IFP solutions for vehicle electrification

IFP offers manufacturers a comprehensive range of engineering tools and services for the design of hybrid and electric vehicles.
The solutions offered are based on an innovative systems approach which is particularly suited to the specific architectures of these vehicles. IFP's test bench equipment and specialized software tools can be used to:

- conduct Life Cycle Analyses;
- define vehicle specifications;
- contribute to the definition of complex subsystems and the physical architecture of the vehicle;
- evaluate and optimize the performance of a given architecture;
- perform vehicle calibration.

This integrated systems approach allows to shorten development cycles. The simultaneous optimization of performance, emissions and fuel consumption makes it possible to keep development costs to a minimum and offer innovative technological solutions: economic benefits that ultimately filter right down to the end customer. IFP solutions can be tailored around the following main areas of expertise.

Smart Vehgan, developed by IFP in partnership with ADEME, GDF Suez, Inrets and Valeo, combining the benefits of hybridization with those associated with the use of a low-carbon fuel, natural gas.

Architecture, integration and vehicle synthesis

Definition and validation of vehicle architectures, component integration (batteries, IC engines and electric motors, transmission, etc.):

- modeling at different stages of the vehicle design cycle (dimensioning, specification, subsystem design, validation of the complete system);
- optimization of the packaging and thermal management of components with respect to the vehicle system;
- tests and experimental validation (subsystem and complete vehicle: HiL platforms with dynamic test benches, virtual test platform);
- advanced vehicle calibration methodologies.

Test bench with a power of ± 120kW to test complete battery packs in a climatic chamber (–40°C to +80°C).

Control and optimization

Definition, development and validation of control systems, particularly at vehicle level for the management and optimization of onboard energy:

- mathematical optimization software with constraints;
- control strategies using a model-based approach;
- rapid control/command prototyping tools;
- HiL and SiL platforms.

Energy storage systems

Specification and integration of energy storage systems:

- experimental system characterization;
- detailed physical behavior modeling (SoC, SoH, etc.);
- control (BMS) developed on the basis of in-depth knowledge of phenomena and through the implementation of high-performance tools (rapid prototyping, HiL platforms);
- dimensioning backed up by modeling.

Electric motors

Integration and development of electric motors:

- experimental characterization of electric motors;
- detailed modeling of their operating modes and their power electronics;
- development of specific control laws (rapid prototyping, HiL platforms);
- design and implementation of power electronics (system scale);
- dimensioning with modeling.

Adapted and dedicated internal combustion engines

Development of internal combustion engines adapted to hybrid, plug-in hybrid or electric vehicles with range extender:

- dimensioning and design;
- detailed experimental characterization and development;
- detailed operating modeling;
- development of specific engine control;
- implementation of energy recovery systems.

IFP virtual test platform for system dimensioning and experimental validation with HiL dynamic test bench.

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