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How is electricity consumption on construction sites in Malaysia related to sources of CO_2?

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ABSTRACT

Recently, low carbon construction projects have increased markedlyacross Malaysia. This is important progress for low carbon construction efforts and it's significant for society and in particular for construction companies. To further develop low carbon construction practices, the industry has to be more innovative with how it uses natural resources and current sources of energy in all areas of the construction site. The aim of this paper is to identify the sources of CO_2 emission with respect to electricity usage on construction projects and evaluate its relationship with those sources. The results show that despite awareness of the importance of construction projects that have a limited carbon footprint, not many of the companies investigated in Malaysia are serious about cutting down their natural resource consumption "Limiting night-time working" proved to be the most important way the carbon footprint of construction sites can be reduced.

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INTRODUCTION

The signing of the Kyoto Protocol in 1997 was a pivotal moment in the evolution of climate change research. At this meeting, many researchers met and put forth ideas about what the result of greenhouse gasses created by manufacturers, factories, construction projects and the transportation sectors were doing to the planet [3]. Since then, a number of studies identifying climate change as the critical issue of our time have been conducted [1]. The 20th century saw the height of the industrial revolution and thus society was changed forever both positively and negatively [4]. The loss of our natural environment is one of the negative outcomes of this revolution [6]. Using excessive amounts of energy without paying any consideration to the detrimental effects to the climate, planet, and future generations have been just a few of the negative consequences of modern technologies [2,9]. Furthermore, these developments have led to a scarcity of natural resources, global warming, air pollution, drought and water shortages and overall critical climate changes. United Nations member countries have worked hard since the signing of the Kyoto Protocol to reduce greenhouse gas emissions and more specifically decrease CO_2 emissions. This effort is aimed at reducing the rise in temperatures and their impact on daily life [10]. In spite of the negative aspects of modernization, these developments have highlighted the importance of human capital in organizations. Thus, firms are required to cultivate their employees to a necessary standard that's valuable to the organization [5]. The industrial revolution and modernization have increased the amounts about construction and building taking place all around the globe. This is primarily the result of an increase in population and human impacts on the planet[14]. This building requires a huge amount of energy. For example in the EU, nearly 40% of energy consumption is related to the construction industry. Construction produces a large amount of CO_2. Although there has been notable improvement and a noticeable increase in demands to increase efficiency and reduce energy consumption in building[11,13]. It was concluded that regardless of mitigation, in 2020, 285.73 million tons of carbon dioxide were estimated to be emitted in proportion to the amount of CO_2 emitted in the year 2000. In other words there was a 68.86% increase in CO_2 emissions. According to Shaffii [15], the electricity industry appears to be the biggest sector of industry responsible for the increase in CO^2.

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Electricity:

Mains power systems are close to construction sites and it is generally believed that they can meet the various energy requirements of construction projects[16]. Other forms of energy such as fossil fuels used in stationary combustion units, natural gas, wind, and nuclear power are also used in building procedures, but electricity is most consistently and always generated. Equipment that uses gas, coal and oil (fossil fuels), also generate a large amount of carbon because they must be burnt as a resource in the process. These figures reveal that 35% of carbons are produced through site activities. Oppositely there are carbon neutral technologies available as sources of energy. All technologies that generate electricity are source of emitting CO_2 and other GHGs. Power systems working with burning coal have the greatest amount of carbon footprint of all generation of electricity. GHG emission could be seen directly as it arises from power systems operation or indirectly.These sources include non-fossil fuels such as solar, nuclear, wave, wind, tidal and biomass. They generate no CO2 [7]. CO2 grams equal to per kilowatt hour is expressed as g CO2 eq/kWh [17].

Details of Assumptions:

Here is list of some of the basic electricity consumption that takes place during construction.

(i) Site Accommodation:

Energy efficient carbon producers have said that when compared to standard carbon, their savings are already 50%. Energy saving is closely related to the amount of carbon produced on site. Reducing these outputs could be beneficial both financially and environmentally. After comparing builders' statements with authentic figures obtained from construction projects a 50% savings was revealed. The primary basis for estimating the emission of carbon reveled the 70% of carbon consumption on site is from electricity [18].

