
**Description:**
The unique report is almost entirely based on the very latest information gathered and interpreted in 2016. Only a global up-to-date view makes sense in this fast-moving subject. Therefore the multilingual PhD level analysts have travelled intensively worldwide in 2015 and 2016 to report the latest research, conferences and expert opinions and to analyse how the markets and technologies will move over the coming 15 years.

A typical 10 year forecast is misleading here. For example, the analyst sees the reinvented traditional ICE powertrain in the form of the 48V mild hybrid peaking just after that and a huge market for the new energy independent vehicles will appear even later. Conferences were attended and extensive interviews carried out in Taiwan, Korea, Japan, Germany, Ireland, UK, USA and elsewhere clarifying such things as the window of opportunity and potential performance of the different options.

A chapter addresses the factors influencing powertrain design from component breakthroughs to new legislation. Another chapter covers the 48V mild hybrid and other chapters analyse strong hybrids in their various forms including fuel cell and the pure electric powertrain in its various forms to come. A final chapter looks at the key component advances now and in future from extreme engine downsizing to multiple energy harvesting/regeneration and structural supercapacitors and batteries.

A new and detailed roadmap is presented for 2016-2036 covering both technology and market development. Ten year forecasts are given for 46 categories of electric vehicle including 48V mild hybrids transitioning to be electric vehicles. No one else has this level of detail. Uniquely, the report presents a bigger picture of opportunity than that addressed by other observers and participants. For example, it is commonly taught that 48V mild hybrids can provide and store four times as much electricity for new clients but we show that accepting many new high power inputs of electricity from harvesting and regeneration is equally important.

Pure electric vehicles are typically seen as the end game in contactlessly charged form but, beyond that, we show how energy independent components can evolve further into structural electronics and variants of the supercapacitor can compete with or enhance batteries. We benchmark what is happening in the air and on water but the focus is land vehicles on and off-road. The future is very different from that commonly portrayed and much more exciting.

Powertrain electrification priorities of some automotive companies beyond traditional ICE for the next ten years Source: Original tables and infographics pull together the analysis with latest presentations from leading vehicle and system manufacturers and developers in three continents. the analysts has travelled intensively to the facilities and events on the subject.

The report comes with 30 minutes free associated consultancy. Powertrains of land vehicles are changing out of recognition. Conventional internal combustion engine powertrains are being economically reinvented as 48V mild hybrids with engines downsized up to 70% and three pure electric modes. They will be able to meet even the 2030 emissions regulations after all.

Strong hybrid powertrains are proving very popular in the newer form of plug-in versions with long pure electric range, the old types being dead-ended other than in niche applications. Even pure electric vehicles are being reinvented with a new end game of energy independent vehicles relying on only sunshine and other ambient energy.

Look closer and the individual components are also being changed radically, including being merged into structural electronics. New forms of rotating electrical machine, energy storage, energy harvesting and regeneration and power electronics have broad applicability across most of this.

The bottom line of all this is that choice of powertrain is not purely a decision based on incremental improvement.
Factors include:

- Design for recyclability
- Disruptive new components
- New principles such as energy independence, autonomy
- Changes in law such as combating global or local air pollution
- Government subsidies and tax breaks that can change suddenly
- Integration of mechanical, electrical and electronic parts - simpler with certain configurations and parts. For example components that move such as batteries swelling and shrinking and motors rotating are tough to integrate into structural materials as "structural electronics" - an important new discipline.
- Change in what is sought as with Porsche Engineering foreseeing a world of autonomous vehicles favouring pure electric powertrains but also commoditising the powertrain if vehicles are typically not bought by individuals any more but used on demand.
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