Future Tendencies for Powertrain

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01_ Introduction

Mission: To assess innovative contributions for powertrain integration

01_ Introduction

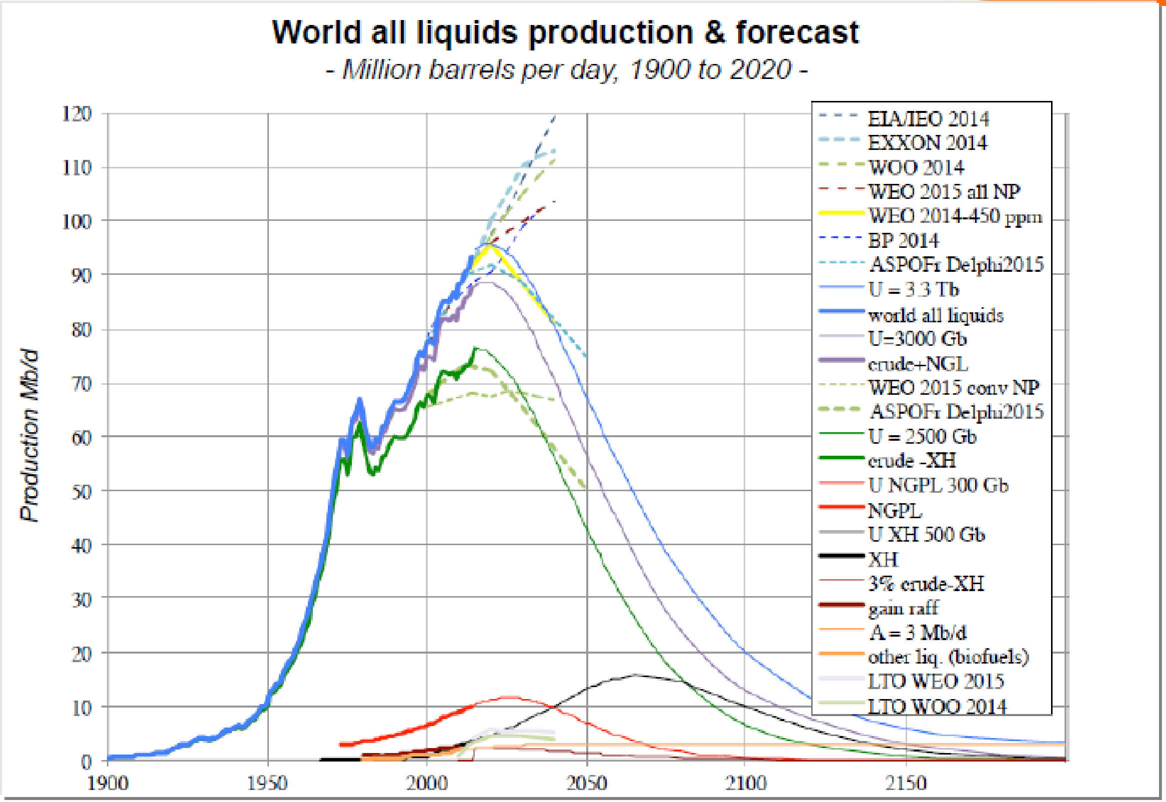
Vision: To contribute offering services for the next future, today

01_ Introduction

Sustanaible Vehicle assessment: to reduce ecological impact of transportation system

01_ Introduction

Oil dependence: Reducing it the 97% for transportation is critical. An oil availability constrain will be faced by 2020 following the lack of investment in oil Exploration & Production since the oil price collapse in 2014



