Summary- EV charging approaches in remote regions – Analysis of capacity, cost and logistics

Governments, policy makers and industries are working collectively to find ways for reducing CO_2 emissions across the industrial spectrum. The automotive industry, which has contributed extensively to the overall CO_2 emissions globally, is finding solutions to tackling this by enhancing the development of upcoming technologies like Battery powered electric vehicles (BEV). By the end of this decade, the number of electric vehicles (EV) worldwide are expected to reach 240-250 million with BEV accounting for 75% of these vehicles while the rest being plug-in hybrids (PHEV) and fuel cell vehicles (FCEV). The rapid rise in the number of EV would result in the requirement for charging infrastructure to develop over a short period of time. This poses a challenge since grid upgrades take some years to complete and hence will delay the installation of charging stations in remote areas especially.

By keeping Sweden as a country of reference, this paper is an exploratory study that looks at the feasibility of installing EV chargers over a short duration in areas where the grid is either weak or completely absent. After carrying out an extensive literature review, the paper investigates two solutions, battery and hydrogen which are either charged/produced in a renewable energy park and transported to the charging station using electric trucks.

The solutions are analyzed by developing two excel based models which show the energy flows along with the CAPEX and OPEX involved for the components in the solution. The analysis shows that battery-based solutions yield profitable results when the distance between the charging station and the energy park is low while hydrogen solutions work more effectively and yield profitable results when the distance between the charging station and the energy park is higher. These unfavorable results in the battery solution are attributed to the high transportation costs that arise from the weight limits of the trucks. Furthermore, the systems in the modelled hydrogen solution are oversized due to which unfavorable results are obtained for low demands while transportation costs do not play a major role in the hydrogen solution. The sensitivity analysis shows that by tweaking certain parameters for either of these solutions, profitable scenarios are obtained for conditions which were initially deemed unfavorable.

Through the exploratory study, it is said that these solutions have the potential to be installed in remote parts of Sweden with battery solutions expected to be implemented before hydrogen owing to the maturity of the technology. For achieving synergies, energy park operators should not restrict themselves to working with charging stations solely as the mentioned solutions have the potential to be implemented in other industries like the telecom industry.