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Electricity Consumption, Exchange-rebate Facility, and Banning of Imported Second-hand Refrigerators: Reviewing an On-going Process

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Abstract

Second-hand and old refrigerators are relatively not energy-efficient. They also use refrigerants such as chloroflourocarbons and hydroflourochlourocarbons. They therefore cause climate change and ozone-layer depletion. Among these and other reasons was the implementation of the Montreal protocol in 1987. The Multilateral Fund for the Implementation of the Montreal Protocol was therefore established to assist needy nations to facilitate the implementation of the protocol. Ghana therefore qualified for the fund and thereby in March 2013 introduced a rebate programme on refrigerators. Households were invited at will to submit old refrigerators for new ones at subsidized prices. As an on-going process, however, it appears the patronage of the facility is not encouraging. The purpose of the study being qualitative and quantitative was therefore to ascertain the response of the public to the exchange-rebate facility in relation to electricity cost and banning of second-hand refrigerators. Cape Coast Polytechnic in Ghana was used as a case study. One-hundred-and-twenty questionnaire were administered at a response rate of 95 percent. Interviews were also conducted among seven suppliers and retailers. Stratified and systematic random sampling methods were employed. SPSS Version 17 was used to analyze data. Cross-tabulations and chi-square tests were also utilized in analyzing the data. It was found that monthly electricity cost per household ranged between 8.00 ($2.49) and GH¢155.00 ($35.74). Only 11% of those using imported second-hand refrigerators had patronized the facility. It is recommended that CEPS and the Energy Commission should intensify their monitoring activities at harbors, national borders and retail shops that still sell imported second-hand refrigerators in the country.
Key words: climate change, energy-efficient, ozone-layer

1. Introduction

Chilling devices such as refrigerators use far less energy than older ones apart from having the advantage of using refrigerants that are ozone-friendly. Using energy-efficient refrigerators can therefore help reduce greenhouse gas emissions and its negative impacts on global climate. Such devices can prevent the impacts of global warming such as heat waves, flooding and the rise of sea levels (Hebden, 2006).

Presently, for example, energy efficient refrigerators use 40% less energy than 2001 conventional models. It was therefore realized in Europe that 20 billion KWh of electricity per annum could be saved annually if all ten-year-old appliances could be changed for new ones. Carbon dioxide ($CO_{2)}$ emissions could also be reduced by 18 billion kilograms. Seventeen billion KWh of electricity and 1.2×10^{10}kg of CO_2 savings per annum could be realized in the U.S. alone (Ecosavings, 2010).

Though there are several ways, by which energy can be saved (EESI, 2010) replacing old appliances is one of the reliable ways by which greenhouse gas emissions could be reduced and cost in energy consumption minimized (Mckinsey & Company 2009). Energy-efficient appliances are identified by many countries using energy-input labeling.

Refrigerators and freezer cabinets contain liquids generally referred to as refrigerant that easily liquefies and vaporizes to facilitate the chilling process. In the 19th century when the technology was introduced, ammonia was used as the refrigerant and continues to be used for large chilling plants due to its low boiling point characteristic. Unfortunately, ammonia is highly toxic and flammable particularly when in large amounts. For this reason better substitutes of refrigerants such as chlorofluorocarbons (CFCS) and hydroflourochlorocarbons (HCFCS), with advantages of being non-toxic, non-flammable and synthetic began to be used from the early parts of 1930s, particularly for domestic refrigerators and freezers (Dimas, 2007).

After 60 years of usage as refrigerants and other purposes including foam blowing, dry cleaning and aerosol propelling, it was realized that these chemicals have negative effect on the ozone layer. This brought about, among other reasons, the Montreal Protocol in 1987. The protocol was introduced on the 16th of September 1987 in Montreal Canada, coming into effect in 1st January 1989 having been signed by 46 nations. The protocol has been revised on eight occasions in London (1990), Nairobi (1991), Copenhagen (1992), Bangkok (1993), Vienna (1995), Montreal (1997), Beijing (1999) and Montreal (2007) (UNEP, 2008).

All ozone-depleting substances contain halogens, particularly chlorine and bromine which have adverse effects on the ozone layer. The Montreal protocol was therefore designed to phase out the production and eventual elimination of various groups of these halogenated hydrocarbons one after the other (USEPA, 1988).

