ENVIRONMENTAL ATTITUDES AND ENERGY CONSUMPTION AMONG TENANTS IN A HIGH-RISE MULTI-UNIT RESIDENTIAL BUILDING IN TORONTO, CANADA

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 ABSTRACT

The influence that environmental knowledge and belief have on people's behaviour is one of the important issues. However, currently, there is not enough study on household energy use at an occupant level or on evaluation of elements that can affect household's energy use in Canadian buildings.

The present study attempts to evaluate energy consumption and its possible correlation with environmental attitudes among the tenants of a Toronto high-rise multi-unit residential building. The research methodology is based on a quantitative survey method, and the focus of the study is on historical annual energy consumption over a three year period. The main tool for collecting data is a developed questionnaire, and Dunlap's NEP scale is used for measuring environmental attitudes.

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The detailed statistical results show that there is a negative correlation between environmentally-conscious attitude and energy consumption of the participants which is in agreement with the study's presented hypothesis.

Keywords— Environmental attitudes, Energy Consumption behavior, New Ecological Paradigm, Multi-Unit Residential Building

1.   INTRODUCTION

Human values can have a big impact on their beliefs. This is defined by behaviours such as a person's approaches or reactions to how their behaviours react in life's impacts (Rokeach, 1979; Schwartz, 1996 and Ardahan, 2010). Values can be imagined as important life goals or standards that define a person's principles through their life's (Rokeach, 1973). In relation to environment and its problems, values may play an important role on for solving and/or for broadening the contradiction between individual and public interests (Karp, 1996).

While conventional energy sources are limited, the demands for energy are increasing every day. In Canada, there have been many energy conservation efforts undertaken to tackle Canada's energy-related problems: energy security, fluctuations in fuel prices, and its threat to pollution. Residential sector in Canada accounts for more than 15% of Canada's energy consumption (NRCan, 2011). Multi-unit residential buildings (MURBs) represent the most significant component of the Toronto residential building inventory. Over half (55%) of the dwellings in the City of Toronto consist of apartment buildings. The majority of all Toronto dwellings (39%) are either mid-rise or high-rise apartment buildings of five or more storeys (Policy & Research city of Toronto, 2007 and Binkley, 2012). MURBs, as the most common form of dwelling in Toronto, are also a significant source of greenhouse gas (GHG) emissions. As a result, reducing household energy consumption would be beneficial for Canadians in order to reduce greenhouse gas emissions and their threat to the environment.

An overview of rental MURBs and their energy consumption shows that these buildings are energy inefficient due to their concrete frames, outdated building structure and features - e.g., heating and cooling equipment, appliances, etc. (City of Toronto, 2011 and Roque, 2013). In

some MURBs the utility costs are included in their monthly rental payments which make improving energy efficiency a challenge. This creates an outcome of consumers not feeling responsible for the way energy is used in their units which is another dimension of high-rise MURB, since the actual consumers (tenants) do not pay their own utility bills.

There has been a significant amount of studies on Canadian household energy consumption, particularly in the matter of residential building design and materials. However, energy behaviour, attitude and usage, is a relatively new topic (Yohanis, 2012). The relations between values and attitudes which are interested about environmental issues and environmentally related behaviour are very complex (Ardahan, 2010). In order to achieve changes in people's behaviours, it is important to gain insight into their beliefs and values and how these might drive them to make decisions. Thus, opportunities for significant reductions in energy consumption could be achieved by evaluating occupant's household energy use and attitude within high-rise MURBs (focus of this study).

This study was part of a larger and an on-going research project which is called "Toronto Tower Renewal" with Ryerson University. The following section explains the specified project's concept and the discussion presented here will be limited to energy data for the residential sector with a focus on a MURB.

2. Theoretical Framework

Understanding and evaluating the tenant's present household energy use and environmentally-conscious attitudes towards energy consumption is significant in order to develop energy reduction strategies such as tenant engagement and education. Also, determining all factors contributing to one's household energy consumption, however, this is complex.

