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Hakcipta terpelihara. Setiap bahagian daripada terbitan ini tidak boleh diterbitkan semula, disimpan untuk pengeluaran atau dipindahkan dalam bentuk lain sama ada dengan cara elektronik, gambar, dan sebagainya tanpa mendapat izin bertulis daripada pengarang atau Penerbit Jabatan Kejuruteraan Elektrik, Politeknik Port Dickson terdahulu.

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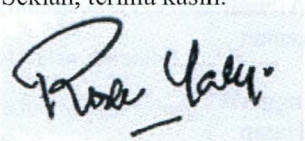
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Akhir kata, saya berharap usaha ini akan menjadi agenda berterusan bagi memastikan kelestarian politeknik sebagai peneraju TVET di dalam pendidikan di Malaysia.

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ROSLEE BIN YAHYA
Pengarah,
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DAFTAR ISI

TAJUK	MUKASURAT
Improving Energy Efficiency Of Massive Mimo Using Small Cell Network : A Review *Alizawati binti Mat Zim*	1
Semarakkan Budaya Hijau Bermula Dari Rumah *Azlina Binti Khairi dan Noor Hashima Binti Harun*	6
Alternative Energy: Review Of Sound Energy To Electrical Energy *Azrinawati bt Samaon*	10
The Development of Energy Harvester Piezoelectric Nanogenerator Device: A Review *Elyani binti Abu Bakar dan Mohd. Ambri bin Mohamed*	15
Energy Harvesting In Fifth Generation 5G Wireless Communications *Nurfarhanah* Omar	20
Sustainable Energy Management System (SEMS) At Politeknik Port Dickson *Nurul Huda bt Jamil*	25
Pemanasan Global dan Solar Path Finder Untuk Penentuan Lokasi Solar *Karthega a/p Shanmugam*	30
Penjanaan Tenaga Elektrik Dari Air Laut: Kaedah Altenatif Kearah Tenaga Bersih *Munirah Binti Md Nujid*	35
Printed Circuit Board Etchant Waste and Environment: A Review *Norhayati binti Affandi*	40
Type of Photovoltaic (PV) Solar Panel used in PV Technology *Norlie Yuzzana Binti Ibrahim*	45
Introduction Towards Energy Efficiency (EE) and Energy Conservation (EC) in Malaysia *Razimah Binti Abdul Rahim*	50
Amalan Hijau Di Bengkel: Ke Arah Melahirkan Pelajar Yang Berilmu dan Berdisiplin *Rozanita Binti Baharudin*	57
go-Green go-Paperless An Awareness In Teaching And Learning At Polytechnic Port Dickson *Thiruchelve A/P Ramasamy dan Wong Kee Meng*	62
Malaysia: Path to 100% Renewable Green EnergyWord *Muhamad Zahari Bin Taslim*	66
Kelestarian Alam: Bertindak Sebelum Terlambat *Zainab Binti Musri*	69
Implementation of Energy Saving Project Through Energy Performance Contract(EPC) *Zamri Bin Zakaria*	76

Improving Energy Efficiency Of Massive Mimo Using Small Cell Network : A Review

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1. Introduction

The demand for data service is increasing dramatically and wireless systems with high throughput and the capability to serve a large number of user equipment are desired [1]. This problem can be overcome by providing an effective and simple solution for improving the energy efficiency of massive MIMO in current cellular network [2]. One of the methods is by applying a small cell network in massive MIMO. This combined approaches provides the highest energy efficiency; small cells contributes to reducing the propagation losses while massive MIMO enables multiplexing of users with controlled interference [3]. Small cell network is a cellular network where the sizes of the cells employed are very small. In massive MIMO, transmitting antenna at each base station consist of a huge number of antenna. For the fifth generation of mobile communication technology, the massive MIMO system is considered one of the most promising systems. The spectrum efficiency of massive MIMO can be increased by an order of magnitude as tens of user equipment can be served on the same time-frequency resource by exploring spatial multiplexing [1].

2. Problem Statement

Since the demand for wireless data services are increasing, the densifications will be occurs in cellular networks. Power consumption is high for a multi user application in massive MIMO. Increasing the capacity and reliability of wireless communication systems using multiple antennas has been an expanded research area since the last two decades. Using multiple antennas is a part of the current Long Term Evaluation (LTE) standard. Massive MIMO or large scale antenna systems, is a technology that has attracted a lot of recent research interest for use in 5G networks. Massive MIMO is a variation of multiuser MIMO, in which the number of antennas at the base station is scaled up by several orders of magnitude, such that the number of antenna elements exceeds by far the number of active users per time-frequency resource. An analysis is needed to overcome this problem. The suitable approach can be used is by employing small cell network in massive MIMO.

3. Massive MIMO

Massive MIMO is a new technology that scales up MIMO by using large-scale antenna systems. The more antennas can be used to help focus the energy into the smaller region of space to carry higher radiated energy efficiency and throughput. When a much larger number of antennas are used per site, more users can be served in parallel. By employing massive MIMO at the base station and combined with small cell this could improve the EE of a cellular network[12]. Massive MIMO systems are a type of cellular communication system where a base station has a large number of antenna that makes different user equipment become orthogonal to each other and the inter-user interference diminishes. Therefore, the data rate will increase and low complexity signal processing techniques can be utilized.

The advantages massive MIMO is the degrees of freedom are increased and the transmitted power can be reduced. Unlike in traditional MIMO systems, inexpensive low power amplifiers can be used in massive MIMO.

Massive MIMO also has some disadvantages in its performance where the systems depend heavily on the antenna properties and the propagation environment. Additionally, with time division duplex (TDD) operation, the performance of massive MIMO becomes limited by the inter cell interference arising from the reuse of pilots in neighbouring cells. Furthermore, due to the communication required between base stations in the distributed case, latency and backhaul requirements can be increased. Moreover, hardware cost and complexity remain crucial in massive MIMO.

4. Small cell network

Small cell network is a cellular network where the sizes of the cells employed are very small. More improvement can be produced in massive MIMO and small cell network in the dynamic part, but at the same time more hardware is required. Therefore increasing in static part depends on the number of small cell area and user antennas. Some small cell areas are put in inactive condition and sleep mode can makes energy efficiency improved. With additional hardware, combination of massive MIMO and small cell in network topology is desirable to achieve higher energy efficiency. Massive MIMO brings large energy efficiency improvements by itself, but the same power consumption can be achieved with half the number of base station antennas (or less) by deploying a few single-antenna small cell areas in areas with active users.

While operating under certain constraints, limitations of interference, and imperfect channel sensing, some throughput and also energy efficiency of MIMO in wireless communication systems was investigated[12]. It shows that stringent is generally beneficial if increasing the number of antennas where there is interference in power constraint. Increasing the number of antennas beyond a certain level does not affect too much increase in throughput [16]. The huge improvements in throughput and energy efficiency is achieved by using extra antenna, where focusing the transmission and reception of signal into smaller region space.
Energy efficient of massive MIMO is always less than small cell network. It proved that, energy efficiency can be improved regardless of the power consumptions when number of cells in small cell network is large [17]. However, it depends on active base station and traffic load. The energy efficiency spectral can be improved extensively by employed overlaid small cell area with current system [18].

Optimization the energy efficiency of cellular networks by using stochastic geometry was done in [3] with respect to the density of base stations, the number of antennas and users per cell, the transmit power levels, and the pilot reuse. The point of using small cells is to reduce propagation losses and massive MIMO is used such as the interference suppression among the user equipment that shares the energy costs related to the base station.
Transmit power of small cell network lower when the antenna density is higher than massive MIMO but it is more energy efficient when the power consumption more than small cell network except the power for transmitting data in massive MIMO is small or the data rate requirement is large [3]. Comparison between the average energy efficiency of Massive MIMO and small cell networks are done in [19] where power control between the non-coordinated base station as well as the uplink and downlink training overhead were considered.

Network coverage can be extend by using small cells and higher spatial frequency reuse can be done by reducing cell size and at the same time, the network capacity also can be increased

[4]. It is developed with self-organizing, low-power and low-cost base station in each cell. In addition, the system capacity can be increased through the simplest and most effective way according to their benefits that explored in the green system design [5]. With reduction of the cell-size, the area spectral efficiency is increased in any cellular networks [6].

4. Approaches for improving energy efficiency

Massive MIMO technique is one of the approaches that can be used to increase the system capacity. Since each base station of multi-cell massive MIMO networks consist of a large number of antennas, it provides high diversity gains and multiplexing for both directions; uplink and downlink [7]. Therefore, massive MIMO technique could reduce the transmission power while increasing the capacity of the network [6]. uplink and downlink transmit powers has the potential to reduce by using large antenna arrays through coherent combining and increasing the antenna aperture [8].

This article shows how energy efficiency can be improved using small cell network and massive MIMO; and to investigate if the size of small cell can effect on the performance of massive MIMO systems. Two main approaches investigated in this article which is massive MIMO and small cell network. Besides, the investigation will be done on the BF techniques.
In the first approach, existing macro base stations are equipped with large scale antenna arrays. This will result in higher energy efficiency when emitted energy of the users is enabled with precise focusing. The block diagram of massive MIMO systems shows each base station is containing with more than one antenna for receives and transmits signals are shown in Figure 1. The second approach is applying small cell network to offload traffic from base station with an overlaid layer of small cell areas. By reducing distance between user and transmitters, lower propagation losses and also higher energy efficiency are achieved. Using too many additional antennas can reduce the efficiency of energy if the power circuit is greater than or comparable to the transmitter power [9].

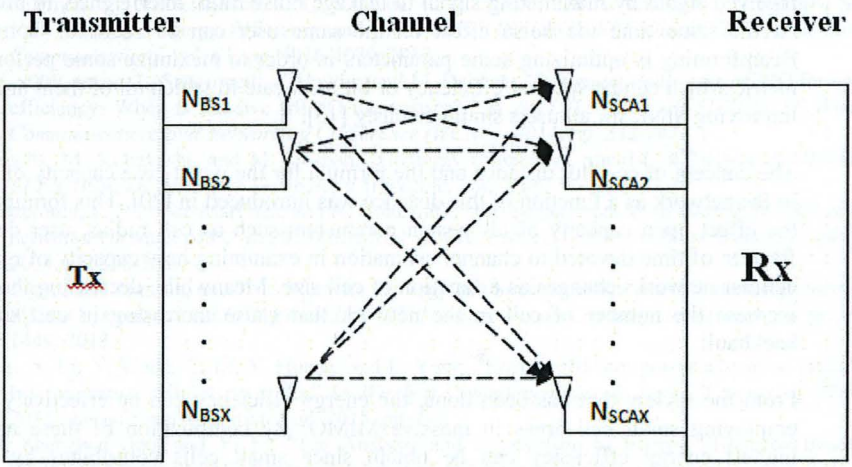


Figure 1. The structure of Massive MIMO system.

The increasing number of antennas per small cell area will obtain higher energy efficiency for small cell areas, thus higher overall network energy efficiency [10]. The system is more power efficient when the data rate increases without increasing the power used. The demand using the massive MIMO can be meet by improving the spectrum efficiency and energy efficiency.

Since the distance between small cell areas and users are short, small cells will require less radiated transmit energy and its will decrease the circuit power consumption [11]. Modeling and analysis in massive MIMO and small cell network has been studied in [12]. Some investigations about BF techniques have been studied recently in [10] and [11].

Transmit and receive beamforming is used for signal transmission from the base station with multiple antennas to one or multiple user equipment which should be covered. Three beamforming algorithms are compared in this paper to investigate the improvement in energy efficiency which are, optimal beamforming only using the base station, Multiflow regularized zero-forcing (RZF) and optimal spatial soft-cell. Wireless communication networks performances can be improved through beamforming technique, using smart antennas. Main beam of the array are adaptively directed towards the desired user by a digital signal processing algorithm and its nulls towards the interferers. This can improve the signal reception and transmission. Beamforming can be applied at both the uplink and the downlink. It is usually called spatial processing or spatial filtering.

For achieving spatial selectivity, beamforming can be used on both the sending and receiving ends. In signal processing, beamforming technique is used for directional signal reception and transmission. Different spatial locations produced the desired and the interfering signals in a cellular system. This spatial separation is exploited by a beamformer can be regarded as a spatial filter separating the desired signal from the interference. In phased array Signals at certain angles are constructive interference while others are destructive interference can be applied.

To optimize the quality of the signal, signals from different antenna elements are weighted and summed. Zero-forcing refers to the signal processing which completely eliminates interference. Zero forcing beamforming performance analysis is studied in [13] and [14] to see the different types of beamforming. The RZF aim is reducing leakage signals to improve the received signal by maximizing signal to leakage noise ratio, interference, to prospected user. At the same time the noise effect on the same user can be reduced. Optimal Transmit Beamforming is optimizing some parameters in order to maximize some performance utility metric which can be spectral efficiency or bit error rate in which all of them are improved by improving SINR for all users simultaneously [15].

The concept of co-pilot distance and the formula for the worst-case capacity of a typical user in the network as a function of this distance was introduced in [20]. This formulation captures the effect upon capacity of all system parameters such as cell radius, user density and the fraction of time devoted to channel estimation in examining how capacity of massive MIMO cellular networks changes as a function of cell size. Meanwhile, decreasing the cell size will increase the number of cell in the network that cause increasing in cell site power and backhaul.

From the review that has been done, the energy efficiency can be effectively improved by employing small cell areas in massive MIMO. By combination of these approaches the highest energy efficiency can be obtain since small cells contributes by reducing the propagation losses while massive MIMO enables multiplexing of users with controlled interference. The energy efficiency would be much better by using lower carrier frequency and the power consumption getting lower while using smaller size of the network cells.

5. Conclusion

The throughput and energy efficiency of massive MIMO were investigated by using the small cell network and the power consumption for different QoS constraints has benergy efficiencyn

analyzed. Threnergy efficiency BF algorithms are compared which optimal BF is using only the base station, Multiflow regularized zero forcing (RZF) BF and optimal spatial soft-cell coordination BF.

It is observed that increasing the number of quality of services (QoS) constraint will increase the total power consumption per subcarrier. It depends on the number of antenna used in base station and small cell areas. The more antenna used in base station, the higher power will be consumed. On the other hand, the higher number antenna used in small cell area will reduce the power consumption in each case. Improvements in the throughput can be realized.
It can be concluded that the power increases as the QoS constraints increased. The increasing number of antennas per small cell area will give higher energy efficiency for small cell areas, thus higher overall network energy efficiency. The increases in power as the number of antennas, the total transmit power along with the data rate of change varies.
The proposed optimal spatial soft-cell coordination BF provides promising results for practical applications, as part of improving energy efficiency can be achieved by this BF method.

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Semarakkan Budaya Hijau Bermula Dari Rumah

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1. Pengenalan

Apabila sesebuah negara semakin pesat membangun, populasinya semakin meningkat. Maka kadar permintaan terhadap sesuatu keperluan adalah tinggi. Gaya hidup manusia yang mahukan kehidupan sempurna seperti rumah, bekalan elektrik dan air, kereta dan lain-lain menyebabkan permintaan terhadap sumber semula jadi turut meningkat. Berdasarkan peningkatan kepada keperluan ini, teknologi hijau menjadi portfolio Kementerian Tenaga, Teknologi Hijau dan Air, (KeTHHA) yang ditubuhkan pada 9 April 2009. Seiring dengan dasar teknologi hijau negara yang dilihat mempunyai peranan yang startegik dan menyeluruh dalam usaha merealisasikan hasrat ini.

Teknologi hijau adalah satu platform penanda aras ke arah pembangunan masyarakat berilmu yang mempraktikkan tenaga lestari dan cara hidup yang lebih baik. Kita boleh hidup lebih lestari jika kita menjadi seorang yang lebih celik alam sekitar, belajar daripada alam semula jadi, hidup dengan lebih sederhana dan menjadi rakyat yang aktif dalam membangunkan alam sekitar.Keuntungan yang kita perolehi daripada penggunaan sumber hijau adalah tenaga hijau ini bersih sehingga tidak membebaskan apa-apa ke udara yang boleh membahayakan alam sekitar. Selain itu,tenaga hijau juga dapat diperbaharui yang bererti kita tidak akan pernah kehabisan sumber seperti minyak yang dijangka akan kering dalam satu dekad atau lebih.

Teknologi hijau meliputi pembangunan dan aplikasi produk, peralatan serta sistem untuk pemuliharaan alam sekitar dan sumber semula jadi, dan meminimumkan kesan negatif yang berpunca daripada aktiviti manusia. Teknologi hijau merujuk kepada produk, peralatan atau sistem yang memenuhi kriteria seperti meminimumkan degradasi kualiti persekitaran, mempunyai pembebasan gas rumah hijau yang rendah atau sifar, selamat untuk digunakan dan menyediakan persekitaran sihat dan lebih baik untuk semua hidupan, menjimatkan tenaga dan sumber asli serta menggalakkan sumber yang boleh diperbaharui.

Mengikut Profesor James G Titus dari Agensi Perlindungan Alam Sekitar Amerika Syarikat: 'Terdapat peningkatan suhu dunia antara 0.4 hingga 0.5 darjah Celsius pada setiap lima tahun bermula pada tahun 1952. Dianggarkan antara tahun 1990 hingga 2025 suhu dunia akan meningkat antara 0.8 hingga 3.6 darjah Celsius.'

Kita sebagai penduduk bumi perlu bertanggungjawab untuk bersama-sama memainkan peranan dalam menjadikan bumi ini tempat yang lebih baik. Oleh hal sedemikian, budaya hijau perlulah dimulakan dari peringkat akar umbi.Anggota keluarga adalah penggerak utama yang dilihat mampu menyelamatkan alam semula jadi. Ibu bapa berperanan dalam mendidik anak-anak agar sama-sama menyemarakkan budaya hijau ini.

2. Langkah-langkah yang boleh dimulakan dari rumah

Di antara langkah-langkah yang boleh diambil dan dimulakan untuk menyemarakkan budaya hijau dari rumah:

1. Anggota keluarga yang terdiri daripada ibu, ayah, abang, kakak dan adik di galakkan untuk mendaftar dengan mana-mana persatuan/pertubuhan. Misalnya Yayasan Hijau (YaHijau) Malaysia. YaHijau ini ditubuhkan untuk memberi pendidikan, kesedaran dan menggalakkan penyertaan orang ramai khususnya masyarakat di peringkat akar umbi dan badan korporat berhubung aplikasi teknologi hijau dan pembudayaan amalan hidup hijau. Ia juga berperanan mempromosi serta meningkatkan kefahaman, pendedahan dan penghargaan serta minat dalam memperkasakan gaya hidup hijau dalam kalangan masyarakat di peringkat akar umbi termasuk pelajar universiti dan sekolah .Pelbagai aktiviti yang menyeronokkan yang dianjurkan oleh yayasan ini contohnya Yahijau roadshow, Yahijau karnival, Yahijau science camp dan banyak lagi. Dengan adanya aktiviti-aktiviti ini, kita boleh mewujudkan sebuah masyarakat yang cinta akan alam sekitar dan semangat dalam membudayakan amalan hijau.
2. Pembudayaan kitar semula. Menyediakan tong sampah yang berasingan di rumah. Mengasingkan antara sampah di dapur iaitu sisa-sisa makanan, botol-botol plastik atau kaca dan kertas-kertas. Kajian oleh Gurder Adams (1990) dan Burca et al. (1994) menunjukkan bahawa penduduk yang mempunyai lebih minat menjalankan aktiviti kitar semula akan menghasilkan lebih banyak sampah yang boleh dikitar semula berbanding dengan penduduk yang kurang berminat dengan aktiviti kitar semula. Mendidik anak-anak supaya belajar untuk mengitar semula dan menjual barang–barang yang dikumpulkan ini pada pihak yang membeli barang-barang kitar semula. Hasil dari jualan diberikan kepada anak-anak untuk disimpankan didalam tabung. Hal ini, dapat menarik minat anak-anak untuk terus mengitar semula barang-barang sekaligus dapat melatih mereka untuk membudayakan amalan hijau dalam kehidupan seharian mereka. Di samping amalan mengitar semula ini bermanfaat kepada mereka ia juga menyeronokkan untuk dilakukan bersama sama.Ibubapa harus menunjukkan teladan yang baik kepada anak-anak supaya dapat mendorong mereka untuk mengamalkan budaya hijau.
3. Membawa ahli keluarga ke pameran-pameran berkaitan inovasi dan teknologi hijau. Misalnya Karnival Inovasi Teknologi Hijau Peringkat Kebangsaan. Antara pengisian di dalam karnival ini, para pengunjung di dedahkan dengan pelbagai program seperti Pertandingan Reka Cipta Inovasi Teknologi Hijau, Pertandingan Reka Bentuk Bandar Teknologi Hijau, Pertandingan Inovasi Tenaga Biojisim, Pertandingan Green Technology Show, Green Cooker Challenge, Pertandingan Solar Vehicle Challenge, dan Xplorace Teknologi Hijau & Kuiz Teknologi Hijau. Dengan adanya aktiviti-aktiviti tersebut masyarakat lebih mesra dengan teknologi hijau sekaligus dapat menarik minat mereka untuk terus menyemarakkan lagi semangat membudayakan amalan hijau
4. "Melentur buluh biarlah dari rebungnya" peribahasa ini menunjukkan bahawa mendidik anak-anak perlulah daripada mereka kecil. Sebagai ibubapa hendaklah menggalakkan anak-anak supaya mereka menyertai persatuan atau kelab yang mesra dengan alam semulajadi. Misalnya, seperti kelab Mesra Alam atau kelab Pencinta Alam Sekitar yang ada di sekolah. Selain itu, Persatuan pengakap dan Pandu puteri juga turut terlibat sama dengan aktiviti-aktiviti mesra alam. Galakkan daripada ibu bapa sangat penting bagi memastikan anak-anak mereka terlibat dalam setiap program alam sekitar yang dianjurkan oleh pihak sekolah. Hal ini bertujuan supaya anak-anak lebih dekat dan mesra dengan alam semulajadi. Justeru bagi melahirkan anak-anak yang suka membudayakan amalan hijau dalam kehidupan mereka.Pelbagai aktiviti lagi yang dianjurkan oleh pihak sekolah seperti kempen "sayangi alam kita" yang boleh menyemarakkan lagi semangat budaya hijau dikalangan anak-anak masa kini.
5. Kita harus mengamalkan amalan hijau sebanyak yang boleh, bermula dengan perkara-perkara mudah yang boleh kita laksanakan. Misalnya bawa bekal air minuman dari rumah tanpa perlu membeli botol-botol air minuman di luar. Andai ingin membungkus makanan di luar, eloklah kita menggunakan bekas makanan sendiri daripada menggunakan bekas styrofoam atau plastik yang tidak mesra alam. Bawalah beg sendiri ketika membeli-belah. Beg plastik atau bekas makanan polisterin untuk tujuan

pembungkusan makanan tidak lagi digunakan kerana beg plastik atau polisterin mengambil masa selama 100 atau 500 tahun untuk dilupuskan secara semulajadi. Bahan toksik seperti yang larut dan meresap ke dalam tanah boleh menjejaskan alam sekitar. Disamping itu, Polisterina dikenali sebagai 'pembunuh senyap' oleh kerana di dalam bekas polisterina mengandungi sejenis gas iaitu HCFC 22, CFC 11 atau CFC. Gas-gas ini merupakan kloroflurokarbon yang boleh memusnahkan ozon. Bahan toksik dan kimia yang berbahaya termasuk stirena,benzena,dan etilena digunakan dalam pembuatan polisterina. Maka, penggunaan plastik atau polisterina adalah sangat bahaya kepada alam sekitar dan juga pada manusia. Jika kita lihat pada hari ini banyak negeri telah mewajibkan penggunaan produk biodegradasi (biodegradable) misalnya wilayah persekutuan Kuala Lumpur,Wilayah Putrajaya, Melaka dan banyak lagi telah mula melaksanakan penggunaan produk biodegrasi. Produk biodegrasi ini seperti beg plastik mudah dikompos, mudah lerai atau hancur dalam tanah dan mesra alam kerana dihasilkan secara kitar semula menggunakan sumber boleh diperbaharui. Selain daripada usaha kerajaan menggunakan produk biodegrasi untuk membudayakan amalan hijau ada juga sesetengah negeri mengenakan RM 0.20 bagi setiap beg plastik yang digunakan di pasar-pasar raya bertujuan supaya masyarakat dapat mengurangkan penggunaan beg plastik sekaligus melatih masyarakat supaya membudayakan amalan hijau serta menyemarakkan lagi semangat budaya hijau di kalangan masyarakat era ini.