Hydrochlourofluorocarbons are less active as compared to chlorofluorocarbons. The Executive Committee of the United Nations Environmental Programme (53/37 and Excom54/39) therefore decided the complete phasing-out period to commence from 1996 to 2030. However, the freeze on consumption and production was set at 2013. The period for commencing its reduction and production was 2015. Thus 2013/2015 became the time for reduction and freezing of HCFCS. This is because HCFCs have low ozone depletion potential (ODP) as compared with CFCs. Whereas the ODP of CFCs is between 0.6 and 1, HCFCS have ODP between 0.01 and 0.5. In spite of this advantage, there was the need to set up a fund to support nations that might find it difficult to cope with the rules and regulations in the protocol (UNEP, 2008).

The Multilateral Fund for the Implementation of the Montreal Protocol was therefore established to assist developing nations, who were signatories to the Protocol but with annual per capita consumption and production of ozone-depleting substances (ODS) lower than 0.3kg to enable them abide by the regulatory measures of the Protocol. By 29th December 2012, 197 countries including Ghana had ratified the agreement. Ghana therefore qualified to benefit from the fund as one of the 147 nations that met the criteria. Donors restock the fund every three years with US$2.1billion released between 1991 and 2005. The purpose of the fund was to finance royalty payments, patent rights on new technologies, train personnel, establish national ozone offices and conversion of existing manufacturing processes (Montreal Protocol, 2007). Introduction of new modern appliances such as freezers and refrigerators falls under the conversion of existing manufacturing process

As part of the Montreal Protocol and its associated fund, the Ghana Government was assisted by the United Nations Development Fund - Global Environment Facility (UNDP-GEF) with Ghana Energy Commission (GEC) as the primary partner in a project entitled “Promoting of Appliance Energy Efficiency and Transformation of the Refrigerating Appliances Market in Ghana”. The objective of the project was to enhance the energy efficiency of appliances sold and consumed in Ghana. Introducing innovative economic tools and regulatory tools such as Minimum Energy Performance Standards and Information Labels (S&L) was to help achieve these objectives. A Rebate Programme has therefore been employed to entice households to replace old but functioning refrigerators with new and efficient ones at subsidized prices. The pilot rebate project was therefore launched on September 18, 2012 in Accra. On May 17, 2013, a nationwide launch to rollout the Rebate Project was inaugurated in Accra by the Executive Secretary of the Energy Commission of Ghana (Energy Commission, 2013; The New Statesman, 2013). Since the project is to end in May, 2016 (a three-year project), it is high time it is assessed to know whether it is achieving success so that some remedial measures could be introduced before the period ends. Data and information from the assessment could also serve as a database for future continual or continuous rollout of the programme.

1.1 Objectives of the study

The main objective of the study was to investigate the progress of the nationwide rebate facility on refrigerators. However, the specific objectives were to:

1. Ascertain the average household cost of electricity of Ghanaians.

2. Investigate the patronage of Ghanaians towards the refrigerator rebate facility.

3. Determine the extent to which Ghanaians support banning importation of second-hand refrigerators as a way of discouraging its use.

1.2 Research questions

Based on the objectives of the study the following research questions were posed:

1. How much do Ghanaians pay on electricity consumption?

2. What is the proportion of Ghanaians who have patronized the refrigerator rebate facility?

3. To what extent do Ghanaians support the ban on importation of second-hand refrigerators?

1.3 Scope and significance of study

The study concentrated on public workers as a case study of Cape Coast Polytechnic in Ghana. It dwelt on consumption of electricity, the exchange-rebate facility and banning of importation of second-hand refrigerators. It sought to find out workers knowledge on household electricity consumption in relation to power consumption of second-hand refrigerators. It also sought to find out the extent to which family members know the electricity consumption of second-hand refrigerators.

On the exchange rebate facility, the study investigated workers knowledge on the facility and to what extent they may be willing to participate. Reasons for participation or non-participation were sought. The motivational factors behind the patronage of second-hand refrigerators and their long-term cost were also ascertained.