Nowadays, the environmental issues and challenges, particularly "energy consumption behaviour" has been the focus of attention for policy makers and scholars in the fields of sociology, environment study, management and so on (Maleki & Karimzadeh, 2011). One of the ways to prevent harming the environment and its destruction is the change in human behaviour towards the direction of the environmentalist dimensions (Quimbita & Pavel, 2005).

The change in the people's behaviour towards the naturalist dimensions can be considered as one of the ways to avoid the damage to the environment and destruction of nature (Quimbita & Pavel, 2005). Based on the theory of Reasoned Action of Fishbin and Ajzen (1975), it is assumed that there is a systematic model between the people's approach towards a certain issue and the related behaviour towards that issue. On the other hand, scholars in the field of environmental study such as Borden and Schettino (1979), Schahn & Holzer (1990), Kaiser et al. (1999), Bayard & Jolly (2006) and Maleki & Karimzadeh (2011) believe that there is a relationship between environmental knowledge and significant environmental behaviour. In addition, Dull & Janky (2011) also found out the evidence on positive relationship between environmental attitudes and household energy consumption in advanced post-industrial societies.

In most cases the previous scholars proved that there was a statistically significant relationship between the environmental attitude and energy consumption (environmental behaviour). However, currently, there is not enough study on household energy use at an occupant level or on evaluation of elements that can affect household's energy use such as environmental knowledge and pro-environmental attitudes in Canadian MURBs.

Statistics on energy consumption in Canada are collected by a number of government agencies including Statistics Canada and Natural Resources Canada's Office of Energy Efficiency. The three main sources for residential energy use data are: The Survey of Household Energy Use (SHEU), the Energy Use Data Handbook (EUDH) and the Comprehensive Energy Use Database (CEUD). In addition, Natural Resources Canada's Office of Energy Efficiency - National Energy Use Database (NEUD) also addresses residential household energy use (Natural Resources Canada, 2011). NEUD compares Canada's energy consumption and carbon emissions, quantitatively, within the residential sector from 1990 to 2009 (Roque, 2013). The national surveys such as SHEU 2007 and NEUD lack other elements that contribute to occupant's household energy use (e.g., social aspects). Obviously, incorporating all factors of one's household energy consumption is not easy; but the national surveys do not consider social or psycho-social aspects.

It should be noted that besides the two national and comprehensive surveys conducted in Canada, SHEU-2007 and NEUD, there has been a limited amount of research done on occupant's household energy use in Canadian MURBs. As mentioned before, the most comprehensive and

cited surveys on household energy use in Canadian high-rise MURBs are SHEU-2007 and NEUD (Finch et al., 2010 & Roque, 2013). However these surveys have discrepancies in their classification of a MURB and lack of other elements that can affect a household's energy use. There is also a lack of information specifically related to high-rise MURBs at an occupant level. These surveys data's are based on general classifications of the residential sector. Factors such as; locations, year of construction, occupancy type, demographics and many more have a great influence on the energy consumption, and cannot be merged into one category.

In Huang's research (2012), she developed a weather normalized energy benchmark for 45 gas-heated high-rise MURBs in Toronto. The normalized annual consumption for these buildings was found to range from 242 to 453 kWh/m^2. In Roque's study (2013), he developed a survey on household energy use and behaviour in a rental MURB in Toronto. The detailed analysis of his survey data resulted in the development of relationships between occupant's demographics and energy consumption. By creating an Artificial Neural Network (ANN) model, results showed that the implementation of the survey may have reduced occupant's energy consumption in the high-rise MURB.

In summary, the research that has been conducted on Canadian MURBs mostly focuses on the energy intensity of the entire building quantitatively. Also, the large number of surveys on household energy use that have been conducted, much less is known about the human side of the energy tension, while residents can play an important role in energy conservation that supplements the engineering solutions.