(ii) Construction Plant:

The fact that machines are not functioning efficiently is revealed in Carbon Subgroup's reports. The engines of these machines work for long hours and not much consideration is given to reduction of fuel consumption. What's more, some sites are operating with oversized machines that are unnecessary for the scale of the project. It has become a point of contention as to whether site activities using electricity and fuel are solely responsible for the 50% of carbon emission[18].

(iii) Location of Site:

It is believed that construction activities consume a small yet significant amount is energy produced on a construction site. This can range from 15% to 35% of the energy produced on the site. Moving, flattening, excavating, elevating, compressing, and blending in construction sites are responsible for a large amount of energy, while secondary sources of energy are utilized either temporarily or permanently. The third largest consumers of energy on the construction site, are the materials related to the use of concrete for scaffolding and formwork[20]. Mismanagement of materials resulting in wastage leads to site inefficiency and directly impacts the amount of energy consumed by the site. Likewise the location of the site plays a very important role in electricity consumption on construction sites. It can affect electricity use, delivery, climate, logistics, local rules and the availability of materials and equipment[20].

Approach:

The impending climate emergencies due to rising temperatures and an increase in the use of fossil fuels has forced many to look for new was to limit carbon emissions worldwide, and create new methods for stopping polluters. Because impacts on the environment isknown, there is an obligation to measure the pollutants produced as a result of construction activities[21]. In the last twenty years the construction industry in Asia has experienced steady growth that is expected to continue[8]. According to Abdullah et al. (2004), 4.5% of GDP in Malaysian construction has had a remarkable impact on the environment [19].

(i) ANOVA:

One-way ANOVA procedure was used to compare means between different factors of electricity used to identify whether there are differences in the strand scores[12]. We chose ANOVA instead of t-tests because the independent variables of the study were greater than two groups.For example, I used ANOVA to determine whether the effect of site location, and the other elements that used on consumption of electricity (a dependent variable) is significantly differ between location. The results were generated using the Statistical Packages for Social Science (SPSS) version 20.

RESULTS AND ASSUMPTIONS

This section is related to electricity use in construction activity.

(i) The Level of Electricity Consumption:

The site superintendentand respondents' opinionsabout electricity use were investigated from their responses to a questionnaire. Correspondingto resultslinked to the foremostway of using electricity on construction sites, It is possible to manage and modify the current pattern of use and ultimately decrease the carbon footprint of construction sites. Furthermore, identifying these hurdleswill help reducegreenhouse gas (GHG) emission by educating contractors or other stakeholders in the construction activities to this pattern of electricity use and its impact on carbon emission.

(ii) Rank of Factors for electricity-Related to Construction Activities:

According to Table 1, the mean of working time at night is 3.67 which is the most prominent aspect of the electricity usage during the building activates with respect to the respondents' viewpoints. The site location with a mean (3.38) is the second most prominent element. Equipment use is regarded as the third most effective factor (mean: 3.25).

Table 1: Rank of Factors for Electricity-Related to Construction Activities

Factors	Mean	Std.Deviation	Mode	Minimum	Maximum	Sum	Rank
Site Location	3.3871	.91933	3.00	2.00	5.00	105.00	2
Concrete Usage	2.7241	. 1.06558	3.00	1.00	5.00	79.00	7
Cleaning of Equipment	2.7742	. 95602	2.00[a]	1.00	5.00	86.00	6
Site Clean up	2.8710	.71842	3.00	1.00	4.00	89.00	5
Equipment Usage	3.2581	.81518	4.00	1.00	4.00	101.00	3
Site Accommodation	3.2258	.95602	3.00	1.00	5.00	100.00	4
Night Working Time	3.6774	1.10716	3.00	1.00	5.00	114.00	1

It's emerged from table 1 that respondents are believed "Night Working Time" is high effect factor for usage of electricity consumption during construction activities. The second factor for electricity consumption is belonging to "Site Location". As follows these factors, "Equipment Usage", "Site Accommodation", "Site Clean up", "Cleaning of Equipment" and "Concrete Usage" are arranged in this category (by comparing their mean).

