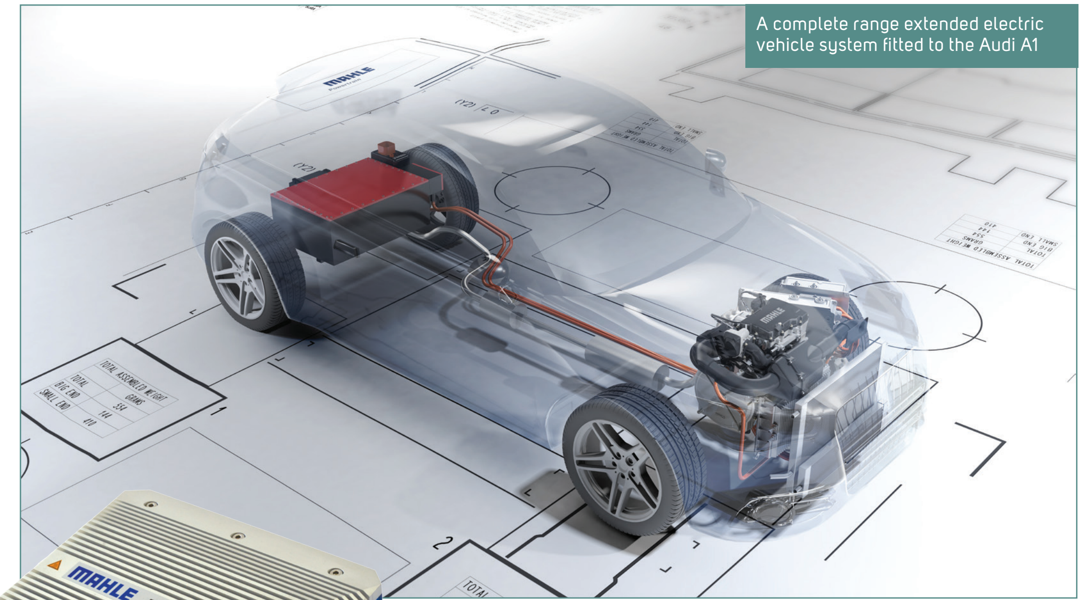
Drivetrain solutions

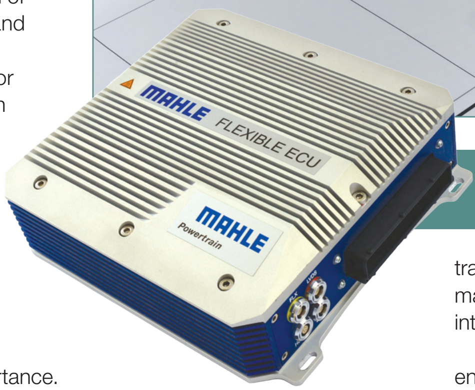
Engineering specialists offering complete integration of drive systems are sought after by vehicle manufacturers keen to develop powertrain strategies across their ranges



A complete range extended electric vehicle system fitted to the Audi A1

All major OEMs operate platform strategies with complete drivetrains developed and shared across wide product ranges. But the proliferation of engines, transmissions and hybrid drive systems increases the complexity of the control and integration tasks. Many OEMs are now turning to experienced engineering service providers (ESPs) to support their in-house drivetrain development activities.

Notwithstanding the challenges of emissions, performance, energy efficiency, and weight and cost reduction, a new critical paradigm has emerged – the integration of complete drivetrain systems and components. In future the IC engine, gearbox, electric motor and associated systems (such as thermal management) will move closer together to become a single, unified system that must be considered a functional unit. For ESPs, the expansion of their core capabilities toward complete propulsion and drive system integration is of growing importance.



Mahle's flexible ECU (MFE) controls a wide range of engine and vehicle systems

Hybrid vehicles in particular represent a major challenge in development and optimization, since there are numerous possible drivetrain configurations, each with its own merits and disadvantages. Engines can be powered by petrol, diesel, CNG or biofuel. Electric motors can be mounted separately, integrated within the engine or transmission, or mounted in the wheels. In certain vehicles, multiple motors are deployed. Batteries also vary in shape, size, weight, voltage, power rating, chemistry and location in the vehicle.

Electrical and electronic devices used in hybrid architectures include inverters, converters, generators, engine and vehicle control units, actuators and sensors. Both the cooling and thermal management systems have become increasingly complicated and include radiators, heat exchangers, intercoolers and condensers, evaporators, bypass valves, multimode pumps, fans and thermostats.

The conventional choice of manual or torque converter automatic transmissions now includes electromechanical, dual-clutch, CVT and single-speed gearboxes coupled to conventional differentials and epicyclic or planetary final drive configurations. This expansion in transmission configurations offers many opportunities for the further integration of hybrid components.

Full hybrid vehicles use an IC engine, which is not necessarily the primary power source or method of propulsion. A combination of motors, which can be connected to the engine, transmission or separately connected to the wheels, can act as torque-fill, propulsion or generation devices. As such, the engine may be required to operate continuously, or infrequently, depending on the operating strategy of the hybrid system, battery state of charge or driver demand.

The engine may be required to start and run at high outputs in a short space of time, become the primary propulsion source and operate similarly to a conventional vehicle, or may not be used very frequently at all. This variation can lead to new challenges for the engine in terms of its optimum design and durability requirements. High loads following a cold start can lead to premature wear and thermal stresses, while prolonged periods of non-use present challenges to the fuel purge system, component corrosion, oil quality and fuel degradation. The requirements of onboard diagnostics (OBD) may also require periodic engine operation to check system performance and integrity even if the base operating strategy does not call for it. The rapid development of these new vehicle types, and their differing operating strategies, could lead to revisions to legislation regarding OBD and emission testing. This presents a moving target for OEMs, meaning vehicle systems must be reconsidered during production.