

Development of a compact-class range extended electric vehicle demonstrator

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ABSTRACT

Research and /or Engineering Questions/Objective:

MAHLE has developed a dedicated Range Extender engine which has been focussed on meeting the requirements for a compact-class range-extended electric vehicle. In order to enable further development and refinement of the Range Extender system (e.g. NVH attributes of the engine), the module has now been installed into a demonstration vehicle. A current production gasoline fuelled compact-class car was used as a donor vehicle and converted into a range-extended electric vehicle (REEV). The all-electric driveline specification has been developed to meet the performance criteria set for the demonstrator, matching the acceleration and maximum speed capabilities of the conventional donor vehicle. Also, a target electric only range has enabled the battery pack capacity to be specified. The resulting vehicle is intended to reflect likely, near to market, steps to further the wider adoption of electric vehicles in the compact-class passenger car segment.

Methodology:

A current production vehicle with a conventional IC engine drive-line has been modified to use an all electric drive-line with a range extender engine. The resulting vehicle is intended to reflect likely, near to market, steps to further the wider adoption of electric vehicles in the compact-class passenger car segment. The electric driveline specification has been developed to meet the performance criteria of the conventional donor vehicle, matching the acceleration and maximum speed capabilities. Also, a target electric only range has enabled the battery pack capacity to be specified.

Following the prototype manufacturing of this vehicle, it will be extensively tested to confirm that the performance meets the targets. The fuel consumption of the vehicle, over the NEDC, will be measured. Simulation work has also been conducted to assess the likely fuel consumption of the REEV over "real world" usage patterns.

Results:

Thus far, the range extender engine has been tested separately on a dynamometer. It has met all performance targets set for it. A model of the REEV has been constructed, using the measured fuel consumption data for the MAHLE Range Extender engine. Initial results from this model indicate that the fuel consumption of the REEV is reduced to less than 40% of that of the vehicle with its original gasoline engine for the NEDC. Analysis of "real world" usage patterns is also showing very significant reductions in fuel consumption when the REEV is recharged every night. Surprisingly, reasonable fuel consumption savings have also been calculated for the "real world" drive-cycles even when the REEV is never recharged.

Limitations of this study:

The results presented in the paper will be limited to the extent of the demonstration vehicle picked (no multiple vehicle application comparison) and test results available at the time of submission.

What does the paper offer that is new in the field in comparison to other works of the author:

This paper will present the MAHLE Range Extended demonstration vehicle. This REEV vehicle will be the first of its kind and neither the vehicle build nor the results presented have yet been presented.

Conclusion:

The paper will present details of the MAHLE Range Extended demonstration vehicle. It will also present the results of drive-cycle fuel consumption testing. These results will be augmented with simulation results to give a view of the likely fuel consumption benefits of such a vehicle in actual service.