The study further ascertained the extent to which respondents support the government's policy of banning the importation of imported second-hand refrigerators and the effect on its patrons, repairers, retailers and importers. It is hoped that recommendations of the study will serve a good purpose to the Government of Ghana and all other stakeholders involved in the exchange rebate facility such as the Energy Commission of Ghana, Ministries in charge of Energy and Environment, and the UNDP which is in charge of the Global Environmental Facility (GEF), as far as the progress of the project is concerned.

2. Literature review

Literature on the study concentrated on energy-efficiency, ozone-layer depletion and global warming. Issues concerning the exchange- rebate programme were also dicussed.

2.1 Energy-efficiency

According to Diesendorf (2007) the goal of energy-efficiency is to lessen the quantity of energy needed to offer products and services. In order to reduce, if not eliminate losses, energy must be used productively by adopting better efficient technologies. For example, a building may be insulated to reduce energy expended in heating or cooling rooms in the building. A new refrigerator will also use significantly less energy compared to an older one. Research has shown that replacing old refrigerators with new efficient ones could reduce energy consumption by 60% in households and reduce greenhouse gases largely (Ecosavings, 2010; Mckinsey & Company 2009).

There are many reasons why energy efficiency must be encouraged. Firstly, in the long term, efficient use of energy reduces cost to the consumer. Thus adopting energy efficient technology has positive implications on financial cost to consumers (Dissendorf, 2007).

Secondly, efficient use of energy is an indirect means of reducing carbon dioxide emissions into the atmosphere. According to the International Energy Agency (IEA), by the year 2050, efficient use of energy in buildings, transportation and industrial processes could lessen global energy demands by one third and contribute significantly to reduction of world's greenhouse gas emissions (Hebden, 2006).

Thirdly, efficient use of energy could reduce financial costs on energy imports, which in turn reduce the rate of depletion of domestic energy resources thus ensuring national energy security. For example, by introducing new technology of refrigerators in Ghana imports on fossil fuel to power plants could be reduced. Energy saved in this regard will serve as surplus for future purposes (Prindle & Eldridge, 2007).

Fourthly, energy-efficiency has positive impact on the global economy. For example A report published by McKinsey Global Institute in 2006 declared that "there are sufficient economically viable opportunities for energy productivity improvements that could keep global energy-demand growth at less than 1% per annum," though the projected value was 2.2 % growth rate through 2020 if the current consumption rate, with its inefficient technologies continue" (Lohr, 2006). The Vienna Climate Change talks (2007) report under the sponsorship of the United Nations Framework Convention on Climate Change (UNFCCC) evidently indicates that emissions can be reduced at lower costs when energy efficiency techniques are globally adopted. Energy-efficient devices can also indirectly protect the ozone layer.

2.2 Ozone-layer depletion

The ozone layer, also referred to as ozone shield is a layer in the Earth's stratosphere. This region has high amounts of ozone (O_3) though the average concentration in the earth's atmosphere is 0.3ppm. It is found within 20 and 30 kilometers above sea level; the thickness varying according to season, altitude and latitude. About 98% of the sun's medium-frequency ultraviolet rays are absorbed by the ozone layer preventing the damage it might cause living organisms upon reaching the earth's surface. These radiations can be harmful to the skin causing sunburn, immune system depression, genetic damage, cataracts, skin cancer and premature skin aging (Dobson, 2005; Andino, 1999).

Free radical catalysts such as hydroxyl (OH), atomic chlorine (Cl) and atomic Bromine (Br) can deplete the ozone layer in the presence of sunlight. Though these radicals have natural sources, the anthropogenic sources have been of great concern. Organohalogen compounds such as cloroflourocarbons (CFC's) and bromoflourocarbons (BFCs), hydrochloroflourocarbons (HCFCs) and hydrobromoflourocarbons (HBFCs) used as refrigerants in refrigerators can therefore have negative impacts on the ozone layer. These compounds and consequent radicals are very stable and can therefore remain in the stratosphere for a long period of time. A radical ion can break down 100,000 ozone molecules once the reaction commences (EIA/EGGUS, 1996).

The use of energy efficient refrigerators with energy efficient components and refrigerants will thus go a long way to protect the ozone layer and the resulting harm that may be caused to living organisms. Though hydrohalogenated compounds can also cause ozone depletion, their contribution is minimal. Their usage has therefore been permitted for some time until 2030. Hydrofluorocarbons (HFC's) compounds have been designed to replace both HCFCs and CFCS. Hydrofluorocarbons used as refrigerants, have relatively no negative effect on the ozone layer (Montreal Protocol, 2007).