6. Menjimatkan penggunaan elektrik di rumah juga adalah salah satu cara untuk kita menyelamatkan alam sekitar. Misalnya menutup suis lampu atau kipas di ruang yang tidak digunakan. Seterusnya, memastikan plug dicabut jika tidak digunakan oleh kerana gajet seperti pengecas telefon bimbit dan gelombang mikro menghauskan tenaga eklektrik selagi mana ia disambungkan ke soket elektrik. Menurut kajian TNB alat elektrik yang dibiarkan dalam keadaan standby akan menggunakan lebih kurang 5%-10% dari jumlah bil elektrik bulanan. Selain itu, kajian dari pihak TNB juga mendapati sebanyak 20% penggunaan tenaga elektrik dalam sesebuah kediaman adalah disumbangkan oleh penggunaan lampu. Maksudnya, jika purata bil elektrik bulanan adalah RM 100, maka 20% daripada jumlah tersebut bersamaan RM 20 adalah untuk membayar penggunaan lampu dalam kediaman anda. Utamakan penggunaan lampu cekap tenaga contohnya seperti light emitting diodes (LED). Tindakan sedemikian akan menghasilkan penjimatan tenaga dan kurang menjejaskan alam sekitar. Selain itu, penggunaan perkakasan elektrik yang menggunakan teknologi inverter juga dapat menjimatkan penggunaan tenaga elekrik oleh kerana inverterberfungsi untuk mengawal penggunaan motor peti sejuk dan penghawa dingin secara automatik. Pengguna juga harus mengutamakan pembelian peralatan elektrik jenis cekap tenaga.

3. Kesimpulan

Kesimpulannya terdapat pelbagai cara untuk menyemarakkan budaya hijau dikalangan masyarakat pada era ini. Jika setiap masyarakat dapat memainkan peranan mereka dengan baik maka kita boleh mewujudkan alam sekitar yang lebih indah. Di samping itu, terdapat juga beberapa cara untuk kita menjimatkan elektrik khusus bagi peralatan-peralatan elektrik yang terdapat banyak didalam rumah yang boleh dipraktikkan dalam kehidupan seharian bagi menyokong kerajaan kearah bumi hijau. Sekali lagi diingatkan, prinsip untuk mengurangkan penggunaan tenaga elektrik adalah dengan menggunakan peralatan cekap tenaga, mengendalikan peralatan dengan cara yang betul dan menghadkan tempoh penggunaan tenaga elektrik.

Perubahan kecil yang kita mulakan pada hari ini akan memberi kesan yang besar pada masa hadapan sekaligus membawa perubahan pada gaya hidup dan perubahan minda ke arah penghayatan dan pengamalan teknologi hijau. Teknologi hijau akan dapat membantu kita dalam memulihara alam sekitar dan kualiti hidup masyarakat. Sebagai manusia yang inginkan

kehidupan yang lebih tenang dan produktif maka kita hendaklah bersama-sama berganding bahu "berat sama dipikul ringan sama dijinjing" dalam menjayakan usaha ke arah teknologi hijau yang boleh menjamin masa depan agar generasi yang akan datang dapat menikmati kehidupan yang lebih baik dan serba canggih.

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Alternative Energy:
Review Of Sound Energy To Electrical Energy

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1. Introduction

The primary energy industry in Malaysia is growing exponentially and its demand is increasing as fast as the nation's GDP and developmental growth. In Malaysia, the primary energy industry relies mostly on natural gas, crude oil petroleum and coal. Renewable energy source from hydropower consumes 4% (2015) of the overall energy source. However, hydropower energy requires high investment cost and will cause other natural destructions such as deforestation. Recently, the government is encouraging the industry to setup and develop new renewable energy such as solar, wind and biomass. As a result, many GLCs as well as the private sector have already setup and developed solar, wind and biomass as alternative energy. But their availability relies too much on natural factors such as weather conditions. [1]

The process of converting ambient sound energy into electrical energy could be achieved through usage of a particular method and mechanism. Based on the law of conservation of energy, "Energy can neither be created nor destroyed, but it can be converted from one form of energy into another". Recent studies have shown that harvesting technology, extracting wasted energy from our environment and then converting it into usable energy has received a considerable amount of interest for research & development but it requires high investment cost. [2]

However, readily available source of energy that is available in the form of sound energy (noise) also has a huge potential to be used as renewable and sustainable sources of energy. This paper takes a step forward in this direction, using sound as a source of energy and converting the sound waves into electrical energy. The noise pollution is one of the most readily available energy creation and most beneficial alternative for converting of sound energy into electrical energy and can be used by the people as energy source. [3]

2. Nature of sound

An easy way Noise is one of 4 major environmental pollution besides air pollution, water pollution and soil pollution. There is much improvement in air pollution and water pollution but not in the case of noise pollution, especially in developed countries. At its current rate, noise pollution will be the main pollution problem of the 21st century due to the increase of development such as transportation and industry in developing countries. [4]

Since sound energy is a mechanical energy which travels in the form of a wave and mechanical wave is an oscillation of pressure which requires a medium to travel; sound energy could not travel through vacuum. The sound waves displace back and forth between the potential energy of compression or lateral displacement strain of the matter and the kinetic energy of the oscillation. The human ears can tolerate sound waves with frequency ranging from about 20 Hz to 20,000 Hz. In the air, at normal temperature and pressure, the equivalent wavelengths of sound waves range from
17 m to 17 mm. [2]

Sound energy is a form of energy related with vibration and the SI unit of sound energy is joule (J). As previously stated sound is a mechanical wave and as such consists physically in oscillatory elastic compression and in oscillation displacement of a fluid. So, the medium acts as storage for both potential and kinetic energy during conversation. Consequently, the sound energy in a volume of interest is defined as the sum of the potential and kinetic energy densities integrated over that volume. [6]

$$W = W_{\text{potential}} + W_{\text{kinetic}} = \int_V \frac{p^2}{2\rho_0 c^2}\,\mathrm{d}V + \int_V \frac{\rho v^2}{2}\,\mathrm{d}V, \qquad (2.1)$$

Where:

V - volume of interest;
p - sound pressure;
v - particle velocity;
ρ_0 - density of the medium without sound present;
ρ - local density of the medium;
c - speed of sound.

3. Alternative Methods of Convertion Sound Energy to Electrical Energy

An easy way Noise is one of 4 major environmental pollution besides air pollution, water pollution and soil pollution. There are 3 alternative methods to convert of Sound energy to Electrical energy.

3.1 Method 1

Piezoelectric material is one of the method used for the conversion of noise energy into electric energy. Piezoelectric crystals are the material which converts mechanical strain to electric energy. Piezoelectric material converted sound energy into electricity by strain application. Theoretically, piezoelectricity is electric charges that accumulate in certain solid materials (such as crystals, certain ceramics and biological matter such as bone, DNA etc) in response to applied mechanical stress. The Piezoelectric effect is the linear electromechanical interaction between the mechanical and the electrical state in crystalline materials with no inversion symmetry. Piezoelectric materials act as transducers that its crystals could convert mechanical strain to electricity.

The crystals are formed naturally e.g. quartz and artificially ZnO, Niobaet Lead etc and sound energy could be converted into electricity using piezoelectric material. The equation for the resonant frequency of the cantilever type piezoelectric is as below

$$fr = w/2\pi = 1/2\pi\ [k/me]1/2 \qquad (3.1)$$

Where
fr - resonant frequency,
w - angular frequency ,
k - spring constant ,
me- effective mass of the cantilever.

Some of the single crystal materials exhibit the phenomenon, when the crystal is mechanically strained (sound energy) or when the crystal is deformed by the application of an external stress, electric charges appear on the crystal surfaces and when the direction of the strain reverses, the polarity of the electric charge is reversed. This is called the direct piezoelectric effect (refer figure 1) and the crystals that formulated are classed as piezoelectric crystal. [5]

The figure 2 shows creative way of development and production of electricity using road traffic noise pollution by piezoelectric.

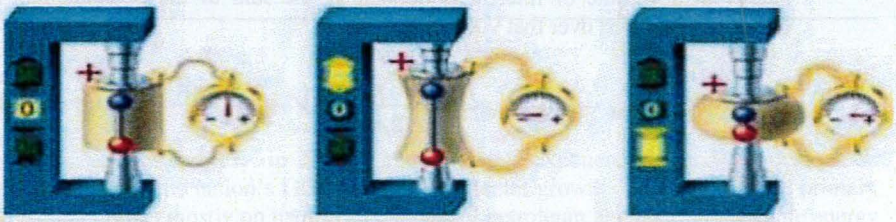


Figure 1. The direct piezoelectric effect

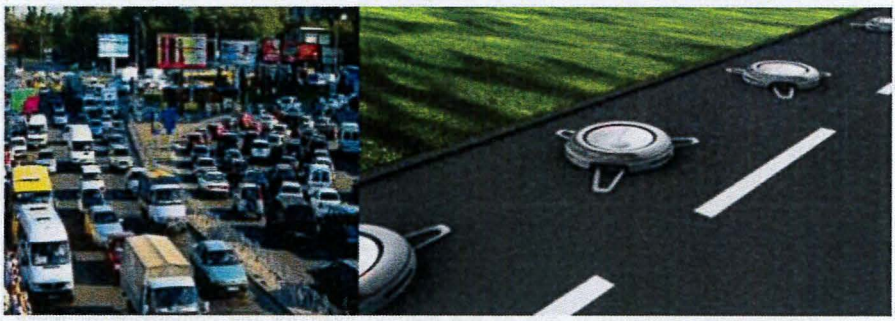


Figure 2. Representing a creative way of development and production of electricity using noise pollution

3.2 Method 2

Another method is converting sound energy into heat energy and then heat energy into electric energy. The form of the conversion begins from the conversion of sound to heat energy, then to electric energy as sound waves travel by oscillating the particles of the medium. Thus, when sound energy travel through the medium, it will disturb the particle of the medium, causing a disturbance. Due to this phenomenon created by particles of the medium, the conversion from sound to heat energy takes place and the particles of the medium collide with each other and vigorous random motion of the energy will automatically turn and converts into electrical form of the energy. The production of heat energy will be higher in a denser medium and more heat production will need material with higher density.



The disadvantage of this method is loss of energy and it's more than that of other methods of production of electricity. Newton's law is applied here during the conversion of sound to electric energy based on the law that energy can't be created nor destroyed. Another

disadvantage of this method is some heat energy would be converted into another form of energy during the conversion, thus proving it is not very effective for energy conversion. [5]

3.3 Method 3

Another Another method uses a similar mechanism to that of the microphone. In this method, material and sources used is a combination of diaphragm, conductor and magnets, while applying the laws and formula of EMF. (Faraday's Law).

In this method, a diaphragm, a conductor and magnetic bars are taken. The diaphragm will get fluctuated by the oscillation and pressure created by the sound wave and a conductor will be attached to this diaphragm and placed in between the magnetic bars. The fluctuation in the curtain will create a movement in the conductor and will affect the magnetic field of the magnet. This in turn will generate what is generally called motional EMF and at the same time generates voltage across it. [5]

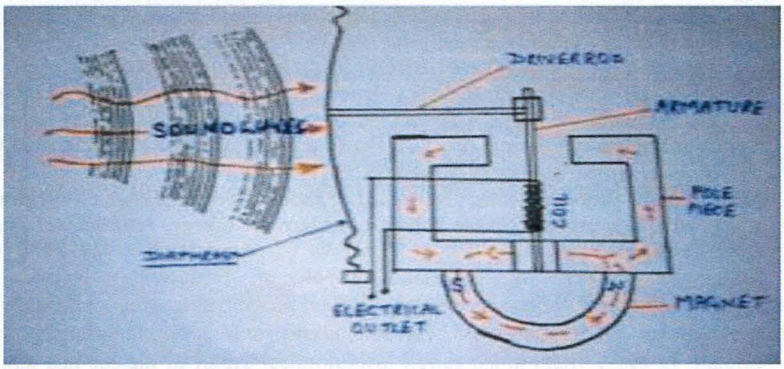


Figure 3. Conductor and magnetic bars

As per faradays law generated emf is given by:

$$\Phi B = \iint B(r,t) * dA \,, \tag{3.2}$$

dA - element of the surface area of moving surface , B - magnetic field

B*dA - the vector product.

Generated voltage

Emf = velocity of conductor Xmagnetic field X length of conductor. (3.3)

$$E = -d\Phi/dt \,. \tag{3.4}$$

where,

E=electromotive force, Φ B=magnetic flux

dΦ = rate of the change of magnetic flux

4. Conclusion

Sound energy (noise) has a high packet of energy therefore is useful to produce huge amounts of electrical energy. The important thing to note is that sound energy is a mechanical form of energy. Therefore according to the law of thermodynamics, mechanical energy could be converted into electric energy. Specifically, during conversion, numerous processes are not involved and procedures convert the noise to electricity conversion. Furthermore, sound energy (noise) has a good future as alternative renewable energy source. However, it needs more encouragement and support from the government, educational institutes, and the private sector for research and development to enhance the technology. Lastly, it is important that we develop sound energy as an alternative energy source because it is more efficient, cheaper & reliable to use in the future.

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The Development of Energy Harvester Piezoelectric Nanogenerator Device: A Review

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1. Introduction

Energy regeneration is the main issue that is never far from the mind of researchers to replace energy derived from natural sources. Thus, there are several types of renewable energy sources device is being studied such as solar energy, wind, waves, kinetic, salinity of sea water, reactor, as well as the heating source which come from solar heating, furnace and more.

Potential Energy or Kinetic Energy; is one of the energy harvests point of supply. It can be used for the purpose of trapping the energy generated for the electronic device application, stated by Ellabban (2014) which considers some mechanical's energy harvesting on MEMS (Micro-Electro-Mechanical System)-based as basic principles from immediate surrounding changes in mechanical such as various past development in these smart systems. This review paper reported on nanogenerator device that use kinetic energy as the mechanism which discuss on the basic structure, design consideration and fabrication process related.

2. Nanogenerator Device

Self-powered nanogenerator devices become an interest scope of research which focuses in utilizing the energy harvests. Many predictions have been made on the development of related device that can sustain in future technological trends using many types of materials such as Graphene. In 2018~ 2024, self-powered flexible mobile devices have been aimed as figure 1. (F. Koffens, 2014).

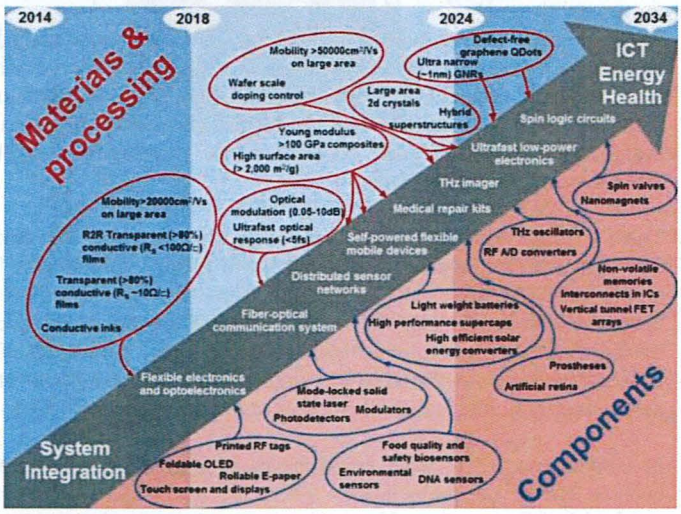
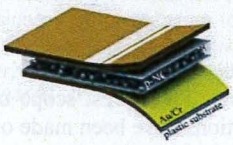
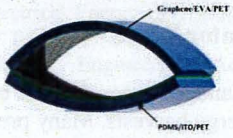
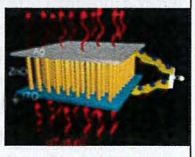


Figure 1. Summarized of future trends roadmaps of Graphene related materials applications.

Nanogenerator studied by Yanchao (2014), W. Zeng (2013), Yang (2012), Wang (2013) and nanoconverter by Wang et al (2015) are the examples of self-powered device. There are several types of nanogenerator; piezoelectric by Park et al (2012), triboelectric reported by M. Shi et al (2016), Zi J. Wang et al (2016), Y. Yang et al (2012), pyroelectric by Y. Yang et al (2012) and Z.L. Wang et al (2012), and recently, there were hybrid structure nanogenerator such as hybrid piezo-pyroelectric by Chen (2016), hybrid piezo-triboelectric by Megdi (2013) and hybrid tribo-pyro-piezoelectric reported by Lin et al (2015). Table 1. below will determine the differences among basic nanogenerator.

Table 1. Determination of basic nanogenerators; piezoelectric, triboelectric and pyroelectric nanogenerators.

Determination	Piezoelectric	Triboelectric	Pyroelectric
Energy Harvests Conversion	from mechanical force or movement to electricity conversion (Thomas, 2013)	from mechanical into electricity conversion (Shi, 2016)	from heat energy into electricity conversion (Thomas, 2013)
Mechanism	The semiconductor property is dependent with the energy generation by piezoelectric property (Nguyen, 2014)	Charge separation and process transfer among two different materials trough mechanical friction and contact (Nguyen, 2014)	Based on the two fundamental processes: contact electrification and electrostatic induction (Nguyen, 2014)
Structure Example	 (Park et al, 2012)	 (M.Shi, 2016)	 (Lin et al, 2015)

3. Piezoelectric Nanogenerator

Nanogenerator base on piezoelectric is an electronic device that can generate electricity from the conversion of mechanical motion into electrical charge which an active element of semiconductor material plays an important role. Thus, in obtaining this energy entrapment, there are some features to be observed in terms of the selection the appropriate materials, design, equipment that can conduct in the development of the device and testing on mechanical and electrical wise.

There's some opponent that have been discussed by the researcher on the significant development of nanogenerator compared to battery. Excellences in supplying various range output voltage and current, lightweight and long last device are among the advantages of battery. However, the materials used in battery, can cause negative environmental effects and have difficulties in recycling. Beside space issue, the difficulties might be occurring in certain circumstance such as for large networks of autonomous systems and in low energy and small device supply in medical application as reported by Hinchet (2015).

In convergence to achieve good design of piezoelectric nanogenerator, material selecting become one of the main factors. There are many kinds of materials usage that have been manipulated from various kinds of matters, energy, and entropy to allow wonderful material properties that suite to the desire design in motivation on entrapping power materials ability.

The first generations of piezoelectric nanogenerator (PENG) have been introduced by Wang and Song, 2006 which determined a single nanowire property using ZnO by characterization using Atomic Force Microscopy (AFM).

Beside altering the growth direction of materials structure, types of materials combine are usually from the combination of more than one materials to other or scientifically called as composite material which has become as one of the famous area of studies by researchers. Each of them have their own different unique properties and advantages in mechanically, electrically and chemically wise, which help contribute in developing new characteristics of piezoelectric nanogenerator specifically. There are several reasons on why combination of those types of materials famously been studied. Besides contribution on high stress-strength potential and temperature ability; the improvement in toughness and stiffness also are accouter. Furthermore, the possibilities in controlling the electrical conductivity are the most significant reasons on the needs of combination, rather than the aiming on uniformity output voltage and current as reported by Park et al, (2012).

4. Design Consideration

Thickness, size, structure and material used are important to determine design consideration concepts. The thicknesses of this nanogenerator are highly depending on the materials characteristic and fabrication method beside the flexoelectricity or the changes in strain's magnitude property on molecule's center of symmetric called Cartesian Orientation (Chang, 2010), which can give an elastic boundary in different conditions with considering on the size of nanogenerator. The attractive of ferroelectric materials in energy harvesting applications is due to the outstanding on its piezoelectric properties. In sustaining of bigger strains in mechanical vibrations for harvesting energy use, the ferroelectric polymers are the mechanism (V. Bahavanasi, 2015).

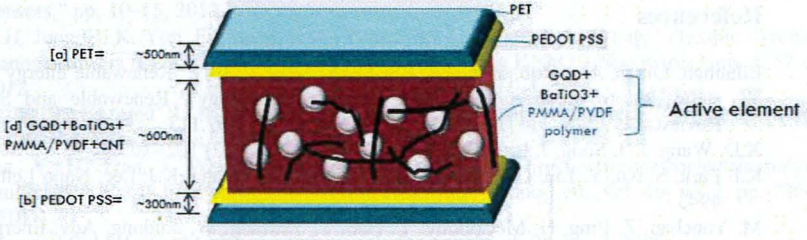


Figure 2. Thickness prediction on nanogenerator device

Furthermore, planning development model in quantitative type research work is the must to avoid any waste in materials, delay in time and ineffective measurement / test judgment. Simulation study is one of the propose method in accompanying any expectation that will occur in experimental result. Material Studio, Comsol, and Finite 2D element are the examples of software use to predict, analyze, investigate and modify desire aim materials properties.

5. Fabrication Process of the Nanogenerator

There are many thin film deposition techniques that can be used in fabricating this harvester's device as showed in figure 3. For the examples of past research, Park et al (2010) use Radio

Frequency Magnetron Sputtering in deposited BaTiO3 embedded with PDMS on plastic substrate while Kwi II Park et al (2012) and Yamaguchi H. et al (2010), use spin coating technique to fabricate their device, same as a thin film nanogenerator based on Barium Titanate ($BaTiO_3$).

The compatibleness and availability with the room environment on all materials deposited using specific equipment with appropriate procedures become the most common technique in many previous study by other researchers used such as spin coating technique, spray coating technique and RF or DC sputtering technique in fabricating specific area such as electrodes, active layer and encapsulate layer.

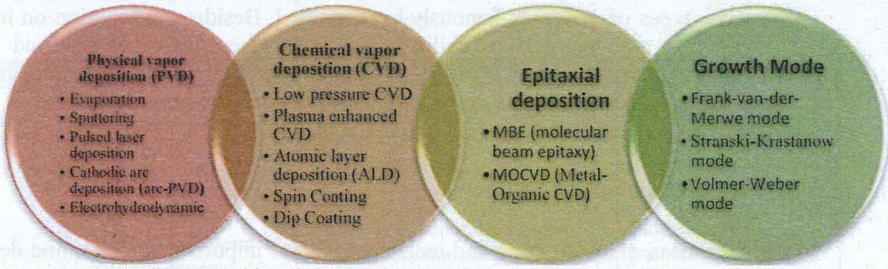


Figure 3. Thin Film Deposition Technique (Zheng Cui, 2008)

6. Conclusion

Nowadays, in toting up to good performance of the device, the demand for new integrations and properties drives the expansion of new piezoelectric nanogenerator devices. To concentrate on these prospects, piezoelectric nanogenerator devices are moving forward with new intelligent blending materials which suites in many circumstances of applications in the future.

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Energy Harvesting In Fifth Generation 5G Wireless Communications

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1. Introduction

Fifth generation (5G) radio access technology will be a key component of the Networked Society. It will address high traffic growth and increasing demand for high-bandwidth connectivity. It also support massive numbers of connected devices and meet the real-time, high-reliability communication needs of mission-critical applications. 5G will provide wireless connectivity for a wide range of new applications and uses cases including wearable, smart homes, traffic safety/control, critical infrastructure, industry processes and very high speed media delivery (Ericsson, 2016).

To enable sustainable 5G networks, new technologies have been proposed to improve the system energy efficiency, and alternative energy sources are introduced to reduce our dependence on traditional fossil fuels. In particular, various 5G techniques target the reduction of the energy consumption without sacrificing the quality of service. Meanwhile, energy harvesting technologies, which enable communication transceivers to harvest energy from various renewable resources and ambient radio frequency signals for communication, have drawn significant interest from both academia and industry (Qingqing Wu et al, 2017).

2. 5G Challenges

5G wireless networks will support up to a 1000-fold increase in capacity compared to existing networks. It is anticipated to connect at least 100 billion devices worldwide with approximately 7.6 billion mobile subscribers due to the tremendous popularity of smartphones, electronic tablets, sensors, and so on, and provide an up to 10 Gb/s individual user experience (J. G. Andrews et al, 2014). Along with the dramatic traffic explosion and device growth, 5G wireless networks also have to integrate human-to-machine and machine-to-machine communications in order to facilitate more flexible networked social information sharing aiming for one million connections per square kilometer. With such excellent expanding demand for wireless communications in the future, researchers are currently looking for viable solutions to meet the strict throughput requirement. In this regard, three paradigms have emerged (Qingqing Wu et al, 2017)

1. Exploit unused and unlicensed spectrum: millimeter- wave (mmWave) communications and Long Term Evolution (LTE) in unlicensed spectrum (LTE-U).
2. Reduce the transmitter-receiver (Tx-Rx) distance and improve frequency reuse: ultra-dense networks (UDNs) and device-to-device (D2D) communications.
3. Enhance spectral efficiency (SE) by deploying a massive amount of antennas: massive multiple- input multiple-output (M-MIMO).

