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

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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This document was prepared by Technical Committee ISO/TC 268, *Sustainable cities and communities*, Subcommittee SC 1, *Smart community infrastructures*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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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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1 Scope

This document specifies a procedure to introduce smart transportation into cities by means of fuel cell light rail transit (FC-LRT). This service contributes to a cleaner atmosphere, with zero emission of greenhouse gases (GHGs) and small particles, an urban view free of catenaries and easy installation of LRT transportation operations, providing safe and comfortable rides for citizens.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
fuel cell light rail transit
FC-LRT
LRT using hydrogen fuel cells for traction

Note 1 to entry: LRT means transportation systems using light rolling stock with steel tires on segregated tracks (e.g. elevated, at ground level or underground).

3.2
conventional LRT
LRT using catenaries or third rails to collect power

4 Concept of smart transportation using FC-LRT

4.1 General

FC-LRT uses hydrogen fuel cells as a power source to drive vehicles. Compared with conventional LRT, FC-LRT has specific advantages. Hydrogen FC-LRT emits only pure water, no GHGs or small particles from the vehicle into the atmosphere around the service line. Hydrogen works as a carrier to store and deliver energy. Over-generated electricity or electricity remaining during off-peak hours can be converted to hydrogen by water electrolysis by using such electricity. Hydrogen can be stored in different forms, including liquid, high-pressure gas and others. Fuel energy stored as hydrogen can be used on demand by generating electricity in fuel cells equipped on LRT vehicles. FC-LRT runs without a power supply from grids. The elimination of overhead catenaries creates good urban views with clear skies. No catenaries or substations are needed. Thus, services can be deployed in cities more easily than conventional LRT. No power from grids makes FC-LRT highly resilient, because power is always available locally on board. The higher energy capacity of hydrogen fuel cells compared with regular batteries enables FC-LRT to run for longer distances than battery LRT. Hydrogen refuelling can be completed more quickly than battery recharging.

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