There is surprisingly lack of information relates high-rise MURBs' occupants' environmentally-conscious attitudes to their actual energy consumption. While literature has shown that there is a strong relation and correlation between environment attitudes and energy consumption of the occupants in residential buildings. It is the intention of this study to fill in this gap. This study would be useful to understand occupant's environmentally-conscious and the impact of social, demographic, and energy behaviour measures in a Canadian high-rise MURB setting. Hence, the current research is testing the environmentally-conscious attitudes relationship concerning energy consumption in the context of a low-income Canadian MURB.

Thus, the issue to be considered here is how attitude affect energy use in a high-rise MURB in Toronto. Hence, this could be possible by finding out the relationship between environmental attitude and energy consumption behaviour. The premise of the research is the attitude of the occupants focusing on energy consumption. The main aim of this study is to examine, correlate the impacts of occupants' environmentally-conscious attitudes on energy consumption in a Multi-Unit Residential Building (MURB) in Toronto.

Considering the main aim of this study, the following objectives are formulated. 1)   To examine the historical energy consumption of household over the past within a Toronto MURB. 2) To conduct a survey to examine a different dimension of household's environmentally-conscious attitudes within a Toronto MURB. 3) To investigate the correlation between household's environmentally-conscious attitudes and their historical energy consumption during the previous years and in the current year within a Toronto MURB.

Also, according to previous studies (Maleki & Karimzadeh, 2011 and Dull & Jacky, 2011) and the presented theoretical perspectives, we can hypothesize:

"It seems that there is a relationship between environmental-conscious attitude and energy consumption behaviour". These objectives will be achieved by evaluating different occupants' attitude survey and comparing the information to their usage of energy.

3.   MATERIALS AND METHODS

A literature review was performed to establish information on the development of households' environmental attitudes studies in general and households' environmental attitudes towards energy consumption in particular. In order to obtain the set of objectives of the study, the empirical research method approach was applied. The methodology comprises the correlation between environmental attitudes and weather normalized energy consumption of the occupants in a Toronto MURB. The independent variable consists of environmental attitude. The dependent variable is the actual and weather normalized annual energy consumption of the household's occupants which might be regarded as a continuous variable. Therefore, an attitude survey (Subjective Measurement) and statistical analysis were conducted to achieve an understanding of the households' environmental attitudes which may affect on energy consumption.

Several ways of measuring people's environmental attitudes and basic ecological worldviews have been established since the 1970s. While only two measures are used frequently: the Ecological Attitude Scale developed by Maloney and Ward in 1973 and the New Environmental Paradigm (NEP) Scale (Table 1) developed by Dunlap and van Liere in 1978 (Fransson & Gärling 1999).The NEP scale became one of the most widely used measures of environmental concern in the world and has been used in more than 100 studies around the world (Freudenburg 2008; Hawcroft & Milfont, 2010; Thomson & Versus Research Ltd., 2013). Also, NEP has already been used in some other household oriented studies (e.g. Do Valle, et al., 2004; Poortinga, Steg & Vlek, 2004; Maleki & Karimzadeh, 2011; Dull & Janky, 2011).

As a result, for the sake of current study, to address environmental attitude, the New Ecological Paradigm (NEP) scale which has been proved to be a valid measure of environmental concerns was used. The NEP survey consists of fifteen questionnaires documenting the tenants' opinions and perceptions concerning the energy use and the environment. These paper-based questionnaires were designed to be only a few short general questions about themselves.

The participants of the study ranged from the ages of 18 years old and over. A maximum number of 50 tenants participated in this project. The tenants (participants) are typically low-income households who are not directly responsible for the payments or fees associated with their energy consumption, these fees are included in the tenant's monthly rental fee.

All survey responses were entered into Microsoft Excel's spreadsheets. After that, the analysis was then performed using IBM Statistical Package for Social Science (SPSS) which has many statistical tools and one of its functions includes the analysis of the survey data. Frequency tables were created for all survey results and to assess the relationship between occupant's attitudes and energy consumption. The NEP scale statements consist of the following scale and scores/values were given on a five-point scale for statistical analysis (Table 2).

