

THE DEVELOPMENT OF ENERGY-EFFICIENT
VEHICLE USING NATURAL GAS
TECHNOLOGIES (NGV)

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SUPERVISOR'S DECLARATION

We hereby declare that we have checked this thesis and in our opinion, this thesis is adequate in terms of scope and quality for the award of degree of Bachelor of Engineering Technology in Energy & Environmental.

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries in which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

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DEDICATION

I dedicate my dissertation work to :

My beloved parents, my dad Wan Arifin Bin Wan Daud and my mom Rusnah Binti Harun. A special feeling of gratitude to them whose always give words of encouragement and push for tenacity ring in my ears.

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LIST OF SYMBOLS

$\mu\text{g}/\text{m}^3$	microgram per meter cubic
Btu	British Thermal Unit
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
F	Force unit
kg	kilogram
km	kilometer
kW	kiloWatt
L	Liter
lb	Pound
MJ	Mega joule
mPa	Megapascal
MPa	Megapascal
mscfd	million standard cubic feet per day
N	Newton unit
NO	Nitric Oxide
NO ₂	Nitrogen Dioxide
NO _x	Nitric Oxide
ppm	Part per million
SO ₂	Sulphur Dioxide
SO _x	Sulphur Oxide
tcf	trillion cubic feet

LIST OF ABBREVIATION

ADC	Analog to Digital Converter
API	Air Pollution Index
CNG	Compressed Natural Gas
DOHC	Dual Overhead Camshaft
ECU	Electronic Control Unit
EPU	Economic Planning Unit
FEM	Finite Element Method
FRP	Fiberglass Reinforced Plastic
KPI	Key Performance Indicator
LCD	Liquid-Crystal Display
LNG	Liquefied Natural Gas
MAP	Manifold Absolute Pressure
NGV	Natural Gas Vehicle
PM	Particulate Matter
PRSS	Petronas Research & Scientific Services
RPM	Revolution per minute
UMP	Universiti Malaysia Pahang
VVL	Variable Valve Lift