Source: Jean Laherre, ASPO France, June 2016

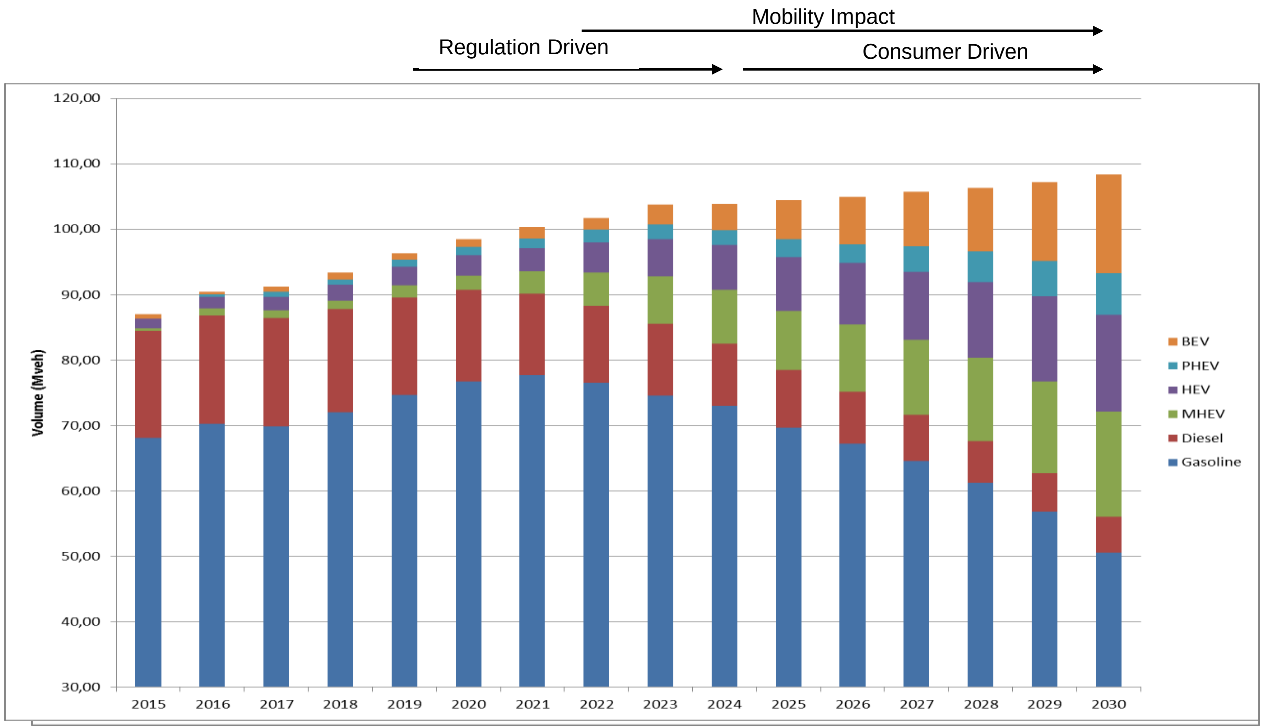
02_ Sustainable vehicle options

Concept phase:
Market positioning

2014: Before Diesel gate

