THE ACCEPTANCE LEVEL OF THE NGV FUEL FOR THE CONTAINER HAULAGE OPERATION

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Abstract
NGV is an eco-friendly fuel that gaining much attention due to an increase in global concern on the environmental impact of petroleum-based fuel consumption. As a result, NGV has emerged as a viable option for the replacement of petroleum-based fuel, driven by the rapid drop in its cost and advancement in engine technology. Yet, uncertainties exist relative to the extent and quality of reserves, safety and community acceptance, fuel cost and continued availability, and sustainability of NGV supply. This study is to identify the acceptance level of NGV fuel among haulage companies. A quantitative method using an administrative survey has been adopted to collect the information of 118 respondents consists of various positions in the Haulage company that participated in the survey. The result revealed safety, economic NGV price, availability of fuel refilling station, and installation cost are statistically influence the acceptance level of NGV fuel among the haulage operator. The finding also reveals the availability of the refuel station as the most critical factor that influences the acceptance level of NGV among the respondent. Given the significant impact of the availability of refueling stations on the successful implementation of NGV adoption, it is crucial for the government to directly involved in the implementation.

Keywords-- Supply Chain Management, Logistics Management, Transportation, Haulage operation, NGV Fuel.

INTRODUCTION
Road transport is now one of the major services in the logistics industry. The efficiency of moving products and goods in the logistics industry is determined by the effectiveness of operations in transportation planning. However, due to the lack of barriers to entry into the market, the number of service providers in the transport industry has grown rapidly and has led to fierce competition in terms of pricing in the market. This has forced transport companies to be more innovative in managing their operating costs.

Fuel costs represent the largest expense of management costs in the transportation industry that affect a company's profitability. In addition to having many options in the shipping mode, customers are also very concerned about the costs involved in shipping the goods. This has resulted in NGVs being seen as capable of reducing fuel consumption costs by up to 50% as a way of solving problems for transport companies in managing fuel costs and also providing more competitive cost to customers.

Besides, increasing public awareness of the threat of air pollution to global warming has led to critical illnesses such as heat stroke caused by excessive release of carbon monoxide from fuel consumption based on petroleum.

RESEARCH BACKGROUND
Road and environmental issues have been paradoxical since transport activities bring many social and economic benefits to society and the country, but at the same time, they have adversely affected the ecosystem. There is no doubt that the existence of transport activities has supported the increasing demand for mobility transport. However, transportation activities are often associated with increased levels of environmental pollution [1]. Also, environmental conditions affect vehicle operating systems that directly create the need for

vehicle maintenance activities that contribute to the removal of hazardous materials from vehicle systems that could adversely affect the environment if not properly managed.

The rapid growth of the industrial sector has contributed to environmental pollution that impacting climate change which will be more difficult to manage in the future. To ensure environmental sustainability, green practices as part of the social life should be the responsibility of industry practitioners to invest in researching and developing green products, creating models that limit the use of harmful substances at all levels of the supply chain. The use of NGV will also reduce the carbon dioxide (CO_2) emissions that are largely contributed by greenhouse operations.

Therefore, NGV is seen as one of the most effective ways to reduce the impact of pollution on the environment and surrounding areas. In the era of globalization, many alternatives have been developed to enhance transportation operations such as the introduction of green logistics activities aimed at protecting and helping reduce carbon dioxide emissions. Therefore, this study is to identify the level of NGV acceptance among Haulage companies.

NATURAL GAS VEHICLE (NGV)
In the mid-1930s the use of NGVs was introduced in Italy and began to expand to other countries as early as 1940. The NGV was an alternative to petrol-powered vehicles that could replace fuel consumption for automotive users. The use of NGV has been widely promoted in developed economies and developing countries to reduce dependence on crude oil supply. In the logistics industry, the usage of petrol to operate transport services has played an important role since over the last century. However, the increasing global concerns over energy and environmental issues have presented a new treat and

challenges to combustion engine (ICE) technology that acquiring a large supply of petroleum and fuel [2].