This is proposed by the Thomson & Versus Research Ltd. Research (2013) which assessed the overall levels of environmentally positive attitudes of the Waikato region (New Zealand) residents during May 2008. The result is compiled as the percentage of respondents in three categories based on the 15-75 scale. The allocation of scores into the categories of Pro-Ecological (Scores in the range of 59-75), Mid-Ecological (Scores in the range of 40-58) and Anti-ecological (Scores in the range of 15-39).

Moreover, historical data (Objective Measurement) on all 136 individual suites' energy use during the previous years was collected from the property manager and were consequently analysed. It should be noted that historical energy use was from an earlier phase of the project which was monthly energy consumption before and after applying "Household Energy Use" survey in May 2012. Occupants' energy consumption was collected by ways of sub-meters which captured the electrical draw of each unit from April, 2011 to June, 2013. The historic monthly energy consumption for 136 units were also normalized with the use of 32-year weather data in Toronto to create an average year simulation using PRISM software.

An important factor of this study is to find the relationship between the attitude of the occupants and the annual consumption, (during the previous years within a Toronto MURB) the correlation testing technique is applied using SPSS which is explained in the following Section. The variables used in this study ensured that the descriptive analysis and hypothesis testing technique are due to the categorical variables. This will provide a deeper analysis of the evaluated statics.

4.   RESULTS AND FINDINGS

4.1   Historical Energy Consumption Results

As discussed previously, the data from this study was obtained through the New Ecological Paradigm (NEP) scale. This scale has been proved to be a valid measure of environmental concerns, by using the responses to the questionnaires. Following the historical energy consumption analysis, the NEP scale results are presented below.

The energy consumption was the amount of electricity used by each apartment unit in a month (kWh/month/unit). According to the analysis results, 19 months before and after applying the specified survey ("Household Energy Use" survey), energy consumption of the 48-surveyed units were 128,035 kWh (125 kWh/m^2), and 114,234 kWh (111 kWh/m^2), respectively. On the other hand, the energy consumption of the 88-non-surveyed occupants was 236,261kWh (126 kWh/m^2) and 118 kWh (118 kWh/m^2) for 12 months before and after the survey respectively. The distribution of the annual energy consumption, using Artificial Neural Network (ANN) approach, shows that the energy behaviour had changed during this period (2011-2013) (Roques, 2012). In other words, after the implementation of the "Household Energy Use" survey in May 2012 by Miles Roque, it was concluded that the households' energy consumption had reduced.

In the current phase of research, the historical data is also tested, before and after applying the "Household Energy Use" survey, using statistical method. This method help to gain a more valid and detailed approach. The results obtained through the statistical analysis are elaborated in the following section.

To achieve the main objectives of this study, the historical energy use of the 50-households who completed the NEP Survey is divided into three different time periods (12 months before, after applying the "Household Energy Use" survey, and the whole period) and used in the data analysis which is presented in Table 3.

In addition to the abovementioned data analysis, with the purpose of having more accurate and deeper data analysis, energy consumption of one year prior to the NEP survey implementation (July 1st, 2013 to July 31st, 2014) was examined. According to the analysis results, total energy consumption of the 50-surveyed units were 94,310 kWh/yr (1,886 kWh/unit/yr) during 12

months before applying the NEP survey (July 2013-July 2014). Also, the PRISM modeling results of the historical energy use showed the average annual energy use (Normalized Annual Consumption-NAC) for the selected Toronto MURB (all 50 units) was 100,708 kWh/yr (2,014 kWh/unit/yr) within the 2013-2014 periods.

Furthermore, in order to gain further insight, the correlations between average energy consumption of the 50 households who completed the survey before applying "NEP" survey (July 2013 to July 2014), and the outside weather temperature (Heating Degree Days) from the dataset are was reviewed and normalized using PRISM. According to the Environment Canada website (National Climate Data and Information Archive), the mean annual HDD and CDD based on 18°C are 3979 and 402, respectively (Figure 1).

