



Contents lists available at ScienceDirect

Transportation Research Part D

journal homepage: www.elsevier.com/locate/trd

Greenhouse gas emissions associated with electric vehicle charging: The impact of electricity generation mix in a developing country

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ARTICLE INFO

Article history:

Received 7 December 2016

Revised 20 May 2017

Accepted 12 June 2017

Available online xxxx

Keywords:

Electric vehicle

Global warming potential

Greenhouse gas emissions

Developing country

ABSTRACT

Since 2012, the government has been promoting the electric vehicles and the development of related infrastructure to encourage local automakers to explore into the alternatively powered vehicles. However, the benefits of grid-dependent EVs can only be harvested under the condition that their use is coupled with a low carbon electricity grid. Thus, it is an additional challenge for Malaysia's that are largely dependent on fossil fuels for electricity generation. The object of this paper is to perform a well-to-wheel life cycle assessment for calculating the greenhouse gas emissions attributable to the usage of ICEVs, HEVs and EVs in Malaysian scenario. These emission calculations will provide the best information for policymakers, researchers, and investors to make appropriate and effective decisions on policies, research and investments in future transport energy. The results show that running EVs with national grid will produce an average of 7% more GHG emissions than HEVs at the same distance. However, they will produce an average of 19% less GHG emissions than the ICEVs. Overall the GHG emissions produced through the usage of EVs are substantial based on the well-to-wheel analysis, as the environmental profile of EVs is linked with the national grid. Therefore, in order to harvest the benefit of EVs towards climate change and global warming mitigation, massive modernization and transformation should be taken for the development of the national grid towards greener sources.

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1. Introduction

The global electric vehicle volume on the road reached 1.26 million in 2015, where there were only half of them in a year before and hundreds in 2005. The Paris Declaration on Electro-Mobility and Climate Change and Call to Action sets a global deployment target of 100 million electric cars in 2030 (International Energy Agency, 2016). With each of the largest automakers globally offering one or more models every year, electric vehicle operations, and the magnitude of their environmental effects, are expected to bloom over time. Recent research report published by national automakers - Proton (Board of engineers Malaysia, 2012), shown that the conventional internal combustion engine vehicles (ICEVs) that travelled on a 1.5 l

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<http://dx.doi.org/10.1016/j.trd.2017.06.018>

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