FACTOR OF ACCEPTANCE NGV USAGE
A. Awareness On Climate Change Issue

The introduction of chemicals, coarse or biological materials that cause harm to the living organism and the environment in the atmosphere is called air pollution [4]. Other than that, Air pollution can be characterized as the presence of pollutant (agent that spoils air quality, for example, sulfur dioxide (SO_2), molecule substances (PM), nitrogen oxides (NOX) and Ozone (O_3) noticeable all around that we in robust at levels which can make some negative consequences for the environment and human well being [3]. Transportation including lorry fundamentally works when there is the combustion of fossil fuel that produces energy which later then translated into motion. Industrial smoke is causing widespread respiratory diseases and distress, an assortment of production lines, chemical factories, and machines are additionally adding to the earth issue. However, as one of the important things in running the daily supply chain, it is undeniable that the trucking industry plays such a crucial role in our daily life. From raw materials to the end product, the whole process needs transportation. Despite all the good things, transportation or to be specific haulage is undoubtedly one of the sources of the global pollutants.

One of the effects of air pollution is it weakens the human health. Air pollution is undoubtedly brought a huge impact on human health. It has been one of the major causes of light decease such as eye irritation and failure of upper respiratory to the continuous and chronic failure of heart, lung cancer, failure of the major respiratory system and might cause death. Air contamination has been appeared to cause intense respiratory diseases in youngsters and incessant bronchitis in grown-ups [3]. The impacts of air pollution on a person may vary. The degree to which people may be exposed to this primary or secondary pollution depends on what kinds of activities they start in, and where the highest concentrations of [14].

By that Tiong Nam between the haulage company which applies the use of NGV to haulage aimed at reducing fuel consumption which may result in the depletion of the ozone layer caused by the release of carbon dioxide gas.

B. The Economic of NGV Price

Diesel, electricity and natural gas are all energy currencies that can be used to power transportation. When considering the cost of running an alternative fuel vehicle—the cost of the energy in the vehicle (the fuel) is one important factor determining the vehicle cost. At the present market price for Compressed Natural Gas (CNG) that use in the NGV vehicle is approximately 50% lower from the r conventional fuels, and it is suitable for all types of applications, including business fleets and vehicles for personal use As compare to other energy currency, the natural gas costs are more stable due to less complexity in term acquiring and production process.

Hence, the Natural gas cost is expected to stay comparatively stable for years to come back, whereas the other energy (the fuel) is highly volatile due to market demand and supply. Many companies use a complete value of possession (TCO) analysis to form vehicle choice analysis on different criteria, like application necessities and vehicle possibility content choices, which are thought of. Based on the observations created [5] there is 2 political economy supporting the choice of NGVs there are higher acquisition prices and reduced defrayment on due.

C. Higher Acquisition Costs

To convert a Diesel engine to an NGV engine, certain modifications in the engine such as replacing CRDI with gas injectors to maintain the injection pressure, modifying the inlet port and piston crown geometry to covert the swirl motion to tumble motion in the combustion chamber. This is because CNG burns are hotter than diesel which may cause damage to seals and valves to lead to engine breakdown. Hence, a modification is required for the engine and the cost of modification will determine the justification for the investment. In many countries, the Government is offering an incentive such as grant and rebate to offset the differential cost of the conversion. Lower CNG prices and government incentives have encouraged many transport companies in another country to perform the engine conversion to NGV.

D. Maintenance Cost

Natural gas which mainly made up of methane is known as one of the cleanest burning alternative fuels. It is currently used in two types of form either in the form of compressed natural gas (CNG) or liquefied natural gas (LNG) to fuel cars and trucks. The Natural gas in the form of CNG is suitable to be used in gasoline-fueled vehicle, but require some modification to avoid damage to exhaust valves and valve seats. This modification is, however, will not change the visual appearance of the engine, nor do they change the engine's maintenance and service requirements.

E. NGV and Safety

Compressed fossil fuel has been used as a vehicle fuel since the first 1940s and nowadays the amount of vehicles on the road is or so four million. Initially, the aggressive cylinders accustomed to store the fossil fuel were manufactured and tested under the commercial cylinder standards however this resulted in cylinders that were tar heavier than they required being. Additionally, with the event of high strength steel and aluminum alloys and also the increasing acceptance of composite cylinder technology, authorities knew the requirement for standards to adopt the raw materials, therefore, the light-weight sturdy and safe cylinders can be approved for used [14-15]).

Besides, some individuals have an idea between fossil fuel vehicles (NGV) with liquefied oil gas (LFG). Compressed fossil fuel (CNG) isn't compatible with LPG cylinders. Distinction operational pressures may end up in ruinous failure (G. Hatris and A. Lawson, 2005). There are two recent instances of vehicles in distinction counties fitted with a liquefied oil Sas (LPG) tank being crammed from compressed fossil fuel (CNG) dispensers.

