# [MAN 1] THE USE OF GREEN TECHNOLOGY VEHICLE AND ITS IMPLEMENTATION IN ENVIRONMENTAL SUSTAINABILITY UNIVERSITY

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### ABSTRACT

Technology and economy development in last millennium have increased the mobility people and the goods. As a result, it effect dramatic expansion on transportation sector. Especially public transportation can be a crucial component of a solution to providing mobility while reducing environmental impact and traffic congestion. However, the use of conventional vehicle that use in current university society will become contra if its need to standardize the vehicle due to high number emission produced by the vehicle. The purpose of this study is to explore the concept of Green Technology especially the Green Technology vehicle and its implementation through the university in environment. This research study is to investigate the type vehicle and the proper implementation green campus for vehicle in Universiti Utara Malaysia. A case study with qualitative approach is conducted by data collection to strengthen information, an interview the related department in university that operate and do maintenance, and observation to explore the practice of green university. The expected finding of this study is to convince university to using green product transportation and implementing green practice that can minimize the emission produced by vehicles. There is limitation throughout this study which include the lack of information source from previous study since Green Technology is still new and information limited for the public.

**Keywords:** green technology, vehicle, emission, green university, environmental, transportation

#### **INTRODUCTION**

Technology and economy development in last millennium have increased the mobility people and the goods. As a result, it effect dramatic expansion on transportation sector. Especially public transportation could be an important component of a solution to providing mobility while reducing environmental impact and traffic congestion. While global environmental problem call for drastic cuts on fossil fuel use. As the environment becomes keep degraded, the Industrialised nations, the world's biggest emitters of carbon, are being urged to make it easier for developing countries to access green technology.

Sustainability of environment rose rapidly and become institution of higher education concern in recent years. Environmental sustainability of higher education nationally and globally is a relatively new movement, and it has already be one of the most prominent topics for leaders in higher education to be discussed in the 21st century (Bardaglio & Putnam, 2009; Bartlett & Chase, 2004). Nevertheless, for environmental

sustainability on many college and university campuses in Malaysia or other country can be general support, for instance Universiti Utara Malaysia (UUM) that initiatively stated to effectively implement comprehensive green campus university.

This study sought to understand how a university implemented a wide-ranging environmental sustainability, focuses more on the improve quality UUM to be leader campus that implementing green university by standardizing any vehicle that use in UUM and improving the efficiency existing bus transportation to be more friendly environmental.

The main purposed of this study is to analyse the possibility to improve quality of Green Technology transportation industry in Malaysia generally, UUM specially. Qualitative approach is conducted through interview with the company whom owned the bus and maintaining vehicle around UUM, in this case, Unic Leisure Berhad, Unit Pendaftar and Unit Kenderaan Universiti Utara Malaysia Berhad. However, this study only cover bus campus, vehicle owned by university, and registered/sticker vehicle owned by staff and student.

Green technology	Conventional technology
Green technology is the use of technical knowledge of various fields in new ways that does not pose any harmful effect on the environment or reduce the effect.	Conventional technology is the use of technical knowledge in various fields in such a way that environment is affected negatively.
In terms of energy, green fuels are those which release the least amount of harmful fumes in atmosphere and are more energy efficient.	In terms of energy, conventional fuels are those which release harmful fumes and are less energy efficient.

 Table 8

 Conventional and green technology differences

# **PROBLEM STATEMENT**

Following to the investigate vehicle to be more green vehicle, there is a tendency where society will become contra to certain technology if university standardizing the vehicle due to standardizing the maximum emission produced by the vehicle.

In addition, there are a lot of literatures that explained as the context of environmental sustainability in high level education and describes associated with green practices, and there is a gap in research that addresses the process of how sustainability of environmental are implemented in higher education settings (Wright, 2010). But, related study regarding how green technology affect much in Malaysia is limited.

Last but not least, there are some practice that University implemented for environmental sustainability. Practitioner curious about the implementation green technology vehicle and it suitable for university, and if so they should implement it for university. Therefore, the purpose of this research is:

- a. To investigate what type of vehicles use in UUM
- b. To determine the proper implementation green campus for vehicle in UUM.

### LITERATURE REVIEW

Green technology is the application the one that has "green purpose". Green here does not mean the colour. It mean the application of the environmental technology and science for the developing and applicate of product, equipment and system to conserve the native resources and environmental, as well as to mitigate or minimize the bad impact on the environment from human activities. And global warming phenomenon was effect on unpredicted climate change. This global issue start due to the activities that humans do since 18<sup>th</sup> century which is on Industrialization era (Sulaiman, 2008).

