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DOMUS – Deliverable Report

Deliverable D6.4 Vehicle and Cost Assessment

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Publishable summary

The aims of *Task 6.3 Full Vehicle assessment & Cost assessment* have been to produce the final vehicle assessment and cost assessment.

The activities carried out in task 6.3 were distributed among three different phases:

- Safety Virtual assessment
- Experimental testing of the windshield antifogging solution at the vehicle level
- DOMUS system cost analysis

By loops of structural design and safety virtual assessment it was demonstrated that a satisfying safety performance of the prototypical vehicle in the event of rear impact could be attained, despite the integration of the vessel of the Thermal Energy Storage in the car rear end.

In the Rear impact the redesigned lighter front seats show a good response in terms of structural integrity, without any risk of exposure to injury of the occupant.
In the opposite the virtual simulation of the front impact unveiled that the seat structural performance would be fully acceptable, only provided that the belt buckle's bracket were redesigned, reducing the resulting unfavourable leverage, thus distributing the safety belt loads on the seat frame in a more balanced way, thereby solving the related structural problems.
This would allow to fulfill all biomechanical requirements and ensure the safety of the occupant.

In its turn, the virtual assessment of the dynamic response of the hybrid CCB to usual inertial loads in the car handling demonstrated the virtual validation of such component, despite the fact that FIS acknowledges that it wouldn't sustain the stresses entrained by the passenger air bag deployment, which assessment was then reckoned not to be necessary.
Therefore more design work would be required to make it compliant with the PAB deployment load requirements.
Moreover further development steps are recommended to improve the performance of the hybrid CCB, particularly making its brackets stiffness fully compliant in all three directions with the specified design thresholds, especially at higher temperatures; its design in composite material should also be made complying with the 1st vibration mode frequency threshold, particularly affected by the behaviour of the driver's half beam sustaining the steering wheel column; this way a fully composite material made CCB would be possible, allowing for a higher weight reduction at unimpaired performance.

The experimental testing in the conditions of the climatic wind tunnel of a Toyota vehicle model, equipped with a windshield treated with a TiO_2 based antifogging coating, demonstrated that a good anti-fogging performance of this technology can be obtained only in an area where the contamination can be controlled. As a matter of fact, it appears that contamination at the vehicle level, resulting from important VOC evaporation or from cleaning agents use to clean the windshield, is a critical point to ensure anti-fogging performance and hence further development to enhance its robustness to be applied on exposed surfaces would be needed.

The cost analysis showed that conclusive evaluation of the cost/benefits ratio is difficult to achieve, because some components affect more than one vehicle feature or performance, e. g. the AGC Glazing the and insulation material provided by HUT, which impact on the vehicle weight and consequently on the vehicle energy efficiency in opposing ways, but also improve the thermal and acoustic performance.
Another point, that's not negligible is that these components aren't integrated in a series vehicle and so the costs happen to be too expensive, when compared with other competing technologies, possibly less performing but already well established in the current production.
Considering only the reduction of energy consumption to warm up the passenger compartment, the global cost of integrating the relevant subsystems is higher than the current cost of a heat pump system, amounting to less than one fourth of the DOMUS contents with a higher benefit in terms of power level consumption, and therefore at present it results too expensive.