The technologies listed above increase the system throughput from three different angles. However, the performance gains introduced by these technologies do not come for free. For example, M-MIMO exploits a large number of antennas for potential multiplexing and diversity gains at the expense of an escalating circuit power consumption in the RF chains that scales linearly with the number of antennas. In addition, power-hungry transceiver chains and complex signal processing techniques are needed for reliable mmWave communications to

operate at extremely high frequencies. In light of this, the network energy consumption may no longer be sustainable, and designing energy-efficient 5G networks are critical and necessary. In fact, in recent years, energy consumption has become a primary concern in the design and operation of wireless communication systems motivated by the desire to lower the operating cost of the base stations (BSs), prolong the lifetime of the user terminals (UTs), and also protect the environment. As a result, energy efficiency (EE), measured in bits per Joule, has emerged as a new prominent figure of merit and has become the most widely adopted green design metric for wireless communication systems (Y. Chen et al,2011). Meanwhile, it should also be noted that EE cannot be improved infinitely by only applying spectrally efficient communication technologies, due to the constraint imposed by Shannon capacity bound as well as the non-negligible circuit power consumption.

Consequently, even with the 5G paradigms for improving EE, the power consumption will still grow because of the explosive data rate requirements in the future. Therefore, improving EE can only ease the power consumption problem to a certain extent and is insufficient for enabling sustainable 5G communications (Qingqing Wu et al, 2017).

Energy harvesting technologies, allow BSs and devices to harvest energy from renewable resources (solar, wind, etc.) and RF signals (television signals, interference signals, etc.), have received significant attention recently. They provide green energy supply solutions for powering different components of wireless communication networks. Therefore, integrating energy harvesting technologies into future wireless networks is imperative (D. Gunduz et al., 2014). Gaining a better understanding of the specific challenges of energy harvesting technologies and alternative energy sources will pave the way to in cooperating them smoothly into the upcoming 5G wireless network planning, design, and deployment. Figure 1 below, is shown about the ecosystem of 5G wireless network.

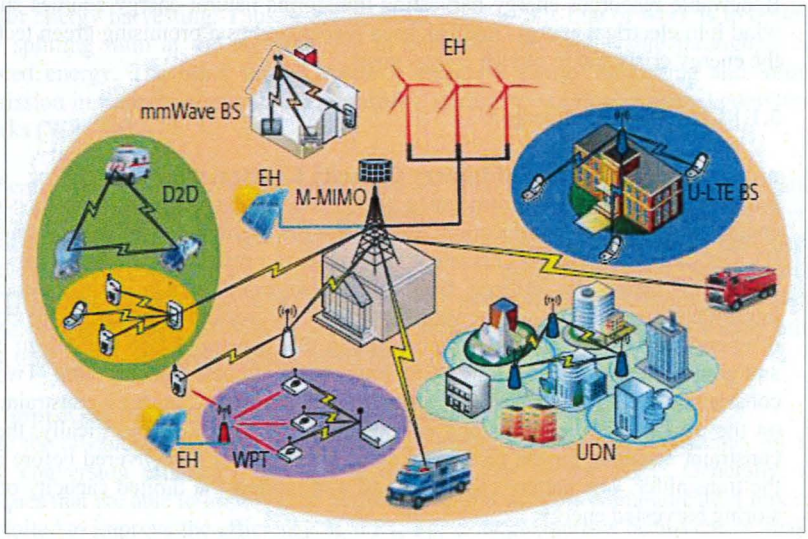


Figure 1. An ecosystem of disruptive technologies for 5G wireless networks.

3. Energy Harvesting in 5G

Besides the above techniques for improving the EE, the energy harvesting technologies drawing energy from renewable resources or RF signals are important enablers of sustainable green 5G wireless networks. In Table 1, energy harvesting from renewable resources and RF energy harvesting as well as other energy harvesting technologies are compared from different perspectives.

Table 1. Comparison of energy harvesting technologies.

Technology	Energy source controllability	Efficiency	Distance	5G applications
Renewable energy harvesting	Non-controllable	Low	Long	Hybrid BSs
RF energy harvesting	Controllable	Low	Long	IoT, sensor networks
Inductive coupling	Controllable	Very high	Very short	Cell phone charging
Magnetic resonant coupling	Controllable	High	Short	Cell phone charging
Laser beaming	Controllable	High	Long	–

3.1. Energy Harvesting from the Renewable Resources

Renewable resources energy harvesting transforms natural energy sources such as solar and wind into electrical energy, and has been recognized as a promising green technology to ease the energy crisis and to reduce energy costs.

3.1.1 Characteristics Energy:

a) Data Causality and Battery Capacity Constraints

Fundamental features that recognize energy harvesting communication systems from non-energy harvesting communication systems are the existence of an energy causality constraint (D. Gunduz et al., 2014). This constraint imposes a restriction on the energy utilization, that is, energy cannot be utilized before it is harvested, which is in essence attributed to intermittent availability of renewable resources. In order to fully accept the potential benefits of energy harvesting, carefully incorporating this constraint into the design of 5G networks and gaining deep understanding of its impacts on 5G networks are vital. Two other relevant constraints are the data causality constraint and the battery capacity constraint, which depend on the data traffic variations and energy storage limitations. Specifically, the data causality constraint accounts for the fact that a data packet cannot be delivered before it has arrived at the transmitter. The battery capacity constraint models the limited capacity of the battery for storing harvested energy.

b) Hybrid Energy Supply Solutions and Energy Cooperation

Due to the uncertain and dynamic changing environmental conditions, the harvested energy is generally irregular by nature. This poses new challenges for powering 5G systems that require stable and satisfactory QoS (Quality of Service). A pragmatic approach is to design a hybrid energy harvesting system, which uses different energy sources, such as solar, wind, diesel generators, or even the power grid, in a complementary manner to provide uninterrupted

service. As an example, for 5G communication scenarios such as UDNs with a massive number of BSs, the integration of energy harvesting not only provides location diversity to compensate for the additional circuit power consumption caused by deploying more BSs, but also reduces the power grid power consumption significantly. In addition, densified BSs employing energy harvesting also facilitate possible energy cooperation between BSs, which has huge potential for realizing green 5G networks. For example, the BSs located in "good" spots will harvest more energy and can correspondingly serve more users or transfer their superfluous energy through power lines to BSs that harvest less energy to realize energy cooperation.

3.2. RF Energy Harvesting

RF energy harvesting, also known as wireless power transfer (WPT), allows receivers to harvest energy from received RF signals (X. Lu et al., 2015, S. Bi, C. K. Ho, and R. Zhang, 2015). Compared to opportunistic energy harvesting from renewable resources, WPT can be fully controlled via wireless communication technologies, which has been therefore regarded as a promising solution for powering the massive number of small UTs expected in 5G applications such as IoT. The following research directions for RF energy harvesting have been identified.

3.2.1 Typical System Architecture and Extensions

Two canonical lines of research can be identified for implementing WPT. The first line focuses on characterizing the fundamental trade-off between the achievable rate and the harvested energy by exploring the dual use of the same signal. This concept is known as simultaneous wireless information and power transfer (SWIPT). Specifically, wireless devices split the received signal sent by a BS into two parts, one for information decoding and the other for energy harvesting. Thus, a fundamental issue of this line of work is to optimize the power splitting ratio at the receiver side to customize the achievable throughput and the harvested energy. The other line of research separates energy harvesting and information transmission in time (harvest and then transmit), leading to wireless powered communication networks (WPCNs).

Specifically, wireless devices first harvest energy from signals sent by a power station and then performs wireless information transmission (WIT) to the target BS/ receiver using harvested energy. Thus, the WPT and WIT durations have to be carefully designed, since more time for WPT leads to more harvested energy for using in WIT but leaves less time for WIT. These two canonical architectures as well as their extensions serve as a foundation for wireless-powered UDNs, M-MIMO, mmWave networks, and so on, which widely utilize RF energy flow among different entities of 5G networks.

a) Improving the Efficiency of Wireless Power Transfer (WPT).

Despite the advantages of WPT, the system performance is basically constrained by the low energy conversion efficiency and the severe path loss during WPT. Generally, the 5G techniques that are able to improve the performance of a wireless communication link can also be exploited to improve the efficiency of WPT. For example, narrow beams can be realized by employing multiple antennas at the transmitter side with optimized beamforming vectors, which is known as energy beamforming (S. Bi, C. K. Ho, and R. Zhang, 2015), and this fits the applications of M-MIMO and mmWave well. In addition, short-range communication-based 5G techniques such as D2D communications and UDNs are capable of improving the efficiency of WPT by reducing the energy transfer distance.

Besides improving the amount of harvested energy, the circuit power consumed by information decoding for SWIPT is also an important design issue since it reduces the net harvested energy that can be stored in the battery for future use. In particular, the active mixers used in conventional information receivers for RF to baseband conversion are substantially power-consuming. This motivates additional efforts on designing novel receiver architectures that consume less power by avoiding the use of active devices.

b) Interference in Wireless Networks with WPT

Another advantage of WPT is that not only dedicated signals but also co-channel interference signals can be exploited for energy harvesting. This fundamentally shifts our traditional viewpoint of "harmful" co-channel interference, which now becomes a potential source of energy. In this regard, UDNs and D2D underlaying communications, where the spectrum is heavily reused across the whole network, provide plentiful opportunities for WPT to extract the potential gain from co-channel interference. In practice, WPT enabled devices can harvest energy when co-channel interference is strong and decode information when co-channel interference is relatively weak. Besides, one may inject artificial interference deliberately into communication systems, which may be beneficial for the overall system performance, especially when receivers are hungry for energy to support normal operations. As such, this paradigm shift provides new degrees of freedom to optimize the network interference levels for achieving the desired trade-off between information transmission and energy transfer.

4. Conclusion

As the conclusion, renewable resource energy harvesting with conventional power grid and RF energy harvesting with conventional battery are envisioned to power BSs and devices, respectively in upcoming 5G networks.

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Sustainable Energy Management System (SEMS) At Politeknik Port Dickson

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1. Introduction

Politeknik Port Dickson was built and established in 1990 under the Polytechnic Management Division of the Ministry of Education Malaysia. Its construction was fully funded by the World Bank. The knowledge devoted by more than 400 academic lecturers and assisted by about 200 support staff to make Politeknik Port Dickson as one of the popular public higher learning institution that able to continually build a transformative and creative learning environment towards generating innovation led economies. To date, Politeknik Port Dickson has succeeded in producing more than 35,000 graduates in various engineering and trading programs. [1]

Recently, there has been a growing concern about energy use in commercial buildings with increasing energy demand and high electricity bill. The United Nations Environment Programme (UNEP) noted that 30%-40% of the world's energy is consumed in buildings (The UNEP website). Since the building sector accumulates approximately a third of the final energy consumption. [2]

2. Sustainable Energy Management System (SEMS)

SEMS is a process of managing the energy consumption in the organization to assure that energy has been efficiently used. [3]

2.1. Energy Policy

Energy Policy is a guide or a plan of action has been agreed formally as the basis for implementing activities or energy management program. [3] Among the policies of energy management in Politeknik Port Dickson is to control energy consumption as follow:

i. To meet the objectives and requirements of the organization
ii. To avoid spending excessive and unnecessary
iii. To meet the recommendations of the MS ISO 9001: 2008
iv. To protect the environment and extend the life of fossil fuels
v. To promote the efficient use of energy
vi. To avoid waste of energy consumption that is not productive

2.2 Energy consumption

All of the indicators include the quantity Q, which is defined as the energy, in kWh, consumed annually or some other given time period in the building or buildings under consideration.
The specific energy consumption (SEC), already, is a simply formulated, easily interpreted, general purpose energy efficiency indicator for buildings. It is defined as

$$SEC = Q/A \qquad (2.1)$$

where A is the area under consideration in meter. Typically A includes either the heated area of the building or all of the built area. [4]

Energy Efficiency Index (EEI) for 2015 (baseline) and target year 2017 for Politeknik Port Dickon. This data is use to monitor the EEI effectively, set up the monitoring profile for overall and essential for the total plant electricity consumption.

Table 1. Energy Consumption and Energy Cost at Politeknik Port Dickson from 2015 to 2017

YEAR	2015		2016		2017	
Month	Energy Consumption (kWh)	Energy Cost (RM)	Energy Consumption (kWh)	Energy Cost (RM)	Energy Consumption (kWh)	Energy Cost (RM)
JAN	327,349	119,482.39	330,101	120,486.87	350,286	127,854.3
FEB	263,177	96,059.61	301,937	110,207.01	300,004	109,501.4
MAC	360,404	131,547.46	380,875	139,019.38	365,968	133,578.3
APR	309,901	113,113.87	277,589	101,319.99	240,660	87,840.9
MEI	260,287	95,004.76	240,363	87,732.50	208,038	75,933.8
JUN	303,599	110,813.64	273,847	99,954.16	303,900	110923.3
JUL	326,694	119,243.31	304,245	111,049.43	320,463	116968.99
AUG	354,320	129,326.80	391,989	143,075.99	297,895	108731.67
SEP	317,280	115,807.20	314,590	114,825.35	294,276	107410.7
OCT	318,545	116,268.93	368,946	134,665.29	311,484	113691.6
NOV	240,472	87,772.28	286,465	104,559.73	242,035	88342.77
DEC	330,101	120,486.87	330,620	120,676.30	258,736	94438.64
TOTAL	**3,712,129**	**1,354,927.09**	**3,801,567**	**1387571.96**	**3,493,745**	**1,275,216.78**

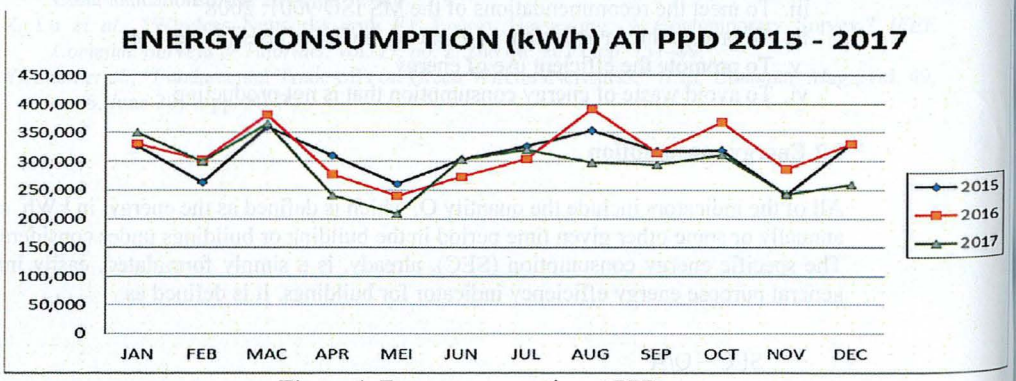


Figure 1. Energy consumption at PPD

By referring to Table 1 and figure 1, total energy consumption saving from January 2015 to December 2017.

Reduction percentage = (Total usage 2015 –Total usage 2017) X 100% (2.2)

Total usage 2015

$$= \frac{(3{,}712{,}129 \text{ kWh} - 3{,}493{,}745 \text{ kWh})}{3{,}712{,}129 \text{ kWh}} \times 100\%$$

$$= \frac{218384 \text{ kWh}}{3{,}712{,}129 \text{ kWh}} \times 100\ \%$$

$$= 5.88\%$$

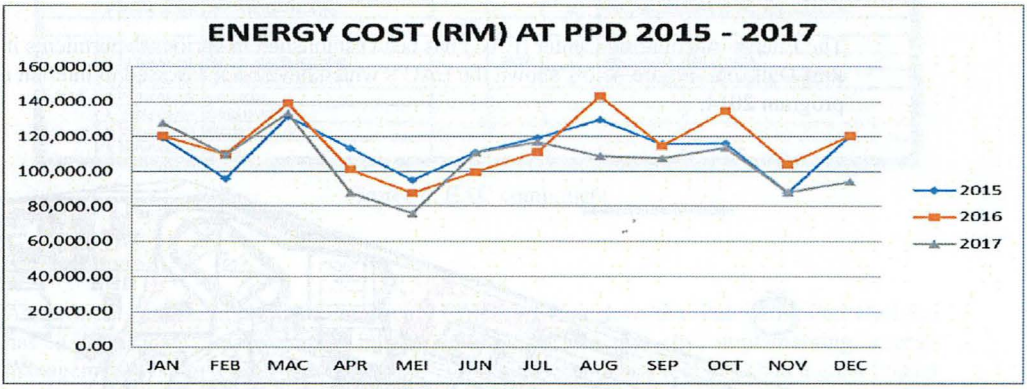


Figure 2. Energy Cost at PPD

By referring to Table 1 and figure 1, total energy cost saving from January 2015 to December 2017.

Total saving in RM = 218384 kWh x 0.365* (2.3)

= RM 79710.16

*Tariff C1 – Medium Voltage General Commercial Tariff. [5]

2.3 Energy Efficiency Index (EEI)

Energy efficiency of communities can be defined as the amount of non-renewable energy sources used in communities (production, operation and transportation) in relation to amounts of units which describe the wideness or service capability (such as floor space or volume of buildings, number of inhabitants and workplaces). [4]

According to [4] energy efficiency increases when this ratio decreases. Concrete indicators can be these ratios:

- kWh, MJ/floor-m2
- kWh, MJ/inhabitant
- kWh, MJ/workplace
- CO2-eq. t/floor-m2
- CO2-eq. t/inhabitant (inh)

- CO2-eq. t/workplace (wp).

Energy Efficiency Index = Total Energy Consumption / Total area of building (m^2) (2.4)

EEI 2015 = 3,712,129 kWh / 7369661 m2

= 0.503 kWh/m2

EEI 2017 = 4377736kWh / 7369661 m2

= 0.594 kWh/m2

2.4 Energy Accounting Center (EAC)

The Energy Accounting Center (EAC) has been established in various departments in Politeknik Port Dickson. Figure below shown the EAC's which have been assessed in internal assessment program 2014.

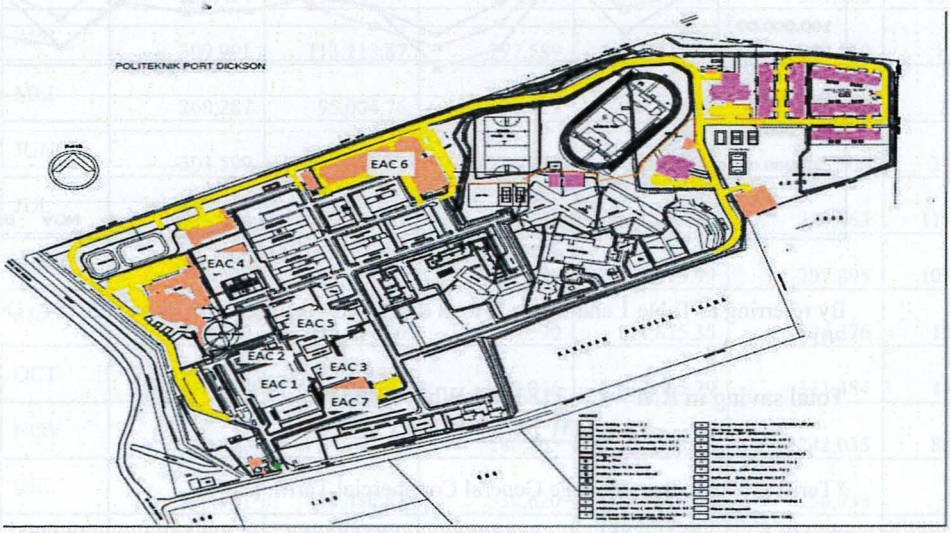


Figure 3. Politeknik Port Dickson Site Plan

	NO	METER NO	METER NAME
EAC1	1	PPD-1-1A-M1	MDB D1 BLOCK B
	2	PPD-1-1A-M2	CLASSROOM BLOCK A
	3	PPD-1-1A-M3	SSB A2 DEWAN BESAR
	4	PPD-1-1A-M4	CHILLER CONTROL PPANEL
	5	PPD-1-1A-M5	BLOCK D
	6	PPD-1-1A-M6	NETWORK DB (ADMIN BLOCK)
	7	PPD-1-1A-M7	NETWORK DB BLOCK SSB(CLASSROOM C)
	8	PPD-1-1A-M8	LAMPU JALAN

	NO	METER NO	METER NAME
EAC2	1	PPD-2-2A-M1	MSB F1 (MAKMAL ELEKTRONIK)
	2	PPD-2-2A-M2	MSB G2 (BENGKEL MESIN)
	3	PPD-2-2A-M3	MSB F2 (MAKMAL TELEKOM)
	4	PPD-2-2A-M4	MSB J1 (BENGKEL LOGI)
	5	PPD-2-2A-M5	MSB J2 (BENGKEL AUTOMATIF)
	6	PPD-2-2A-M6	DB HR (PUMP HOUSE)
	7	PPD-2-2A-M7	FEEDER PILLAR NO2
	8	PPD-2-2A-M8	MSB K2 (BENGKEL KAYU)
	9	PPD-2-2A-M9	MSB K1 (BENGKEL UKUR BAHAN,AWAM)
	10	PPD-2-2A-M10	MSB K1 (BENGKEL FOUNDARY)

	NO	METER NO	METER NAME
EAC3	1	PPD-3-3A-M1	BLOCK HHP
	2	PPD-3-3A-M2	MDB C1(BLOCK SSB)

	NO	METER NO	METER NAME
EAC4	1	PPD-4-4A-M1	SSB 'LB' AT LECTURER BLOCK
	2	PPD-4-4A-M2	SSB CF-2 CLASSROM BLOCK
	3	PPD-4-4A-M3	SSB GM GARAGAE BLOCK
	4	PPD-4-4A-M4	OXIDATION MOTOR
	5	PPD-4-4A-M5	FEEDER FILLER NO1
	6	PPD-4-4A-M6	FEEDER FILLER NO2
	7	PPD-4-4A-M7	OP TO DB LSSA
	8	PPD-4-4A-M8	SSB LT LECTURE THEATRE

	NO	METER NO	METER NAME
EAC5	1	PPD-5-5A-M1	SSB-WA3 BLOCK
	2	PPD-5-5A-M2	SSB WAF 1ST FLOOR BLOCK A
	3	PPD-5-5A-M3	DB -LPR BLOCK A
	4	PPD-5-5A-M4	SSB-WA4 BLOCK A
	5	PPD-5-5A-M5	DB-LSS BLCK A
	6	PPD-5-5A-M6	DB PROJECT ROOM BLOCK A
	7	PPD-5-5A-M7	2ND FLOOR BLOCK A
	8	PPD-5-5A-M8	A/C SB CHILLER ROOM
	9	PPD-5-5A-M9	DB ISOLATOR INCOMING SUPPLY
	10	PPD-5-5A-M10	MAIN SWITCH ROOM BLOCK A

	NO	METER NO	METER NAME
EAC6	1	PPD-6-6A-M1	SSB GIRL HOSTEL BLOCK G1
	2	PPD-6-6A-M2	SSB GIRL HOSTEL BLOCK G4
	3	PPD-6-6A-M3	SSB SURAU
	4	PPD-6-6A-M4	SSB CAFETERIA
	5	PPD-6-6A-M5	FEEDER FILLER NO1
	6	PPD-6-6A-M6	DB LLC

	NO	METER NO	METER NAME
EAC7	1	PPD-7-7A-M1	TPN MSB LAB
	2	PPD-7-7A-M2	TPN MSB DEWAN WAWASAN

Figure 4. EAC component

3. Conclusion

As a conclusion, the analysis of the Energy Effiency Index show that Politeknik Port Dickson has a significant improvement in the energy performance by implementing energy management system (SEMS) from 2015 to 2017. SEMS conducted in PPD had a great impact on the EEI decrease of 5.88% in 2017. The amount of energy saved in 2017 compared to 2015 was 218384 kWh which equivalent to RM 79710.16.