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REFERENCES

Houghton, J.T., Y. Ding, D.j. Griggs, M. Noguer, P.J. Van der Linnden, X. Dai, K. Maskell and C.A. Johnson, 2001. *Climate change 2001: the scientific basis*, Cambridge University Press Cambridge.

Esmaeilifar, R., M. Samari and M.W.M. Shafiei, 2014. Implementation of Low Carbon Construction Activities in Order to Optimize Water Consumption on the Construction Site.

Climate Change Secretariat, 2002. *A Guide to the Climate Change Convention and Its Kyoto Protocol*, United Nations Framework Convention on Climate Change (UNFCCC), http://unfccc.int/resource/guideconvkp-p.pdf.

Masomi, E., D.M. Asl, A. Eghdami, S. Ashore and P. Ghanimat, 2014. The Study of Corporate Entrepreneurship and its Relationship with job satisfaction: The Case Study: Sepah Bank, branches of Golestan Province. Research Journal of Recent Sciences, 3(3): 104-111.

Wahabm A.R.S., A. Hussain, A.A. Zadeh, A.F. Shah and J. Hussain, 2014. Employees' Perception and Motivation towards Training and Development Programmes in Health Sector of Pakistan: A Case Study of Khyber Pakhtunkhwa. Research Journal of Recent Sciences, 3(2): 1-7.

Charandabi, S.E., and N. Bohlooli, 2014. Investigation and Prioritizing the Key Factors of Success in Small and Medium Size Enterprises. Research Journal of Recent Sciences, 3(2): 31-34.

Zaferani, Z.A. and H.N. Aliakbari, 2014. Investigation the relationship of Staff's training courses with their Performance. Research Journal of Recent Sciences, 3(4): 1-6.

Samari, M., N. Ghodrati, R. Esmaeilifar, P. Olfat and M.W.M. Shafiei, 2013a. The Investigation of the Barriers in Developing Green Building in Malaysia. Modern Applied Science, 7(2): 1.

Samari, M., 2012. Sustainable Development in Iran: a Case Study of Implementation of Sustainable Factors in Housing Development in Iran. Paper presented at the International Proceedings of Economics Development & Research.

Christy, J and R. Spencer, 2003. *Global Temperature Report* 1978-2003, Earth System Science Center, The University of Alabama, US.

Samari, M., and M.W.B.M. Shafiei, 2012e. Project management best practices for the developing construction industry. Elixir Online Journal., (48): 6.

Bernard, H.R., 2000. Social Research Methods: Qualitative and Quantitative Approaches. Sage Publishing Ltd., London.

Casals, X.G., 2006. *"Analysis of building energy regulation and certification in Europe: their role, limitations and differences", Energy and Buildings*, 38(5): 381-92.

Wee-Kean, F., M. Hiroshi, H. Chin-Siong and L. Yu-Fat, 2009. *Energy Consumption and Carbon Dioxide Emission Considerations in the Urban Planning Process in Malaysia.*

Shaffii, N., 2010. Malaysia Country Report, Construction Industry Development Board Malaysia.

Brockman, M.D., 2007. *Land and Environment Court Proceedings, Environmental Defender's Office Ltd.*

Parliamentary Office of Science and Technology, 2006. *Carbon footprint of electricity generation*.

Ko, J., 2010. *Carbon: Reducing the footprint of the construction process*.

Samari, M., R. Esmaeilifar and M.W.M. Shafiei, 2014a. Green Building: Strategic Approach to Sustainable Economy. The International Journal of Business & Management, 2(7).

United Nations Centre for Human Settlements (Habitat) Nairobi, 1991. *Energy for Building − Improving Energy Efficiency in Construction and in the Production of Building Materials in Developing Countries*, HS/250/91 E ISBN 92−1−131 174−8.

Shaik, S.S., and T.A. Samuel, 2009. *Methodology for estimating emissions in underground utility construction operations, Journal of Engineering,* Design and Technology, 7(1): 37-64.