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Analysis of Real World Data from a Range Extended Electric Vehicle Demonstrator

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ABSTRACT

MAHLE Powertrain has built a range-extended electric vehicle demonstrator, with a series hybrid configuration. The vehicle is intended to operate predominantly purely electrically. Once the battery state of charge is depleted a gasoline engine (range extender) is activated to provide the energy required to propel the vehicle.

As part of the continuing development of this vehicle, MAHLE Powertrain has recorded data during real world driving, with the aim of further investigating the actual usage a range-extended electric vehicle under non-laboratory test conditions. The vehicle is instrumented with a data acquisition system which records physical parameters, for example coolant temperatures, as well as CAN-based data from the engine and vehicle management systems.

This recorded data has been analysed, using tools developed in-house, to establish the effect of environmental factors such as ambient temperature, human behavioral characteristics and variation in usage patterns on the efficiency and operational behaviour of the range-extended electric vehicle system as a whole. Of particular interest are factors such as the frequency, and duration, of operation of the range extender engine under normal daily usage. The resulting data will guide the design direction and specification, at both component and system level, in future range-extended electric vehicle design and development programmes.

This paper presents an overview of the recorded data and analysis of the key trends identified. The hardware and software systems are briefly discussed and the control strategy is described within the context of the results presented. This paper also demonstrates that both the range extender unit and the traction circuit components have been sized correctly and that a reduction in traction battery pack size, relative to a pure electric vehicle, is both feasible and appropriate.