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Pemanasan Global dan *Solar Path Finder* Untuk Penentuan Lokasi Solar

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1. Perubahan cuaca (Climate change)

Sejak beberapa tahun kebelakangan ini, memang tidak di dapat dinafikan bahawa suhu persekitaran semakin meningkat. Walaupun peningkatan suhu ini dianggap perkara biasa, namun peningkatan suhu secara mendadak ini bukanlah sesuatu yang boleh lagi dianggap normal. Berdasarkan rekod NASA, secara puratanya, suhu permukaan bumi telah meningkat sebanyak 1.1 degree Celcius sejak abad ke – 19 di mana kebanyakkan peningkatan suhu ini berlaku semenjak 35 tahun lepas. Mengikut NASA juga, tahun 2016 direkodkan sebagai tahun yang paling tinggi suhunya. Pada cerdiakawan dan pakar kajicuaca menyatakan bahawa perubahan suhu tetap berlaku sekiranya terdapat perubahan bentuk orbit bumi dan juga pada kecondongan paksi bumi. Namun begitu, memandangkan perubahan ini berlaku secara mendadak, para saintins memutuskan bahawa penyebabnya boleh dijuruskan pada aktiviti-aktiviti manusia..

2. Apakah kesan Global Warming terhadap muka bumi?

Sejak kebelakangan ini revolusi industri telah berlaku secara pesat di seluruh dunia di mana manusia mencapai kemajuan yang boleh dibanggakan dari semua aspek. Ini merangkumi pemodenan dari segi pengangkutan, perubatan, telekomunikasi, perindustrian yang telah memudahcarakan kehidupan manusia di muka bumi ini. Walaubagaimanapun keadaan ini dicapai dengan penggunaan sumber semula jadi di persekitaran seperti bahan api fossil yang sememangnya terhad kewujudannya. Penggunaan bahan semula jadi melalui revolusi industri ini sebaliknya telah membebaskan gas rumah hijau seperti gas Karbon Dioksida (CO2), Metena (CH4), Nitrus Oksida (N2O), Klorofluorokarbon (CFC) dan Karbon Monoksida (CO) akibat daripada aktiviti manusia yang dijalankan sejak sekian lama. Gas- gas ini mempunyai sifat untuk memerangkap haba ke permukaan bumi dan menghalangnya daripada keluar ke angkasa lepas (green house effect) yang seterusnya menyebabkan suhu bumi meningkat secara mendadak. Peningkatan suhu bumi secara mendadak inilah yang dikenali sebagai Global Warming.

Mengikut akhbar Utusan Online, dalam Journal Perubatan Britain, The Lancet, wujud kesukaran untuk memperlahankan pemanasan global dan keadaan ini telah menimbulkan bencana besar yang memberi impak kepada kehidupan manusia selain menjejaskan mata pencarian secara global.

Kesan langsung daripada pemanasan global adalah peningkatan suhu lautan (hydrosphere) sebanyak sejak 1969. Peningkatan suhu ini memhasilkan suatu fenomena serius yang dikenali bagai lautan asidik (Ocean acidification) yang boleh menjejaskan kehidupan akuatik. Fenomena ini menyebabkan lautan bertambah sifat keasidannya akibat berinteraksi kimia antara karbon dioksida di atmosfera dengan air masin dari laut. Selain kehidupan akuatik, impak ini turut dirasa oleh golongan manusia yang bergantung kepada sumber protein dari lautan.

Tambahan pula, paras laut juga telah meningkat. Peningkatan ini dikaitan dengan penambahan suhu laut yang menyebabkan air laut mengembang. Selain itu, peningkatan paras laut ini adalah kesan daripada pencairan ais glaseir. Akibatnya, berlakulah banjir yang menjejaskan pertanian, penternakan dan tempat tinggal manusia. Bencana alam lain seperti kemarau, putting beliung turut berlaku secara berleluasa.

3. Implikasi tehadap kesihatan manusia dan ekonomi

Menurut jurnal perubatan Britain, The Lancet, tahap produktiviti di kalangan perkerja buruh dan ladang telah turun secara mendadak sejak tahun 2000 di negara India dan Brazil. Isu ini juga menyentuh aspek keselamatan dan kesihatan pekerja yang perlu ditanggung oleh syarikat apabila pekerja terkena heat stroke dan sebagainya. Penurunan produktiviti menjejasan ekonomi sesebuah negara yang menjadikan industri perladangan dan pembinaan sebagai tulang belakang pembangunan sosio-ekonomi negara tersebut.

Selain daripada itu, bilangan penduduk yang menjadi mangsa masalah malnutrisi semakin meningkat di Afrika dan Asia dan mencatat peningkatan sebanyak 422 juta berbanding 398 juta pada tahun 1990. Malah, kekurangan nutrisi merupakan masalah kesihatan terbesar yang timbul akibat perubahan iklim. Keadaan ini dapat dikaitkan dengan informasi yang diberikan dalam persidangan bertajuk 'Climate change – resillence to Agricultural System' yang diadakan dari 29Nov – 5 Disember 2015 di Univerisity Agriculture Faisalabad, Pakistan yang mengumpulkan lebih dari 50 pakar akademik kajicuaca dan pertanian di Pakistan dan 14 negara Asia. Workshop ini membincangkan kesan langsung Global Warming kepada sektor pertanian, hutan, sumber air, dan sumber makanan ruji manusia sedunia.

Perubahan cuaca ini mengakibatkan bencana alam seperti kemarau yang menjejaskan output keluaran pertanian utama. Keadaan ini menjadi lagi serius apabila timbulnya peningkatan populasi nyamuk yang seterusnya meningkatkan bilangan pesakit denggi seluruh dunia yang memudaratkan kesihatan pada lebih 100 juta orang setahun. Pertubuhan Kesihatan Sedunia (WHO) dalam kajiannya bertajuk Lancet Countdown menganggarkan akan terdapat 250 000 kematian setahun akibat perubahan iklim pada masa akan datang iaitu dari tahun 2030 dan 2050.

4. Bagaimana dunia memandang isu ini?

Scenario ini telah mencetuskan perbincangan seluruh warga dunia untuk mencari jalan penyelesaian yang sesuai dan mampu dibuat pada masa ini kerana akan mendatangkan impak yang lebih serius kepada generasi akan datang. Sekiranya fenomena ini dipandang lewa dan tidak tanggani dengan segera, generasi baru terpaksa menanggung perlbagai kesan selain kos pemulihan dan pembersihan yang sangat serius untuk memberi laluan kepada pembangunan secara normal tanpa diganggu oleh ancaman perubahan cuaca dan kekurangan sumber bahan api fossil.

Malah, sumber dari akhbar Berita Harian menyatakan, Persidangan Pertubuhan Bangsa-Bangsa Bersatu (PBB) yang dijalankan baru-baru ini, Encik Masagos Zulkifli Masagos Mohammad, Menteri Sekitaran dan Sumber Air Singapura telah menjadikan 2018 sabagai tahun tindakan iklim bagi negara tersebut. Turut dinyatakan oleh beliau mengenai hasratnya untuk memberi lebih kesedaran kepada masyarakat setempat supaya masyarakat dapat bertindak segera menghadapi cabaran Global Warming ini. Ini jelas menunjukkan bahawa penyelesaian untuk cabaran ini bukan terletak dari satu-satu pihak kerajaan sahaja malah jatuh ke tangan seluruh penduduk yang mendiami dunia ini.

Memandang isu ini dibincangkan pada tahap dunia, Malaysia yang kaya dengan pelbagai keunikan flora dan fauna juga tidak terkecuali dari mengambil serius segala tindakan penyelesaian isu pemanasan global. Antaranya ialah pemasangan solar panel yang boleh secara langsung megurangkan masalah pemanasan global. Solar Panel menggunakan tenaga solar yang bersih tanpa bergantung kepada kepada bahan api fosil yang menjadi penyebab utama dalam penghasilan gas rumah hijau dan seterusnya memberi impak kepada pemansan global.

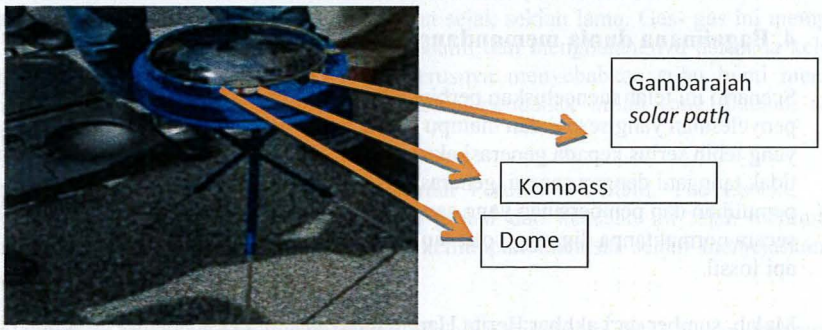
5. Malaysia dan tenaga solar

Malaysia mempunyai struktur geografi yang amat baik dengan penerimaan solar radiasi sebanyak 400-600 MJ/m sebulan. Walaupun kos Photovoltaic (PV) adalah agak mahal, kebanyakkan kawasan perumahan dan industri mula memasang solar panel di kawasan mereka. Tajuk seterusnya menyentuh sedikit teknikal untuk memastikan solar panel yang dipasang pada tempat tersebut adalah sesuai untuk sepanjang tahun ataupun sebaliknya. Solar Path finder digunakan untuk mendapatkan maklumat tersebut.

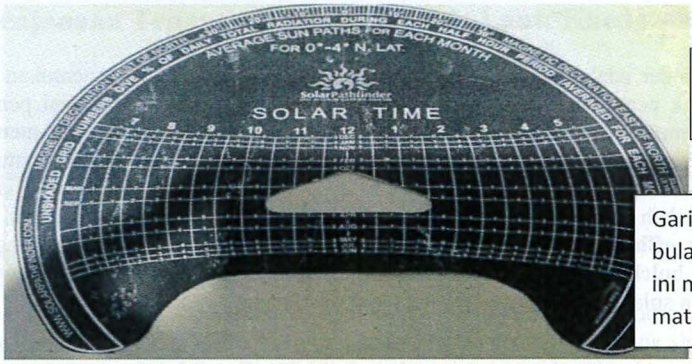
6. Solar Path Finder dan cara menggunakannya

Solar path finder merupakan suatu alat yang digunakan untuk membuat analysis pada sesuatu tempat untuk mengetahui sifat keteduhan sepanjang tahun (*annual shading profile*). Alat ini membantu mengesan pergerakan matahari pada sesuatu tempat yang dijangka akan didirikan solar panel. Selain pergerakan matahari, *solar path finder* memberi informasi kepada kita tentang sesuatu kawasan yang dipilih untuk meletakkan solar panel itu sama ada akan menerima cahaya maksimum berterusan ataupun jatuh di tempat teduh secara kekal sepanjang tahun. Dengan ini, analisis untuk sifat keteduhan sepanjang tahun (*annual shading profile*) dapat diwujudkan sebelum pembinaan solar panel bagi mengelakkan pembaziran dan kekurangan effisen dalam sistem solar panel.

Gambarajah dibawah menunjukkan *solar path finder*. Alat ini terdiri daripada Base, dome, sunpath diagram.



Rajah 1. *Solar path finder*

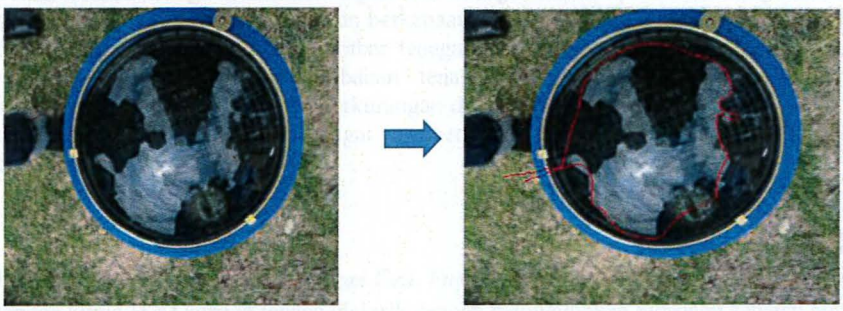


Garis melintang untuk setiap bulan sepanjang tahun. Garis ini menunjukkan pergerakan matahari untuk bulan

Rajah 2. Gambarajah '*solar path*'

Dome merupakan penutup lutsinar dimana refleksi persekitaran seperti pokok, bangunan, tiang lampu dan sebagainya akan jatuh pada permukaan tersebut. Di bawah Dome terletaknya *sun path diagram* yang menberi laluan pergerakan matahari untuk setiap bulan sepanjang tahun. Berdasarkan gambarajah di bawah, garis melintang dilabel dengan Jan, Feb, Mac dan seterusnya sehingga Disember yang menunjukkan kedudukan matahari untuk bulan-bulan tersebut sepanjang tahun. Manakala Solar time menunjukkan waktu dari 7am hingga 5pm(siang). Perlu diketahui bahawa, kedudukan matahari tidaklah sama dan akan berubah dalam sesuatu masa untuk tahun tersebut. Contohnya kedudukan matahari pada pukul 1 tenghari pada bulan Dec adalah berbeza dengan kedudukan matahari pukul 1 bulan Jun. Maka garis melintang yang untuk setiap bulan inilah yang akan membantu pengkaji menunjukkan pergerakan matahari pada setiap bulan.

Terlebih dahulu, alatan ini perlu disetkan dahulu kompas magnet menunjukkan arah Utara. Setelah cermin Dome diletakkan di atas sun path diagram kelihatan refleksi teduhan seperti pokok dan segala bayang akan dapat dilihat pada gelas dome tersebut seperti gambar di bawah. Teduhan itu kemudiannya dilukis menggunakan pensil untuk analisa seterusnya.



Rajah 3. Kawasan yang teduh (pokok, bangunan dan sbg) shading dilukis dengan pensel

Dengan ini, kawasan dalam solar path yang jatuh teduh itu akan sentiasa tidak akan mendapat cahaya matahari pada solar time dan bulan yang tertera pada skala tersebut. Seperti yang dimaklumkan kedudukan matahari berubah mengikut solar path, bahagian yang dilukis dengan pensil ini menunjukkan waktu dan bulan dimana kawasan ini sentiasa dalam keadaan teduh secara kekal sepanjang masa. Keadaan ini boleh menjejaskan fungsi solar panel. Dengan ini kita dapat mengetahui sesuai ataupun tidak sekiranya pembinaan solar panel diteruskan pada tempat dimana path finder ini diletakkan.

7. Kesimpulan

Solar path finder adalah satu teknik analisa yang digunakan untuk menentukan lokasi yang paling banyak penerimaan tenaga solar untuk sepanjang tahun. Analisa ini penting supaya tahap penerimaan solar adalah maksimum pada bila – bila waktu dengan mengambil kira pergerakan matahari pada kedudukan yang berbeza pada bulan-bulan tertentu untuk sepanjang tahun. Ini boleh mengelakkan kedudukan solar terletak di tempat teduh apabila kedudukan matahari berubah pada waktu tertentu. Kedudukan solar yang optimum menjamin penghasilan tenaga yang efficien. Penggunaan solar perlu banyak digunakan supaya penghasilan gas rumah hijau boleh dikurangkan. Pemanasan global secara langsung boleh dikawal sekiranya pemansangan solar menjadi sesuatu yang biasa dikalangan penduduk.

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Penjanaan Tenaga Elektrik Dari Air Laut: Kaedah Altenatif Kearah Tenaga Bersih

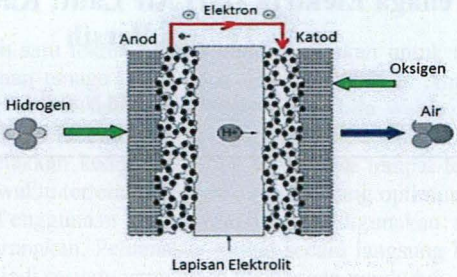
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1. Pengenalan

Tenaga mampan merupakan salah satu kunci utama dalam menghadapi cabaran dunia moden dan juga merupakan bahagian penting dalam pembangunan sains dan teknologi. Prestasi tenaga mampan ini dapat dipertingkatkan dengan memperkasakan penggunaan sumber tenaga boleh diperbaharui *(renewabale energy)* dengan lebih cekap (J. K. Kim, F. Mueller, 2014). Salah satu elemen sumber tenaga boleh diperbaharui ini adalah air laut. Air laut merupakan sumber tenaga altenatif selain daripada solar, angin, *fuel cell*, mini hidro, biogas dan biomas. Air adalah kompoun yang paling banyak dipermukaan bumi meliputi 70.8% daripadanya. Ia juga merupakan cecair lut sinar yang terdiri daripada molekul H_2O. Setiap molekul air mengandungi 2 atom hidrogen dan 1 atom oksigen. Air di lautan menyerap haba 1000 kali lebih berkesan dari udara di atmosfera, jadi air penting di dalam mengawal kepanansan global. Haba dari matahari akan diserap oleh air yang menyebabkan molekul air berubah kepada hidrogen peroksida (H2O2). Penyelidik dari Universiti Osaka mendapati cara untuk menukarkan air laut kepada hidrogen peroksida (H2O2) dengan menggunakan cahaya matahari, yang kemudiannya boleh digunakan untuk menjana elektrik dengan menggunakan konsep *Fuel Cell*. Ini dapat menambahkan jumlah tenaga alternatif yang sedia ada iaitu penggunaan tenaga solar memandangkan dunia terus bergerak ke arah tenaga hijau. Tenaga Solar membolehkan pengurangan pelepasan gas berbahaya atau rumah hijau yang dihasilkan oleh pembakaran bahan api fosil. Walau bagaimanapun, kelemahan bagi keupayaan penjaanaan tenaga elektrik melalui tenaga solar adalah bergantung kepada kepanjangan waktu siang. Untuk menggunakan tenaga solar pada waktu malam, tenaga solar harus disimpan dalam bentuk tenaga kimia dan digunakan sebagai bahan api untuk menghasilkan tenaga elektrik. Oleh yang demikian, kajian berkenaan air laut sebagai sumber tenaga alternatif amat diperlukan bagi menggantikan sumber tenaga konvensional yang menggunakan arang batu dan empangan hidro. Kedua-dua bahan tenaga konvensional ini tidak akan bertahan lama kerana sumber-sumber ini akan berkurangan dan kos pembeliannya juga mahal. Berbanding dengan pengguna air laut sebagai sumber tenaga altenatif yang sentiasa ada tanpa berkurangan.

2. Konsep *Fuel Cell.*

Kajian ini menggunakan konsep *Fuel Cell. Fuel Cell* merupakan elektrokimia yang mengubah tenaga kimia H2O kepada tenaga elektrik dengan menggunakan hidrogen sebagai bahan bakar dan oksigen sebagai bahan oksidan (EG&G Technical Services, Inc., 2006). Hasil dari reaksi kimia ini menghasilkan tenaga elektrik, air dan haba. Tindak balas dari penghasilan elektrik berlaku di elektrod. Setiap Fuel Cell mempunyai 2 elektrod, positif di kenali sebagai anod dan negatif di kenali sebagai katod. kedua-dua elektrod ini dipisahkan oleh elektrolit, dalam kajian ini elektrolit yang digunakan adalah air laut. Bahan bakar iaitu hidrogen akan bergerak ke bahagian anod, manakala oksigen bergerak ke bahagian katod. Apabila kedua-dua bahan kimia ini menghentam elektrolit, kesannya adalah oksigen dan hidogen akan membebaskan elektron dan seterusnya menghasilkan arus elektrik. *Fuel Cell* ini akan terus menghasilkan elektrik selagi mana bahan bakar hidrogen masih wujud di dalam air.



Rajah 1. *Diagram Polymer Electrolyte Membrane Fuel Cell (PEMFC)*

3. Penjanaan Tenaga Elektrik dari Air Laut

Mekanisma elektrokimia bagi pengecasan bateri air laut adalah dengan menggunakan air laut sebagai bahan katod. Sodium yang terdapat di dalam air laut akan terurai semasa proses pengecasan bateri. Sodium yang terurai ini akan mengasingkan oksigen yang terdapat dalam sebatian kimia air laut iaitu H_2O_2. Ia berfungsi sebagai pengoksidan untuk menghasilkan arus elektrik. Aplikasi bagi teknologi bateri air laut sebagai produk yang dikomersialkan masih lagi terhad di sebabkan oleh bahan elektrod yang berkos tinggi. Elektrod dihasilkan dari gabungan beberapa logam seperti *magnisium, nikel, stannum atau litium* di mana kesemua bahan-bahan ini berkos tinggi dan terhad. Gabungan elektrod yang betul, akan menyebabkan bateri air laut lebih berprestasi dalam penghasilan sumber tenaga elektrik (Moohammad Riyanto, 2017).

Kaedah pengambilan data mengambil kira beberapa faktor antara iaitu jenis bahan yang digunakan dan suhu air laut. Jenis bahan memainkan peranan yang sangat penting dalam penghasilan tenaga elektrik bagi menentukan atau membezakan sama ada bahan yang digunakan adalah terminal positif dan terminal negatif. Suhu juga merupakan salah satu elemen penting dalam meningkatkan tenaga elektrik secara semula jadi. Selain itu, kuantiti air juga diambil kira supaya data yang diperolehi adalah releven.

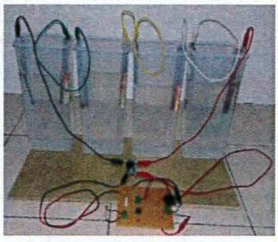
Tujuan kajian ini adalah untuk menganalisa prestasi gabungan bahan elektrod iaitu kuprum, zink dan aluminium. Hanya tiga bahan elektrod di uji kerana ia mudah didapati dan murah harganya. Selain itu, kajian ini bertujuan untuk melihat penghasilan tenaga elektrik di waktu siang atau malam dalam kemasinan air laut yang sama dan mempunyai kuantiti air yang sama sebagai bahan elektrolit (M. Kar, B. Winther-Jensen, 2014). Kebiasaannya kuprum di jadikan sebagai bahan katod dalam sel galvanic kerana ia mempunyai kecekapan yang tinggi dan sesuai di dalam air laut (O. Hasvold, 1995). Manakala zink dan aluminium pula dijadikan sebagai bahan anod dan mampu menjanakan kuasa keluaran yang tinggi dalam bateri air laut.

4. Analisa Dapatan Data

Kaedah yang digunakan adalah dengan meletakkan plat kuprum dan zink di dalam bekas yang berisi air laut. Plat kuprum digunakan sebagai katod dan plat zink digunakan sebagai anod. Kajian ini dijalankan pada waktu siang dan malam bagi mengkaji keberhasilan tenaga elektrik

malalui air laut. Kedua-dua plat ini direndamkan ke dalam air laut dan disambungkan kepada multimeter untuk mendapatkan bacaan voltan arus. Terdapat 4 bekas air laut yang digunakan. Setiap bekas air laut mempunyai plat kuprum dan zink atau plat kuprum dan aluminium di mana plat-plat ini disambung secara sesiri bagi menghasilkan voltan sumber tenaga elektrik yang tinggi. Sekiranya ke semua plat disambungkan secara selari, tenaga elektrik yang dihasilkan mempunyai voltan yang sama pada setiap bekas.

Kajian dijalankan adalah pada waktu siang dan malam. Sebanyak 5 bacaan data yang diambil pada waktu siang dan 5 bacaan data pada waktu malam iaitu pada jam 2.00 petang, 3.00 petang, 4.00 petang, 5.00 petang dan 6.00 petang. Manakala di waktu malam pula adalah pada jam 8.00 pm, 9.00 pm, 10.00 pm, 11.00 pm dan 12.00 am. Kuantiti air laut adalah pada kuantiti yang sama iaitu sebanyak 1.5 liter. Manakala pH air laut pada ketika itu adalah berada pada tahap alkali.



Rajah 2. Pengujian amali

Jadual 1. Jenis bahan 1 : Kuprum dan Zink

MASA(siang)	2 : 00 p.m	3:00 p.m	4:00 p.m	5:00 p.m	6:00 p.m
KUANTITI AIR	1.5l	1.5l	1.5l	1.5l	1.5l
pH air	alkali	alkali	alkali	alkali	alkali
Suhu Air	35	34.5	33	33.2	31.5
Sambungan material	sesiri	sesiri	sesiri	sesiri	sesiri
keluaran	5 v	5v	5v	5v	5v
Arus	20mA	20mA	18mA	16mA	14mA
Keluaran + Booster	8.2 v	8.2 v	8.1 v	8 v	7.5 v

Kajian pertama melibatkan gabungan kuprum dan zink. Dapatan menunjukkan bacaan voltan di waktu siang bagi ke lima-lima data yang diambil adalah berkeluaran 5V. Walaupun bacaan voltan menunjukkan bacaan yang sama, namun demikian bacaan arus adalah berlainan. Semakin menghampiri ke waktu malam, nilai arus semakin berkurangan. Bacaan maksima arus yang diperolehi sebanyak 20mA dan bacaan minima adalah 14mA. Ini menunjukkan semakin masa menghampiri ke malam, suhu air akan berkurangan. Ia akan mempengaruhi bacaan arus yang dihasilkan. Bacaan arus adalah berkadar terus dengan suhu.

