

## Mono-Gas Fuelled Engine Performance and Emissions Simulation using GT-Power

Muhammad Yusri Ismail<sup>a</sup>, Ahmad Jais Alimin<sup>b</sup>, and Shahrul Azmir Osman<sup>c</sup>

Department of Plant and Automotive Engineering, Faculty of Mechanical and Manufacturing Engineering, Universiti Tun Hussein Onn Malaysia,  
86400 Parit Raja, Batu Pahat, Johor, Malaysia

<sup>a</sup>yusri890@yahoo.com, <sup>b</sup>ajais@uthm.edu.my, <sup>c</sup>shahrula@uthm.edu.my

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**Abstract.** The scarcity of oil resources and the rise of crude oil price had driven the whole world to seek for an alternative fuel for automotive industry. One of the prospective alternative fuels for compression ignition (C.I.) engine is compressed natural gas (CNG). In order to operate CNG in a C.I. engine as mono-gas engine (RE), several modifications are required. The modifications that involves are compression ratio, fuel injection type, addition of spark plug and fuel itself. So as to reduce the time in preparing the experimental test bed and high cost analytical study a 1-dimensional simulation software GT-Power was introduce. The GT-Power simulation model for a 4 cylinder medium duty C.I. engine (DE) and RE has been built to study the effects of conversion process to the performance and emissions of the engine at various operational conditions: low, medium and high load conditions. As compared with DE model, results from RE model showed loss in brake power (BP) and brake thermal efficiency (BTE) by 37.3% and 19% respectively. Meanwhile, for brake specific air consumption (BSAC) RE predicted to undergo an average of 19412.6 g/kW-h and increment in volumetric efficiency by percentage of difference 22%. In other side, oxides of nitrogen (NO<sub>x</sub>) RE engine model predicted reduction of 48.1% (engine mode 1-9) and increased in hydrocarbons (HC) by 90.3.

### Introduction

A natural gas vehicle (NGV) is an automobile that use compressed natural gas (CNG) or liquid natural gas (LNG) as an alternative fuel. NGVs are first been used as a substituted to gasoline fuel during mid 1930 in Italy. After the energy crisis in mid 1970's most of the developing countries start to promote NGVs to reduce dependency on foreign oil [1]. In Malaysia, the used of NGVs were started for the use of taxi cab and airport limousine during the end of 1990s. Increased of NGV user can be seen during 2008 as the fuel subsidies were removed which seen an increasing price of diesel and petrol fuel. **Figure 1** show the amount of NGVs up to 42 thousands which reflect to the pull back of subsidies from the Malaysia government [2]. On the other side Proton had also taking into account regarding on fitting Persona, Waja and Saga model with CNG kits. International Association for Natural Gas Vehicle (IANGV) set a target to achieve 50 million NGVs user by 2020 which seen a bright future for CNG as an alternative fuel.

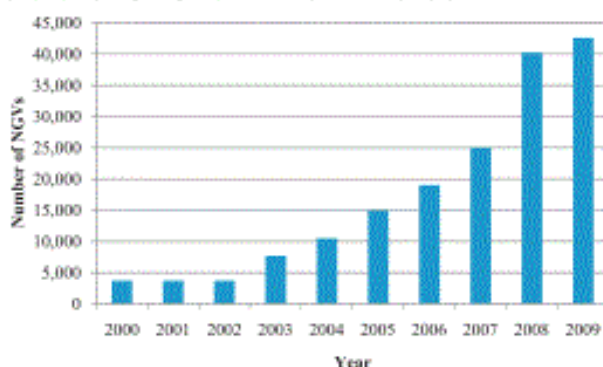


Figure 1: Natural gas vehicles in Malaysia [2]