Free radical catalysts such as nitric oxide (NO) and nitrous oxide (N_2O) may also help deplete the ozone layer. Thermal power plants that use fossil fuels (coal, processed crude oil and natural gas) generate most global electricity. These fuels when combusted produce nitrogen oxides including nitrous (NO) and nitric oxides (N_2O). The more fuel is burnt, the higher these gases are generated and migrate into the earth's atmosphere. Inefficient and old refrigerators use more energy per unit work done thus consuming more energy than their new more energy- efficient ones. Thus replacing old and inefficient refrigerators directly reduces energy consumption of these devices and subsequently help reduce the rate at which the ozone layer could be depleted (EIA/EGGUS, (1996). Using energy efficient appliances can also positively influence the global warming phenomenon and its negative effects on global climate.

2.3 Global Warming

It has been observed since the 1970's that less energy leave the atmosphere than entering, with most of the energy being absorbed by the earth's oceans (Rhein, 2013). Within the region up to 700m in the oceans, 90% of energy increase has been stored in this regard by 1971 (IPCC, 2014). This observed century-scale increase in the average earth's temperature is referred to as global warming (IPCC, 2013). Since 1850, only one-third of the earth's surface temperature-increase occurred before 1980 (Riebeek, 2010; Jansen, Overpeck, Briffa, Duplessy, Joos, Masson-Delmotte, et al, 2007). Between 1980 and 2010 the remaining two-thirds has occurred (IPCC, 2013).

One of the major causes of global warming is emissions from fossil fuel combustion, such as CO_2 and other greenhouse gases. Since the mid-20th century, there has been enough evidence to show that it is extremely likely that human influence is the major cause of global warming (IPCC 2007). Hence reducing emissions by reducing

energy consumption could be one sure way of combating the effects of global warming. Using energy-efficient devices such as refrigerators could help achieve this purpose. The impacts of global warming could thus be reduced to the minimum desired levels.

Global warming impacts on climate change may differ from location to location. It could result in the following:

- Cause rise in sea levels,
- Changes in quantity and quality of localized precipitation,
- Changes in precipitation patterns,
- Reductions in sea ice, glaziers and permafrost,
- Heat waves and droughts,
- Heavy rainfall, ocean acidification,
- Extinction of biological species resulting from temperature regime shifts,
- Threat to food security due to decrease in crop production and loss of biological habitat because of flooding and inundation (USNRC, 2012; Battisti, David & Naylor, 2009).

Mitigating global warming by reducing emissions through energy efficiency adaptations therefore has profound benefits.

Between 1970 and 2000 greenhouse gas emission growth was 1.3% per annum and 2.2% per annum from 2000 to 2010 (IPCC, 2014). In order to reduce this trend the UNFCC signatories have agreed to reduce global warming to below 2.0^{o}C as compared to pre-industrial level (UNFCC, 2011). Adapting to energy-efficient refrigerators, globally in general and Ghana in particular could be a contributing factor to reducing the impacts of global warming. Ghana, being a party to the United Nations Framework Convention on Climate Change (UNFCC) with the ultimate responsibility to prevent human-induced climate change needed to adopt policies that are designed to reduce, if not prevent greenhouse gas emissions (UNFCCC, 2005; Gupta, et. al. 2007). An exchange-rebate programme on refrigerators is one way by which this objective could be achieved.

2.4 The exchange-rebate programme

The Government of Ghana in conjunction with UNDP-GEF under The Ghana Refrigerating Appliance Rebate Programme has been inviting individuals in Ghana, since March 2013, to replace old but functional refrigerators by purchasing new and efficient ones. A rebate is offered to those who relinquish old but functional refrigerators. The main objective was to enhance the use of energy-efficiency refrigerators sold in Ghana.