In each case, there was a frightening accident with the vehicle being utterly destroyed and substantial injury caused to the supply station. Simply however the filling took place isn't clear however in each case it's thought that AN LPG cylinder was fitted to AN existing NGV.

These incidents diagrammatically illustrate the requirement for education and adequate review procedures within the NGV business. Vehicle house owners ought to be created responsive to the variations between compressed fossil fuel (CNG) and liquefied oil gas (LPG) and for the requirement to own their vehicles overconfidence and inspected as needed by native regulations.

Regulatory authorities ought to implement certification systems for fresh converted vehicles and regular review of the vehicle and parts like cylinders. Similarly, inspectors would like adequate coaching to make sure they're responsive to potential hazards.

Information at the refueling station is additionally vital each on the fuel pumps and for any staff refueling vehicles that ought to get on the lookout for vehicles that are potential issues.

F. Number Refuel Station

The ability to make alternative fuel options available for Haulage operation is depending on the ability to justify the investment return for the infrastructure of refueling stations. The availability of NGV refueling stations and quick refueling time were the main concerns expressed by the taxi driver in the study by [9]. Hence, Getting the right projection on the number of the truck to participate in the NGV application is critical to making the business case for the initial truck and infrastructure deployments [18].

G. Diesel price

As per [7] suggestion, three central points will be considered by the consumer choice when settling on a green-obtaining choice which are accessibility, cost, and supply. As petroleum-based fuel subsidies were slowly removed since the year 2008, the cost of diesel has also appreciated since then which witness a prompted extreme increases in the quantity of new NGV in [3]). The cost of NGV fuel been constantly less expensive by 30 –50% half than petroleum or diesel (Seisler 2015). This will be a noteworthy credit for a taxi owner to change over to NGV which inline with Mohd Suki (2013) finding that customers' choice to buy ecologically item is exceptionally impacted by its cost, which means the low value improves purchase.

H. Government Policy

Government initiative relates to domestic public assistance or initiatives. This implies the government plays a significant role in the growth of the NGV ecosystem, and all the government's initiative attempts are essential. The Malaysian government has introduced several measures to encourage the use of NGV fuel as an alternative fuel (Semin, Idris, Bakar 2009) such as an incentive in road tax reduction and tax incentives to encourage the purchase of new NGVs as well as a sales tax on NGV conversion kits which eventually decreases the owner's capital expenses. Based on a study conducted by Ong, Mahlia, and Masjuki (2011) the demand for natural gas vehicles (NGVs) has dramatically increased due to the introduction of government policy that makes NGVs more appeal to consumers. However, much like the rapid expansion of any development, it can be left stretched without full investment. Hence, governments should make greater attempts to promote the NGV's consciousness to the public on the environmental issues on an ongoing basis. This includes an initiative for offering a soft loan to users and producers of environmentally friendly products [9]. The awareness campaign to the public on NGV's should not be limited by using social advertising to inform and promote public knowledge and concern about the environment. The government should launch a campaign to promote consciousness on environmental protection activities such as "go-green campaign, Earth Hour," and other campaign activities to reduce the burden of environmental.

DEVELOPMENT OF CONCEPTUAL FRAMEWORK

The objective of this study is to investigate factors that influence the Haulage company to use NGV fuel for its operation. To facilitate the study, a conceptual framework was developed based on work by Nor'Aini Yusof (2015) that focuses on the implementation of NGV fuel applications among the owner of the car in Malaysia.
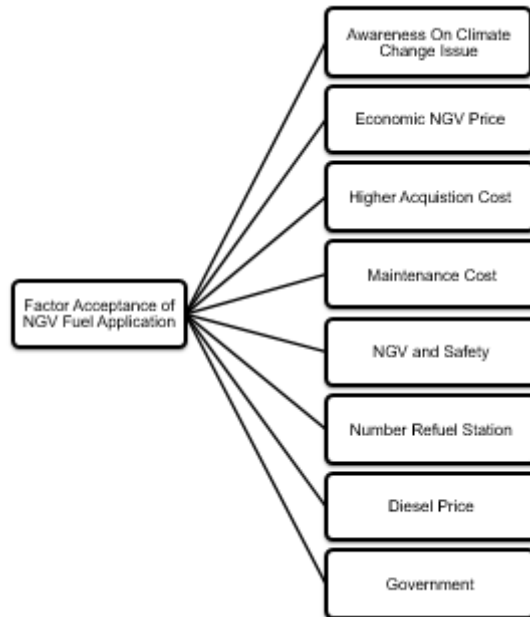

Figure 1. Development of Conceptual Framework of Research

RESEARCH APPROACH

In this study, the data was collected based on a quantitative method to explore and understand the experience of the respondent on their empirical observations and critical interpretations of subject research. The use of the quantitative method is appropriate in investigating individual perception in social science [11].