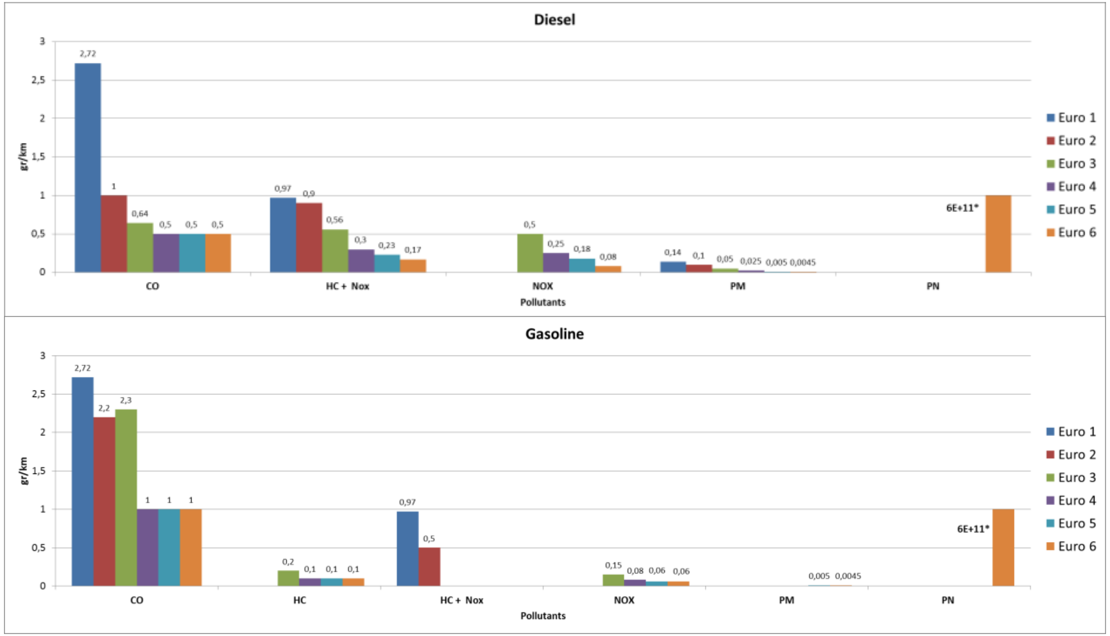
2015: After Diesel gate

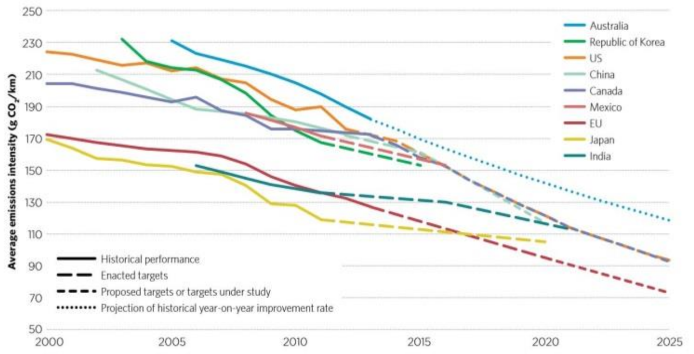
Boston Cons. Group
Market Forecast to 2030 (global view)