As expected, the energy consumption turned out to be the highest in the winter and summer months due to heating and cooling requirements. Energy was consumed only in the form of electrical fan-coil units and plug loads (per suite).It should be noticed that the shoulder season are indicated by the months from mid-September to mid-November and from mid-March to mid-May (which has the minimum average monthly energy consumption).

4.2   NEP Survey Results

A total of 50 households completed the NEP survey and after gathering the survey data, the information was then categorised into various demographics. The demographics were categorized into various groups such as gender, age, nationality and general information. The following demographical and general information distribution was obtained from the 50 survey responses (Table 4).

- Gender: majority of the participant in this survey consisted of male gender (72%).
- Age: a majority of respondents (44%) were between the ages of 46-60 years.
- Ethnic origin: 52% of the respondents grew up in Africa.
- Years of residency: 62% of the respondents resided in the selected Toronto MURB for more than 7 years.

-        Number of people living in the unit: 82% of the respondents were in single occupant households.

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To explore the relationship between environmental attitudes and energy consumption, a series of statistical tests was carried out. With respect to the main objective, at this stage, the relationship between the environmentally-conscious attitudes of 50-housholds who completed the NEP survey and their energy consumption for each of the three were statistically examined. In order to test the relationship between the 15-item NEP scale scores and energy consumption (normalized and actual energy consumption) of 50-housholds for different periods, "Pearson Correlation test" was conducted.

The test results showed the correlation coefficient (r) between these two variables is significant at $p<0.05$. As shown in Table 5, there is a moderate negative correlation between the NEP survey scores and historical energy consumption of the 50 households who responded to the NEP Survey in 2014. As this is a negative correlation, this indicates that as occupants' attitude scores increase, their energy consumption decreases for each of the three periods. This means that as the people attitudes get more positive towards environment, their responsible energy consumption behaviour also increases. This result was confirmed using both the NAC and AEU as energy consumption variables.

Of the results shown in Table 5, it is evident that the correlation between normalized energy consumption (NAC 2013-2014) and household's attitude, after applying "Household Energy Use" survey, had the higher correlation (moderate negative correlation at r= -.391, p=0.005) compared with the actual energy consumption in different periods. This can be likely due to the fact that normalized energy consumption (NAC) is a more reliable measure of energy consumption. It should be noted that weather normalization methods is based on the assumption that energy consumption for space heating follows a linear relation to the difference of the indoor and outdoor temperature, namely HDD and the other end-use is constant over the year (Fels, 1986).

In the next phase of statistical tests, another test (Pearson Correlation test) was run to check the relationship between the reductions in annual consumption and the 50-households' environmentally-conscious attitudes who completed the NEP Survey. Results of the test indicated that there is a correlation between occupants' environmentally-conscious attitudes and the difference in their energy consumption before and after applying the "Household Energy Use" survey, when the NAC was used as the energy consumption variable ($r = 0.297$; $p = 0.036$). As such, it is shown that when the score of environmentally-conscious attitude of households goes up, their energy consumption difference increases (their score of their energy consumption decreases).

However, no significant correlations could be found between occupants' attitudes and energy consumption when AEU was used as the energy consumption variable. This can be likely due to the fact that normalized energy consumption (NAC) is a more reliable measure of energy consumption because it is normalized based on the long-term annual HDD as explained previously. In present study, it could be asserted that there is a negative correlation between household's environmentally-conscious attitude level and energy consumption. So, in this regard, it can be concluded that as a result of the correlation test, our hypothesis is correct. This means that having high environmentally-conscious attitudes towards the energy consumption have positive effects on occupants' energy consumption level.

This finding is compatible to the results obtained by Maleki and Karimzade (2011) and thus in order to explain the relationship between attitude and behaviour, and their work could be of great help in this work. They conducted a study to find a possible correlation between energy consumption and environmental attitudes among the 383 citizens of Urmie, West Azarbaijan (cold climate). In their results, the correlation coefficient (R) between these two variables was 0.177 which is significant at $P= 0.001$. Their findings were also well-matched to the results obtained by Dunlap et al (2000), Salehi (2010).

