

TOWARDS CAMPUS SUSTAINABILITY: ESTIMATING ON-CAMPUS VEHICLE CO₂ EMISSIONS IN UNIMAS

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Abstract: Carbon dioxide (CO₂) emission from motor vehicles is a one of major contributing factors to global warming. Efforts to reduce CO₂ emissions should involve all parties including universities. In 2017, Universiti Malaysia Sarawak (UNIMAS) has committed to reduce CO₂ emissions from its campus upon joining the low-carbon campus initiative. Thus, the current study aims to estimate the baseline of on-campus vehicle CO₂ emissions by using mobility analysis of 5,294 entry vehicle data from two main gates (West and East) and 15 parking zones in the campus. Parking volume observations and traffic assignment analysis using the Bureau of Public Roads functions were undertaken to determine the links' volumes. Subsequently, vehicle CO₂ emissions were derived from the estimated vehicle fuel consumption. The results reveal that a total of 1,333.4 kg of CO₂ emissions were expelled by on-campus motorised vehicle movements (which were predominantly petrol cars that comprised 80% of the observed vehicle trips). Additionally, the study discovered that the average on-campus vehicle CO₂ emission was 12.4 kg per kilometre which far exceeds the European Standard for road traffic CO₂ emissions. Thus, to achieve the status of a low-carbon campus, it is imperative for the university management to properly address Sector 3 CO₂ emissions from the transportation segment by employing effective strategies and policies to significantly reduce private vehicle dependency among university staff and students.

Keywords: Sustainability, low carbon campus, fuel consumption, vehicle CO₂ emissions, transportation.

Introduction

CO₂ emissions have continued to increase as human energy consumption has intensified over the years in which the burning of fossil fuels has been the primary source for energy. In 2020, Malaysian CO₂ emissions were estimated to be 256 million tonnes which have increased by an average of 3.1% per annum since 2009 (BP Plc, 2021). The biggest contributor to CO₂ emissions in the country is the electricity energy sector, followed by transportation and waste management (handling and disposal) sectors. In the 10th Malaysian Plan, the government of Malaysia has committed to reducing its carbon dioxide emission intensity to the gross domestic product (GDP) by 40% per GDP by 2020 to reduce the country's carbon footprint (Ho *et al.*, 2013). Consequently, the Ministry of Energy,

Green Technology and Water has developed a framework for low-carbon cities that guides the implementation on reducing carbon emissions in the country.

As far as upholding sustainability is concerned, universities are expected to practise significant responsibilities to resolve issues pertaining to sustainability and serve as a role model to society. The institutions should embark on sustainable plans that facilitate and monitor negative environmental impacts by campus facilities and activities that highly consume energy, particularly from electricity-driven infrastructures and on-campus transportation activities. In addition, implementation of good sustainability practices in the university's policies and curricula would then influence the industry's commitment towards reducing CO₂