

<https://doi.org/10.7250/CONNECT.2025.027>

SELECTION OF CRITERIA FOR LOAD ANALYSIS ON ELECTRICAL GRID IN THE CONTEXT OF TRANSPORT ELECTRIFICATION IN LATVIA

Aleksandrs SCEDROVS^{1*}, Maksims FEOFILOVS²

^{1,2} *Institute of Energy Systems and Environment, Riga Technical University, Azenes iela 12/1, Riga, LV-1048, Latvia*

* *Corresponding author. Email address: scedrovs@gmail.com*

Abstract – The following research paper addresses the pressing issue of the projected load on the electricity grid in the context of transportation electrification in Latvia. This is examined in relation to potential Electric Vehicle (EV) growth models, the current status, and implementation plans aimed at achieving the goals set by the Latvian Updated National Energy and Climate Plan 2021–2030, the Alternative Fuels Infrastructure Regulation (AFIR), and the Renewable Energy Directive (RED). The analysis considers local legislation, electricity and Renewable Energy Sources (RES) production and consumption profiles, as well as the charging habits of EV owners. The goal of this study is to create a comprehensive model for electricity demand prediction with Distributed Energy Solutions (DES) and Smart Charging capabilities for grid infrastructure development. According to research conducted by Danish scientists, “in a favorable scenario where 25 % of vehicles are electric by 2030, they are expected to contribute approximately 4 % to the peak load on a winter workday between 6 and 8 PM. In the worst-case scenario, they contribute 15 % to the peak load. In 2040, 80 % of the vehicles are expected to be electric and contribute between 15 % and 55 % to the annual peak consumption in Denmark.” The tendency behind shift in peak loads stresses the need for proactive grid planning highly relevant to Distribution System Operators (DSOs). The current grid development related to public ‘Destination’ EV charging primarily responds based on unsystematic requests for electricity connections by Charging Point Operators (CPOs) and an internally developed general simultaneity coefficient methodology. Furthermore, the ‘Highway’ EV charging infrastructure within Trans-European Transport Network (TEN-T) must be built from scratch in accordance to AFIR regulation, with specific attention given to the core sections as well as the transport flow context to the comprehend sections of it. The author also examines the shift in the EV charging profile, from predominantly “Home” overnight Alternating Current (AC) slow charging to Direct Current (DC) fast charging on-the-go. The modeling of network system scenarios for case of Latvia considers changes in charging patterns relatively to Electric Vehicle Charging Infrastructure (EVCI) availability by System Thinking approach. The causal loop diagram incorporates not only social (users’ habits), economic (growing portfolio of new affordable and used EVs, and future price parity with Internal Combustion Engine Vehicles (ICEV)), and governmental (incentives, tax tariffs, and fines for missed CO₂ targets) part, but also the technical – flexible transportation electrification options such as Battery Energy Storage Systems (BESS) and Vehicle-to-Grid (V2G). As a result, the paper states that the change of charging habits and, thus, a raising public EV Charging Infrastructure growth and its utilization rate could severely impact the peak load and must be addressed.

Keywords – *Battery Energy Storage Systems; DSO; EV Charging; EVCI; Peak load; Smart Charging; Transport electrification*