In the next stage, the level of the 50-occupants' environmentally-conscious attitudes towards energy consumption were determined. From the total of 50 households being examined in this study, in terms of environmental culture of sample, results indicated that the majority of the

households (76%, N=38) who completed NEP survey held Mid-ecological views; 18% of the households (N=9) achieves an Pro-ecological score which is more likely to support actions that enhance the environment. While only 6% of the participants (N=3) achieved an Anti-ecological score on the NEP which is less likely to support actions that enhance the environment.

This result could reflect household's' attitude to environmental issues and as discussed the change in the behaviour will not happen by itself, unless environmental knowledge and pro-environmental attitude change. Also, it is important to clarify how the environmental behaviour of people can be influenced by the environmental knowledge and belief. Therefore, consumers' attitudes are considered as important determinants of household energy usages (Dull & Janky, 2011). The impact of the households' environmentally-conscious attitude on their energy consumption was examined. The difference between category one's (occupants with Pro-ecological attitudes) levels of energy consumption, and the other two groups (occupants with Mid-ecological attitudes and occupants with Anti-ecological attitudes) were examined using a "One-way ANOVA" test.

Results showed that there was a statistically significant difference at the $p<.05$ level between different three categories in terms of energy consumption (NAC) (Table 6).

In our sample, the average energy consumption in different NEP scale categories is varied. Distribution of energy consumption (energy behaviour) shows that those who had particularly higher environmental-conscious attitude, consumed less energy. For instance, according to the normalized data (NAC), the average energy consumption of the occupants with Pro-ecological attitudes (1,294 kWh/yr) was less than the occupants with Mid-ecological (1,686 kWh/yr) and Anti-ecological attitudes (3,169 kWh/yr). In order to analyze data more in detail, another test was applied which called Post hoc test in the analysis of Variance (ANOVA). Results showed that there was a statistically significant difference at the $p<.05$ level between different three categories in terms of energy consumption (NAC) and those households who allocated in Pro-ecological category consume less energy compared to the other groups. These results are well-matched to the results obtained by Dunlap et al. (2000), Salehi (2010) and Dull & Janky (2011).

Moreover, for the current set of analysis, "One-Way ANOVA" test is also performed in order to analyse the 15-item NEP aforementioned scale' results demographically (age, gender and nationality). After the results for the 15-item NEP scale were analyzed demographically, non-significant differences were observed by regions of origin, age and gender of the participants. These results were based on the significant value (p) which is greater than 0.05 (Gender, F= 2.314, p=0.135; Age, F= 1.143, p=0.342; Country of origin, F=1.47, p=0.209).

Lastly, to achieve the objective of this section, an "independent-samples t-test" was conducted to determine whether there is a significant difference between the attitudes and energy consumption of 24-households who completed both surveys and the 26-housholds who completed just one of them. The results show that there were no difference between energy consumption and attitudes of those occupants who participated in both surveys and those who did not. This result is the same as the previous section's result where it was found out that "Household Energy Use" survey does not affect the participation in the current survey (NEP Survey) and there is no bias from the previous experience.

5.   CONCLUSION

Nowadays, the environmental issues and challenges, particularly "energy consumption" behaviour has been the focus of attention for scholars in the fields of engineering, environment study, management and related areas. The change in people's behaviour towards energy consumption/naturalist dimensions can be considered as one of the ways to avoid the damage to the environment and destruction of nature.

To attain behavioural changes, at first, it requires a change in individual's attitude towards that issue. For this reason, achieving an understanding of human attitudes (e.g. environmental attitudes) and exploring individual cognition is essential (Maleki & Karimzadeh, 2011). It should be mentioned that the issue of energy is a priority and of high importance in this research because the statistical sample for this study are residents of the cold region of Canada where due to the climate and ecological conditions there is inevitably a high level of energy consumption. Therefore, knowing about household's energy consumption pattern and factors affecting it, have important and central roles in the energy use area.

