

AUTOMOTIVE CASE STUDY THERMAL OPTIMISATION FOR ELECTRIC VEHICLES



Optimisation of thermal system control to increase the range of electric vehicles

Ricardo supports global automotive customers to improve the efficiency of their electric vehicles. This work forms part of its mission as a world-class environmental, engineering and strategic consulting company, to support the decarbonisation of the global transport and energy sectors.

CHALLENGE

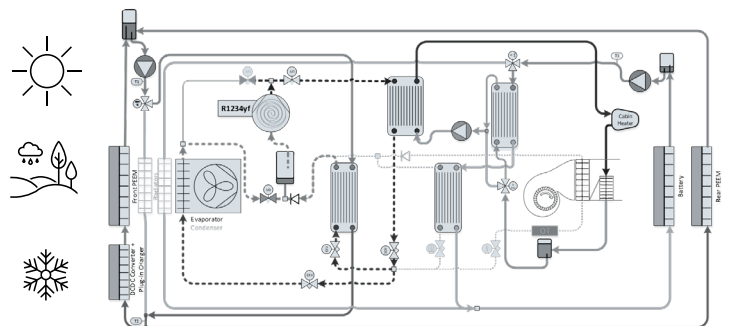
Thermal systems have a significant impact on electric vehicles range.

- Without a combustion engine, electric vehicles do not have a source of waste heat for warming the cabin.
- All the energy to heat up the vehicle comes from the battery.

Impact of ambient temperature and climate control can be seen on OEM websites through 'range calculator' tools.

- For example, at -10 °C the reduction in range can be 20 to 40 %, depending on the driving style.

Challenge is to increase electric vehicle range with minimal impact on vehicle attributes.



APPROACH

Ricardo led a research programme to reduce the energy required by the thermal systems in battery electric vehicles.

The optimisation of control system for the thermal system was based on a systematic approach for identifying opportunities and developing robust control algorithms.

- Offline optimisation – to allow the optimiser freedom to tune control parameters over many cycles.
- Online implementation – integrate in vehicle demonstration with Model Predictive Control (MPC) and Electronic Horizon – using route information to reduce the thermal energy requirements

In parallel with the control system optimisation, a new tool was developed to optimise the thermal system design by evaluating thousands of different thermal system architectures before detailed analysis. The tool considers many attributes including thermal performance, cost, mass and complexity over a wide range of use case scenarios.

This project was in collaboration with Jaguar Land Rover and funded by the Office for Zero Emissions Vehicles (OZEV) and Innovate UK.

RESULTS

- Client gains a detailed understanding of development costs associated with their product strategy and pathways to mitigate initial investment
- Client obtains access to a detailed dataset of xEV component costs and competitive targets that provides guidance to their cost reduction efforts, supplier selection and negotiation process
- Client benefits from insights on financial risks and opportunities for their planned products based on current and future trends in technology and its costs

SUMMARY

Ricardo have proven the tools and process for optimising both the thermal system architecture and the coordinated control required to extract the best performance from a given hardware configuration.

- Demonstration in climatic wind tunnel
- Real time optimisation
- Integration with electronic horizon

The Ricardo control and thermal teams are available to discuss how to apply this technology to your applications.

FIND OUT MORE ABOUT THERMAL SYSTEM OPTIMISATION

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