The closed-ended questions were developed to collect the information from the and 118 respondents who participated in answering the questions. This number is sufficient for the data analysis requirement using Statistical Package for Social Sciences (SPSS). The data collected from the survey were analyzed using the descriptive and inferential analysis to identify converging or diverging areas of interest.

RESULT AND DISCUSSION

The data collected from the interview session will be discussed and analyzed in this section. As for the interview result, all the findings will be summarized according to the theme that reflects the objective of the study.

Descriptive Analysis
1. Level of Acceptance
Nine (9) questions were developed to unveil the respondent acceptance level on the various factor that influence the intention of the respondent to use NGV for the Haulage operation. The respondent's acceptance level was verified using developed five-point scales as shown in Table 1.

Table 1. Level of Acceptance

Question	1	2	3	4	5	Mean	Std. Dev
Environmental awareness due to high carbon dioxide produces in diesel consumption.	1 (0.8)			73 (61.9%)	44 (37.3%)	4.3475	.57553
Installation cost of NGV fuel system.			3 (2.5%)	58 (49.2%)	57 (48.3%)	4.4576	.54919
Maintenance cost of NGV system.				84 (71.2%)	34 (28.8%)	4.2881	.45483
NGV is one of the safety fuel available in market.			2 (1.7%)	42 (35.6%)	74 (62.7%)	4.6186	.53779
Number of NGV refuel station.			3 (2.5%)	57 (48.3%)	58 (49.2%)	4.4661	.54978
The distribution infrastructure are limited.			4 (3.4%)	68 (57.6%)	46 (39%)	4.3559	. 54734
High fluctuate of diesel price.	1 (0.8%)	2 (1.7%)	1 (0.8%)	73 (61.9%)	41 (34.7%)	4.2797	.65222
The price of NGV has been always cheaper by 30% - 50% than petrol and diesel.	2 (1.7%)	1 (0.8%)	6 (5.1%)	52 (44.1%)	57 (48.3%)	4.3644	.76978
The NGV users get the reduction 50% of road tax from government.		1 (0.8%)	1 (0.8%)	67 (56.8%)	49 (41.5%)	4.3898	.55522

The first finding shows that the majority of the respondents 99.2% (61.9% - agreed, 37.3% - strongly agreed) are aware of the impact of fossil fuel-based engines that release a high carbon dioxide to the air. Only 0.8% of the respondents are not sure about the impact.

Despite a concern on the environmental implication of diesel usage, the majority of the respondents (49.2% - agreed, 48.3% - strongly agree) are still hesitate to use NGV due to the high installation cost require to install a separate system for NGV. Only 2.5% of the total respondents are not shown concern on the installation cost.

In any equipment investment, maintenance cost is always a critical element in the total cost ownership (TCO) evaluation that basically will influence the decision. The importance of this element is evident in this study where the majority of the respondent are emphasizing this aspect (28.8%-strongly agree, 71.2% - agree).

In terms of safety, the majority of the respondent (62.7% - strongly agree, 35.6% - agree) feel confident about the NGV characteristic as an engine fuel and the current installation design of the NGV system for their operation. Only 1.7% of the respondent is not sure about this aspect.

Respondent also being asked their concern on the number of NGV refuel station. The result shows that about 97.5% of respondents (48.3% - agreed, 49.2%- strongly agreed) concern

on the number of NGV refilling stations that available for them to shift to NGV fuel. Only 2.5% of the respondent not really concern about this factor.

The availability of NGV refuels station has directly impact respondent perception on the distribution infrastructure which shows more than 96.6% of respondents (57.6%-agreed, 39%-strongly agreed) agree that the limited distribution infrastructure can affect the acceptance level.

Furthermore, about 96.6% of the respondents (61.9%- agreed, 34.7% - strongly agreed) indicate the high fluctuate of diesel price affects the acceptance level. Only 2.5 % of the respondent not agree and 0.8% remain neutral.

