10th International Workshop on Sustainable Road Freight Transport,
4th-5th December 2023

Economic Impacts of the Electric Road System Implementation on Rotterdam-Antwerp Corridor

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Abstract

Electric Road System (ERS) is a road that supplies electric power to the vehicles in motion. This allows powering and charging adequately-equipped road freight vehicles with electricity from the infrastructure while in motorway traffic, and using onboard batteries or another energy source (e.g. diesel, LNG, hydrogen) for the final leg between the electrified portion of the road and the customer. The implementation of ERS brings a number of benefits, including lower investment costs for vehicle purchase, reduction of resource intensity of vehicle electrification by allowing the use of smaller batteries, improved logistics performance for ERS users and a more even time distribution of electricity grid load.

Previous research[1] on ERS in Belgium and the Netherlands investigated the socio-economic performance of ERS and the corridors where such implementation could be interesting. The Dutch-Belgian road link between Rotterdam and Antwerp was shown to be one of the links where the traffic volumes and composition might justify implementation of ERS with substantial economic and environment benefits.

Given that the ports of Antwerp and Rotterdam might benefit from such ERS deployment, it is very interesting to zoom in on this specific axis. A closer investigation of impacts of ERS on Rotterdam – Antwerp corridor is useful to answer several important questions, which due to the scale of previous studies were not asked, or for which the answers of previous studies cannot be transposed.

Research questions

In this research the following four groups of research questions are defined.

- First, on the potential demand: What are the potential ERS traffic volumes that could use the Antwerp-Rotterdam corridor if it were developed? Are those sufficient to justify ERS implementation?
- Second, on the infrastructure investment and operation: What is the required investment, and can break-even point for profitability to be reached for this corridor in isolation? Or is a wider electrified network is required? Would this be a good investment at this scale?
- Third, on the best corridor route selection: With alternative road links available between Rotterdam and Antwerp, which route is best suited to be electrified from an economic perspective?

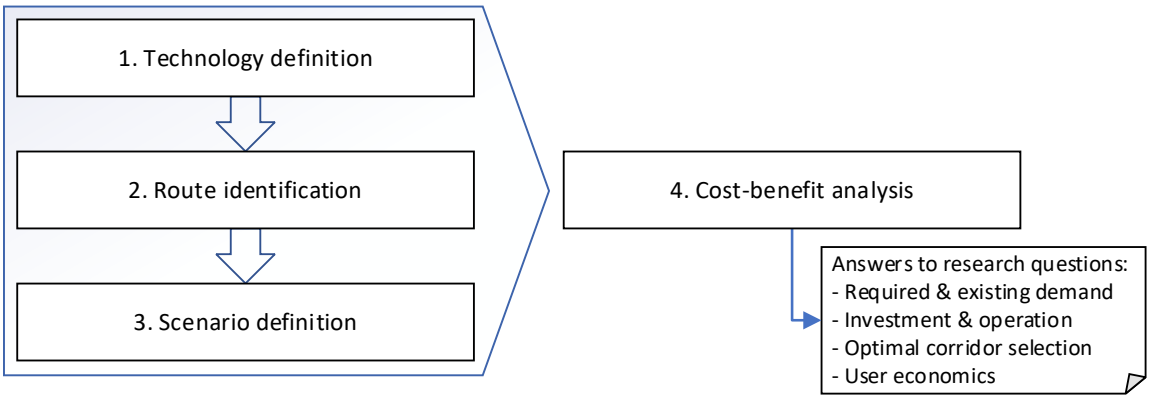
[1] (Aronietis and Vanelslander 2023), (Movares 2020) and (Decisio, EV Consult, and Sweco 2022)

- And last, from the point of view of the users – road freight transport operators: How do the economics look like, and could trucks be operated on ERS profitability in this corridor setting? Is this similar for all ERS technologies or are there substantial differences due to which a specific ERS technology should be preferred?

Methodology

To answer the research questions defined above a methodology, shown in Figure 1, is followed.

Figure 1 - Methodology summary



Step 1: Technology definition. There are several technology options available for developing ERS, each of those having a different technology readiness level. They can be categorised in three technology groups: overhead catenary, ground conductive and ground inductive. In this research we intend to remain unbiased towards preference of any of those, with the different technologies reflected as different cost structure sets to simulate the differences in performance of the different infrastructure and vehicles.

Step 2: Route identification. In this step the alternative Rotterdam – Antwerp routes are identified, and scenarios for different pre- and post-haulage differences defined based on the geographical locations of industry in the proximity of the selected routes.

Step 3: Scenario definition. In this step we prepare and validate the scenarios for cost-benefit analysis, taking into account the economic characteristics of the technology alternatives from Step 1, identified route scenarios from Step 2, and parameters that relate to other inputs and allow performing sensitivity analysis.

Step 4: Cost-benefit analysis. The results of this last step allow answering research questions that relate to the required road freight demand for profitable operation of ERS system for system operator and users. The calculation of the alternative routing scenarios allows selecting the corridor route with the best economic performance and determine the involved costs and benefits from investment and operation of the system for both, the ERS operator and the system users.

References

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