The UNDP-GEF is therefore assisting the Government of Ghana with Ghana Energy Commission as the primary agent in facilitating the programme. The functions of the Commission are as follows:

- To make recommendations on policies that will develop indigenous energy resources,
- Encourage efficient, safe and good use of energy,
- Make provision for legal, regulatory and supervisory structures through licensing, prescription of legislative instruments, inspection, monitoring and rule observance
- To create national plans that safeguard periodic adequate energy demands through judicious accountability, evaluation, land briefing, establishing detailed records that will ensure national energy development and utilization and

- Advance competitive energy market by ensuring performance standardization (Energy Commission, 2013)

The Ghana Energy Commission introduced the Minimum Energy Performance standards and Information labels with legal backing from Energy Efficiency Standards and Labelling Regulations, 2005 (LI 1932), as well as the Energy Efficiency Standards and Labelling (Household Refrigerating Appliances); Regulations 2009, (LI 1958). These legislative instruments were introduced against the backdrop that there have been power output deficits since 1984 with increasing domestic electricity demand. Wastage in electric power supply system, imprudent use of electricity by consumers and inexistent standards and labeling system also called for these legislative instruments (Energy Commission, 2013).

The aims of the instruments were to encourage consumers to patronize energy-efficient devices, to discourage people from dumping second-hand products in the country, reducing electricity cost among Ghanaian consumers and hunt down inefficient refrigerators. It was expected that the introduction of the rebate system will improve energy-efficiency, reducing the need for new power projects and saving about $72m per annum. This surplus could be channeled into some other needed projects. In a bid to achieve its mandate concerning the project, a labeling system was introduced. Information on refrigerator type and model, manufacturer's name, trade mark, estimated annual power consumption, energy-efficiency star rating, type of refrigerant and climatic region were introduced on product package. It is required that stars on labels are printed in black, label wording should be in English, colored and on waterproof material; and labels visibly attached on refrigerator doors and packages. It is to be noted that, the climatic class is expected to be tropical or sub tropical. The lower the annual energy consumption, the fewer consumers pays for electricity and the more efficient ozone-friendly the refrigerator is; thus, five- star refrigerators were the most efficient (Energy Commission, 2013).

As a secondary partner to the project, the Customs, Excise and Preventive Service of Ghana (CEPS) was expected to prevent entry of second-hand and inefficient refrigerators into the country. It was also expected to make sure that such importers are notified, to properly label products, within 48 hours. Such importers were required to do so within 28 days, after which the product should be exported out of the country if notice is not complied (Energy Commission, 2013).

Non-compliance to the regulation attracts penalty. Offenders could be fined not exceeding two hundred and fifty (250) penalty units, or a term of imprisonment not exceeding 24 months or both. Those who condoned and connived with importers were also guilty of the law (Energy Commission, 2013).

The Ghana Refrigerating Appliance Rebate Programme offers rebates GH¢200 and GH¢300 when an energy efficient label refrigerator is purchased (Antwi-Adjei & Nyarko, 2014), (Refrigerators include deep freezers). Rebates are given to only those who own up their old and inefficient refrigerators. Averagely shifting to energy efficient refrigerators can contribute to annual national savings of GH¢432 (Energy Commission, 2013).

To be able to qualify for the rebate facility an individual must be a Ghanaian using domestic electricity. He must have either a voter ID, National ID or a passport and be willing to complete a form that contains details of where one resides so that refrigerator could be examined later. The refrigerator should be used but functional. The household must also be willing to hand over the old refrigerator. When an old functional refrigerator is sent to the retail outlet it is tested and when found functional allowed selecting the desired refrigerator. Price difference is then paid after giving a discount souvenir coupon (Energy Commission, 2013).

The refrigerator only needs to be old but not necessarily imported second-hand (Antwi-Adjei & Nyarko, 2014). From the Energy Commission (2013) rebate vouchers are granted on first-come and first-served basis. It is limited to one refrigerator to each individual. Ecobank Ghana Limited, as a member of the Ecobank Transnational Incorporated (ETI) with 78 branches in eight regions in the country, controls the rebate financing. It is also expected to give loans to individuals who cannot afford to purchase new and efficient refrigerators after granted the rebate discount. The Government of Ghana is allocating GH¢1m annually for the three year period, beginning from March 2013 subject to annual rebate applications from individuals. Rebate amounts are GH¢200 for 2-star and GH¢300 for 3-, 4- and 5-star refrigerators (Antwi-Adjei & Nyarko, 2014).