02_ Sustainable vehicle options

Concept phase:
Progressive stringent regulations

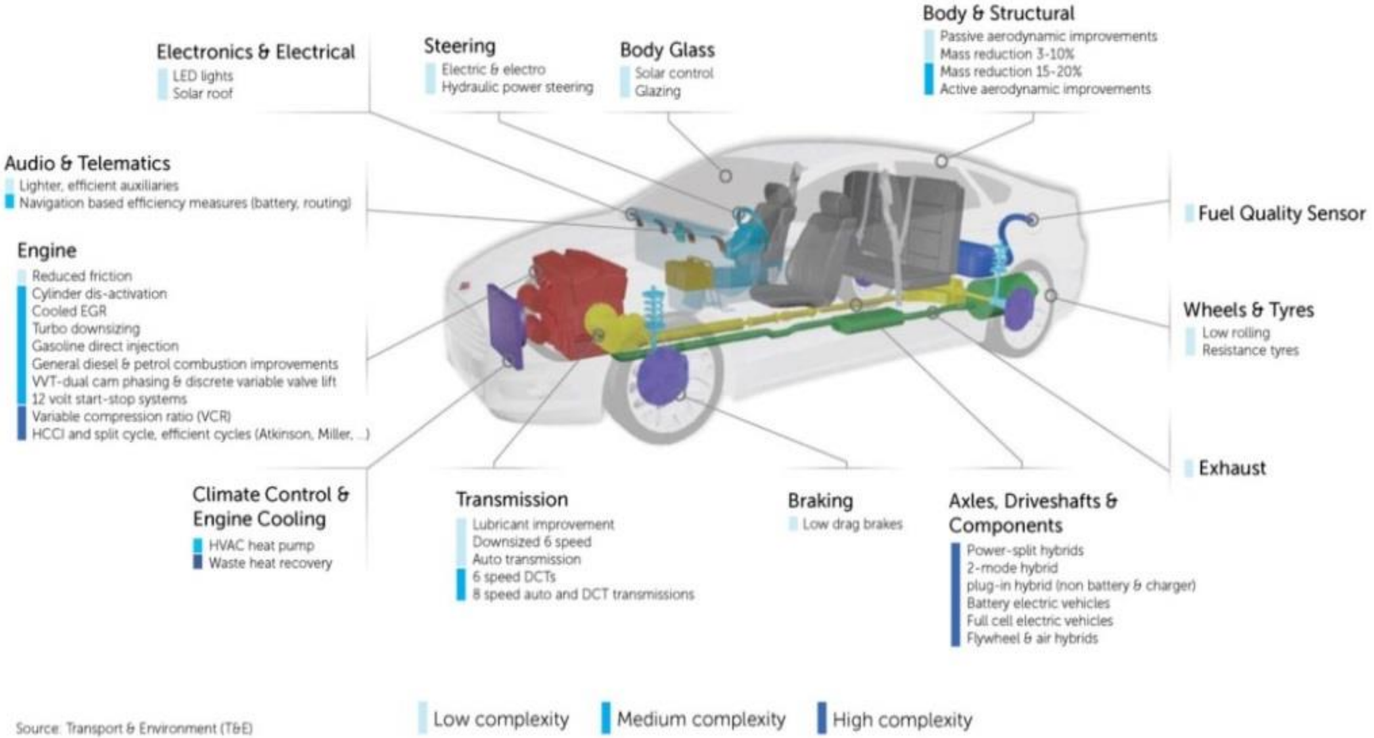




Note: CO_2 emissions and fuel economy for all standards normalised to European test cycle (NEDC). The coverage of 'passenger vehicles' differs by country; SUVs are included in the EU, Japan, Republic of Korea, China and India, and covered under 'light trucks' in North America and Mexico. The EU met its 2015 target in 2013, so the EU trajectory to its next target year (2020) is a straight line from actual 2013 new passenger vehicle emissions intensity to the 2020 target; Japan, which met its 2015 target in 2011, has a similar approach. EU 2025 target is a mid-point between proposed targets of between 68 and 78 g CO_2/km. The BAU projection for Australia is the rate of passenger vehicle improvement recorded from 2009-13 (3.5 per cent).
Source: Adapted from ICCT 2014 and, for Australia, NTC 2014

