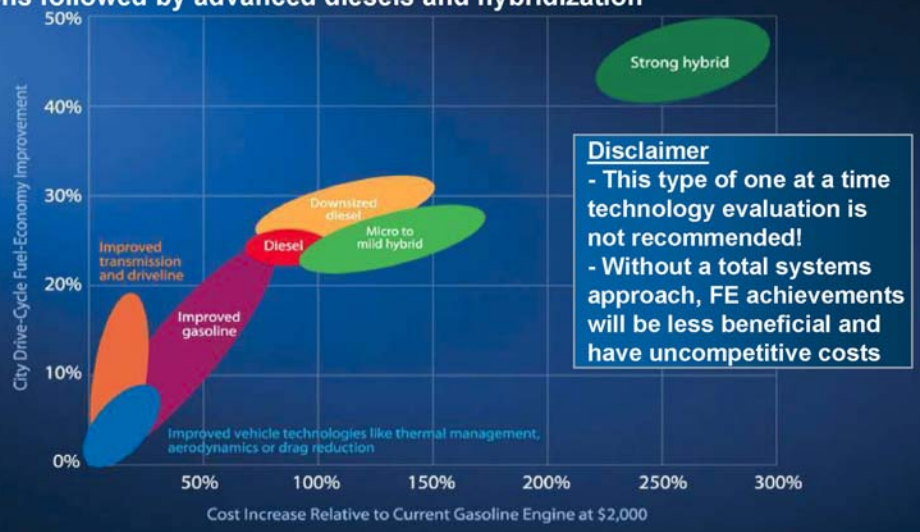
Appendix A

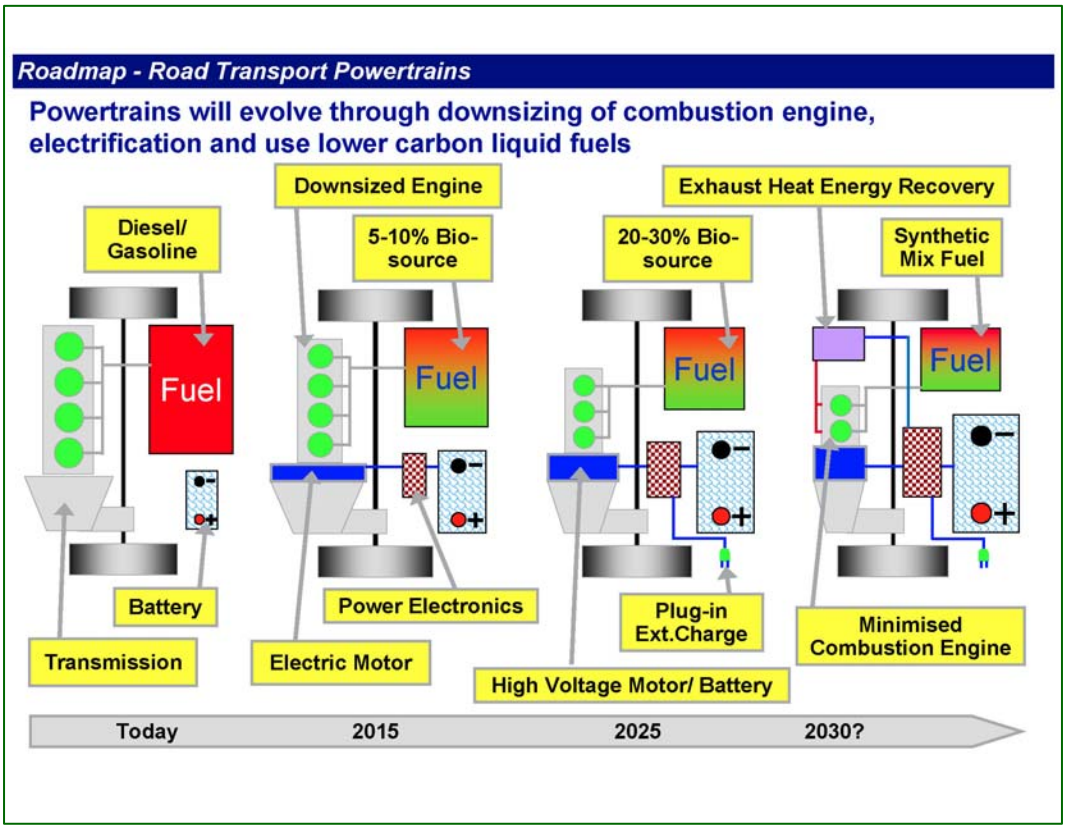
Vehicle Technology Roadmap

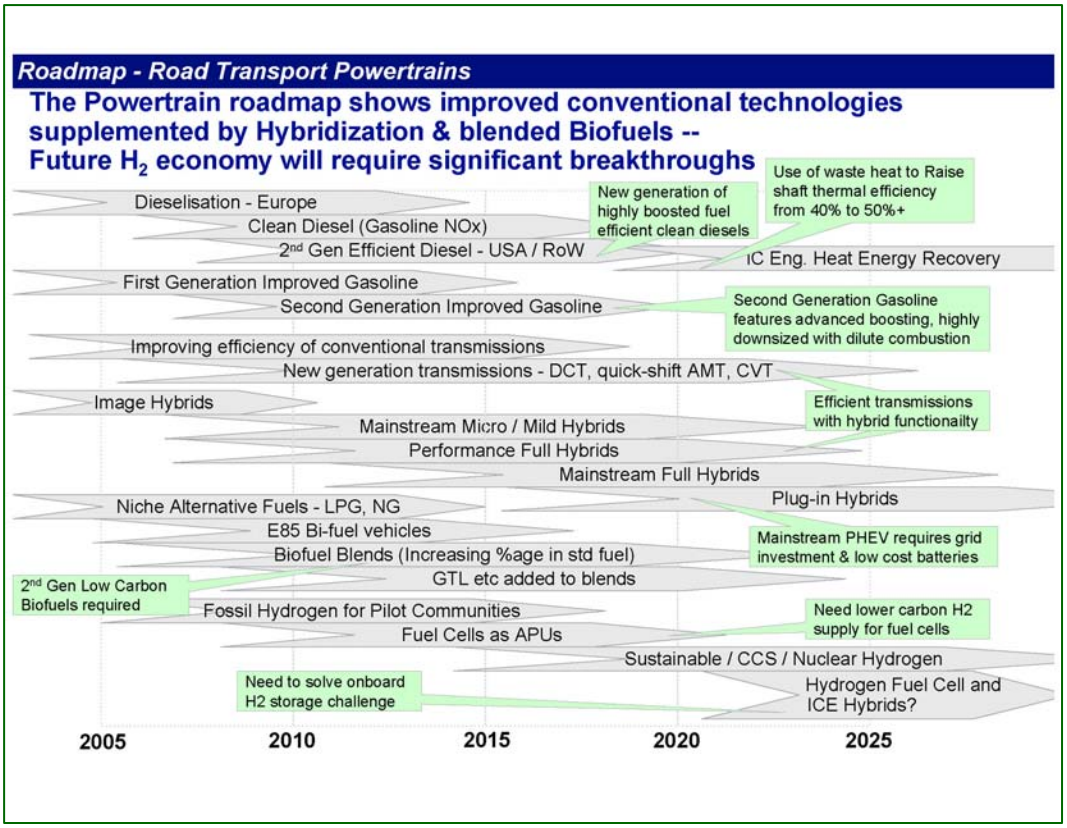
Source: Ricardo, Inc.

Cost / benefit analysis for fuel economy actions – shows a combination of improved efficiency vehicle system and powertrain actions followed by advanced diesels and hybridization



Disclaimer
- This type of one at a time technology evaluation is not recommended!
- Without a total systems approach, FE achievements will be less beneficial and have uncompetitive costs


Roadmap - Road Transport Powertrains
Powertrains will evolve through downsizing of combustion engine, electrification and use lower carbon liquid fuels
Downsized Engine
Exhaust Heat Energy Recovery
Diesel/ Gasoline
5-10% Bio-source
20-30% Bio-source
Synthetic Mix Fuel
Fuel
Fuel
Fuel
Fuel
Battery
Power Electronics
Plug-in Ext.Charge
Minimised Combustion Engine
Transmission
Electric Motor
High Voltage Motor/ Battery
Today
2015
2025
2030?


Roadmap - Road Transport Powertrains
The Powertrain roadmap shows improved conventional technologies supplemented by Hybridization & blended Biofuels -- Future H2 economy will require significant breakthroughs