Jadual 2. Jenis bahan 1 : Kuprum dan Zink

MASA(malam)	8 : 00 p.m	9:00 p.m	10:00 p.m	11:00 p.m	12:00 a.m
KUANTITI AIR	1.5l	1.5l	1.5l	1.5l	1.5l
pH air	alkali	alkali	alkali	alkali	alkali
Suhu Air	30	30	29.5	28	27.5
Sambungan material	sesiri	sesiri	sesiri	sesiri	sesiri
keluaran	3 v	3v	3v	3v	2.8v
Arus	13mA	13mA	12.8mA	12.5mA	12.5mA

Manakala di waktu malam pula, keluaran voltan menyusut ke 3V. Ini di sebabkan oleh suhu air laut yang berkurangan. Semakin panas suhu air laut, semakin tinggi voltan yang dapat dihasilkan oleh air laut.

Jadual 3. Jenis bahan 2 : Kuprum dan Aluminum

Masa (siang)	2.00 p.m	3.00 p.m	4.00 p.m	5.00 p.m	6.00 p.m
Kuantiti air	1.5l	1.5l	1.5l	1.5l	1.5l
pH air	alkali	alkali	alkali	alkali	alkali
Suhu Air	35	34.5	34	33	32.5
Sambungan material	sesiri	sesiri	sesiri	sesiri	sesiri
Keluaran	2v	2v	1.6v	1.4v	1v
Arus	8mA	8mA	7.8mA	7.6mA	7.2mA

Jadual 4. Jenis bahan 2 : Kuprum dan Aluminum

Masa (malam)	8.00 p.m	9.00 p.m	10.00 p.m	11.00 p.m	12.00 a.m
Kuantiti air	1.5l	1.5l	1.5l	1.5l	1.5l
pH air	alkali	alkali	alkali	alkali	alkali
Suhu Air	30	29.5	29	28.5	28
Sambungan material	sesiri	sesiri	sesiri	sesiri	sesiri
Keluaran	1v	1v	0.8v	0.6v	0.3v
Arus	4mA	3.5mA	3.3mA	3mA	2.8mA

Bahan yang kedua adalah gabungan bahan kuprum dan aluminium. Masa, kuanti air laut dan pH air laut adalah sama seperti bahan 1 iaitu kuprum dan zink. Dari bacaan ini di dapati keluaran voltan adalah berkurangan dari bahan 1. Keluaran voltan yang dihasilkan hanya 2V pada jam 2.00 pm dan 0.3V pada jam 12.00 am. Manakala arus yang terhasil juga akan berkurangan. Bacaan arus yang paling tinggi hanya dapat dihasilkan pada keluaran 8mA iaitu pada jam 2.00 pm.

5. Kesimpulan

Kesimpulan dapat dibuat melalui pemerhatian terhadap kedua-dua bahan yang digunakan menunjukkan bahan 1 iaitu gabungan kuprum dan zink dapat menghasilkan voltan arus yang tinggi berbanding bahan 2 iaitu kuprum dan aluminium. Faktor kuantiti air laut dan pH air laut tidak mempengaruhi dalam kajian ini. Penghasilan voltan dan arus di pengaruhi oleh faktor suhu. Di mana penghasilan voltan dan arus berkadar terus dengan suhu. Semakin suhu meningkat, penghasilan voltan dan arus juga meningkat ini dapat di lihat melalui kedua-dua bahan kajian yang digunakan. Apabila disambungkan bahan 1 (kuprum dan zink) bersama litar *Booster* , bacaan voltan yang diperolehi adalah 8.2 V. Dengan bacaan keluaran ini, ia dapat diaplikasikan di kawasan laut atau pantai seperti lampu kecemasan, lampu perkhemahan, lampu perahu dan sebagainya. Ia dapat memberi kemudahan kepada para nelayan dan pengunjung untuk berkhemah di kawasan pantai.

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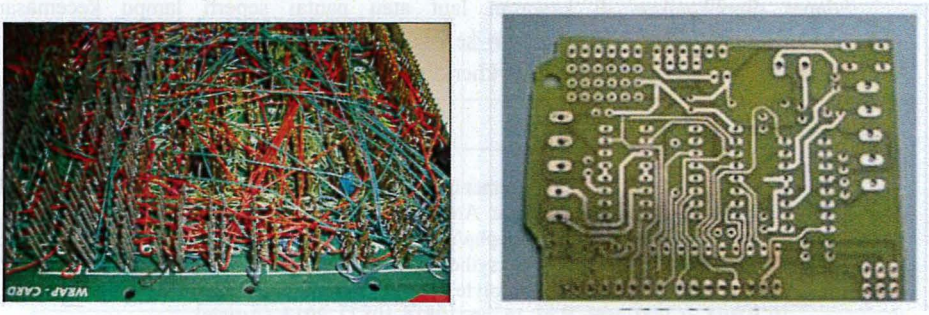
Printed Circuit Board Etchant Waste and Environment: A Review

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1. Introduction

Printed circuit board (PCB) is a board that connect electronic components. It is made up of a resin or plastic board and a conductive metal usually made of copper. Instead of wires, copper track as the conductive metal makes the electrical connections between components and the parts of the device possible. PCB is just like the brain of a device because it is not only supply power, it supports the mechanics of a device and it also route signals to different components.

Before the invention of PCB, point to point construction or wire wrapping circuit was the option. As the circuit design is bulky and unreliable, it required large sockets and regular replacement. Figure 1 shows the different between (a) early electronic circuit board and (b) current circuit board.



(a) (b)

Figure 1. Electronic circuit board (a) early stage layout (b) current layout [Siobhannichofaigh]

The advances in PCB technology is usually defined in terms of how many copper layers it has. From the first PCB invented in 1936 up to date, it can be anywhere from one to 10 layers (Roettinger)(Eirik Holm) or it can even be more layers depending on the circuit design. Single-sided PCB has one copper layer, double-sided PCB has two copper layers on both sides of one substrate layer and multi-layer PCB has outer and inner layers of copper, alternating with layers of substrate. PCB with more layers provides additional space for connecting components and therefore allow for much higher component density. Therefore, the more components available on PCB, the more complex the device become, while in term of PCB repair and modification resulted to be more difficult also.

A circuit design on a single layer PCB making is normally introduced to electronics students as one of a required skill that they need to fulfill. Single layer PCB is simple, therefore students can easily understand, easy to design, and it is less costly (Microcontroller Lab). Students in Electical Department of Politeknik Port Dickson get the experience to design electronic circuit on a single layer PCB during their Project course on the fourth semester of their study. They go through all the processes in the PCB making including designing the

layout of circuit on computer software, printing the circuit layout on a glossy paper, and ironing the printed layout on a PCB board.

The next task is etching process, whereby part of the PCB conductive material is removed leaving only the circuit track connecting all component. Once etching is done, components are ready to be inserted at their respective places on the PCB board.

2. PCB Etching Issue`

Etching is a third step procedure in developing electronic circuit design on PCB board. Referring to Figure 2(a) and 2(b), etching is a process of removing unprotected parts of conductive material surface or metal such as copper, zinc or steel by using strong acid. While parts of metal surface covered with waxy ground as shown in Figure 2(c) remain, as it is resistant to the acid reaction. Copper is removed from the board except the protected area where wired connections are present. It is the process to make copper traces to connect different components on a circuit board.



(a) (b) (c)

Figure 2. Etching steps (a) circuit design transfer (b) PCB board dipped in strong acid (c) result [Siobhannichofaigh]

Etching process that involves the usage of strong acid or etchants to take off the conductive material surface is called wet etching. The whole substrate can be either dipped in the solution or the solution is sprayed on the substrate (Mahmood Toofan)(Nam-Trung Nguyen). As shown in Table 1, wet etching is often chosen by students as their first choice for patterning PCB circuit board because it is mainly cheap and straightforward. However, strong chemical solutions such as hydrofluoric acid (HF), hydrochloric acid (HCL), and nitric acid (HNO3) are needed in order to remove unprotected copper. These chemical solutions are extremely hazardous and therefore, great care should be taken, not only during handling on these materials but also outside the etching process. Chemical waste from etching process or spent etchant $FeCl_2$ and CuCl is an environmental problem and cannot just pour it down the drain. It supposedly takes it to a hazardous waste facility.

Table 1. Wet etching criteria

Advantage	Disadvantage
• Simple equipment	• Large amounts of etchant chemicals
• High etching rate	• Chemical and disposal costs are extremely high
• High selectivity for most material	• Potential of chemical handling hazards
• Low cost, easy to implement	• Wafer contamination issues

Everybody who is directly or indirectly involved in etching process especially electrical engineering staffs and students, should aware of the hazardous during the etching handling stage, pre and post etching stage. Sub-topics below discuss briefly the hazardous of both mentioned etching stage.

2.1. Etching Handling Stage Hazard

2.1.1. Burns

The behaviour of acid solutions is corrosive. Concentrated acids can cause severe burns if it is directly contacted or splashes on skin or in eyes. Although the dilution of concentrated acids is less hazardous, it can give the same effect as concentrated acids if it is repeatedly contacted or splashed to the skin or eyes.

The easiest way to avoid the hazardous of chemical solution is by conducting the right mixing method for acid and water. Acid should be added to the water and not the opposite way by adding water on the acids. The later will produce large amounts of heat and can result in boiling concentrated acid. Another method is by wearing a protective cloth, glove and eye goggle in order to protect skin and eyes. Besides that, the mixing area should be provided with emergency shower in the case of acids contact or splashing (Michael McCann).

2.1.2 Chemical Pneumonia and Emphysema

Another acid solution behaviour is evaporative. Nitric acid produces brownish nitrogen dioxide gas which unfortunately cannot be easily detected since it has poor odor. There is no indication whether someone has been overexposed. Similarly, a mix between potassium chlorate and hydrochloric acid releases highly toxic chlorine gas. Overexposed to these gases can cause chemical pneumonia or emphysema depending on the amount of gasses inhale by the person.

Etching with both nitric acid; and a mix of potassium chlorate and hydrochloric acid requires good air ventilation. The acid trays and sink where acids are mixed should have either a slot exhaust hood or laboratory-type hood (Michael McCann).

2.2. Pre and Post Etching Hazard Storage and Disposal

2.2.1 Reaction

Acid solution can react with other acid. Hydrofluoric acid attacks all silica containing materials, including glass.

In order to avoid the risk of chemical reaction, a safe storage should be provided in the etching area. Concentrated acids should be stored separately from other chemical. It must be used and stored in polyethylene (PE) bottles and vessels. Bottles for storage of HF must have secure caps and lids that can provide a gas-tight seal to prevent escape of hydrogen fluoride gas (Steve Elwood).

2.2.2 Toxicity

Hydrofluoric acid should never be disposed of by drain. Elementary neutralization of HF does not permit drain disposal, even if the resulting solution pH is 7. Neutralization of hydrofluoric acid with a basic material produces metal fluoride salts, which are toxic.

It must always be collected as hazardous waste in closeable plastic containers. All materials that have been contaminated with hydrofluoric acid still exhibit a hazard and therefore should also be disposed of as hazardous waste. These materials include research devices, empty bottles formerly containing HF, spill debris and personal protection garments worn while using HF.

3. PCB Making and Etchant Waste Management

It is recommended for Electrical Department of Politeknik Port Dickson to handle all hazards related to PCB making process as mentioned in the above topics by two basic actions. First is by implementing rule and the second is setting up e-waste committee. Both actions are important since the PCB making is a repeatedly performed by Project 1 students every semester or every six months. These actions are in line with the Environmental Quality Act 1974 (ACT 127), Environmental Quality (Scheduled Waste) Regulations 2005. Listed below are the details of the actions.

Rules:

i. PCB making process: The rules include technique of mixing etching acids, ethics of wearing secure cloth and cloth accessories, and action after etching process
ii. Secure etching area:The project room should be provided with a good air ventilation system, and have effective water system for emergency situation
iii. Etchant storage space: Etching acid should be placed in a specific place in the project room

E-waste committee:

i. Responsible to provide etchant waste container: They have to ensure all staffs and students put their etching waste in the storage provided.
ii. Responsible to plan for etchant waste disposal: Spent etchant must be disposed in a correct and save way. They can send it to a waste management company such as Kualiti Alam Sdn. Bhd in Negeri Sembilan. Alternatively they can reuse the spent etchant by giving it to other staffs or students for their PCB etching process.
iii. Responsible to increase awareness of how to handle PCB etchant correctly among all Electrical Engineering staffs and students.

4. Conclusion

PCB is one of the main elements in an electronic or electrical devices and systems. In the etching stage, the process of making PCB produces a hazardous waste and need to a systematic waste management. All staffs and students that are directly or indirectly involved in the process should aware to the rules and know their roles in order to contribute to sustainable green environment.

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Type of Photovoltaic (PV) Solar Panel used in PV Technology

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1. Introduction

Photovoltaic (PV) is a device that can accept the direct conversion of sunlight into electricity without any heat engine interference. That's why solar panel is potentially one of the most useful renewable energy technologies that available in the market. All photovoltaic (PV) cells consist of two or more thin layers of semiconducting materials, and the most common material used in PV would be silicon. When the semiconductor item in photovoltaic exposed to light, the electrical charge generated and this can be conducted away by metal contact as direct current (dc). The biggest advantage of the use of photovoltaic devices are as a stand-alone systems. The output power from solar system can be used for power source, water pumping, remote building, solar home system, communication, satellite and space vehicle and for other application as well. Therefore the demand for photovoltaic is increasing every year in the world.

2. Photovoltaic (PV) Characteristic.

Photovoltaic (PV) modules are a combination of PV cell. PV cell are made up from semiconductor type. Two types of semiconductors are Instrintic and Extrinsic [1]. Due to its ample availability, silicon is an element in Group IV of periodic table which contains four valence electrons, as illustrated in figure 1.

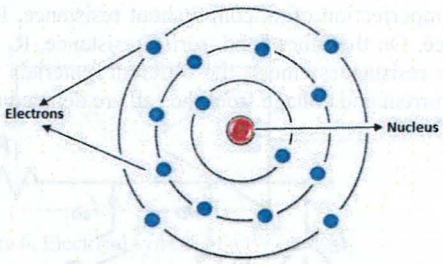


Figure 1. Anotomic structure of silicon.

The nucleus contains 14 protons and 14 neutronos and 4 valence electrons.The nearest with nucleus is the orbital can hold only two electrons is filled, the next outer orbital can hold eight electron and the outermost orbital is said to be in the valence band.In this condition, the electrons are said to be conduction band. The interconnection of silicon atoms are done via covalent bonding due to sharing the electron.

Where solar energy in the form of photons strikes the outer orbital electrons, the energy may be transferred to these electrons, provided the incident solar energy has the correct quantum of energy. If the photonic energy is more than the electron's binding energy, then the electron absorbs only the energy required to break away from its orbital. This is called the photoelectric effect.The excess energy appears as heat.

2.1. Structure of PV cells.

A Silicon-based PV cell basically comprises an emitter, an absorber and metal contact, as afigure 2 below. An anti-reflected coating is used to maximize absorption.Besides that, front metal contacts are attached to the top of PV cells with optimum spacing among them such that sunlight is allowed to penetrate the cell. They are used to collect the electrons from the cell and channel them to the outer circuit.The emitter consist of n-type silicon whereas the absorber consists of the p-type and p^{++}.type silicon.The back metal contact is located at the rear of solar cell to collect the electrons from the outer circuit back into cell.

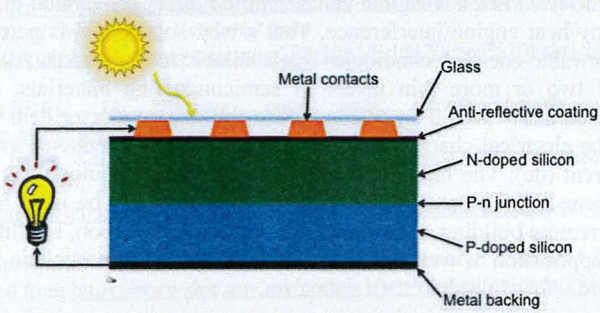


Figure 2. Typical structur of Silicon-based solar cell

2.2 Characterization of PV Cells

A PV cell can be modelled as an equivalent electrical circuit series –parallel as in figure 3. The cell act as a current source with the light generated current, I_{ph}. Since a PV cell is made from a semiconductor, a diode with a dark current, I_0 is modeled across the current sources. Due to the imperfection of silicon, a shunt resistance, Rsh is connected in parallel with the current source. On the other hand, series resistance, R_s is modeled in series with the cell to represent the resistances among the different materials which are used to fabricate the cell. The output current and voltage from the cell are denoted as I and V respectively.

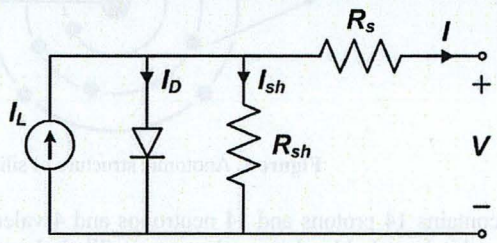


Figure 3. Equivalent circuit model of a PV cell.

2.3 Anatomy of a PV cell

A PV cells are constructed such that the electrons can flow easily through the circuit when connected. Thus conducting paths in the form of metallisation appearing on top of a typical PV cell are embedded onto the top surface of crystalline cells. A typical metallisation is shown in figure 4. The fingers are used to collect electrons out from a cell while grids are used transport the electrons to the next connected in series.

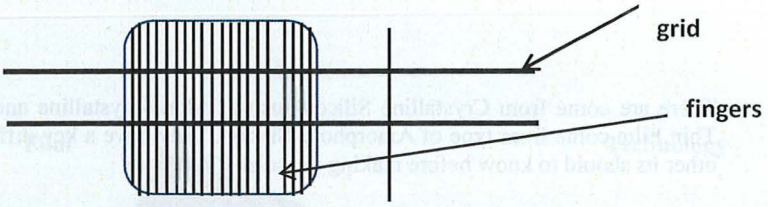


Figure 4. Typical appearance of a PV cell.

The cells are connected in series or series-parallel to form a PV module.However, several forms of protection are used to protect the solar cells for the outdoor usage. These forms of protection are shown in figure 5. The cells are first encapsulated by layers of transparent foil. The bottom of the PV module is covered with a non-transparent tedlar sheet to protect the cells. On the other hand, the PV module is covered by transparent tempered glass on the top. And the solar backsheet is the last layer at the bottom of the solar PV panel and is typically made of a polymer or a combination of polymers.

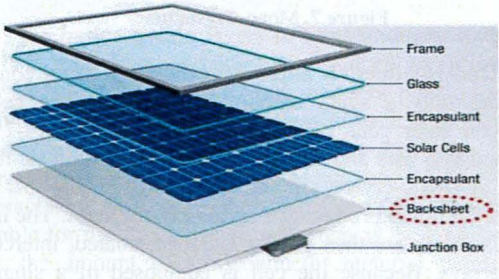


Figure 5. Component of a PV module.

A common electrical symbol of a PV module used in a schematic drawing is shown in a figure 6.

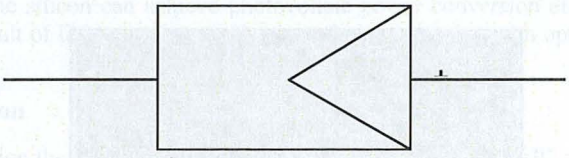


Figure 6. Electrical symbol of a PV module.

3. Type of Solar Cells Technology

Historically the majority of PV cells made from silicon (Si) which is a Group IV element of the Periodic table.It is crystalline element and many PV technologies and types of solar modules available and being developed are made up of Si.The popular types of Crystalline Silicon technology(c-Si) is a Mono-Crystalline technology (mono-Si) and Poly-Crystalline technology (poly-Si).In addition, Amorphous silicon (a-Si) which is none crystalline, or more popularly called thin-film. Copper indium gallium selenide (CIS,CIGS) and Cadmium Telluride (CdTe) also in Thin Film Technology.All type of Pv cells can serve same function in overall solar PV system, can capture energy from sun and turn it into electricity.

In this paper the discussion only focus in 3 types of cells technologies used in solar industries.

There are come from Crystalline Silicon such as Mono-crystalline and Poly-crystalline and Thin Film come from type of Amorphous Silicon. They have a key differences between each other its should to know before making the solar PV system.

3.1 Mono-Crystalline Technology

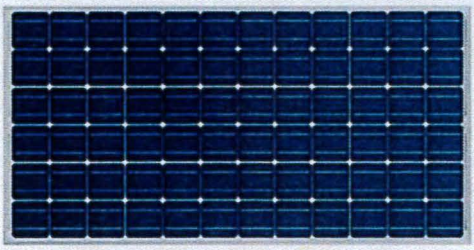


Figure 7. Mono-Crystalline .

Crystalline Silicon is offers an improved efficiency when compared to amorphous silicon while still using only a small amount of material. The commercially available multi-crystalline silicon solar cells have an efficiency around 14-19%. In mono-crystalline the Silicon is formed into bars and cut into wafers. These indicate that the silicon used in single-crystal silicon. A single-crystal silicon seed is dipped into this molten silicon and is slowly pulled out from the liquid producing a single-crystal ingot. The ingot is then cut into very thin wafers or slices which are then polished, doped, coated, interconnected and assembled into modules and arrays. Because the cell is composed of a single crystal, the electrons that generate a flow of electricity have more room to move. As a result, monocrystalline panels are more efficient than their polycrystalline counterparts. These types of photovoltaic cells are also widely used in photovoltaic panel construction

3.2 Poly-Crystalline Technology

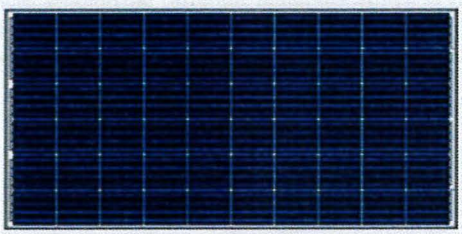


Figure 8. Poly-Crystalline

Polycrystalline solar panels are also made from silicon. However, instead of using a single crystal of silicon, manufacturers melt many fragments of silicon together to form the wafers for the panel. Polycrystalline solar panels are also referred to as multi-crystalline or many-crystal silicon. Because there are many crystals in each cell, there is to less freedom for the electrons to move. As a result, polycrystalline solar panels have lower efficiency ratings than monocrystalline panels[2].They are generally cheaper to produce than monocrystalline cells, due to the simpler manufacturing process, but they tend to be slightly less efficient, with average efficiencies of around 12%.

3.3 Thin Film Technology



Figure 9. Thin-Film

Thin-film solar cells are basically thin layers of semiconductor materials applied to a solid backing material. Thin film photovoltaics are produced by printing or spraying a thin semiconductor layer of PV material onto a glass, metal or plastic foil substrate. By applying these materials in thin layers, the overall thickness of each photovoltaic cell is substantially smaller than an equivalent cut crystalline cell, hence the name "thin film". As the PV materials used in these types of photovoltaic cells are sprayed directly onto a glass or metal substrate, the manufacturing process is therefore faster are cheaper making thin film PV technology more viable for use in a home solar system as their payback time is shorter. Thin film greatly reduce the amount of semiconductor material required for each cell when compared to silicon wafers and hence lowers the cost of production of photovoltaic cells. Thin film materials have higher light absorption than equivalent crystalline materials; thin film PV cells suffer from poor cell conversion efficiency due to their non-single crystal structure, requiring larger sized cells. Gallium arsenide (GaAs), copper, cadmium telluride (CdTe) indium diselenide ($CulnSe_2$) and tatium dioxide (TiO_2) are materials that have been mostly used for thin film PV cells[3].Barnet et. Al. investigated that solar cells utilizing thin film polycrystalline silicon can achieve photovoltaic power conversion efficiencies greather than 19% as a result of light trapping and back surface passivation with optimum silicon thickness [4].

