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DOMUS – Deliverable Report

Deliverable D6.2 Assessment of prototype vehicle performance

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Publishable summary

WP6 objective has been the final evaluation and validation of all the advanced components and systems developed in the frame of the DOMUS project and integrated in a prototypical vehicle.
To this aim an extensive experimental testing of the prototypical vehicle was performed in the frame of *Task 6.2 Vehicle physical testing*, in order to establish its performance against the originally set targets and verify the achievement of the project targets by comparison with the previously established performance of the normal production vehicle.

The reference vehicle chosen as a case study for the application of all the envisaged innovations is the Fiat 500 BEV made in Toluca plant (Mexico) since 2013 until 2020.

The physical testing of the prototype vehicle was carried out using a chassis dynamometer in a climatic wind tunnel facility where real operational conditions were created in different environmental conditions.
The solutions developed within WP3, WP4 and WP5 and integrated in the prototype vehicle were verified with a special focus on:

- Energy efficiency
- Comfort
- Safety

An additional target of the physical experimental campaign was to validate the numeric models developed in WP1 and WP2 against both the values of thermal parameters measured at specified locations and the estimated subjective comfort (which is the object of deliverable *D6.3 Assessment of prototype vehicle during real driving tests*).

The standards ***DIN 1946-3:1962-06*** and ***WLTP 3B standard, homologation driving cycle*** were taken as a reference experimental protocol.
Tests were carried out at both cold and hot environmental weather conditions, the highest energy consumption of the auxiliary devices in the car being measured in the cold ambient conditions, as expected.

As no fogging of the glazing occurred during the test at intermediate cold temperature (14°C), the holistic control system of the active comfort elements, developed during the project, could pilot the HVAC in recirculation mode for most of the WLTP cycle duration, resulting in an improved vehicle thermal performance, which at comparable comfort levels for the passengers allowed an energy consumption lower by almost 10 %, compared to the baseline vehicle, in line with the expected outcomes of the project.

The heating panels integrated into car interior components, activated by the automatic holistic control during the first minutes of the warm-up, contributed to the passenger comfort in a non-negligible way.

On the other hand, a comparative numeric simulation performed with the co-simulation models of both the baseline and prototypical versions of the testing car, developed in the frame of WP1 and WP2, showed that no driving range improvements are to be expected with the proven vehicle configuration, disproving the hypothesis made before the project start.

The test of the vehicle acoustic sensitivity to intrusion noise in hemi-anechoic chamber proved that the combination of the laminated glazing, introduced to provide an auxiliary defogging and defrosting function, with the insulating panels, based on phase change materials and integrated into the door trim and in the ceiling liner, offer an improved acoustic comfort to the passengers in the car cabin.

The experimental testing of such heated glazing provided by AGC and integrated into the DOMUS prototypical vehicle was assessed at -3 °C complying with the relevant international standard, and showed an autonomous capability of its defogging function to ensure the demisting of the windshield and the lateral front windows in a time interval compatible with the prescribed specifications, with limited energy consumption; nevertheless it was demonstrated that a minimum level operation of the blower, to direct

fresh air to the glazing, is necessary to eliminate the noticeable humidity rate which builds up in the car cabin.

In the opposite, the experimental testing of the defrosting function of the windshield and lateral windows, carried out in climatic chamber at -18 °C and in the same operative conditions, failed to be comply with the prescribed specifications, indicating the need of a contribution from the defrosting mode operation of the HVAC.