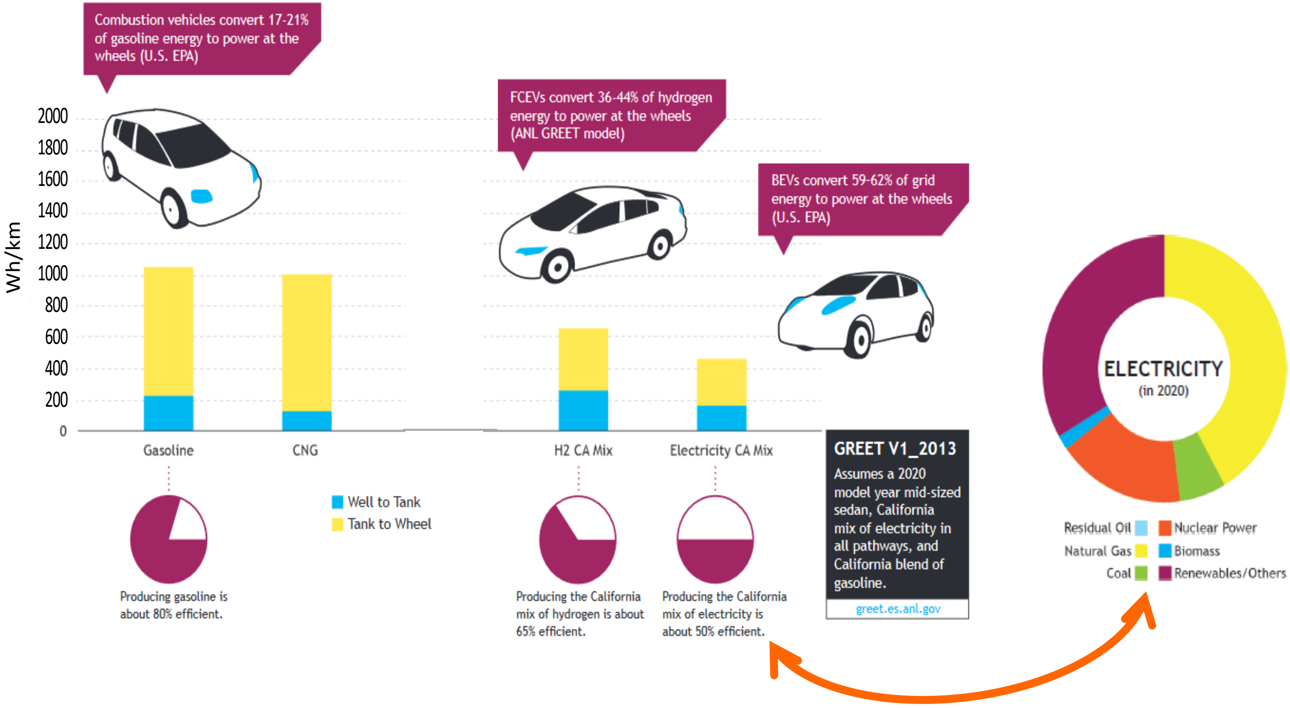
02_ Sustainable vehicle options

Concept phase: Possible improvements



02_ Sustainable vehicle options

W2W* includes all the inputs necessary to drive a vehicle

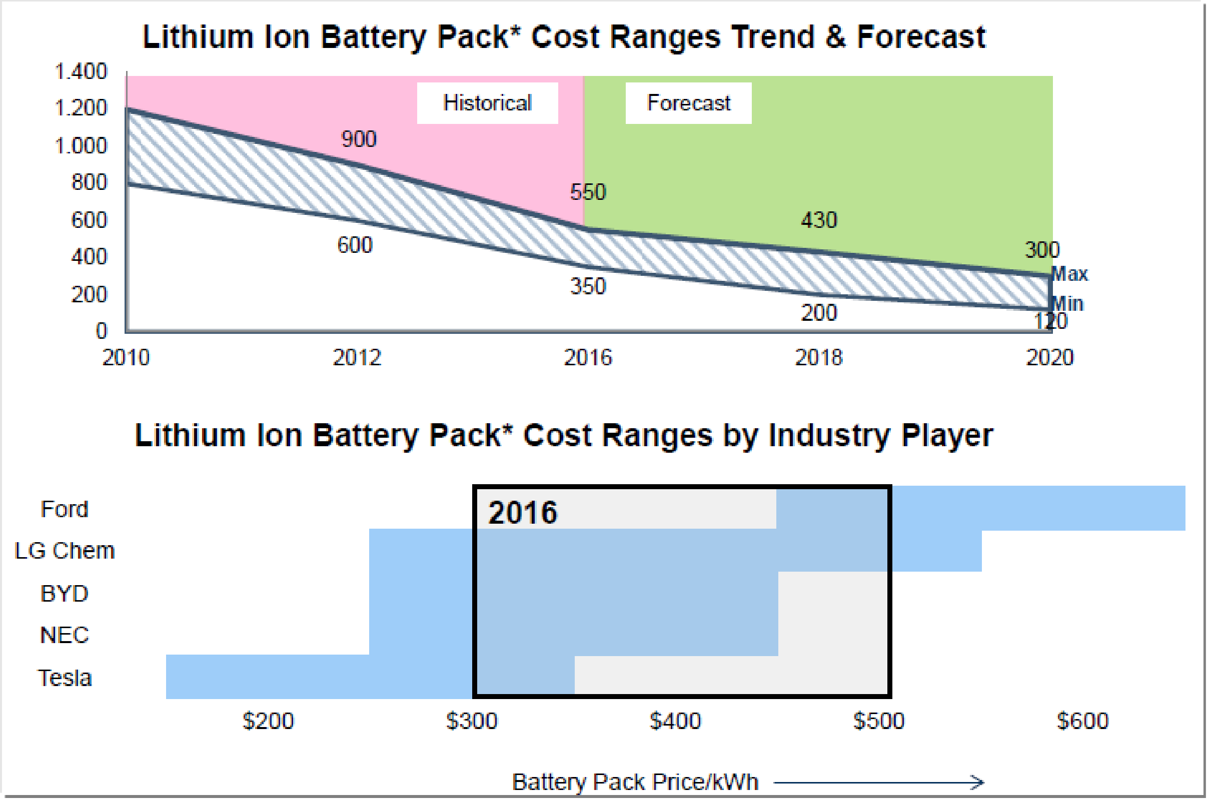


(*) Well to Wheel

Source: California, Fuel Cell Partnership (ARGONNE National Laboratory)

03_ Electrification and hybridization options

A reduction in battery production costs is expected with greater expected range



