

Major Project Questions

Project Title: Alternative Power for Auxiliary Systems within a Drive Cycle Simulation.

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Question 1

Was there any substantial issues that Covid-19 played in the completion of your project? If not what aspects of the project had taken longer than planned and why?

Question 1 Response (maximum 200 words)

As discussed in section 7.2, there were issues. Originally the plan included engine dynamometer testing to be used to compare results, however closure prevented this leading to the comparison of simulated WLTP data with NEDC data simulated and provided by manufacturer. This prevented thorough validation as ideally results via the dynamometer and simulation would produce a comparison between practical real world and simulated data. Additionally, the constraints of the virus created issues with other assignments completed in the same timeframe (section 7.2) however the additional time given by extending the deadline counteracted these delays.

The practical testing duration taken longer than planned. After completing multiple tests on the engine in the workshop the specific scope of the project was determined resulting in additional tests requiring completion. After focusing on the specific area most of the previous tests were void of usefulness to the project hence resulting in an overall increase in testing time. During the latter stage of the project additional testing wanted to be undertaken via an engine dynamometer. Ideally the early “wasted” testing duration could have been better used with the dynamometer testing if a more thorough project scope was decided upon at the beginning.

Question 2

Reviewing the WNQ figures expressed in figure 27 can you explain how you derived the 51% decrease in fuel consumption and what is the accuracy of combining the both comparators namely NEDC and WLTC figures?

Question 2 Response (maximum 200 words)

The fuel usage between the alternative and standard systems with AC on was a 51.3% (102.56/199.83) hence meaning the potential decrease of 48.7% from the standard system. Therefore I retract the previous statements made in section 6.5 and 8 as each should read a “...potential decrease of 48.7% reducing the fuel usage to 51.3% of standard”.

The accuracy according to Mock *et al* (2014) was 90% for the classification of vehicle used with the WNQ of 0.9 (section 6.5). Hence using the WNQ value the changed NEDC from published can be compared to validate the accuracy of the simulation. The standard system (no AC for NEDC) was 90.19% meaning overall the simulation was very accurate compared to the manufacturer published figures.

Question 3

Throughout your report you mention the term KERS. What specific system would you have utilised and what are its limitations?

Question 3 Response (maximum 200 words)

As expressed in 3.2.4 and 3.3 the Specific system incorporates the Rencool electrical AC compressor, Brake motor IE1, controllers and around 135 AVX 850 super-capacitors. The Brake motor would be operated from the controller during deceleration to engage via a centric clutch system similar to a conventional AC compressor to mechanically link and generate 240v DC Using a Transformer the voltage can drop to 12volts as a supply to the AC compressor or be stored in to the capacitors. The capacitors with a 2.5 to 2.7 volts capacity would be mounted in series in groups of 5 to boost voltage to 12.5 -13.5 and then mount these groups parallelly to boost capacitance or charge. Delivering the required 109.3kw for the longest stationary duration in the WLTC cycle of 67s. The limitations of this system include the storage of the capacitors being designed for the 67s duration within the WLTC and any longer the AC compressor would have to operate from Battery supply recharged via engine. Additionally, the capacitors can hold charge for long periods without decay or discharge making them more beneficial to be used jurying warmup from previous vehicle usage to reduce engine loading.

Question 4

What other features would the KERS system have an influence on mainly regarding operational and packaging?

Question 4 Response (maximum 200 words)

Concerning packaging the KERS system specified the section 3.2.4 and 3.3 the electric compressor (Rencool, 2016) would fit in the same location as the previous compressor (Denso, 2020) as all dimensions are smaller. The capacitors and controllers for both the motor generator and compressor would have to be fitted an area within the passenger compartment or boot space. Lastly the motor generator would have to be incorporated into the transfer box or compromising either the rear or front prop shafts, with the first option being the most complex but retains all original driving functions. However the alternative replacement to limit vehicle performance a single prop shaft is easier to install and provides negative space to fit the motor within. The operation of this system includes the increased loading on the drivetrain when decelerating to engage the motor could lead to component fatigue but prolong braking system lifetime. The practical operation would have to be similar to the systems used in sone EV's where engagement of the motor is activated via releasing of the accelerator.

Question 5

What further areas would you liked to have investigated if you were to expand your aims?

Question 5 Response (maximum 200 words)

As mentioned in the seminar paper conducting a questionnaire for qualitative research into AC usage. Ideally looking at the driver interaction of the AC UI while using the vehicle. With this the average AC usage with desired preferences could be looked at, as results from the standard AC simulated was using the highest loading recorded from practical workshop testing. The collected data would determine the AC preference and hence the loading from a given selection of participants and could also be further analysed to show trends. For instance, AC operation by location, age, gender, vehicle type owned, weather and

journey duration. With such results varying in answer and ambiguity careful planning would have taken place and answer be selected via a multiple choice of closed questions (Breach, 2009).

Breach, M., 2009. *Dissertation writing for engineers and scientists*. Edinburgh: Pearson education limited. Section 3.9-3.11.