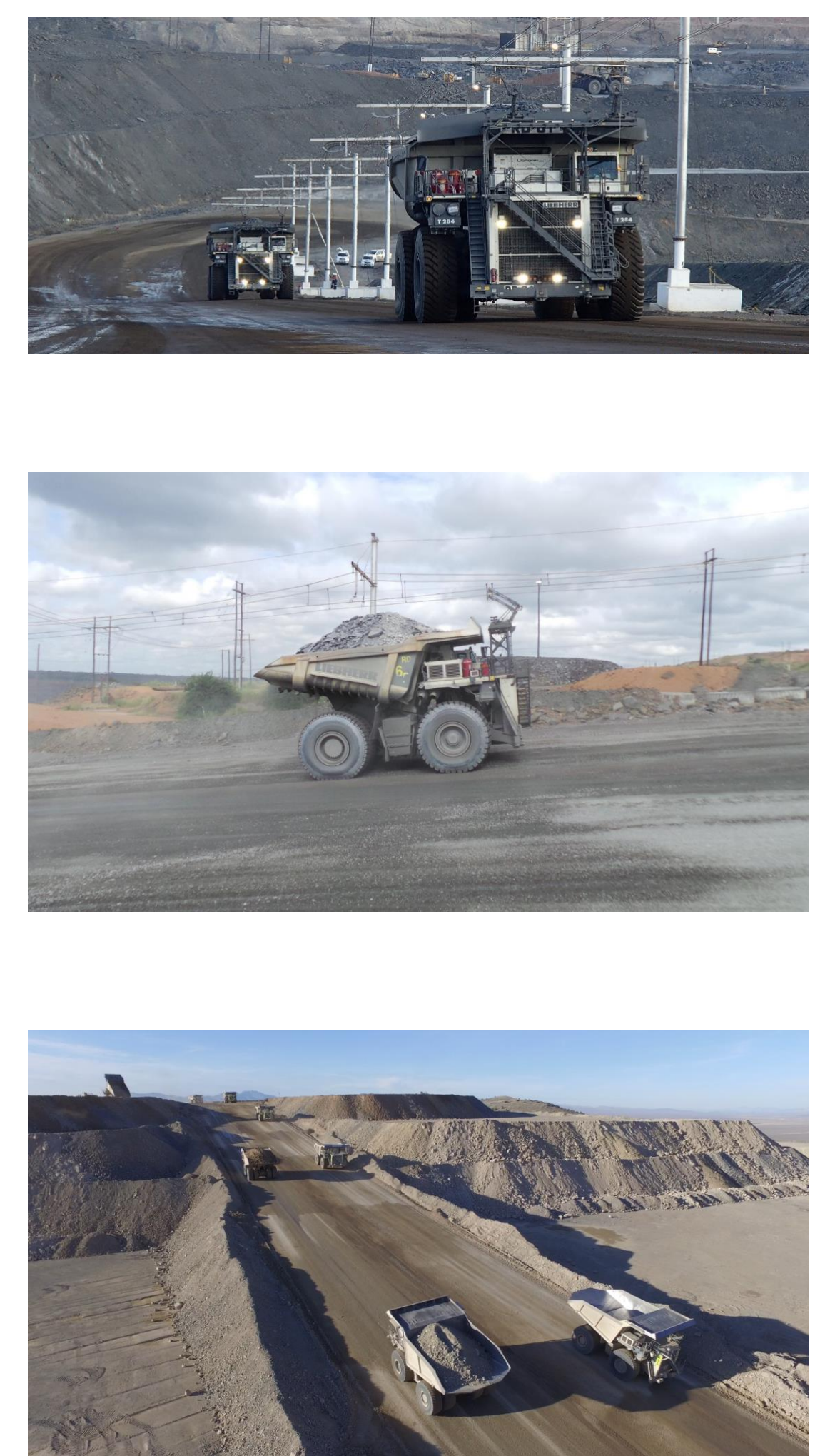
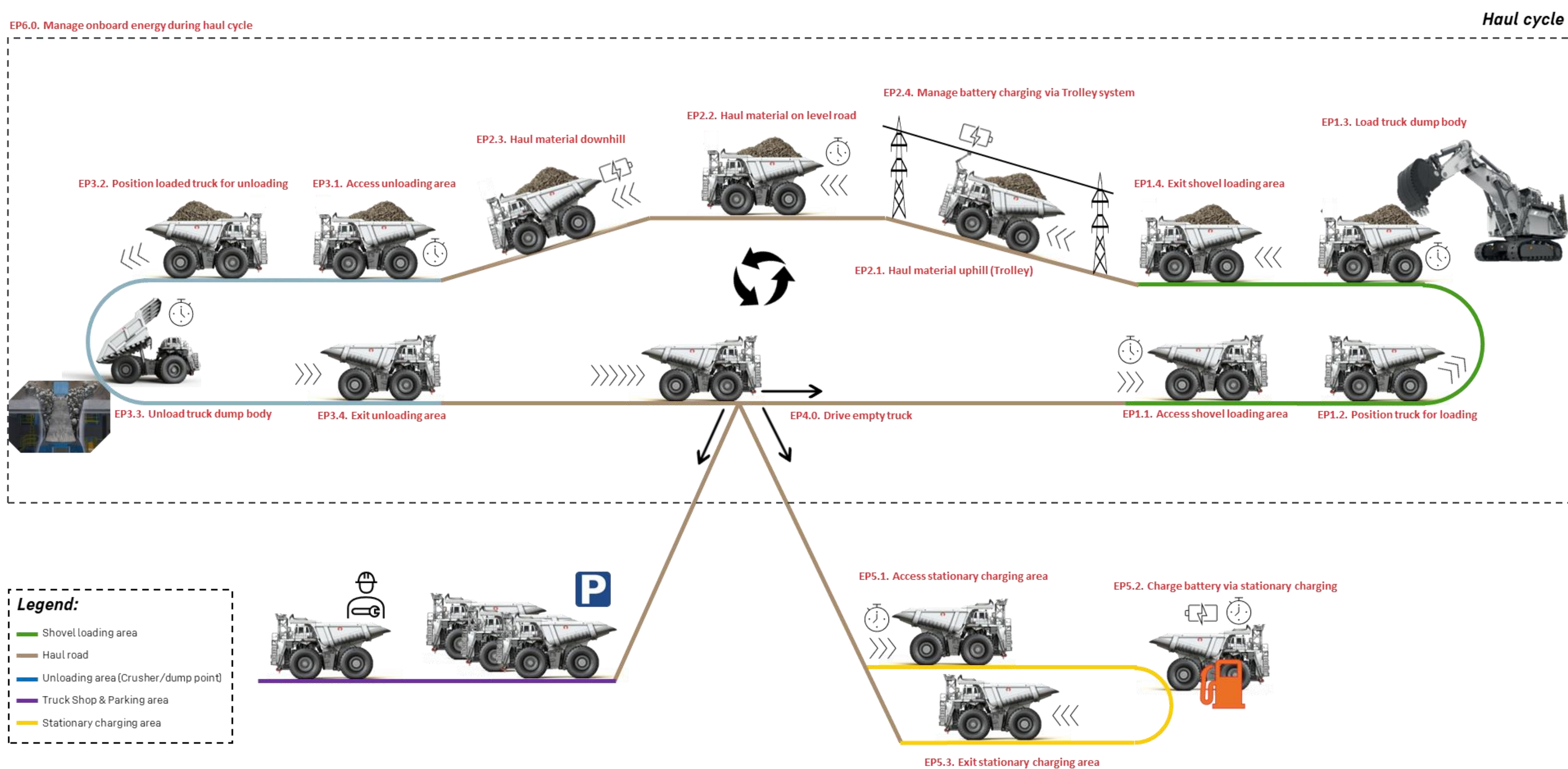
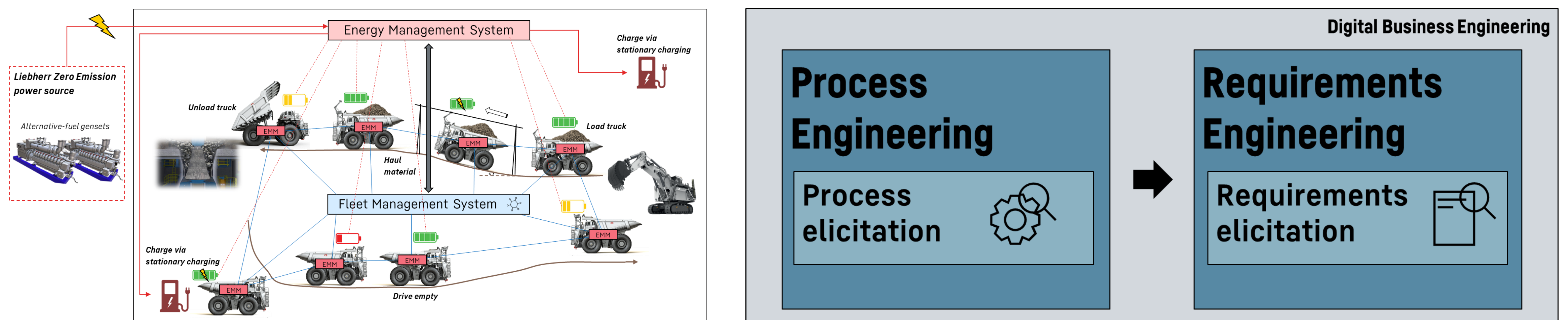