4. Conclusion

As a conclusion there are many different "types of photovoltaic cell" available on the market, but to generate any meaningful solar power as an alternative power source, individual solar cells need to be combined together to produce modules, panels or large solar arrays to generate more electricity. Selection in choosing the suitable type of solar technologies to be used in PV system is crucial. Considerations about compatibility and suitability of the technologies need to be taken into account align with the budget and the performance required to be achieved in the future.

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Introduction Towards Energy Efficiency (EE) and Energy Conservation (EC) in Malaysia

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1. Introduction

Electrical energy utilization in commercial buildings is increasing rapidly with the increase in utilization of more and bigger capacity electrical. To tackle these issues, implementation of energy conservation (EC) and energy efficiency (EE) in the consumption side are two possible options. . EC could be defined as an applied technique in energy utilization without affecting the standard of living in the society. EC will definitely save investment of generating energy thereby enhancing the current economy of the nations (ECC., 1996). Malaysia has set a sustainable development program energy use and EC are becoming more and more important. Interest to EC is motivated by concerns about environmental problems such as climate change, greenhouse gases, global warming and threats to biodiversity (Abrahamse et al., 2005, Gardner & Stern, 2002). Malaysia puts in some effort to EE and EC in our local industries with the introduction of related guidelines to be accepted, adopted and practiced by all concerned. The primary goal of the EE and EC are to achieve better energy efficiencies and energy conservation of natural resources leading to sustainability and reduction of greenhouse gases emission leading to less air pollution and global warming.

2. Definitions

2.1 Energy

Energy is an ability to do work. Energy comes in different forms such as Heat (thermal), Light (radiant), Motion (kinetic), Electrical, Chemical, Nuclear energy, Gravitational and etc. People use energy for doing work like cooking, walking, heating and cooling rooms, manufacturing, lighting, entertainment, and many other uses. For example, our bodies convert chemical energy from food into mechanical and electrical energy to allow us to move.

2.2 Energy sources

Energy sources are classified into two groups

(i) Renewable (an energy source that can be easily replenished). For examples solar energy, geothermal energy, wind energy, biomass and hydropower

(ii) Non-renewable (an energy source that cannot be easily replenished). For example petroleum products, hydrocarbon gas liquids, natural gas, coal and nuclear energy.

2.3 Energy Efficiency (EE)

EE is using technology that requires less energy to perform the same function or "*using less energy to provide the same service*." Using a light-emitting diode (LED) light bulb or a compact fluorescent light (CFL) bulb that requires less energy than an incandescent light bulb to produce the same amount of light is an example of EE.

2.4 Energy conservation (EC)

EC is saving energy or any behavior that results in the use of less energy. For example turning the lights off when leaving the room and recycling aluminum cans are both ways of conserving energy.

2.5 Energy Star

EE label was introduced in 2006. EE label provides info to customers concerning the energy consumption of an electrical appliance. Energy rating label shows the predictable energy consumption of each electrical equipment based on EE rating system. The star rating system has a minimum of 1 star (lowest efficient) and a maximum of 5 stars (highest efficient). EE label is issued by the Energy Commission to manufacturers of electrical appliances who comply with the standards and requirements of energy performance test for star rating established by the Energy Commission.



Figure 1. Energy Level labels

3. Energy Efficiency (EE) and Energy Conservation (EC)

Behavioural approach and technology approach are two common ways in energy management (Mohon et.al., 1983). These two approaches are also known as structural and non-structural conservation methods. Al-Mofleh et al., (2009) explains the two methods in electrical energy conservation in Malaysia by the integration of three measures: use of efficient electrical equipment; application of passive energy technology in buildings, such as insulation, evaporative cooling, ventilation and solar heating; and supporting tools such as public awareness, energy codes, regulations, energy information and databases. The use of efficient electrical equipment and application of passive technology in buildings are categorized as structural energy management whereas public awareness, energy codes, regulation and other supporting elements are termed as non-structural energy conservation measures.

The strategies to implement EE and EC in Malaysia environment include: the aggressive promotion of EC and EE technology to effect higher energy savings both for the consumer and producer through information, education and communication campaigns; intensify collaboration effort with the private sector in implementing EE programs through voluntary agreements; continuous implementation and expansion of the appliance and equipment energy standards and labelling implementation of building energy usage standards; integration of energy efficiency concepts in the procurement practices of the government; the provision of

technical assistance in energy use efficiency; the use of alternative fuel to reduce dependence on imported oil; and periodic program monitoring and evaluation to assess the effectiveness of the energy efficiency and conservation plan.

Mahlia et al. (2004) studied on cost– benefit analysis of implementing minimum EE standards for household refrigerator–freezers, mitigation of emissions through EE standards for room air conditioners (Mahlia et al.,2004), energy labeling for electric fans (Mahlia et al.,2005), and calculation of annual EE improvement of TV sets (Mahlia et al.,2006). Saidur et al. (2005)focused on developing energy guide label for domestic refrigerators, energy and exergy analysis of residential, transport and commercial sectors (Saidur et al., 2007) and on greenhouse gas emissions from household appliances (Saidur et al., 2007). Taufiq et al. (Taufiq BN et al., 2007) presented an exergy analysis of evaporative cooling in Malaysian buildings. The present study is on investigating the Malaysian scenario of energy resources, energy consumption pattern, available schemes of EC and management in various key consumption sectors.

It is declared policy of the government to promote the EC and efficient utilization of energy resources through adoption of the cost effective options toward the efficient use of energy to minimize environmental impact. The primary goal of the government towards EE and EC is to make it a way of life and increase awareness in order to avoided million tons CO_2. The National Energy Policy 1979 has acknowledged three objectives:

(i) *Supply* - Ensure the provision of adequate, secure and cost-effective energy supply.
(ii) *Utilization* - Promote efficient utilization of energy and eliminate wasteful and non-productive patterns of energy consumption
(iii) *Environmental* - Minimize negative impacts of energy production, transportation, conversion, utilization and consumption on the environment.

The National Energy Efficiency Policy is mentioned *as 'Boost the nation's energy efficiency & conservation and to ensure productive use of energy and minimize a waste in order to contribute to sustainable development and increased welfare as well as national competitiveness'*. The EE regulatory's framework and their sectors initiative have been shown in Table 1 and Table 2 respectively.

Table 1. EE Regulatory Framework

Regulatory	Description
Electricity Supply (Amendment) 2001 – Act A1116	Empowers the Minister to promote the efficient use of electricity (Section 23A, 23B & 23C) • Determine efficiency standards; • Installation to meet efficiency requirements; and • Equipment to meet efficiency requirements
Efficient Management of Electrical Energy Regulation 2008	Requires installations consuming 3 million kWh or more over a 6-month period to engage a registered energy manager to: • analyze total consumption of electrical energy; • advise on the development and implementation of measures to ensure efficient management of electrical energy; and • monitor the effectiveness of implemented measures
Amendment of Electrical Supply Regulations 1994	Enable the enforcement of the Minimum Energy Performance Standards (MEPS) on electrical appliances (television, air conditioner, refrigerator, domestic fan and lighting) • Gazetted in May 2013
MS1525: Code of Practice for Energy Efficiency and Use of Renewable Energy for Non-Residental	Code is mandatory under the Uniform Building By-laws (UBBL) • Introduced in 2001 & updated in 2008

Buildings	

Table 2. EE Programm Initiative

EQUIPMENT	INDUSTRIAL	BUILDING
• Promotion of 5-Star Rated Appliances - 5-Star Refrigerator Campaign - 5-Star Air Conditioner Campaign • Minimum Energy Performance Standards (MEPS) - EE Lighting Campaign - High Efficiency Motors	• Energy Audits and Energy Management in Industries - Energy Audit and Management in Large & Medium Sized Industries • Promotion of Co-generation - Cogeneration in Industries and Commercial Buildings • Increasing the use of energy efficient machineries and equipment.	• Energy Audits and Energy Management in Buildings - Energy Audit and Management in Large Commercial Buildings - Energy Audit and Management in Government Facilities - Energy Audit and Management in Medium Sized Commercial Buildings • Energy Efficient Building Design - Energy Efficiency in New Buildings

4. Energy efficiency in electrical equipments

Advanced industrial equipments are commercially available to support consumers in order to achieve EE goals. The goal of conversion can be defined as the optimum selection of hardware, technically and economically, for adequate implementation of the task. Below are major groups of electrical equipments such as lighting, motors, heat pumps ant other electrical appliances (Bose., 1992).

4.1 Lighting

The percentage of electrical energy used for lighting in industrial facilities represents 10–20% of their total energy (Proceedings of IEEE, 1993) and in buildings about 30–35% of total energy is consumed by lighting and other appliances, except air conditioning (Bellarmine GT & Turner MC., 1994). Savings can be done by many advanced lighting fixtures and control methods. Table 3 shows the comparison between various lighting fixtures. In practice it is found that some lighting fixture cannot be used in other applications, mostly in places where immediate lighting is required whenever the fixture is switched on. EC in lighting for new advanced houses is designed for 100 lumens/Watt as compared to 15 lumens/Watt in classical houses (Proceedings of IEEE, 1993 & Bellarmine GT & Turner MC, 1994). The most favorable electrical lighting design aims to reduce the amount of lighting power density (the maximum allowable lighting density permitted by the code, expressed in W/m2). In advanced houses, it was limited to an average of 8 W/m2 (Saidur R et al., 2005) as compared to more than 35 W/m2 in typical classical residential houses. The new compact fluorescent fixtures are built with electronic ballast which has a good power factor and lower power consumption (Proceedings of IEEE, 1993).

Table 3. Technical specification of lighting fixtures.

Type	Lumen/Watt	Life time (h)	Relight time (min)	Energy saved (%)
Tungsten	12–25	800	0	0
Mercury	35–63	16,000	3.5	58–76
Fluorescent conventional	25–65	18,000	0	40–77
Fluorescent compact	40–81	18,000	0	62–81
Metal halide	80–100	7500	10–15	81–85
High presser sodium	80–140	20,000	<1	81–89

4.2 Electrical motors

The motor consumption may be expected to equal 50% of the total electrical energy. Most of the designs oversized the motor specification with respect to the load by a safety factors of 10–15%, resulting in 27–49% more power consumption during the life cycle. The speed of recent motors can be controlled smoothly by electronic devices, resulting in good savings in energy consumption (Gadi K., 1997). Good preventive maintenance will result in longer life time, less energy consumption and high reliability service (Gadi K., 1997). It is very useful to record information and measurements of the motor for performance evaluation to help make decisions at the proper time for regular maintenance. The use of efficient DC motors, will provide up to 40% reduction in energy consumption as compared to conventional AC motors of similar rating capacity (Proceedings of IEEE, 1993 & Bellarmine GT & Turner MC, 1994).

4.3 HVAC and heat pump

Most of buildings are used HVAC (heating, ventilation, and air conditioning) to keep people comfortable. The air conditioning unit consists of mainly a compressor, evaporator and condenser. Recent energy efficient designs of the main components of air conditioning systems have contributed in reducing their energy consumption. For instance, the use of a variable speed motor will reduce the energy consumed in each of the air conditioning unit. The recent centrifugal chiller has lower electrical consumption, 0.6–0.65 kW/ton refrigeration, as compared to the old chiller values of 1.2–1.5 kW/ton refrigeration, which represents an energy saving of 43–50% (Vapor 1996) (1 ton refrigeration ¼ 12,000 Btu/h). The design specification of the air conditioning system must be based on the real conditions of the plant, therefore any over sizing and additional safety design factor may be canceled. Heat pumps are used in many industrial countries. Heat pumps are manufactured for various applications, both for heating and cooling purposes.

5. Public awareness campaigns for EE and EC

Public awareness campaigns generally look for to draw attention to the economic and also the environmental benefits of rational use of energy. In several industrial energy costs only account for a small portion of total costs. Hence, compared with alternative value saving potentials, energy cost reduction potentials are often overlooked and remain unrealized. Similarly, in households, the use of modern forms of energy often only accounts for a small portion of total household expenditure. This additionally explains the widespread lack for attention to aspects of energy use. Most public awareness campaigns pursue to draw the

consideration of energy users not only to the economic advantages of lower energy costs, but also to the environmental impacts that are related with the continuously growing energy use, in particular in industrialized and in urban areas. Many of the campaigns emphasize the message that greater consciousness and efficiency in energy use can enhance the quality of life in society as a whole. Most of campaigns concentrate on giving energy tips for avoiding unnecessary energy use and energy costs by changing some of habitual consumption patterns. Other campaigns are wider in their public information message. Some campaigns focus energy efficiency as one aspect of product quality. Furthermore, other campaigns are designed to accompany the introduction of energy efficiency or environmental labels.

6. Conclusion

The aim of this paper was to introduce on the EE and EC. This paper also discussed the some strategic options aimed towards EE and EC in Malaysia. Electrical energy conservation in Malaysia can be achieved through the integration of three tools 1) use of efficient electrical equipment, 2) application of energy efficiency technology in industrials, equipments and buildings and 3) supportive tools such as public awareness, energy codes, regulations, energy information and databases. There is a requirement for any technical improvement within the existing energy management systems. The Governmental subsidies needed for supporting the industry concerned in producing EE equipments and technology. The proper selection of the types of technology is essential for EE and EC depending on the type of application, the climatic conditions and the industries requirements. It is also very essential to develop and adopt codes of practice and regulations for EE and EC.

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Amalan Hijau Di Bengkel: Ke Arah Melahirkan Pelajar Yang Berilmu dan Berdisiplin

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1. Pengenalan

Umpama aur dengan tebing begitulah ilmu dan disiplin yang saling berperanan dalam pembentukan masyarakat yang maju dan berakhlak. Usaha mewujudkan golongan yang berlimu dan berdisplin ini perlu dimulakan dari pendidikan di rumah dan seterusnya peralihan pendidikan ke peringkat sekolah dan pengajian tinggi. Melahirkan pelajar-pelajar yang cemerlang akademik sahaja tidak lengkap tanpa pakej dengan akhlak yang baik. Justeru itu, penerapan nilai amalan hijau dan mempraktikkan gaya hidup hijau di kalangan pelajar-pelajar Jabatan Kejuruteraan Elektrik, Politeknik Port Dickson antara usaha terbaik yang mampu membentuk keperibadian pelajar untuk menjadi pelajar yang bertanggungjawab kepada dirinya, masyarakat dan negara. Pelbagai amalan hijau boleh dipraktikan di Jabatan Kejuruteraan Elektrik (JKE) tetapi pengkhususan penulisan ini adalah kesan amalan hijau di bengkel yang boleh membentuk etika pelajar yang berlimu dan berdisiplin supaya ianya dijadikan budaya dan amalan kerja yang cemerlang dalam pekerjaan mereka nanti. Budaya amalan hijau di bengkel yang boleh membentuk pelajar yang berilmu dan berdisiplin adalah impak daripada dua faktor iaitu:

i. Amalan hijau dalam pengurusan bengkel
ii. Amalan hijau dalam kerja bengkel

2. Amalan Hijau Dalam Pengurusan Bengkel

Secara umumnya pengurusan bengkel di JKE di kendalikan oleh Pembantu Makmal dan juga di bawah penyeliaan pensyarah. Menurut Mohamad, Yasin, dan Rahman (2012), pengurusan bengkel melibatkan penyelenggaraan dan operasi teknikal yang kompleks di mana ia berkembang dengan cepat dan memerlukan sumber inventori yang besar. Pengurusan Bengkel juga adalah pengurusan yang merangkumi dokumentasi, persekitaran bengkel, keselamatan dan peralatan bengkel Mohammad et al. (2012). Menurut Rubai'ie (2015), pengurusan bengkel merupakan satu bidang yang perlu diberi perhatian kerana aktiviti-aktiviti pengurusan boleh mempengaruhi hasil kerja dan kepuasan kepada pelaksanaan program kepada pengguna. Menurut Asnul et al. (2011), sistem pengurusan bengkel yang baik dan efisyen dapat mengelakkan berlakunya pembaziran masa, tenaga dan wang. Selain itu, pengurusan bengkel yang baik dapat mewujudkan persekitaran ruang kerja dan pembelajaran yang lebih kondusif. Suasana persekitaran bengkel yang selesa dan teratur memainkan peranan dalam penghasilan sesuatu produk yang berkualiti dengan penjagaan kawalan keselamatan yang teratur dan mampu menjadi contoh kepada sekolah mahupun instituisi lain.



Rajah 1. Suasana Bengkel Teknologi Komputer

Semua program di JKE menggunakan makmal/bengkel untuk pengajaran dan pembelajaran amali. Pengurusan dan penyeliaan yang baik memberi impak yang tinggi kepada keberkesanan pembelajaran pelajar. Suasana makmal/bengkel yang selesa, selamat dan bersih pastinya memberi keseronokan kepada pelajar untuk membuat kerja amali. Menurut Asnul Dahar & Nurul Faizah (2011), alatan dan bahan yang terdapat di dalam bengkel perlu diurus oleh guru yang berpengetahuan kerana sekiranya diurus oleh guru yang tidak mempunyai pengetahuan dalam pengurusan, ini akan mendatangkan masalah dan seterusnya bengkel akan berada di dalam keadaan yang tidak terurus dan sistematik . Disamping itu, pengalaman juga merupakan salah satu faktor yang penting dalam pengurusan bengkel seperti yang dinyatakan oleh Eric Hoyle (1995) dalam Wan Ahmad (2013).



Rajah 2. Pengajaran dan pembelajaran amali di Bengkel Pemasangan JKE

Khine (2004) dalam N. Othman & K. A. A. Rahman (2009) berpendapat, pendidik yang berkesan seharusnya merangka pengetahuan baru berdasarkan pengalaman lepas. Tiada siapa yang dapat menyangkal atau tidak bersetuju dengan kenyataan tersebut. Setelah mengalami pengalaman ganguan terhadap pelaksanaan amali, ianya telah merangsang penyelidik untuk memikirkan apakah langkah penyelesaian yang boleh diambil hinggalah kepada penulisan ini. Di dalam sebuah tesis oleh S. A. Sharudin (2008) menyebut keadaan kelengkapan yang terdapat di dalam sebuah bengkel membantu menjamin keberkesanan pengajaran dan pembelajaran (PdP). Jika PdP tidak berkesan yang terkesan adalah pelajar sendiri, pelajar pula akan keluar membawa imej institusi secara tidak langsung.

3. Amalan Hijau Dalam Kerja Bengkel

Pelajar-pelajar JKE telah dilatih untuk mengamalkan amalan hijau di bengkel. Mereka diterap dengan budaya kerja yang positif seperti disiplin, tekun dan dedikasi. Menurut Abd Rahman, S. (2012), keselamatan semasa berada di bengkel sangat perlu dipatuhi oleh setiap penggunanya. Sikap dan kesedaran terhadap keselamatan bengkel mesti dipupuk di semua peringkat pengguna bengkel. Keselamatan bengkel adalah tanggungjawab bersama antara pihak pengguna dan perlu diberi perhatian serius dari masa ke semasa. Manakala setiap

individu yang terlibat mesti melengkapkan diri dengan pengetahuan dan amalan keselamatan serta sentiasa mengamalkan budaya kerja yang teratur dan selamat. Kemalangan yang kerap berlaku di bengkel dapat dielakkan jika para pelajar sentiasa mengamalkan dan mematuhi langkah-langkah keselamatan yang telah disediakan (Abd. Hamid, A.L. 2012).

Terdapat tiga bahagian utama amalan keselamatan yang perlu dititikberatkan apabila berada atau sedang melakukan kerja dalam bengkel iaitu keselamatan diri, keselamatan peralatan dan keselamatan tempat kerja. Ketiga-tiga bahagian ini dapat mengundang kepada kemalangan dan masalah jika tidak diamalkan oleh setiap pengguna (Wan Yusof, W.S.A. 2008).

3.1 Keselamatan Diri

Keselamatan diri semasa berada di bengkel perlu ditekankan terutamanya dari segi pemakaian. Pakaian yang sesuai dapat mengelak daripada bahaya semasa melakukan kerja. Pakaian yang sesuai juga memberikan keselesaan kepada pengguna semasa melakukan kerja dan secara tidak langsung ia menjadikan sesuatu kerja yang dilakukan lebih mudah (Saipudin, S. 2000). Dalam aspek pemakaian ini, pelajar-pelajar JKE telah di tetapkan untuk mematuhi peraturan pakaian yang sesuai ketika di bengkel. Peraturan tersebut termasuklah pemakaian baju bengkel, gunakan kasut yang tertutup dan bertapak getah, elakkan dari memakai perhiasan diri yang diperbuat daripada logam seperti jam, rantai emas, loket , cincin dan sebagainya. Secara umumnya, kesan dari peraturan pemakaian ini boleh membentuk displin diri kepada pelajar untuk sentiasa menjaga keterampilan diri dengan cara pakaian yang sesuai sewaktu bekerja.



Rajah 3. Pakaian pelajar di bengkel

3.2 Keselamatan Peralatan

Keselamatan peralatan merupakan satu aspek yang amat penting dan perlu dititikberatkan. Semua pihak mesti beringat dan sentiasa mengamalkan langkah keselamatan semasa di bengkel terutamanya ketika menggunakan peralatan. Di bengkel JKE, pelbagai peralatan digunapakai untuk bengkel amali kejuruteraan elektrik dan elektronik antaranya yang menglibatkan mesin dan peralatan elektrik berkuasa tinggi. Risiko kejutan atau renjatan elektrik boleh berlaku sekiranya sikap tidak peka kepada etika kerja dan tidak mematuhi "Standart Operating Procedure" (SOP) pengggunaan peralatan. Berdasarkan kepada jadual 1 menunjukkan nilai arus elektrik menentukan kesan kepada seseorang yang terkena renjatan ini.

Jadual 1. Kesan dari Arus Ulang-Alik pada 50/60 Hz (Sumber: NIOSH)

Jumlah arus	Kesan pada badan
1 mA	Tiada kesan yang nyata
16 mA	Arus maksima kebiasaan bagi seorang boleh "pegang dan lepas"
20 mA	Otot pernafasan terganggu atau mengalami kelumpuhan
100 mA	Tahap arus Fibrillasi ventrikular
2 A	Jantung terhenti dan kerosakan organ dalaman
15/20 A	Fius alatsuis akan terbuka

Sebagai langkah keselamatan terhadap penggunaan peralatan ini, JKE telah menyediakan "Standart Operating Procedure" (SOP) pada setiap peralatan yang digunapakai di bengkel. Pensyarah bertanggungjawab memastikan pelajar mengikut prosedur ini supaya risiko kemalangan tidak berlaku. Menurut kajian Ishak (2013) dan Said & Zahari (2011), yang mengatakan pelajar seharusnya mengetahui prosedur-prosedur peraturan penggunaan peralatan dan sentiasa berwaspada dalam mengendalikan dan penjagaan peralatan supaya peralatan tidak mudah rosak dan tidak membebankan pihak kolej untuk membelinya.

Pematuhan terhadap keselamatan peralatan ini juga boleh membentuk tanggungjawab kepada pelajar untuk menghargai peralatan yang terdapat di bengkel tersebut sebagai hak yang perlu dijaga dengan baik. Amalan ini ini diharap boleh menjadikan pelajar mengetahui kewajiban untuk menjaga amanah dan harta. Sebagaimana firman ALLAH "Dan janganlah kamu merugikan manusia pada hak-haknya dan janganlah kamu merajalela di muka bumi dengan membuat kerosakan" (QS Asyu'ara' " 183)

4. Kesimpulan

Budaya kerja selamat mampu diamalkan oleh setiap individu sekiranya dipupuk ketika individu berada di institusi pengajian lagi sebelum mereka memasuki alam pekerjaan (Roslena, 2012). Menurut Ahamad (2015), pelajar yang mempunyai persepsi positif dalam diri mereka mengenai kemudahan belajar di sekolah, mereka akan mempengaruhi prestasi pelajar lain. Ini kerana persepsi pelajar dalam sesuatu perkara seperti keselamatan akan memberikan pandangan positif yang mampu mencerminkan pengaruh yang lebih baik dalam suasana amalan keselamatan dalam bengkel dan jika persepsi dalam keadaan sebaliknya ianya mampu memberikan impak amalan keselamatan yang negatif di dalam bengkel.