Latest researches are following and make a study about the alternative for green energy production and source. Relevant governments and organization such as World Energy Council (WEC) are the key roles to implement and develop a huge-scale of green technology efforts that meet the society needs thru the unlimited ways into the future without exploiting or even damaging natural resources. Furthermore, meeting current requirement with believing the next generation have an ability to meet their own needs. Green chemistry, green building, environmentally purchasing, green nanotechnology are the Examples of green technology supplies include but not limited to energy (Bakar, 2011).

### Green technology opportunities

World's economies is embark a new revolution of industrial due to the unpredicted climate change. For this reason, some countries around the world have notified policies, regulations and systematic structure to work up their usage of green energy and green technology in a move toward zero-carbon and 'healthier' economy. Green energies it can be energy efficiency, energy conservation, renewable energy and any kind of energy that are more sustainable from environment point of view by diminishing pollution and total energy consumption. Among the scholar aware of green technology opportunities are as follows:

- "The future of technology is mostly green technology. With increasing energy costs and the global warming threat, the benefit of using green technology acknowledge much of businesses to maximize decarbonisation, minimize waste, and impact their business positively to others" (Zainura, 2010).
- "In the 21<sup>st</sup> century, the largest economic opportunity is Global warming" (John, 2009).

"It is always ahead. It has recognized clearly that propagation of green technology can secured competitiveness in the world. The country that has a wealth of overflow resources to get, biomass, the biodiversity, the rainforest, natural gas, water power, the land mass, and the commitment of its leadership" (Volker, 2010).

### **Transportation**

Over the past decades, transportation has developed as the solution of human mobility. Nowadays, car is considered as a comfortable and convenient transportation solution, and it became as a human habit not a necessity. Furthermore, modern city development and dependency communities to support needs of vehicle infrastructure has grown. The vehicle transport systems have significant environmental, economic and social costs that have been experienced over the past decade. As a high-density communities are mostly located outside the city, the university is also facing the same problem where students rely on buses and private vehicles (Klein, 2002).

To help academic collaboration, is required for educational institutions walkable, green and user friendly campus where buildings are in close proximity. But, some university that has huge area are very dependant thru transportation system. Thus, institutions of higher education, and university are aiming to develop an alternative models to switch from automobile dependent transportation. (Miller, 2001). Toxic that came out from polluted gas emissions are the main environmental problem that vehicle dependent transportation causes. Toxic gases like nitrogen,  $CO^2$  and unique particulates that vehicle and transportation around campus released will effecting the air quality of the campus.

### **Environment definition overview**

Sustainability of environment: This research will primarily focus on what has become known as "Sustainability of Environment," that is more into environmental issues also by taking economic and social interests (Simpson, 2008).

Campus Sustainability: is a term that be used regarding to sustainability of environment in a campus or university setting (Bartlett & Chase, 2004).

Green: is the term that will be utilized to indicate a reference to environmental sustainability. The "green" term can be used as an adjective, noun, and/or a verb (Creighton, 1998; Edwards, 2010).

Green Campus: is a term that will be used in reference to the university that has applicate a comprehensive sustainability of environment. Nevertheless, "campus greening" term generally use to indicate this implementation process in the university. Using all these terms may help to describe the concepts smartly by minimizing word usage (Edwards, 2010; Simpson, 2008).

There is not much differences with the big city, university community must address the same environmental issues of the 21st century including pollution, scarcity, especially global climate change. By implementing green campus initiatives that address these issues, and practicing green technology, educational leaders can be potentially to save financial resources over time as well as improve human and also environmental health.

There are plenty examples of campus and university that have implemented green campus initiatives and focused on campus operations. Examples of areas that have been addressed include water conservation, energy management, solid waste management, dining services, grounds management, transportation, and purchasing (Creighton, 1998). By implementing these initiatives, campuses are able to save money, conserve scarce resources, and demonstrate sustainable solutions that the rest of society can use as models for transformation (Edwards, 2010; M'Gonigle & Starke, 2006).