Retailers were supposed to have had a minimum of 3 years proven experience in refgrigerator dealership in Ghana. Personnel should have a good appreciation of the star label philosophy. They should ensure that all refrigerators are 100% compliant to Energy Efficiency Standards (LI 1958) and ISO 9000 Certification.

Participating retailers include Somovision, Appliance Masters, Melcom, ROWI and Coolworld (Energy Commission, 2013).

3. Research Methodology

This work was initiated as a case study in Cape Coast Polytechnic. The polytechnic has a population of 102 teaching and 235 non-teaching staff (Cape Coast Polytechnic, 2014) categorized into senior members, senior staff, junior staff and laborers. Thirty participants from each category of staff were selected to take part in the study making a total of 120. However, 114 staff responded to the questionnaire at a response rate of 95 percent.

A questionnaire of both open and closed-ended questions was used to gather information. Quantitative and qualitative data were solicited. Interviews were also conducted. Stratified and systematic random sampling methods were employed to sample the target population after the sample size and sampling frame were determined. Statistical Package for the Social Sciences (SPSS) version 17 was used to analyze the data. Demographic data such as age, educational background, staff status, highest educational attainment, place of abode and gender were analyzed in relation to electricity consumption, involvement in rebate facility and banning of second-hand imported refrigerators. Seven key informants in the second-hand refrigerator import and retail business were interviewed using the unstructured interview mechanism. Tables, frequencies and percentages were used to display data. Cross-tabulations and chi-square tests were employed in analyzing the data. Significance level was 0.05 in all cases for the chi-square analysis.

4. Results and discussion

This section presents demographic characteristics of the respondents. It also discusses the results pertaining to the study.

4.1 Demographic characteristics

Age distribution of respondents ranged from 23 to 56 years. About thirty-seven percent were between 31 and 40 years while 31.3 percent were between 41 and 50 years (table 1). Thus, about 70 percent of the respondents constitute the most productive, having worked between 10 and 30 years. The sample units could thus be described as capable of purchasing at least one refrigerator for domestic usage (table 1).

Table 1: Age distribution of respondents

Age (years)	Frequency	Percent
Less than 30	22	19.6
31-40	41	36.6
41-50	35	31.3
More than 50	14	12.5
Total	114	100.00

Distribution by sex showed that about 78 percent of respondents were male; the remainder being female could be attributed to the reason that more men than women are employed in the institution. The sampling methods employed could therefore be considered as reliable (refer table 2). This distribution however is encouraging since in the family settings purchasing a refrigerator is a preoccupation of the male gender. This is because female incomes, as compared to female counterparts appear to be lower in domestic settings. For same reason it is also the responsibility of men in domestic households to pay electricity charges. The Ghanaian culture also demands that such domestic responsibilities are borne by males in their domestic environments.

Table 2: Gender distribution of respondents

Gender	Frequency	Percent
Female	25	22.3
Male	87	77.7
Total	114	100.00

Distribution of place of residence covered 34 suburbs. Residential areas include urban peri-urban and rural communities. Popular among locations are Abubonko, Jukwa, Elmina, and Anyeiku. Others are Cape Coast Polytechnic Campus, Greenhill and Asokyaano. About 25 percent forming the majority resides in Abura and Akotokyir. The target population was therefore a good representation for the study in this regard.

In terms of occupation, the sample included various categories of employees ranging from labourers to senior members. Participants include accounts officers, lecturers, administrative assistants, heads of departments, service persons, security officers and engineers, typists, and labourers. The sample therefore cut across as many as possible category of workers in the polytechnic community. In terms of valid percentage returns, 27.3 percent, 21.8 percent, 24.5 percent and 26.4 percent of senior members, senior staff, junior staff and laborers respectively took part in the study.

The distribution of highest educational attainment were basic education 34.2 percent, SSS/ 'O'/ 'A'/Vocational education 13.5 percent and tertiary qualifications 52.3 percent (refer table 3). This could be that the institution is a tertiary organization and therefore higher level of educational background is expected from employees. No illiterate took part in the study. It is therefore assumed that respondents have some basic knowledge in the questions posed in the questionnaire and therefore could give more reliable responses.