Penerapan budaya amalan hijau bengkel di JKE memberi impak yang tinggi terhadap sahsiah dan disiplin pelajar. Selaras dengan visi politeknik untuk dengan menjadi institusi TVET premier yang diterajui industri seharusnya menjadi tanggungjawab JKE untuk melahirkan graduan yang bukan sahaja berdaya saing serta memenuhi pasaran industri tetapi juga berakhlak tinggi, berketrampilan dan menjadi harapan negara. Kesedaran terhadap kepentingan amalan hijau di bengkel dan kesannya kepada pembentukan akhlak dan budaya kerja yang sihat pelajar-pelajar perlu diambil tanggungjawab bersama oleh pensyarah dan pihak pengurusan yang berkaitan. Kolabarasi bersama industri boleh memantapkan lagi pengetahuan, kefahaman dan penerapan teknologi dan amalan hijau pada tenaga pengajar dan pelajar. Secara tidak langsung Politeknik dapat mengetahui keperluan industri terhadap pekerja-pekerja yang mempunyai ciri-ciri amalan hijau yang diperlukan, perkembangan

teknologi hijau di industri dan seterusnya mengeluarkan tenaga kerja yang berilmu, berkemahiran dan berakhlak tinggi kepada pihak industri. Oleh itu, budaya amalan hijau ini perlu dilihat kepada implikasi jangka panjang dalam agenda kelestarian yang memerlukan perancangan program yang pelbagai dan berterusan.

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go-Green go-Paperless An Awareness In Teaching And Learning At Polytechnic Port Dickson

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1. Introduction

Teaching and learning based on digital electronic media is a step towards transformation of today's Malaysian Polytechnics towards to a more flexible, dynamical e-Learning and mobile learning. It is to encourage lecturers and students to "go-Green go-Paperless" switching from paper-based sources to digital media. Besides efficient and affordable, digital media helps our education system to go paperless and green in a secure and legal manner. Nichos (2003) believes that e-Learning is the use of various network-based technology tools aimed for education. In tandem with the development of the digital electronics industry, especially the use of mobile devices such as smart phones and tablets that are widespread, has led lecturers at Polytechnic Port Dickson to produce a variety of teaching and learning media in the form of e-Book (electronic book) and m-Book (mobile book). In 2008, Allen Kupetz posed the question, "Is the Paperless Classroom Possible?" and listed the advantages of going paperless. Although he is cautious to note that"...paperless doesn't mean any less paper. It means simply that technology is giving us new options to reduce or eliminate much of the paper we use today and to enjoy the cost savings that result" (Kupetz, 2008). It is not just a new tool or a method of teaching and learning but a new paradigm of learning (Yuniarti, 2014). Moreover, production of digital electronic book, can enhance the quality of teaching and learning and make it more efficient, creative and innovative. To support this aspiration, lecturers from Polytechnic Port Dickson have developed several e-Books and mobile-Books for electronic learning coordinated in the concentric collection in the electronic library (e-Library). An innovative study was conducted to look at the level of usage of digital electronic books and to identify the awareness of "go-Green go-Paperless" at Polytechnic Port Dickson. This study used questionnaires as the main instrument and data was analyzed by using statistical software. The findings help lecturers to develop a more effective teaching and learning delivery system as well as to attract and improve the performance of students by increasing the use of digital electronic books for going paperless and green.

Keywords: go-Green, go-Paperless, e-Book, m-Book, e-Learning, m- Learning, e-Library

2. Objective

The main goal of this paper is to give an awareness in teaching and learning at Polytechnic Port Dickson to go paperless and green. In fact, there is a growing momentum around world climate change and increasing deforestation. Therefore, it becomes responsibility of everyone at Polytechnic Port Dickson to reduce paper dependence by saving trees and for cost cutting measures. Lecturers are encouraged to create more digital electronic based material to support e-Learning and m-Learning. Students can revise or make referrals via e-Book or m-Book beyond class time to make "Student Learning Time (SLT)" more effective without borders. In addition, non-face-to-face learning can be exercised when a lecturer is out of office or is unable to conduct a lecture in the classroom. Students are also able to explore the fun of learning through the electronic media environment as well as conventional learning that focuses solely on printed materials in line with the blended learning concept pioneered by the

National e-Learning Policy for Higher Education Institutions. It can also establish strategic links in the development of 21st century teaching and learning quality in line with the "Pelan Pembangunan Pendidikan Malaysia 2013-2025".

3. Background

"go-Green go-Paperless" is the current slogan that is being campaigned in Malaysian Polytechnics, generating awareness about the importance of trees among the people and reduce deforestation to curb the effect of global warming. Every year, the world produces more than 300 million tons of paper and over 60% of the timber harvested worldwide each year is used for paper and paper products. The educational stream is the one industry that uses up a significant amount of paper all over the world. Better late than never, even Polytechnic Port Dickson should take right steps to cultivate paperless and green management in teaching and learning process.

In recent shows that each department of Polytechnic Port Dickson increased use of paper and raising costs, sour economy in a slump and departments budgets stretched thin. Polytechnic Port Dickson is trying to devise methods for cost containment and implementing the "go-Green go-Paperless" not only prepares students for today's technology driven workplace but also helps the department's budget by reducing use of paper and toners. Teaching in paperless can develop a solid rationale relying on ideas for teaching and learning in a paperless environment and use varied technologies and develop innovative pedagogies. The process of teaching and learning became the focus of lecturers at Polytechnic Port Dickson since the ages. This is led to the transformation of human life with the development of science and technology. Human skill and creative thinking has prompted humans to communicate effectively through the use of mobile devices. Students at Polytechnic Port Dickson are also lack of computer usage. All this causes them difficult access to the internet in the campus due to lack of "wifi" or "hotspot" internet connection. The introduction of eBook and mobile Book training modules for the e-Library in order for "go-Green go-Paperless" at Polytechnic Port Dickson is one of the ways in which students can use the mobile-Learning approach with or without having to go "online".

According to De Porter's research, he reveals that humans can absorb a material as much as 70% of what is done. As much as 50% of what is heard and viewed audio or visual, whereas it only looks at 30% and from what it earns is only 20%, and from which only 10% is read. The problem is the reading of print books is not getting the focus of the students. There is no "live" visual element available from printed material. Hence, this situation demonstrates the graphics and digital images are particularly appealing to students for learning and a high understanding can be obtained because e-Learning and m-Learning are the world and the latest trends for the present generation. Secretary General of the Ministry of Education, Tan Sri Dr. Johari bin Mat at an e-Learning conference in May 2000 in Kuala Lumpur, said *"Technology has and will be an important component of teaching and learning in our nation's education system. The approach in teaching in preparing the filling and delivery of learning materials need to be modified according to the existence of technology. Teachers should be able to integrate technology into the process of teaching and learning ".* From that perspective, educators' responsibilities and challenges are enormous in the effort to interfere with technology in their teaching and learning process. In this era of globalization, the use of ICT is a very important necessity in all affairs in polytechnics. There are some lecturers supplied with PC or laptops and some are not supplied with laptops. Students also lack the ease of computer usage. This causes them difficult access to the internet in the campus due to lack of internet connection. These problems become the real cause of why polytechnic students cannot use the internet widely. The introduction of "mBook4eLibrary" at Polytechnic Port Dickson is one of the ways in which students can use the e-Learning approach without having to "go online". e-Book or

m-Book production also has the potential to be used to assist lecturers in enhancing students' understanding of technical topics through the "multimedia interactive" method regardless of time or where the student resides. The "go-Green go-Paperless" initiative makes the learning environment tended to a culture of environmental preservation. Reduction of paper use will reduce tree cutting in the paper-producing industry. In addition, material management is easy to store and easy to carry as it does not involve large space and is easily accessible. All the materials produced in the form of e-Book or m-Book can be collected concentrically and facilitate students.

4. Methodology

A Polytechnic Management Information System which is so called "Sistem Pengurusan Maklumat Politeknik (SPMP)" is a computerized database of student's information organized and programmed in such a way that it produces regular reports on operations for every level of department in Polytechnic Port Dickson. It is usually also possible to obtain special reports on assessment from the system easily. Students taking software class in computer application and C Programming were taught using a paperless classroom. Students submitted assignments by using USB flash drives and CiDOS virtual network data storage hard drive through Polytechnic e-Learning Portal. Lecturers upload notes and grade assignments through CiDOS virtual data storage hard drive by using CiDOS commands and tracking features. At the end of the semester, students receive lecturers' feedback after their assignments were graded. Final examination result can be obtained online by log in into SPMP using personal identification number and a valid password.

Traditional textbooks are still being sold and used at Polytechnic Port Dickon. Thousands of Ringgit spent in every semester by students to purchase paper-based textbook. With the rapidly growing smart phone and tablet technology, eBooks become more cost effective way of learning and teaching. As these technological advances have made their way into Polytechnic Port Dickson it is the right time to start using eBooks or m-Books at Malaysian Polytechnics. Reducing paper consumption is a simple way to have a huge impact on the environment. Polytechnic Port Dickson can drastically reduce their management expenses by reducing their paper usage.

A set of questionnaire was designed to explore the awareness of "go-Green go-Paperless" concept and knowledge among the students and lecturers under study. The questionnaire was instrumented on a sample of 50 imparting education at Polytechnic Port Dickson by adopting convenient sampling method. The quantitative data analysis has been done using SPSS package is applied to explore and identify the awareness and preparedness about "go-Green go-Paperless".

5. Findings And Analysis

An elementary descriptive analysis is made to assess and explore the awareness of "go-Green go-Paperless" among the students at Polytechnic Port Dickson. A set of questionnaire was designed to explore the awareness of "go-Green go-Paperless" concepts among the respondents at Polytechnic Port Dickson. The analysis of the data flows into the part for exploring the demographic information of Polytechnic Port Dickson. The awareness about the "go-Green go-Paperless" among the respondents will be analysed using descriptive analysis. Table-1 is prepared to describe demographic information of the respondents. The respondents under study were chosen from Polytechnics Port Dickson on convenience sampling basis. The questionnaire was self-administered by the researcher by a closed interaction with the respondents under study. From Table-1 it is clear that, approximately 70% of the respondents at Polytechnic Port Dickson are aware of "go-Green go-Paperless".

Table 1. Demographic Information Of Respondents

Demographic Items		No of Respondents				Percentage
No of Respondents		50				
Sex	Male	40				80
	Female	10				20
		Fully Aware	**Partially Aware**	**Not Aware**	**Total**	
Respondent Strength	Upto 20	4	3	3	10	20
	20-50	5	3	2	10	20
	50-100	6	5	5	16	32
	100 & above	2	6	6	14	28
	Total	17	17	16	50	
Type of Course	Comp. App	9	3	0	12	24
	C Program	8	8	2	18	36
	Elec Tech	6	4	3	13	26
	Eng. Maths	4	2	1	7	14
	Total	27	17	6	50	
Department	Electrical	6	5	3	14	28
	Mechanical	7	5	4	16	32
	Civil	8	2	1	11	22
	Commerce	3	3	3	9	18
	Total	24	15	11	50	

6. Conclusion

In this era of globalisation, green and sustainability, Polytechnic Port Dickson as an educational institution has responsibility in implementing "go-Green go-Paperless". The integration of digital electronic media is an excellent recommendation for lecturers in Polytechnic Port Dickson in delivering lessons in the classroom. This paper shows that lecturers at Polytechnic Port Dickson developed a solid rationale relying on ideas for teaching and learning in the "go-Green go-Paperless" environment and use varied technologies and develop innovative pedagogies. They are aware of the challenges of this environment and concerned about the disadvantages of using the paper-based books. Thus, they develop a realistic and critical view of the paperless classroom. Let our goal move to "go-Green go-Paperless" environment and it is an ongoing process that requires constant evaluation, new initiatives and awareness.

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Malaysia: Path to 100% Renewable Green EnergyWord

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1. Introduction

Nowadays, people are getting interested in the renewable green energy trend. It has been widely spread both in domestic and international industries. In other words, we are heading toward a world of 100% renewable green energy someday. But, I would like to address a fundamental question: Why renewable green energy? Energy issues are intricately connected with the issue of climate change and it is renewable energy that will play a growing role in all of this.

1.1 Paris Agreement : December 2015

As we may know well, a major cause of climate change is greenhouse gas emissions from the use of fossil fuels. To limit the rise in the global mean temperature to two degrees Celsius above pre-industrial levels, we must cut greenhouse gas emissions to half of the 1990 levels by 2050. In December 2015, the Paris Agreement was adopted. The agreement aims at "keeping a global temperature rise, well below 2 degrees Celsius and pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius".

This has two very important meanings. First, we shared a clear awareness that it has become possible to spread renewable green energy all over the world. Second, renewable green energy must inevitably become a major player, now that it has been acknowledged that in the long-term, greenhouse gas emissions must be effectively reduced to zero after 2050. In effect, it was strongly acknowledged that we can and must reach 100% renewable green energy.

In fact, more than 600 leaders of cities and local communities, as well as over 110 companies, have declared their intention to shift toward 100% renewable energy. Although Malaysian companies lag somewhat behind, some are starting to join this trend. It is proving when Bukit Tagar Sanitary Landfill (BTSL) started its involvement to shift and sustained its development in Selangor.

2. Cost of Renewable Green Energy

Next, I would like to talk about how much renewables have been installed worldwide. Wind power generation started to be introduced in the 1990s and gradually increased in the 2000s, and the cumulative installed capacity is now about 500 gigawatts (GW), equivalent to 500 nuclear reactors in other country. Meanwhile, solar photovoltaic (PV) power generation started to increase about a decade ago. The cumulative installed capacity is about 300 GW, and the increase is coming at a pace faster than wind power.

According to the Renewables 2017 Global Status Report released by REN21 on June 7, 2017, the amount of investment in the renewable green energy market rose steadily from about 45 billion dollars in 2004 to about 310 billion dollars in 2015, although it dropped to 240 billion dollars in 2016, or 23% down from the previous year. I wondered why it decreased at first, but found a reason. It is because the initial cost of installation has gone down drastically. The renewable green energy market has now reached the point where the amount of money invested can go down even while the installed capacity increases.

How about the cost of electricity generated by renewable green energy? The costs of land-based wind, hydro, and geothermal power generation are almost the same as for electricity generated by burning fossil fuels. The costs of photovoltaic power generation have decreased to the same level as thermal power, under the right conditions. The costs of offshore wind power generation also have started to drop. Therefore, in the future, the costs of renewable green power generation as a whole are expected to be equal to or less expensive than thermal power.

3. Malaysia's Path to 100% Renewable Green Energy

So, what must Malaysia do to move toward 100% renewable green energy? We must gradually reduce the use of non-sustainable energy, which comes from fossil fuels. With the decreased use of energy as a whole and the increased use of renewable green energy, we can achieve 100% renewable green energy in the future.

Policy objectives (by government) have an important role to play in promoting renewable energy. In example, European countries have set targets of around 30% or greater as the renewable green energy ratio of power generation in 2020. Some have already achieved their targets, and the rest are continuing to work toward them. In contrast, Malaysia's target is just 10% in 2050. Compared to European countries, Malaysia is 30 years behind. So the big question is this: How can we catch up? So, progressive plan must be design by corporate and government to make it better such as what has TNB done before.

Personally, I would like to thanks to TNB for buying renewables green energy from BTSL. TNB showed their support and encourage other big company invest and develop more in green power generation. If we look in BTSL, they have gas engine that can generate power from 1200kW- 2000kW. They used the biomass energy as the fuel for the engine. As you can see from Figure 1, Gas Engine (GE) 1 can generate power 1200kW. Gas Engine (GE) 2 and 3 generate 1560kW, Gas Engine (GE) 4 generate 1948W.

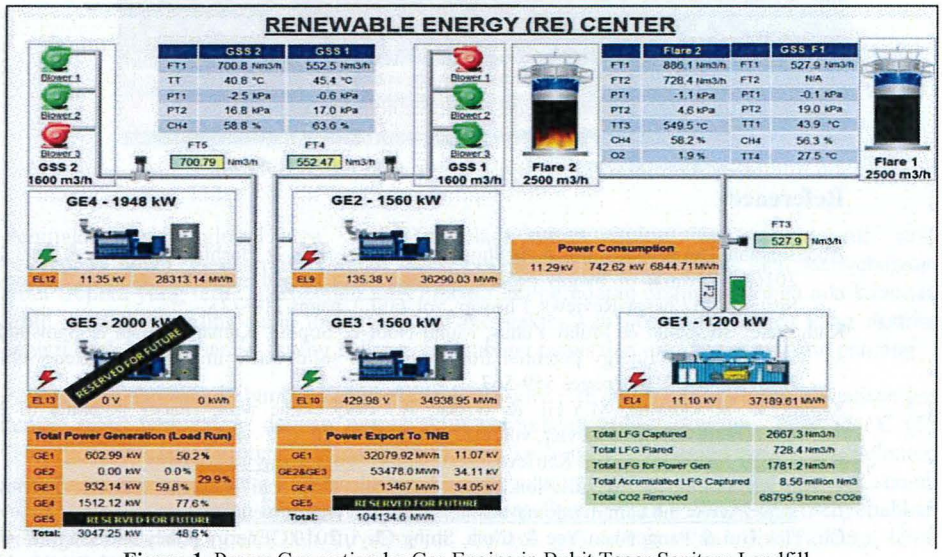


Figure 1. Power Generation by Gas Engine in Bukit Tagar Sanitary Landfill.

4. Roles of Communities and Individuals

The movement toward 100% renewable energy needs to be community-driven. It is also important to have economic benefits for communities, in order to achieve social consensus and ensure that revenues return locally. Some municipalities have adopted local ordinances to promote renewables. In some large-scale renewable energy developments, forests have been cleared to make way for massive photovoltaic facilities, and this has attracted criticism. In response, some effort is now being made to develop guidelines and zoning regulations prior to future projects being undertaken. These examples show that consensus-building and sustainability are also important in the world of renewable energy.

Lastly, I would like to conclude my opinion by summarizing what each of us can do to achieve 100% renewable green energy in three item. Know, Participate and Think. I hope we will get involved somehow and think proactively about all of this.

Know:

- Know climate change risks
- Know the limits and risks of nuclear power
- Know the limits of fossil fuels
- Know the possibilities of renewable green energy
- Know the advantages of energy-saving

Participate:

- Participate in seminars and symposiums
- Become a supporter and/or a member of NGOs
- Participate in volunteer activities
- Participate in community activities
- Participate in politics such as via elections

Think:

- Think about sustainable society
- Think about the next generations
- Think about visions for energy in the future
- Think about energy-saving methods
- Think about how to increase renewable green energy
- Think about how to choose energy sources

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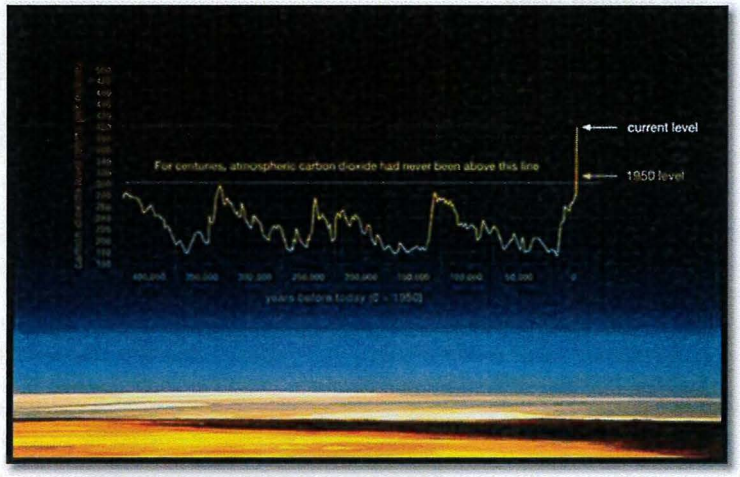
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Kelestarian Alam: Bertindak Sebelum Terlambat

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1. Pengenalan

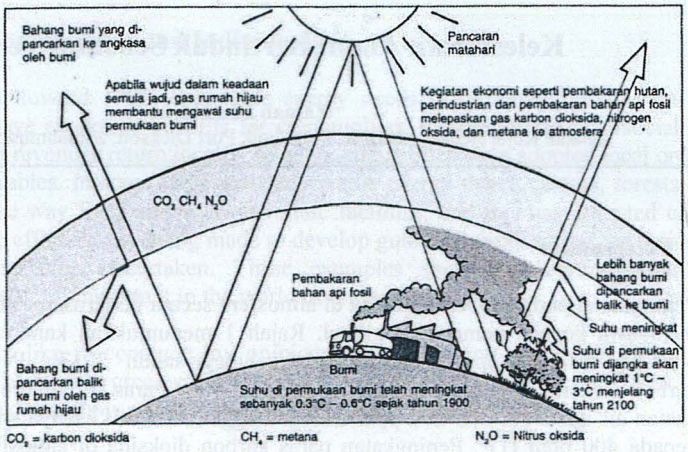
Peningkatan paras karbon dioksida di atmosfera secara berterusan sejak lima dekad yang lalu membawa kepada pemanasan global. Rajah 1 menunjukkan kandungan karbon dioksida (parts per million – ppm) di atmosfera sehingga tahun 2013 . Peningkatan ketara paras karbon dioksida di atmosfera dapat dilihat, dimana paras karbon dioksida di atmosfera pada zaman ais adalah sekitar 200 ppm dan sehingga tahun 2013 ianya telah meningkat sehingga kepada 400 ppm [1] . Peningkatan paras karbon dioksida di atmosfera akan meningkatkan suhu yang kemudiannya merujuk kepada isu pemanasan global. Peningkatan paras karbon dioksida dikaitkan dengan evolusi industri yang mana manusia mula menggunakan bahan api fosil secara lebih meluas.



Rajah 1. Kandungan Karbon Dioksida (ppm) Di Atmosfera

Peningkatan suhu global juga boleh merubah sistem ekologi. Ia mempengaruhi pola penurunan hujan, mencairkan ketulan ais sehingga meningkatkan paras laut, menyebabkan ribut tropika yang teruk, perubahan arus ombak dan peredaran angin, sehingga ada kawasan lebih sejuk berbanding pada masa kini. Ini mengakibatkan perubahan cuaca yang ekstrim seperti berlakunya banjir, puting beliung, gelombang panas dan juga kemarau yang panjang.

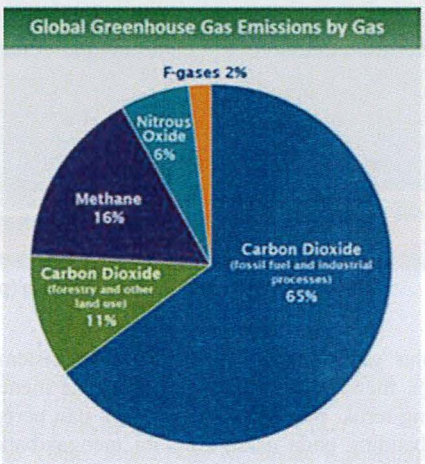
Purata suhu permukaan bumi boleh mencapai kira-kira −18 °C (0 °F),[1] tanpa kehadiran gas rumah hijau berbanding dengan purata suhu permukaan bumi sekarang iaitu 15 °C (59 °F).[2][3][4] . Apabila pancaran matahari menuju ke bumi , sebahagian tenaga ini melantun semula ke ruang angkasa sebagai haba. Walaubagaimanapun dengan kehadiran gas rumah hijau , sebahagian tenaga ini akan diserap dan dipantulkan semula ke bumi dan menyebabkan peningkatan suhu global. Oleh itu semakin banyak gas rumah hijau di atmosfera, lebih banyak haba akan kekal di bumi dan meningkatkan suhu bumi. Rajah 2 menerangkan bagaimana gas rumah hijau memberi kesan terhadap peningkatan suhu bumi.



Rajah 2. Pancaran Matahari Dan Kesan Gas Rumah Hijau Terhadap Pemanasan Global.

2. Gas Rumah hijau

Komponen utama gas rumah hijau adalah wap air, karbon dioksida, metana, nitro oksida dan fluorinated gas. Rajah 3 menunjukkan komposisi kandungan gas rumah hijau di ruang atmosfera . Terdapat dua cara bagaimana gas rumah hijau boleh memasuki ruang atmosfera kita iaitu samada melalui aktiviti manusia ataupun melalui proses semulajadi seperti respirasi haiwan dan tumbuhan.



