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Sensitivity analysis of potential fuel savings by implementation of fuel economy standards for motorcycle

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Abstract Due to the decrease in the total petroleum reserves worldwide, and the growing increase in the price of petroleum, fuel consumption has become the dominant factor in the selection of the proper vehicle. However, in some countries such as Malaysia, people tend to use fuel-efficient vehicles such as motorcycles. Statistics shows that in Malaysia, the number of motorcycles is almost half of the total registered vehicles. Therefore, motorcycles as widely used vehicles have an impact on overall energy consumptions in the country. Minimum fuel economy standard can be one of the effective policies to reduce the fuel consumption in transport sector. While the main problem to set the minimum fuel economy standard is to identify the annual fuel economy improvement of the vehicle, this study aims to find a method to calculate the annual fuel economy improvement and to calculate the potential reduction in fuel consumption by implementing a fuel economy standard for motorcycles in Malaysia. The calculation is based on four scenarios of sensitivity analysis which are 5, 10, 15, and 20 % from the baseline fuel economy. While this study only covers the fuel economy standard of motorcycles, the method can be applied to the other types of motor vehicles without major modifications.

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List of Symbols

AEI	Annual fuel economy improvement for motorcycle (%)
AS_i	Applicable stock in year i of motorcycle
BFC	Baseline fuel consumption (km/l)
C	Constant value
E_0	Fuel consumption of baseline motorcycle (l)
ES_i	Energy saving in year i for motorcycle (km/l)
FC_i	Fuel consumption in the year of i (km/l)
FES	Fuel economy standard of motorcycle (km/l)
i	The particular year
IFS	Initial fuel saving (l/km)
k	Order of polynomial
L	Lifespan of motorcycle (year)
M_{AVG}	Average traveled per year (km)
Na_i	Number of motorcycles in the year i
Na_{i-1}	Number of motorcycles in the year $i-1$
Na_{i-L}	Number of motorcycles in the year $i-L$
SF_i	Scaling factor of motorcycle in the year i
SFC	Standard fuel consumption (km/l)
Sh_i	Shipments in year i for motorcycle
SSF_i	Shipment survival factor in year i for motorcycle (%)
TEI_s	Total fuel economy improvement due to the standards for motorcycle (%)
U_0	Traveled distance of the baseline motorcycle (km)
X	Year predicted − year start
Y	Predicted value
Yse_s	Year of standard enacted of motorcycle
Ysh_i	Year i of shipment of motorcycle
η_s	Percentage standard efficiency improvement of motorcycle (%)