This research attempted to gain an understanding of whether there is a relationship between occupant's household energy-conscious attitudes and energy consumption of 50 households in a high-rise MURB in Toronto. The main tool for measuring the occupants' household environmental consciousness was Dunlape's NEP scale which has been proved to be a valid measure of environmental concerns. Paper-based surveys also incorporated some general information of demographics (gender, age and country of origin).

Results indicated that total energy consumption in the studied MURB is linearly related to the outdoor temperature. The normalized annual energy consumption of the 136-households was within the range of 78-79 kWh/m^2 during 2011-2012 (before applying "Household Energy Use" survey), and 74-73 kWh/m^2 during 2012-2013 (after applying "Household Energy Use" survey). With respect to the main objective of the study, the analysis showed there was a statistically significant negative correlation between the 50-respondents' households environmental attitudes and their energy consumption. Also, it should be noted that this result was confirmed using both the Normalized Annual Consumption (NAC) and Actual Energy Use (AEU) as energy consumption variables. This finding is compatible to the results obtained by Maleki and Karimzade (2011) and thus in order to explain the relationship between attitude and behaviour. In their results, the correlation coefficient (R) between these two variables was 0.177 which is significant at P= 0.001. Their findings were also well-matched to the results obtained by Dunlap et al (2000), Salehi (2010).

Moreover, in order to analyze the data more in detail, another test was applied. Results showed that there was a statistically significant difference at the p<.05 level between the different three categories in terms of energy consumption and that those households who were allocated in the Pro-ecological category consume less energy compared to the other groups. The present study findings are consistent with results obtained by Dull and Janky (2011) which showed relationship between environmental attitudes and households' energy consumption.

This indicates that as occupants' attitude scores increased, their energy consumption decreased for each of the three periods. In turn, this result suggests that as the people's attitudes get more

positive towards the environment, their responsible energy consumption behaviour also increases. In essence, this means that having high environmentally-conscious attitudes towards the energy consumption has a positive effect on occupant's energy consumption level.

For future research on occupant's household energy use in another Toronto MURBs, some other factors must be taken into account when analyzing energy consumption behaviour. Therefore, if the purpose of a research is understand of the affecting factors on environmental behaviour, other factors besides environmental attitude (e.g. environmental knowledge/ literacy) must also be considered.

When analyzing the underlying causes for attitudes and behaviours, demographic factors such as gender, age, income, education and employment are regarded as important (Lovelock, 2010; Diamantopolous et al., 2003). The occupants' information collected throughout the present study, only obtained the occupant's general factors such as age, gender and country of origin. To improve and strengthen the validity of the results, the result for 15-item NEP scale needs to analyse demographically and in more detail. As a result, a survey of household's environmental attitude incorporates other elements such as occupants' education, income and employment is needed.

6.   ACKNOWLEDGEMENT

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8.   TABLE AND FIGURES

Table 1: The New Ecological Paradigm Scale under its revised version (Dunlap et al. 2000)

1. We are approaching the limit of the number of people the earth can support.
2. Humans have the right to modify the natural environment.
3. When humans interfere with nature it often produces disastrous consequences.

4. Human ingenuity will insure that we do NOT make the earth unlivable.
5. Humans are severely abusing the environment.
6. The earth has plenty of natural resources if we just learn how to develop them.
7. Plants and animals have as much right as humans to exist.
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.
9. Despite our special abilities humans are still subject to the laws of nature.
10. The so-called 'ecological crisis'facing humankind has been greatly exaggerated.
11. The earth is like a spaceship with very limited room and resources.
12. Humans were meant to rule over the rest of nature.
13. The balance of nature is very delicate and easily upset.
14. Humans will eventually learn enough about how nature works to be able to control it.
15. If things continue on their present course, we will soon experience a major ecological catastrophe.