#### Alternative campus transportation

One of the essential feature of any campus or university around the world is their transportation system. With their uniqueness location, accessibility, and type of density, community members of university need access to travel to and from campus, as well as around the campus itself, as they engage in student activities inside or outside campus. Alternative transportation initiatives strive to provide safety, convenient ways for people to travel from, to, and on campus and minimalize impact on human and also environmental health (Krueger & Murray, 2008). Some of campus transportation

initiatives concern is to cut the traffic congestion caused by single car drivers following by solving parking accommodation issues (Havlick & Toor, 2004). Alternative transportation programs can consist of mass transit options, providing bicycling, and designated walking paths. Even in rural areas, ride sharing and Carpool are becoming increasingly popular on college and university campuses (Bardaglio & Putnam, 2009). Transportation programs can also implement green technologies for instance electric transportation vehicles, human powered vehicles, and alternative fuel vehicles (Krueger & Murray, 2008)



#### Figure 2

Green transportation hierarchy alternative campus transportation source: http://www.sustainability.ucdavis.edu/local\_resources/images/progress/ chart\_mode\_split\_2009\_2010.gif

#### **Electrification vehicle**

Transition to electrical vehicle can help nation by generally produce low emission over their normal gasoline usage under some circumstance condition. Electrification transportation can reduce emission in such a way like electric vehicle replace inefficient combustion engine (62 percents of the energy consumed due to the friction and heat) with electric motors, electric vehicle substitute a high carbon source of fuel (oil) with renewable energy, electrification able to allow greater flexibility in the design of vehicle, potentially allowing creation of various type of new vehicle that can meet transportation need efficiently (Dutzik &Alana, 2016).

On the other hand, high initial price, limited range of travel between charger and limited recharging infrastructure is key barrier of public acceptance of electric vehicle. Despite of that, between 2007-2014 the cost of batteries decreased by 8 percent annually, while next generation of electric car may available in the next 2 or 3 years. Personal cars are not the only one vehicle, but electric public transportation such as subways, commuter rail, and bus are existed in some country (Dutzik &Alana, 2016). In order to support decarbonisation of transportation, university need to boast the usage electric bus compare to the conventional, because barriers is not much effect since the scope is small.

# **RESEARCH AND METHODOLOGY**

### Methodology

Describe the methods used to gather the data or information. The used of literature is to review and define the context as described in previous chapter. Case study methods can be used to pursue different research objective such as to provide description, to test theory, and to generate theory. This study used case study as methods to investigate the proper implementation of Green transportation and its implementation Green Technology in University. Data is collected by conducting an interview and observation at Unit Kenderaan UUM as shown the case study framework in Figure 2.



**Figure 2** Case study framework

The analysis based on the result of the interviews (transcribing and interpreting the conversation), observation and calculating the emission and link the finding to the research objective of Green Technology. The interview session has been conducted by listed the questions before the interview started.

- How many total of Bus that UUM provide for the student?
- How many total students of UUM?
- How many Office vehicle that own by UUM (Van, office car, trash truck)?
- What kind of Bus that UUM use for the student transportation?
- May I know how much cost of fuel that one UUM Bus need per-day?
- How much length kilometre of every route A,B,C,D.E?
- Is it possible if there are any ways that can be implemented in UUM transportation system to reduce cost and to strengthen Green campus title?
- May I have bus specification that provide in UUM?

### **Data collection**

This study include primary data and secondary data. Primary data collected from interview and observation in Unit Kenderaan and Unic Leisure Sdn Bhd. Secondary data is collected from articles and journal. Secondary data is important of providing knowledge, understanding on the issue, identifying the factor influence and citing the

literature review. The most common source for secondary data is come from online literature or online sources. Gaining more knowledge of information based on the scope of research can be applied to help the analysis of the research more effective and get view from many perspectives.

### FINDINGS

Pusat Kenderaan is department in UUM that in-charge for managing for all university vehicle. Pusat Kendaraan manage for total 244 UUM Vehicle such as van, car office, truck, trash truck, and bus. All the vehicle that owned by UUM from various type of brand for instance Hyno, Isuzu, Scania, Man. Based practitioner interview, he stated that mostly the university vehicle are based on diesel and 13 Bus that UUM owned are used for staffs and for activities outside campus.

However, for student transportation around campus it manage by Unic Leisure Transtour Sdn Bhd. Unic Leisure Transtour Sdn Bhd is one of the subsidiary of private Company Unic Group of Companies (UGC) in Malaysia focusing in providing bus transportation service. UGC own 206 buses with 236 employees in five states Johor, Selangor, Penang, Perlis, and Kedah. In UUM itself UGC owned 36 Bus that operate daily.