Source: Nicholas Meilhan, Frost & Sullivan

03_ Electrification and hybridization options

By 2021, 30+ BEV with over 200-mile autonomy have been announced to be launched

Source: Nicholas Meilhan, Frost & Sullivan

03_ Electrification and hybridization options

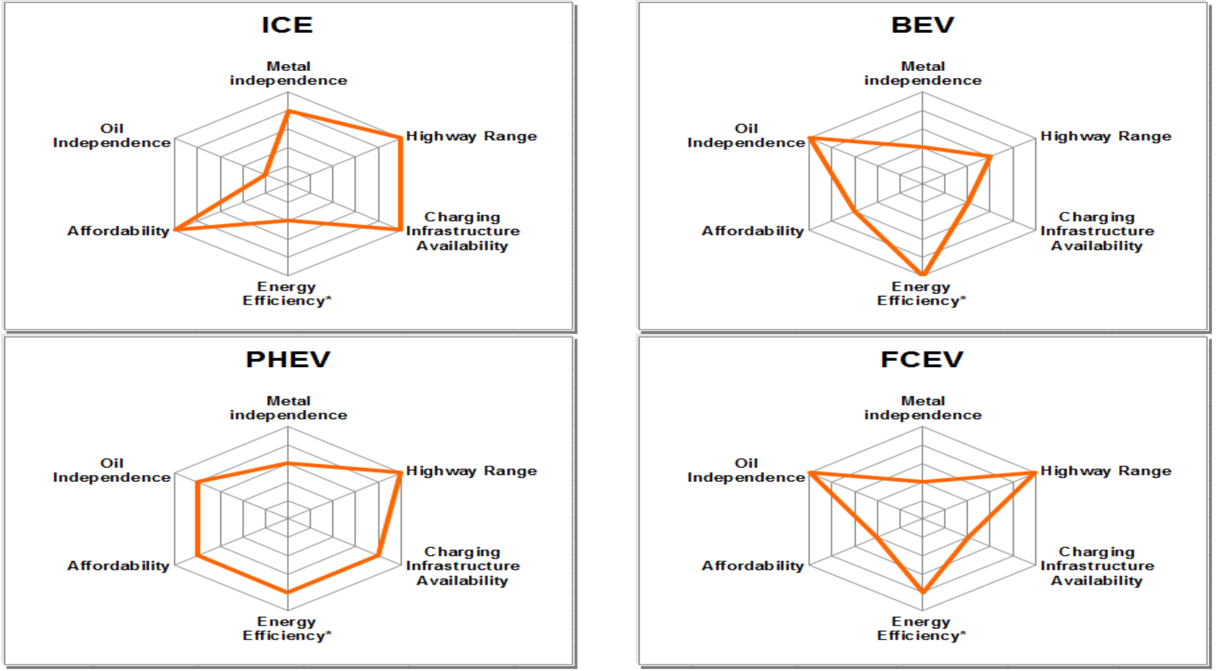
Increasing range of BEVs in the near future (200+ miles) → PHEVs are only a short-term solution or are expected to contribute significantly to the future of electric mobility