Table 2: Five-point scale for statistical analysis

The scale consists of:	Points
Strongly agree	5
Agree	4
Neither agree nor disagree	3
Disagree	2
Strongly disagree	1

Table 3: Analysis of the 50-households energy consumption during different periods

	50-housholds Annual Energy Consumption (kWh/unit)		
	2011-2012	2012-2013	2011-2013
Normalized Annual	1,705	1,562	1,572

Consumption (NAC)			
Actual Energy Use (AEU)	1,748	1,619	1,683

Table 4: Distribution of the NEP survey results' variables

	Variables	Frequency	Percent
1	**Male**	**36**	**72**
	Female	14	28
2	18-30 years old	6	12
	31-45 years old	9	18
	46-60 years old	**22**	**44**
	Over 60 years old	13	26
3	Canada	13	26
	Europe	2	4
	South/Central America or Caribbean	6	12
	East Asia	1	2
	West Asia	1	2
	Africa (e.g. Ethiopia)	**26**	**52**
	Other	1	2
4	0-1 Year	3	6
	2-4 Years	9	18
	5-7 Years	7	14
	More than 7 Years	**31**	**62**
5	**1 person**	**41**	**82**
	2 Persons	9	18

*1) Gender 2) Age, 3) Nationality, 4) No. years he/she is living in the selected Toronto MURB 5) No. of people live in his/her household

Table 5: Correlation between occupants' annual energy consumption and their attitudes

| | Annual Consumption (kWh) vs. Environmentally-conscious Attitude | | | | | |
| | Normalized Annual Consumption (NAC) | | | Actual Energy Use (AEU) | | |
	2011-2012	2012-2013	2013-2014	2011-2012	2012-2013	2013-2014
Pearson Correlation(r)	-0.256	-0.36*	-0.391**	-0.34*	-0.26	-0.343*
Sig. (2-tailed) (p)	0.073	0.011*	0.005	0.015*	0.064	0.015

*Correlation is significant at 0.05 level (2-tailed)

Table 6: The difference between 15-item NEP scale and energy consumption (kWh)

| | Normalized   Annual Consumption(NAC) | | Actual Energy Use (AEU) | |
	NEP Different Categories	Std. Deviation	NEP Different Categories	Std. Deviation
2011-2012	F (2)= 3.68, p=0.033*	742	F(2)=3.1; p=0.46	605
2012-2013	F(2)= 3.001 p=0.059	788	F 2)= 3.09; p=0.055	459
2013-2014	F (2)= 3.68, p=0.033*	910	F(2)=4.31; p=0.019*	1023

*Correlation is significant at 0.05 level (2-tailed)

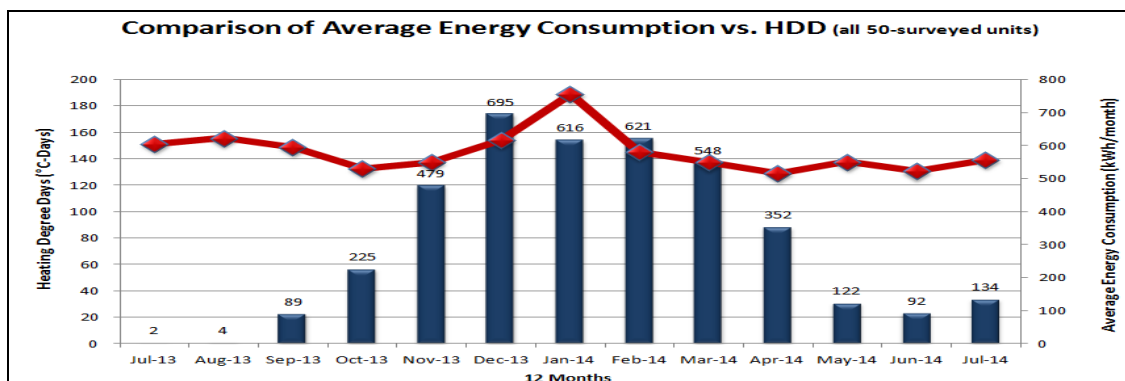**(F)=ratio value; (p) = Sig. value at NEP different levels**

Figure 1: Average energy consumption comparison vs. HDD (50-surveyed units)