Master Thesis

Development of a charging concept for electric mining trucks



“Operate a fleet of battery electric mining trucks”: Elementary processes overview

Problem Statement

Liebherr Mining, through its Zero Emission strategy, contributes to achieving the goal of net zero emissions mining by 2050, providing mobile equipment with zero emissions powertrain technology, such as the battery electric mining trucks that are currently being worked on.

For the efficient operation of battery electric mining truck fleets in open-pit mines, a Fleet Energy Management System (FEMS) is required to enable the Fleet Management System (FMS) to orchestrate fleet assignments (route planning, truck – shovel allocation, and real-time truck dispatching) for material hauling and battery replenishment based on real-time data of the onboard energy levels.

Finally, identify the opportunity for the manufacture of a potential Liebherr Zero Emission Genset running on alternative-fuel for mining applications.

Solution Concept

The solution is the proposal of a methodology for the derivation of requirements of the Fleet Energy Management System (FEMS), in the first step, the elicitation of the process involving material hauling and energy replenishment is performed, and in the second step, the elicitation of the proposed requirements is performed.

Regarding the Liebherr Zero Emission Genset, an analysis of the current market offer, estimation of foreseen power output and identification of potential partnerships is carried out.

Results

The first result is the detailed analysis of the identified elementary processes, system logic, data objects and interactions with entities external to the Object of Analysis. Subsequently, the Fleet Energy Management System (FEMS) requirements were derived and prioritized for the proposal of a Product Backlog.

As a second result, opportunities for a heavy-duty Liebherr Zero Emission Genset were identified in specific power ranges and potential partners in markets such as Europe and Asia for manufacturing outsourcing.

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