	Vehicles & End-Users Targeted	Risks
BEVs	• Weight < 1.5 tons • Segment A & B • Urban • Commuting • 2nd vehicle	• Requires the deployment of a fast charging network • Electricity grid constrains at local level as well as on highway corridors • Limits on cobalt and lithium availability if deployed in large scale • Limited range in highway driving conditions
PHEVs	• Weight > 1.5 tons • Segment D & Higher • Suburban & Rural • Unique vehicles	• Limited incentives compared to BEV as not 100% electric • Electricity grid constrains at local level • More complex architecture as embarking 2 powertrains • Some end-users don't charge it • NEDC cycle too optimistic on fuel consumption & CO_2 emissions
FCEVs	• Weight > 1.5 tons • Segment D & Higher • Suburban & Rural • Unique vehicles	• Needs renewable electricity to produce clean hydrogen & increase well to well energy efficiency • Expensive fuelling infrastructure to be deployed • Limits on platinum availability if deployed in large scale

Source: Nicholas Meilhan, Frost & Sullivan

03_ Electrification and hybridization options

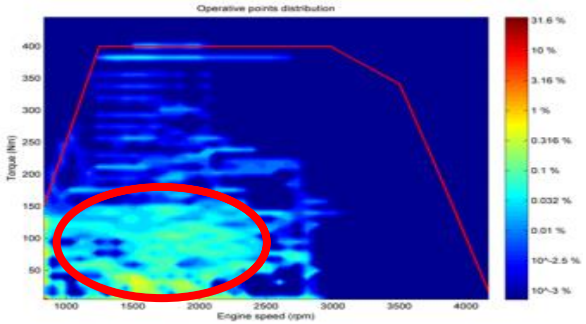
Plug-in hybrids represent the best trade-off for a sustainable vehicle at a global scale in the short to medium term – up to 2025

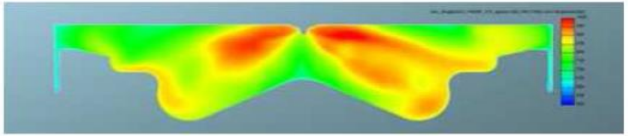


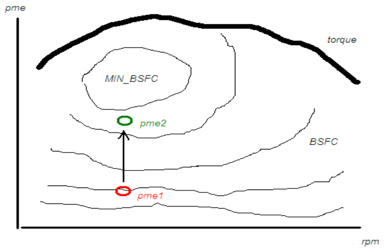
(*) Energy Efficiency depends on W2W in each region. (California resources have been taken into account)

Combustion efficiency

- Engine calibration
  - Engine calibration is a key point in the CO_2 saving.
  - Specific fuel consumption optimization focused mainly in the driving cycle
- Combustion concepts
  - GDI - Direct injection petrol engines
  - HCCI – Homogeneous Charge Compression Ignition
  - Variable compression ratio
  - Cylinder de-activation







04_ ICE improvement options

Gasoline

Advantges	Disadvantages
Engine feels reactive and smooth. Reduced weight. Small initial and low maintenance cost. Good feeling to drive. Can be easily retrofitted for alternative fuels(CNG ,LPG) Silent drive-engines. Low on emissions .	Torque is less at low rpm. Idling performance is weak (consumes high amount of fuel while running on low rpms). Overtaking is slow without gear changing as torque output is less. Overall fuel efficiency is a bit less as compared to a diesel counterpart. Service requirement is frequent as compared to Diesel motors.