Next, about 92.4% of the respondents (44.1%- agreed,48.3% - strongly agreed) agree that the price of NGV has been always cheaper by 30%-50% than petrol and diesel which encourage them to use this fuel.

Lastly, the majority of respondents (56.8%-Agree, 41.5% - strongly agree) indicate that the reduction of 50% of road tax costs granted by the government is attractiveness.

Inferential Analysis
The information obtained from the descriptive analysis has provided us with general information regarding the current status of the research subject. However, this information is not sufficient to report various issues. For this reason, additional statistical analysis reporting is needed to examine the relationship between acceptance variables developed in the conceptual framework.

Multiple regressions have been used to analyze further the relationship between these variables to the readiness of the haulage company to adopt NGV.

The requirement of multiple regressions must be met to ensure the accuracy of the results from the regression analysis. There are three steps in the analysis of the outcome by using the standard multiple regression techniques that includes checking the assumptions, evaluating the model and evaluating each of the independent variables [16].

Step 1: Checking the assumption
In standard multiple regression techniques, there are few steps to be followed to analyze the result as follows:

a) Sample size
Based on [20], the sample size requirements can be calculated by taking into account the number of independent variables as the following formula:

Formula of sample size = N > 50 + 8m
(m= number of independent variables)

Based on the above formula, a minimum of 114 respondents are required to respond to the survey and the total 118 samples collected from the survey were sufficient to meet the standard regression requirement.

Outliers were checked using the Mahalanobis distance test using multiple regression programs. The maximum score from the test was 27.782.

Based on the 8 variables developed in the framework, the critical value for evaluating the Mahalanobis distance values was calculated at 20.09 in adopted from Tabachnick and [17]. and [16].

Table 2. Outlier Residuals Statistics

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	.8307	2.0423	1.5085	.32373	118
Std. Predicted Value	-2.094	1.649	.000	1.000	118
Standard Error of Predicted Value	.083	.230	.113	.026	118
Adjusted Predicted Value	.8180	2.0456	1.5107	.32540	118
Residual	-.84434	.96493	.00000	.38375	118
Std. Residual	-2.114	2.416	.000	.961	118
Stud. Residual	-2.302	2.479	-.003	1.003	118
Deleted Residual	-1.00168	1.01604	-.00219	.41859	118
Stud. Deleted Residual	-2.350	2.541	-.003	1.011	118
Mahal. Distance	4.094	37.763	8.924	5.512	118
Cook's Distance	.000	.099	.009	.014	118
Centered Leverage Value	.035	.323	.076	.047	118

a. Dependent Variable: Use

b) Normal P-P plot of regression standardized residual
Normal P-Plot regression shows a straight line (from bottom left to top right) relationship with the predicted dependent variable scores. This indicated appropriate data used in the multiple regression.
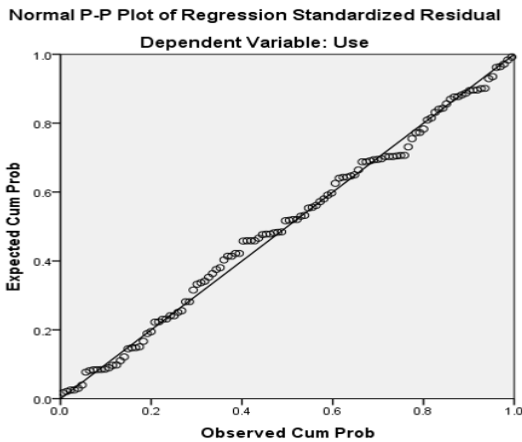

Figure 2. Normal P-P Plot of Regression Standardized Residual

c) Histogram
Figure 3 confirms that the data were suitable to be used in the multiple regression analysis because the residuals were normally distributed about the predicted dependent scores.
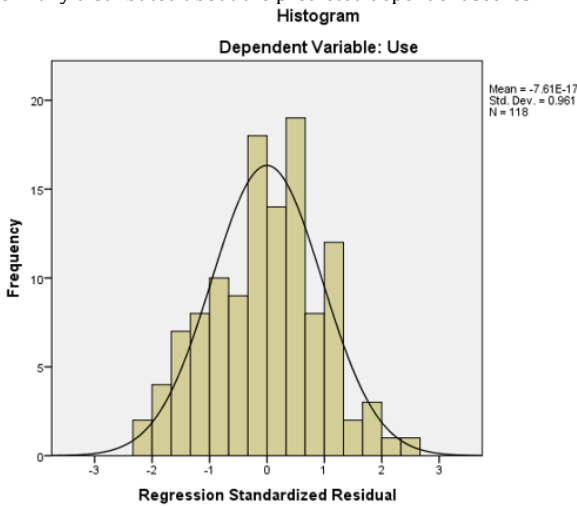

