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Clean and competitive solutions for all transport modes

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**Zero Emission flexible vehicle platform with modular
powertrains serving the long-haul Freight Eco System**



ZEFES - Deliverable report

D8.2 Baseline use case assessment



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Publishable summary

Within the ZEFES Project, zero-emission heavy-duty vehicles are demonstrated in real-world logistics operations across Europe using operational measurement data provided by vehicle owners, including logistics service providers, shippers, and original equipment manufacturers (OEMs). The project aims to evaluate the performance of vehicles, vehicle components, and supporting innovations under realistic operating conditions experienced in freight transport.

As part of this effort, nine zero-emission trucks based on battery-electric vehicle (BEV) and fuel-cell electric vehicle (FCEV) technologies are deployed across 15 logistics use cases. To enable a consistent comparison, reference operational data has been collected from conventional heavy-duty vehicles currently performing the same missions. This data is obtained through access to vehicle OEM portals, Fleet Management System (FMS) platforms, and dedicated data loggers.

These reference vehicles are diesel internal combustion engine (ICE) trucks and represent the operational baseline against which the performance of the zero-emission demonstration vehicles will be evaluated in subsequent assessment phases.

This deliverable establishes the baseline (reference) Key Performance Indicators (KPIs) derived from the operational data of the diesel trucks. The KPIs describe key operational characteristics of the missions, including vehicle energy consumption, operational range, payload levels, driving speed, mission duration, and stop behaviour. These baseline indicators provide the reference values that will be used in the subsequent evaluation of the battery-electric and fuel-cell demonstration vehicles.

The report first introduces the project context and explains the role of the baseline assessment within the overall evaluation framework. It then describes the methodology used for the assessment, including the data sources, data processing steps, and the modelling and simulation framework used to analyse the operational missions and calibrate the baseline vehicle models.

Based on this methodology, the report presents the baseline assessment results for the selected logistics use cases using real-world operational data from diesel trucks. The deliverable concludes with a summary of the main findings and provides recommendations related to data collection, KPI evaluation, and preparation for the comparative assessment of the zero-emission demonstration vehicles in the following evaluation phase.

The baseline use case assessment demonstrates the potential and limitations of real-world operational data. While KPIs were quantified for most use cases, data availability and signal completeness limited certain evaluations. Nevertheless, the wide diversity of baseline mission types, geographic coverage and operational conditions is assumed to provide a realistic representation of long-haul and regional freight transport in Europe.

Looking at the operational diversity of the use cases, the selected missions represent a broad spectrum of real European freight operations in the TEN-T corridors across Northern, Central and Western Europe.

The results of diesel consumption converted to energy consumption show that baseline energy consumption varies substantially across use cases, ranging from approximately 2 to 8 kWh/km. The main drivers of this variability are driver behaviour, traffic condition, weather, elevation profiles, payload levels and mission structure. As we do not receive information from the vehicles about the first three variables, the last three factors show that steep gradients and higher vehicle mass consistently result in increased energy demand. These results show that operational conditions have

a strong influence on vehicle energy performance and proves the importance of evaluating KPIs on a mission-specific basis.

The refuelling events occurred at varying intervals; While some were observed after approximately 400 km, the majority occurred within 800–1,200 km.

The analysed vehicle gross weight varies significantly across the use cases. Only one mission consistently operates at the maximum permissible gross combination weight of 44 tonnes. Most other missions remain below 40 tonnes, with an average gross combination weight of around 30 tonnes.

From the mission duration and stop structure, differences in pure driving time between mission directions are moderate and are mainly influenced by route length and, most likely, traffic conditions. The stop events also represent the significant contributor to total mission duration and differences in the mission time per direction across most use cases.

Overall, the real-world mission data from the reference vehicles made it possible to establish baseline KPIs for the majority of use cases. The core KPIs, including energy consumption, mission duration, stop behaviour, average driving speed and operational range, were successfully quantified.

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