

Plug-In Hybrid Electric Vehicle (PHEV) - A Sensible Addition to E-Mobility?



Fig. 1: FEV LiION DRIVE (based on Fiat 500)



Fig.2: FEV ReEV (based on Dodge Caliber)

FEV has developed two concept cars based on the Fiat 500 and the Dodge Caliber that represent platforms for testing a variety of e-traction components. Their modularity allows the investigation of different electric motors, batteries as well as range extender modules. They also serve as development platforms for design of operating strategies and the integration of safety concepts. Powertrain electrification offers a promising possibility to make mobility more environmentally friendly, comfortable and exciting than ever before. The fascinating vision of electricity generated from renewable energy sources has sparked a public debate that is almost unstoppable. The battery technology is the key element in strongly hybridized and purely electric drive concepts. Enormous efforts are being undertaken in many organizations to develop battery systems that are suitable for vehicles. For the foreseeable future, lithium-ion technology appears to be the best system - despite its technological limits, which have to be skillfully expanded. This refers in particular to the behavior of the battery at extreme ambient temperatures where it can only offer a limited charging capacity or performance with respect to driving, heating or cooling of the passenger compartment.

A Plug-In Hybrid concept can provide an efficient solution to control such limitations. The battery capacity for this concept's purely electric driving mode is set for a driving range of 40-80 km, a distance broadly proven to be sufficient by statistical analysis. This allows for significant reductions in system cost and vehicle weight. The Plug-In Hybrid concept also uses a drive unit that is driven by a combustion engine. This allows the use the vehicle for either urban driving in the purely electric mode, or in the hybrid driving mode at higher speeds as well as under more difficult weather driving conditions, especially in winter.

Therefore, the driving range is virtually independent of the battery. This significantly improves end customer acceptance of e-mobility.

To demonstrate the advantages of the approach, FEV has developed two concept cars based on the Fiat 500 and the Dodge Caliber. The preservation of the useable space was paramount for the integration of the e-traction components in the production cars. The electric motor is mounted in the installation space of the combustion engine. The remaining space can either be used for additional battery modules or alternatively for the installation of a Range Extender Module. The lithium-ion batteries are in-house developments, which are installed under the floor near the vehicle's longitudinal beams. In the Fiat 500, the Range Extender Module was mounted in place of the petroleum tank, which had its capacity reduced to 12L. The FEV concept cars are experimental vehicles for testing a variety of e-traction components. They have been designed in a modular fashion to allow the investigation of different electric motors, batteries as well as the Range Extender Modules. Furthermore, they serve as development platforms for the design of operating strategies and the integration of safety concepts.

Areas of development

- Vehicle integration of the e-traction components
- Vehicle application and safety concept (e-gas safety)
- Tailoring and testing of the lithium-ion batteries (preferably for underfloor installation)
- Integration and application of a battery management system (LiION MAN)
- Integration and application of the Range Extender Module (1-, 2-, 3-, 4-cylinder, Wankel engine)

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