Use of waste heat to Raise shaft thermal efficiency from 40% to 50%+
Dieselisation - Europe
New generation of highly boosted fuel efficient clean diesels
Clean Diesel (Gasoline NOx)
2nd Gen Efficient Diesel - USA / RoW
IC Eng. Heat Energy Recovery
First Generation Improved Gasoline
Second Generation Improved Gasoline
Second Generation Gasoline features advanced boosting, highly downsized with dilute combustion
Improving efficiency of conventional transmissions
New generation transmissions - DCT, quick-shift AMT, CVT
Image Hybrids
Efficient transmissions with hybrid functionailty
Mainstream Micro / Mild Hybrids
Performance Full Hybrids
Mainstream Full Hybrids
Plug-in Hybrids
Niche Alternative Fuels - LPG, NG
E85 Bi-fuel vehicles
Mainstream PHEV requires grid investment & low cost batteries
Biofuel Blends (Increasing %age in std fuel)
GTL etc added to blends
2nd Gen Low Carbon Biofuels required
Fossil Hydrogen for Pilot Communities
Need lower carbon H2 supply for fuel cells
Fuel Cells as APUs
Sustainable / CCS / Nuclear Hydrogen
Need to solve onboard H2 storage challenge
Hydrogen Fuel Cell and ICE Hybrids?
2005
2010
2015
2020
2025