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Smart community infrastructures — Smart transportation using fuel cell light rail transit (FC-LRT)

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Introduction

Light rail transit (LRT) has been used as convenient urban public transportation in cities for over 100 years, due to its smooth acceleration and deceleration performance, good ride comfort and larger passenger capacity than bus vehicles. Although LRT has high energy efficiency and operation stability, as well as producing zero emissions, it has shortcomings. Conventional LRT is powered with electricity supplied from the outside of vehicles through catenaries and pantographs. Setting up catenaries and substations calls for considerably high capital cost and long construction times, and spoils urban views. The voltage of electricity depends on power grids and service lines, resulting in poor interconnection in rail service networks by LRT. If the grid power fails, services are suspended on all LRT lines. LRT equipped with energy storage using batteries and super capacitors is available, but the working distance in relation to charging time is not long enough for commercial services.

Fuel cell light rail transit (FC-LRT) solves such problems with conventional LRT. Normally, hydrogen fuel cells are adopted as power sources for FC-LRT. It is not necessary to equip rolling stock with pantographs, hang catenaries or install substations, resulting in preservation of the urban view and open skies. The elimination of the facilities leads to reduction in construction and maintenance costs and time, and also safety improvements, especially on the risk with high-voltage grids exposed in cities. Fuel-cell-powered vehicles emit no GHGs or small particles, only water. LRT vehicles with energy storage, which do not rely on grids for power supply, can run on tracks independently of voltage, whether electrified or not, wherever the track gauges are the same. The on-board power source makes LRT highly resilient, especially when the power grid fails. Fuel cells enable LRT vehicles to run for longer distances than possible with other on-board energy storage.

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