Based on interview that practitioner did with Unic Leisure, he stated that,

- "The average fuel consumed for UUM bus is RM180 per-day"
- "The length for route A,B,C is 10.5km while route D is 17km"
- "Bus that Unic Leisure provide for UUM get the recognition from some award as the best university Transportation system in Malaysia"
- "Bus maintenance are do regularly to provide safety for student and bus quality"

Туре	Yutong C12D Intercity Bus
Engine	ISB,7E6280B Cummins EURO 6
Rated Power	210kw/2300rpm
Fuel	Diesel
Emission	EURO 6
Fuel Tank(km)	300
Door	2+2+0, 2+2+1
Transmission	Manual, with kick down function. Intarder



Source:http://en.yutong.com/produ cts/ZK6118HGA-Africa.shtml

Source:http://www.unicgroup.com.my/ab out/companies/unic-leisure-transtour/#

Туре	Yutong ZK6118HGA
Engine	C245 20
Rated Power	210kw/2300rpm
Fuel	Diesel
Emission	EURO 3
Fuel Tank(km)	270
Door	2+2+0, 2+2+1
Transmission	Manual

Leisure collaborate with Yutong co.Ltd where the company maintain their ISO/TS16949:2002 Quality Management System Certification issue by DQS. In order to keep the product competitiveness, Yutong heavily invest on the research and development. In 2008, the one and only research that specially focused to study about buses and providing accurate test data and to make sure stability of product quality.

As the company who provide the service to UUM, Unic Leisure are ready to provide the latest technology that are more friendly environmental. The problem is university are able to provide the fine cost and the operation cost or not. Because the main concern of UUM want to Unic leisure is, company able to provide bus for student that can give more accessibility move in and out from the bus. If we compare from the previous bus, the old bus the door is pretty small and some of the bus also its only has 1 door for accessibility, and capacity student that can be carried out is less since the bus are seat. Thus, in 2013 UUM start to renew their bus to the latest technology that are more convenient at that time.

In Addition, the company maintained their quality by change the old bus one by one with the newest bus in effort at preserving the environment. Company did well by substitute the old bus which also help company to saved cost due to new bus technology that may can be cost saving in term of fuel. Although, it does not effected much on how environment affected by oil usage. Thus, practitioner found some latest technology that may help to decrease pollution in university.

Туре	Yutong E12 Pure Electricity		
Motor	Electric motor YTM280-CV4-H,		
	Water cooling		
Rated Power	210kw/2300rpm		
Fuel	Lithium ion battery, capacity 295 kWh,		
	16 batteries (9 in rear, 7 in roof)		
	estimate lifespan 4000 cycles		
Emission	Zero Emission		
Fuel tank/	320		
Range (km)			
Door	2+2+0, Double pneumatic swing in		
	front door, double pneumatic swing out		
	middle door. 2+2+2 Double pneumatic		
	swing in front door, double pneumatic		
	swing out middle door, double swing in		
	rear door		
Transmission	none		



Source: http://yutongeurobus.se/img/e12img01.jpg

### **CONCLUSION & RECOMENDATION**

This study show the Green technology is not apply much on university transportation system. Transportation system is the important role on the carbon emission and pollutant level in community such as university. Transportation policy also needed to limit the number of motor vehicles in campus that use by student or staff, the use of bicycle and campus bus will encourage a healthier environment. The pedestrian policy will persuade students and staff to be more active by walk around campus, and avoid using private vehicle. The use of public transportation will decrease carbon footprint around campus and more friendly environmentally.

The current transportation system and vehicle that UUM own already good enough. Based on primary data, company keep maintain the bus quality. Despite the some of the bus already pollute the environment due to the dark smoke as the come out of the fuel usage. However, UUM are encourage to support the green technology transportation system with cooperation with Unic Leisure Sdn Bhd. to keep innovating the vehicle that use around campus to be more friendly environmental to strengthen 'Green Campus' slogan. It also proven by UImetric that, in term of transportation system, UUM are the best among all University in Malaysia.

Based on this information, the university can implement an innovative way to green technology, limitation number of vehicle, prohibit students or staffs vehicle that harm environment, the usage catalytic converter, or even usage electrical bus. Green technology especially usage of electrical bus for student is practice that generate more benefits than expenditure to business and community. In conclusion, the study case shows the university are ready to practice green technology.

# LIMITATION AND SUGGESTION FOR FUTURE RESEARCH

This study and research implies some limitation, limitation of theme, time limit, small scope of study make it more difficult to generate information with the new issues that exists recently. Furthermore, is heavily importance to make comparison among the technology, university, and their transportation system. The result would much better if the researcher could extend time to investigate and study more about Green Technology for transportation and calculate estimation emission that exist in site study.

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