Rajah 3. Komponen Utama Gas Rumah Hijau

Kegiatan manusia sejak bermulanya Revolusi Industri (dikira dari tahun 1750) telah meningkatkan kepekatan karbon dioksida di atmosfera sebanyak 40% iaitu dari 280 ppm pada tahun 1750 hingga 406 ppm pada awal tahun 2017.[5] Jika dilihat dari Rajah 3, Karbon dioksida merupakan komponen gas rumah hijau yang paling besar yang dibebaskan ke atmosfera. 65% karbon dioksida tersebut dihasilkan oleh aktiviti manusia datangnya dari pembakaran bahan api terutamanya arang batu, minyak dan gas asli dan aktiviti-aktiviti perindusrian seperti kilang-kilang simen. Selain itu aktiviti-aktiviti seperti penebangan hutan,

hakisan tanah dan aktiviti penternakan haiwan pula menyumbang sebanyak 11% karbon dioksida ke atmosfera [5].

Metana (CH4) turut menyumbang sebanya 16% gas rumah hijau . Sebilangan besar pengeluaran gas metana disebabkan oleh indusri yang melibatkan minyak dan gas iaitu semasa proses pengekstrakan, pemprosesan , pengangkutan dan penggunaan bahan bakar fosil.[1] Sekiranya metana bocor ke udara sebelum digunakan contohnya akibat daripada paip bocor, ia akan menyerap haba matahari dan seterusnya memanaskan atmosfera. Walaupun metana tidak kekal lama berada di atmosfera , tetapi kesanya terhadap ilkim jauh lebih dahsyat kerana ia berkesan dalam memerangkap haba. Ia dikatakan 84 kali lebih kuat memerangkap haba berbanding karbon dioksida. Aktiviti-aktiviti manusia dalam bidang ternakan , pertanian dan pembusukan sisa organik di tapak pelupusan sisa pepejal turut menyumbang kepada peningkatan gas metana di atmosfera [3].

Satu lagi komponen gas rumah hijau adalah Nitrous Oxide. Ia menyumbang sebanyak 6% gas rumah hijau ke atmosfera . Aktiviti pertanian , penggunaan tenaga, perindustrian dan pengurusan sisa adalah aktiviti-aktiviti yang menyumbang Nitrous Oxide. Peningkatan penggunaan baja sintetik dalam industri pertanian dan perladangan adalah penyumbang terbesar gas Nitrous Oxide selain dari aktiviti kenderaan bermotor.

Fluorinated gas (F-gas) juga merupakan salah satu komponen gas rumah hijau. Ianya terdiri daripada gas hydrofluoro carbons, perfluoro carbons, sulfur hexafluoride dan nitrogen trifluoride. Gas-gas ini biasanya dibebaskan dalam kuantiti yang lebih kecil, tetapi kerana ia merupakan gas rumah hijau yang kuat, kuantitinya yang sedikit sahaja telah memberi kesan terhadap pemanasan global . F - gas dihasilkan oleh aktiviti manusia seperti dari kerja-kerja perindustrian dan sistem penyejukan [3].

Ketumpatan gas rumah hijau dan jangka masa gas rumah hijau berada di atmosfera akan mementukan kesan jangka panjang terhadap perubahan iklim atau kesan pemanasan global. Setiap gas rumah hijau yang dibebaskan ke atmosfera akan mempunyai jangka masa yang berbeza untuk tinggal kekal di ruang atmosfera . Ada gas rumah hijau yang akan kekal bertahun dan ada yang kekal sehingga berpuluh ribu tahun.

3. Peranan Individu Dan Pihak Berkuasa Tempatan Mengawal Pelepasan Gas Rumah hijau.

Penyelidikan dengan jelas telah membuktikan bahawa faktor yang menyebabkan pemanasan global adalah akibat dari aktiviti manusia itu sendiri. Sikap manusia yang tamak , mementingkan diri dan tidak menghargai alam sekitar telah menyebabkan kemusnahan mukabumi ini. Industri berlumba-lumba mengeluarkan produk mereka tanpa memikirkan kaedah yang sesuai untuk mengurangkan gas rumah hijau yang dibebaskan. Contohnya : Industri pencuci atau pelarut menggunakan CFCs dalam bentuk cecair sebagai bahan pencuci minyak dan gris dalam peralatan elektronik dan elektrik, mikrocip dalam komputer dan pelbagai jenis logam. CFCs dalam bentuk gas pula digunakan sebagai pencuci peralatan perubatan. Pembakaran sampah secara terbuka juga tidak diberi perhatian oleh pihak berwajib . Ini merupakan contoh-contoh kerakusan dan ketidakperhatinan manusia terhadap kepentingan menjaga alam sekitar. Langkah-langkah mudah boleh kita mulakan sebagai usaha kita untuk mengurangkan perlepasan gas rumah hijau ke atmosfera.

3.1. Mengurangkan Pengunaan Tenaga Elektrik

Tenaga elektrik yang dihasilkan datangnya dari pembakaran bahan bakar . Pembakaran bahan bakar ini menyebabkan pembebasan gas karon dioksida ke atmosfera. Oleh itu setiap individu

perlulah berhemah dalam menggunakan tenaga elektrik. Matikan suis barangan elektrik seperti televisyen, komputer, penghawa dingin jika tidak digunakan.Tindakan yang mudah ini bukan sahaja boleh menjimatkan bil elektrik namun mengurangkan pelepasan karbon dioksida. Pengurangan penggunaan hawa dingin ini boleh mengurangkan lagi pembebasan CFC(Kloro flourokarbon) yang bertindak sebagai agen pemanasan global. Individu yang ingin membeli peralatan elektrik yang baharu juga diingatkan untuk membeli barangan elektrik yang mempunyai label Energy star kerana barangan ini menggunakan kurang 15% daripada penggunaan tenaga elektrik. Penggunaan mentol dirumah-rumah juga boleh digantikan dengan mentol Compact Flourescent Light (CFL) kerana ia lebih menjimatkan tenaga dimana lampu jenis ini hanya menggunakan 1/4 tenaga daripada jumlah tenaga yang digunakan oleh mentol biasa.

3.2. Mengurangkan kebergantungan kepada pengangkutan bermotor

Oleh kerana kebanyakan gas rumah hijau yang dibebaskan adalah karbon dioksida, maka kita digalakkan untuk mengurangkan penggunaan kenderaan bermotor yang menyumbang kearah pengeluaran karbon dioksida dan karbon monoksida. Bagi perjalanan jarak dekat sebagai contoh dalam sekitar kampus, adalah digalakkan untuk berjalan kaki . Amalan ini bukan sahaja 100% mesra alam, malah suatu amalan yang menyihatkan tubuh badan. Jika kita menunggu seseorang atau membeli makanan menggunakan khidmat kaunter pandu laju, berhentikan enjin kenderaan. Amalan berkongsi kereta, menggunakan perkhidmatan pemgangkutan awam seperti bas, ERT, monorail dan lain-lain lagi amat digalakkan bagi mengurangkan pelepasan karbon ke atmosfera. Kenderaan kita juga perlu diselenggara mengikut kekerapan tertentu kerana kereta yang tidak diselenggara akan menyebabkan pembakaran yang lebih tinggi dan menyumbang kepada peningkatan gas rumah hijau

Industri sepatutnya beralih kepada bahan bakar yang baharu seperti penggunaan minyak kelapa sawit untuk mengantikan diesel. Ujian awal ke atas beberapa buah teksi dan kenderaan PORIM yang meliputi semua aspek teknikal dan prestasi memberi petanda-petanda baik dan menyakinkan untuk digunakan sebagai bahan pembakar [5].

3.3. Mengamalkan konsep 3R

Konsep 3R (Reuse, Reduce & Recycle) merupakan cara terbaik untuk mengawal dan mengelolakan sampah. Reuse, Reduce, dan Recycle sebenarnya dapat dilakukan oleh sesiapa sahaja,di mana sahaja dan pada bila-bila masa sahaja. Reuse bermaksud menggunakan kembali sampah yang masih dapat digunakan untuk fungsi yang sama ataupun fungsi lainnya . Reduce bermaksud mengurangkan segala sesuatu yang mengakibatkan sampah dan Recycle pula adalah proses mengolah semula sampah menjadi barang atau produk baru yang bermanfaat.

Reuse boleh dipraktikan oleh masyarkat kita dengan mudah sebagai contoh memberikan barang-barang kegunaan harian yang tidak kita perlukan lagi kepada adik, saudara mahupun kepada pihak yang memerlukan. Kain juga boleh digunakan untuk mengantikan tisu untuk tujuan mengelap. Penggunaan bateri sepatutnya menggunakan bateri yang rechargeable.

Reduce penggunaan beg plastik semasa membeli-belah dengan membawa beg sendiri. Beg plastik tidak mesra alam dan tidak boleh dibiodegradasikan. Sebagai contoh di pasaraya tertentu, larangan pengunaan plastik bag pada hari Sabtu telah dilaksanakan dan recycle bag diperkenalkan. Pasaraya berkenaan juga turut mengenakan bayaran 20 sen kepada pelanggan yang ingin menggunakan beg plastik di pasaraya berkenaan. Mengurangkan penggunaan

bahan pakai buang seperti pinggan kertas dan cawan plastik juga adalah merupakan konsep Reduce.

Recycle dapat kita lakukan dengan cara mengumpul dan mengasingkan bahan buangan mengikut jenis seperti tin aluminium,kaca,kertas. Apabila individu melaksanakan konsep recycle maka sudah tentu ia akan menghantar barang kitar semula ke tempat dimana barang-barang tersebut dikumpulkan dan dijual kepada agensi yang berdaftar dan mempunyai pengalaman dalam proses kitar semula. Selain menyelamatkan bumi , ia turut menjana pendapatan keluarga terbabit . Proses ini akan dapat mengatasi masalah kekurangan bahan mentah dan seterusnya memperlahankan pemanasan global akibat daripada pembebasan gas metana daripada proses pereputan.

3.4. Mengurangkan barangan import

Apabila kita membeli barangan import, agen pengangkutan memainkan peranan penting.Sebelum kita menerima barangan import sebagai contoh makanan, makanan itu perlu dibungkus dengan rapi dan disimpan di dalam peti sejuk untuk mengekalkan kesegarannya. Peti sejuk memerlukan gas fluorinated untuk tujuan penyejukbekuan. Gas fluorinated merupakan salah satu gas rumah hijau. Kapal kargo yang menggunakan bahan bakar dan melepaskan karbon dioksida dan karbon monoksida ke udara diperlukan untuk mengangkut barangan import. Oleh itu , kita digalakkan untuk mengutamakan produk tempatan dan adalah lebih baik jika kita dapat mengusahakan untuk menanam sumber makanan secara usaha diri . Selain menjimatkan, ianya juga mengalakkan proses fotosintesis yang menyerap karbon dioksida dan membebaskan oksigen ke udara. Walaupun kita lihat usaha yang remeh tetapi sebenarnya , kita telah dapat mengelakkan banyak karbon dioksida daripada memasuki atmosfera kita akibat daripada pembakaran bahan bakar yang digunakan untuk mengangkut sumber makanan import tadi .

3.5. Pembangunan Terancang Dan Penguatkuasaan

Pembangunan yang dilaksanakan di sesuatu tempat seperti pembangunan kawasan perumahan perlu di awasi oleh pihak berkuasa tempatan kerana selalunya pihak pemaju akan menebang dan membersih kawasan teutama kawasan yang penuh dengan pokok-pokok untuk dijadikan kawasan perumahan. Pihak Berkuasa tempatan seharusnya memastikan pembangunan yang dibuat tidak merosakkan alam sekitar dan seharusnya cuba untuk mengekalkan ekosistem yang sedia ada. Berbagai akta telah diwujudkan untuk melindungi alam sekitar sebagai contoh Akta Kualiti Alam Sekeliling 1974 diwujudkan bagi melindungi alam semulajadi. Akta Perhutanan 1984 pula melarang pembakaran samada melibatkan pembakaran terbuka mahupun melibatkan pembakaran kawasan hutan . Akta Pengangkutan Jalan 1987 (Akta 333) pula mengawal perkara berhubung dengan penggunaan kenderaan bermotor.

Walaubagaimanapun akta yang diwujudkan tidak berkesan seandainya pihak berkuasa tempatan tidak menjalankan tugas mereka dengan baik. Rondaan patut dipertingkatkan dan pemaju, pengusaha kilang wajib mendapatkan nasihat daripada Jabatan Alam Sekitar sebelum memulakan sesuatu operasi perindustrian. Penguatkuasaan undang-undang bagi pembalakan haram yang menyebabkan kemusnahan alam sekitar juga perlu ditingkatkan kerana ia membawa masalah seperti hakisan tanah, banjir dan pemanasan global.

3.6. Menaiktaraf infrastruktur dan sistem pengangkutan awam

Infrastruktur dan sistem pengangkutan awam harus diperluaskan dan dipertingkatkan mutu perkhidmatannya kerana jika sistem ini cekap dan mutu perkhidmatannya bagus, maka penggunaan kereta persendirian juga boleh dikurangkan. Dengan pengurangan kereta

persendirian bermaksud pengurangan bahan bakar digunakan dan pengurangan pelepasan gas rumah hijau ke atmosfera. Adalah lebih baik lagi sekiranya sistem pengangkutan awam menggunakan konsep sistem pengangkutan hijau dimana pengangkutan awam ini menggunakan bahan bakar mesra alam seperti biogas berbanding bahan bakar berasaskan fosil.

4. Kesimpulan

"Dunia ini hijau dan cantik dan Tuhan telah melantik kamu sebagai pengurusnya. Dia melihat apa yang kamu lakukan" – Hadis Muslim

"Kita tidak mewarisi alam sekitar daripada nenek moyang kita, sebaliknya kita meminjamnya daripada generasi akan datang. Oleh itu, jagalah alam sekitar supaya anak dan cucu kita dapat menikmatinya." – Mahatma Gandhi.

Daripada petikan hadis muslim dan kata hikmat dari Mahatma Gandhi di atas, jelas membuktikan tentang peranan manusia sebagai khalifah Allah atau sebagai pengurus muka bumi untuk memainkan peranan dalam isu penjagaan alam sekitar. Dari masa ke semasa isu ini pemanasan global yang disebabkan oleh pelepasan gas rumah hijau ke udara semakin membimbangkan kerana manusia semakin rakus untuk mengejar pembangunan, kemodenan dan kekayaan tanpa mengira kesan kerosakan yang dilakukan terhadap alam sekitar ini.

Merujuk kepada Zaini Ujang (2008) meskipun kempen kitar semula yang dilakukan di negara kita masih jauh ketinggalan, hanya 5 peratus dalam tempoh 15 tahun berbanding dengan negara maju seperti Denmark, Singapura dan Jepun yang telah mencapai sasaran 40 hingga 50 peratus bagi tempoh 20 tahun, namun usaha ini harus diteruskan. Kesedaran dalam diri serta sikap cintakan alam merupakan nilai utama yang perlu dititikberatkan.Namun begitu, sikap tersebut tidak akan lahir dengan sendirinya. Ianya bermula dari rumah, dimana ibubapa seharusnya mendidik anak-anak bagaimana untuk menghargai alam sekitar [8].

Selain memberi kesedaran dan kefahaman pentingnya menjaga kelestarian alam, penguatkuasaan juga merupakan satu cara lagi bagi mempastikan segala akta dan undang-undang yang telah dibuat bagi memastikan kelestarian alam dipatuhi . Kerajaan dan pihak berkuasa tempatan juga patut mengambil tindakan sekiranya ada individu atau syarikat yang secara terang-terangan melanggar akta yang telah ditetapkan. Dengan adanya penguatkuasaan yang dilakukan akan menyebabkan orang perseorangan atau industri-industri akan lebih perihatin tentang perlunya menjaga kelestarian alam.

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Implementation of Energy Saving Project Through Energy Performance Contract(EPC)

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1. Introduction

EPC definition is a single procurement contract for engineering, construction, installation, start-up, measurement, verification, operation and maintenance that specifies performance energy saving improvements in buildings/facilities that will result in sufficient avoidance energy cost and enhanced recovery from utility systems to pay for the cost of equipment, material, labour, subcontracts, fees, insurance, bonds, permits, debt servive, and all cost associated with the implementation of the contract scope over the life of the contract. In simple terms, EPC is a project approach that utilizes the energy savings and venue gains to pay for the project cost.

As many facility owners are focussing on reducing their energy consumption and energy cost, an increasing number of entities, including the government sector, are pursuing Energy Performance Contracting (EPC) and public private partnership to develop and finance energy efficiency activities in their facilities.

1.1 Energy Servive Company (ESCO)

ESCO is a contractor that undertakes services related to implementation of energy efficiency projects for their clients. A full-fledged ESCO is able to provide all services under one single contract with the client, namely the Energy Performance Contract or whatever term the ESCO may use e.g. Energy Service Contract, Energy Savings Contract, etc.

An ESCO will provide services as a one-stop shop for energy efficiency projects, which will ease the process of project implementation, as the client does not need to manage all the technical stages in project development, procurement and commissioning, and the ESCO will guarantee that savings will occur. However, some supervision and management are required to ensure that the ESCO will perform its duties in a satisfactory manner. Thus, it is important to establish a good working relationship with the ESCO and monitor their performance during the engagement.

ESCO at PPD is Taiace Engineering Sdn. Bhd. Taiace Engineering Sdn. Bhd is a Malaysian based company established since 1996 as a manufacturer for various products such as DC Power and Cooling System for telecommunication industry, Power Distribution panels for buildings, and Green Technology products. Exporting to more than 12 countries, Taiace is now the leader in energy efficiency solutions in Malaysia with vast experience in energy saving projects with telecommunication industries, government offices and industrial/commercial buildings.

2. Project Objectives

Implement energy saving measures using Green Technology via Energy Performance Contract (EPC) method. Targeted energy savings is more than 15% with minimum guaranteed savings of 10%. Outcome from the project will be:-

- No investment from the Client as investment is done by Taiace
- Maintenance on all installed equipment (such as air conditioner, lighting etc) will be borne by Taiace. This is additional savings to the Client.
- Client building's owner will enjoy free remote energy monitoring throughout the contract period.
- Thru business model agreed during Skim Jejak Jaya Bumiputra (SJJB) meeting:
- Savings will be shared on 80% Taiace: 20% Client. Contract period will be 80 months and all savings and equipment to be transferred to government in good condition after contract period.

2.1 Project Scope

Project Scopes are as below:-

- To train user technical representative as energy manager at Taiace cost.
- To conduct energy audit by Greentech Malaysia/appointed ESCO and submit baseline report for reference.
- To install remote energy monitoring system for the whole building's energy usage monitoring via internet.
- To implement (design, manufacture, install and commission) energy saving measures and equipment to produce optimum savings with competitive cost.
- To maintain all the Energy Saving Measure (ESM) equipment installed properly.
- To provide annual reporting on energy savings performance for verification purpose.
- To assist user achieving 3-Star Energy Management Gold Standard by AEMAS

2.2 General Scope of Work

Generally, the work comprises performing Energy Saving Measures with the objective to reduce monthly energy consumption as much at least to the agreed guaranteed saving level of 10%.

(A) Detailed Energy Audit

- Conduct energy audit to identify relevant existing conditions of applicable facilities following provided requirement details. The energy audit shall identify all feasible energy conservation, load management, and renewable resource options with benefits exceeding costs over the contract term.
- Prepare comprehensive energy audit report including baseline, guaranteed saving and proposal of Energy Saving Measure (ESM) for submission to the Client.

(B) Energy Saving Measure (ESM)

- Propose Energy Saving Measure (ESM) in optimization of operation, enhance system/equipment efficiency or/and install additional equipment to reduce energy consumptions.
- Prepare engineering analysis of each ESM proposed, amount of saving for approval.
- Execute each of ESM approved, monitor and verify the result from the implementation of ESM. Company shall maintain operation of ESM to ensure the guaranteed saving is achievable.
- Conduct comprehensive service and maintenance for the entire contract period for the equipment installed under ESM.

(C) Measurement & Verification (M&V)

- Develop measurement & verification plan for each ESM to be approved by the Client's Representative.

- Conduct measurement & verification activities on each ESM to quantify saving from implementation of ESM.
- Conduct annual verification activities, as to verify the guaranteed saving declared is maintain. In the event of guaranteed saving is not achievable, technical justification shall be reported to Client

3. Energy Target and Plan

User has to set up an Energy Target & Plan to improve its energy consumption efficiency. The energy target and plan will indicate the number of energy conservation measures (ECMs) that will be implemented over the next three years and will also indicate the expected energy saving target to be achieved from the implemented measures.
With committed no/low cost measure as below:-

- Energy efficiency awareness/training
- Promoting daylighting in open space/ higher lux level
- Promoting standby mode office equipment
- Promoting rescheduling load/equipment
- Setting up room temperature 24Celcius

Above behaviour control can be successfully implemented if there is an Energy Committee within the user themselves. Energy Manager can be appointed and undergo AEMAS Energy Manager Training Course as the first step to get a move towards energy efficiency, with involvement from the ground level to the management level too. We can expect saving at least 3% through this commitment

3.1 Create Energy Baseline and Determine Energy Saving

Energy saving result after implementation has to be measured and verified against the baseline energy consumption of the organization or machine/equipment. In general, energy saving can be determined by comparing energy use before and after implementation as follows:

Energy Savings = Base year energy use – Post retrofit energy use +- Adjustment

The "Adjustment" is the factor to bring the base year energy use and post retrofit energy use to the same condition. Normally, the affected conditions are weather, occupancy rate, number of machines, level of output, etc. The Adjustment can be either positive or negative.

To determine the energy savings according to the M&V Concepts, proper type of measurement has to be selected to suit the implemented ESMs and investment criteria of the organization. According to the International Performance Measurement & Verification Protocol (IPMVP), there are four options for conducting measurement and verification as follows,

- Option A: Partially Measured Retrofit Isolation; or
- Option B: Retrofit Isolation; or
- Option C: Whole Facility; or
- Option D: Calibrated Simulation

Based on experience with other EPC project with government, all parties had agreed to use Option C-Whole Facility as the best method of conducting M&V to declare the energy saving achieved, where energy use is measured by the electric utility meters for a twelve month base year period and throughout the post retrofit period.

Option C is best applied where:

- The energy performance of the whole facility is to be assessed, not just the ESMs
- There are many different types of ESMs in one facility
- The ESMs involve diffuse activities which cannot easily be isolated for the rest of the facility, such as operator training or wall and window upgrades
- The savings are large enough to be separated from noise in the base year data during the time of monitoring
- Interactive effects between ESMs or with other facility equipment is substantial making isolation techniques of Options A and B excessively complex

Major future changes to the facility such as new buildings were expected during the period of savings determination. A metering system will be installed to isolate the energy consumption under adjustment or new power intake system direct from TNB be constructed.

Proposed Energy Saving Sharing Ratio = Taiace 80%: PPD 20%

Terms:
U1= Baseline usage during energy audit (Energy kWh & Maximum Demand kW)*
U2= Usage after energy saving installation (Energy kWh & Maximum Demand kW)*
U3= Average previous 1year monthly usage (Energy kWh & Maximum Demand kW)
**As per M&V report*

$$\text{Energy saving Percentage} = \left(\frac{U1-U2}{U1}\right) X 100\%$$

Monthly payment to Taiace = $U3X$ Energy Saving Percentage $X80\%X$ Current Tariff

For example; if, year 2013 indicates the baseline year, so, saving for month of October 2014, will be compared with October 2013.

4. Proposed Energy Saving Measure (ESM)

Table 1. Show the selected measure for estimated energy conservation.

ESM	Description	Status	Unit	Estimated Saving Percentage
1	New Split Unit Air Conditioner	Proposed layout	155	11.90%
2	VFD for AHU	Done	15	3.5%
3	Installation Voltage Optimisation Units .(VO) / Power Quality Device.	Done	2	3.0%
4	Light Bulb Replacement	Done	8500	2.5%
5	Street Lighting	Nil	-	-
6	Hydrogen Gas migration	Done	139	3.0%
	Remote Monitoring System - Online Web Dashboard (will be online in 3 weeks time)	Done	72	N/A
	TOTAL EXPECTED SAVING			23.90%

** *Above data of energy saving is subjected to the detail energy audit, upon project approval.*

5. Conclusion

As a conclusion, Energy Performance Contract (EPC) is not new to the world but very new to Malaysia due to lack of exposure and lack of interest as electricity tariff is much lower than other countries. Recent increase of TNB tariff has become an eye opener to everybody that energy cost is no longer in comfort zone. Effort on reducing bill has become popular topics of discussion. Not much can be saved by managing behaviour. In order to save more energy, huge investment will be required. The best way to do it is by applying EPC method because the total ownership cost will either be the same or even better compare to direct investment on capital expenditures. The benefit will be enjoyed immediately without investment and achieving energy reduction target more than 10% is assured.

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