04_ ICE improvement options

Diesel

Advantges	Disadvantages
• High torque output hence pulling power is high (acceleration is good) • Good overtaking performance through more speed range in single gears. • Fuel efficiency is high as compared to gasoline counterpart. They are more efficient even in low • Service requirement is less frequent.	• Retrofitting is not possible in most of the cases . • Overall cost of the car with diesel engine is high. • Service requirement is less but more expensive. • Engine does not feel smooth and generally crude. • Pollution is high (especially particulate and Nox)

04_ ICE improvement options

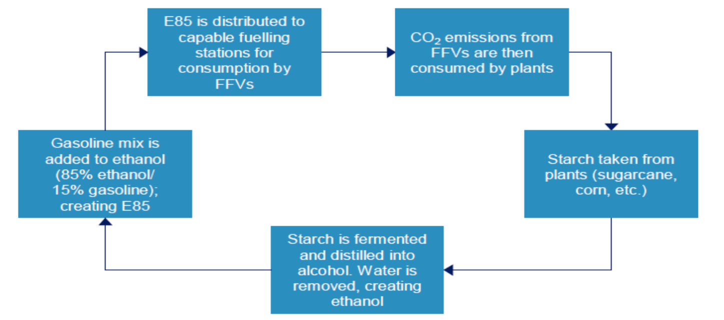
Natural Gas

Advantges	Disadvantages
CO2 advantages in comparison to gasoline and diesel engines today Low cold-start emissions Mature technology available and combination with traditional fuels possible CNG is more evenly distributed over the world than oil Cost effectiveness in the mass market possible	Exhaustible energy source No standard gas solution across Europe (LPG vs CNG) New infrastructure has to be built up parallel to the conventional one Using gas as fuel has general problems with storage and the costs of storage, the handling, the volume and the range Customer resistance to drive gas driven vehicles

04_ ICE improvement options

Biofuels

Advantges	Disadvantages
Immediate potential for CO2 savings Biofuels are relative easy to implement Existing infrastructure can be used if biofuel is blended with conventional fuels Mature, traditional combustion engines can be used	Shortage of arable crop and possible competition with food production Changes to the engine system and changes within the fuel supply to the engine necessary if used in high blending Potential for corrosion in the fuel system Profitability is questionable



Source: PwC Automotive Institute

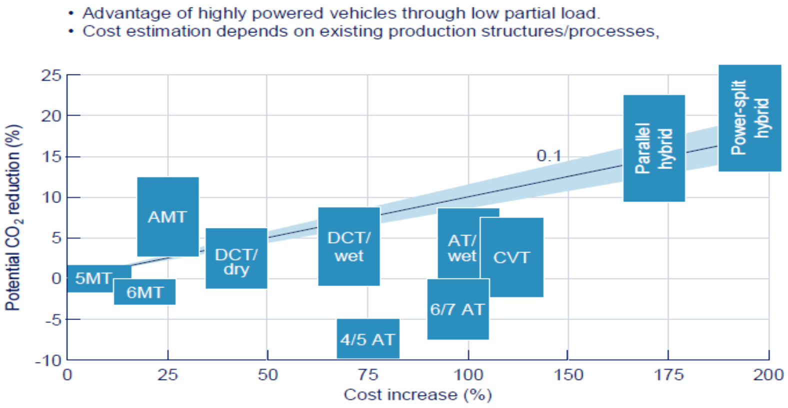
05_ Transmission options

Gearbox optimization

- Transmission types

Potential	MT	AMT	CVT	AT	DCT
Cost	+++	++	–	+	–
Weight/Package	+++	++	+/–	+/–	–
Technology	+/–	+/–	+	++	+++
Comfort	+/–	+/–	+++	++	++
Sportiness	+	+	–	+/–	++
Fuel efficiency	+/–	++	+	+	++
Market	–	+	–	+	++

Source: ATZ



Source: ATZ

06_ Conclusion

- Main stakeholders to **tune the timing for electrification process** with very contrary interests

- EVs are expensive and have short range, ICEs will continue to dominate the market but customers will **switch to EVs as soon as they will be competitive, PHEVs represent the best trade-off** for a sustainable vehicle at a global scale in the short to medium term

- During 1st quarter 2018 Alternative powered vehicles (APV=EV+HEV+NGV+LPG + E85) demand **reach + 26.9% in EU. They are still "just" 6.5% of the total** (source ACEA)

Thank you for your kind attention

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