Figure 3. Histogram

d) Co linearity diagnostics
The cut-off points for determining the presence of multicollinearity are a tolerance value of less than 10 and the VIF value of above 10. The result shows the tolerance value for each independent variable was more than .10, and these results were supported by the VIF value, which was below 10. Therefore, the results indicated no violation of the multicollinearity assumption.

Table 3. Coefficient

Model	Standardized Coefficients	t	Sig.	Collinearity Statistics	
	Beta			Tolerance	VIF
(Constant)		-3.153	.002		
Awareness	-.071	-.955	.342	.982	1.019
Installation Cost	.278	3.627	.000	.918	1.089
Maintenance	.044	.584	.560	.964	1.038
Safety	.298	3.820	.000	.887	1.128
1 Refuel Station	.316	3.944	.000	.844	1.185
Limited Infrastructure	-.021	-.260	.795	.817	1.224
Diesel Price	.082	1.063	.290	.918	1.089
Economic of NGV Price	.284	3.744	.000	.943	1.060
Government	-.057	-.755	.452	.933	1.072

Step 2: Evaluating the model
In this study, the value of R square was .416. When expressed as a percentage multiplied by 100, this means that the model explained 41.6 5% of the variance in frequency of experience.

Table 4. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.645[a]	.416	.367	.39942

a. Predictors: (Constant), Government, Limited Infrastructure, Maintenance, Diesel Price, Awareness, Installation Cost, Economic of NGV Price, Safety, Refuel Station

b. Dependent Variable: Use

The model in this study is statistical significance [$F(9,108)$ = 8.540, $p < 0.000$].

Table 5. ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	12.262	9	1.362	8.540	.000[b]
Residual	17.230	108	.160		
Total	29.492	117			

a. Dependent Variable: Use

b. Predictors: (Constant), Government, Limited Infrastructure, Maintenance, Diesel Price, Awareness, Installation Cost, Economic of NGV Price, Safety, Refuel Station

Step 3: Evaluating each of the independent variables
The 8 independent variables developed to predict the dependent variable (Use). Only installation cost, safety, refueling station and price ($p < .05$) made a significant contribution to the prediction of the dependent variable (Use). The beta coefficient value used standardized coefficient is adopted to determine the biggest impact among the variables [16]. Results (see Table 3) indicate that the independent variable namely the refuel station was the largest beta coefficient (Beta = 0.316) that made the strongest contribution to explain the dependent variable. In other words, the refuel station was the best factor that influenced the acceptance level of NGV fuel application.

CONCLUSION

Survey questions were developed to find out the level of acceptance company towards the NGV fuel application. These question covers the awareness, economic NGV price, maintenance, safety, investment cost, refuel station, diesel price and government support towards NGV.

The result revealed that the majority of the respondent agreed on the limited number of NGV refueling stations as a significant factor that influences the company to use the NGV. The majority of the Haulage companies do not dare to take a risk in installing NGVs system if there are not sufficient NGV refueling stations. This finding supports the suggestion by [10] & [19]) that suggests the limited availability of natural gas supply in a strategic area resulting in low acceptance in the NGV usage. Despite several measures initiated by Malaysian government to encourage the use of CNG as an alternative fuel [3] such as a 50 percent decrease in road tax and tax incentives to encourage the purchase of fresh NGVs as well as a sales tax on NGV conversion kits which eventually decreases the owner's capital expenses. It is still not successful to convince the Haulage company to use the NGV.

The finding indicates that the success of the usage of NGV fuel is much depending on the availability of NGV refueling stations. The company will not take the risk and it will cost more to the company if the refueling station is not located at the strategic operation area. The refueling station's primary goal is to refuel vehicles to a 100% charge condition (SOC) throughout the daily operations of the station. The limited number of refueling stations will increase the refueling time that will eventually increase the cost and reduce the efficiency of the operation [3] & [12]. This shortfall will hinder NGV development in Malaysia as most of the companies are reluctant to implement NGVs until the refueling infrastructure is fully developed.

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