Table 3: Highest educational attainment

Qualification	Frequency	Percent
Basic education	38	34.2
SSS/SHS/'O'/'A' level/ Vocational/Technical	15	13.5
Tertiary	58	52.3
Total	114	100.00

Over 94 percent of respondents use refrigerators in their homes. While 17.5 percent had used refrigerators for less than five years, 37.7 percent and 40.4 percent had used refrigerators from 6 to 10 and more than 10 years respectively. Out of this distribution, about 47 percent are imported second-hand while 53.5 percent of the respondents use brand new refrigerators (table 4).

Table 4: Status of refrigerator

Type	Frequency	Percent
Imported second-hand	53	46.5
Brand new	61	53.5
Total	114	100

The study also showed that 68.8 percent of the respondents had on one occasion or another sent their refrigerators for repairs. The study further showed that about 81 percent of those with imported second hand refrigerators had sent their refrigerators for repairs on one occasion or another; 18.8 percent had not. Conversely, 59.3 percent of those with new refrigerators had never sent their refrigerator for repairs while about 41 percent had. In addition to this the study revealed that those with imported second hand refrigerators have between 1 and 4 times sent their refrigerator for repairs than those with new ones. It therefore appears that imported second hand refrigerators are frequently sent for repairs than new ones. Chi square analysis however gave a minimum expected count of 0.45. Thus no association could be established between the two variables.

It is therefore illogical, to say that, imported second hand refrigerators are repaired more often than brand new ones since ageing, power cuts, location (distribution) and brand are contributing factors. An aged brand new refrigerator may have functional problems than an imported second-hand one. For example, a four-year imported second-hand refrigerator may be functionally better than a fifteen-year old brand new one of the same brand, location and electricity distribution. Similarly, in a location where electricity supply is erratic refrigerator performance could be negatively affected due to fluctuating power.

Particular geographic locations having erratic power supply could also negatively affect refrigerator performance without regard to whether it is brand new or imported second-hand. Thus using energy efficient appliances alone might not be a panacea for reducing electrical energy consumption, reduction of carbon dioxide emissions, reduction of financial cost on energy imports and an assurance of a positive impact on the global economy. A poor refrigerator brand might break down earlier than a good brand. Thus replacing old fridges with new ones might not necessarily be one surest way to reduce cost by 40% as indicated by Mckinsey and Company (2009) in the long term. These factors must therefore be addressed in tandem.

More than 22 percent of the respondents were uncertain to the assertion that changing old refrigerators could save about 40% of household electricity cost. While 21.1 percent strongly disagreed or disagreed, 56.1 percent agreed or strongly agreed. Sixty eight percent of the respondents also agreed or strongly agreed that replacing old refrigerators with new ones could reduce cost of electricity consumption, 19.3 percent strongly disagreed or disagreed while 21.1 percent were uncertain (table 5). The educational background of majority of the respondents could be the reason for this distribution since about 65.8 percent were above basic education.

Table 5: Knowledge on saving 40% cost using new refrigerators

Response	Frequency	Percent
Strongly disagree	10	8.8
Disagree	14	12.3
Uncertain	26	22.8
Agree	43	37.7
Strongly agree	21	18.4
Total	114	100.0

Average cost of electricity in households ranged between GH¢8.00 ($2.49) and GH¢155.00 ($35.74) per month ($1= GH¢3.218). The mean, median and modal cost were GH¢38.596, GH¢30 and GH¢40 per month respectively. About 49 percent of the households pay up to GH¢30; 34.2 percent pay between GH¢31 and GH¢60; 9.6 percent between GH¢61 and GH¢90; and 7 percent more than GH¢91. The first and third quartiles were GH¢19.5 and GH¢45 respectively. Thus 50 percent of the households pay between GH¢19.5 and GH¢45 as monthly electricity cost, while 75 percent pay between GH¢8 and GH¢45. According to Mckinsey and Company (2009), replacing old refrigerators with energy efficient ones could thereby reduce monthly household electricity cost by between GH¢3.2 and GH¢46 reducing the mean, median, and modal cost to GH¢15.44, GH¢12 and GH¢16 respectively. In a country where daily minimum wage is GH¢6 (Essel, 2014) this amount could be substantial to many households.

Seventy-one percent of the respondents were of the view that second-hand refrigerators were less expensive in the short term than brand new types of the same characteristics. About 80.1 percent thought that, in the long term, they are more expensive though 64.4 percent did not know the power consumption of their refrigerators in kilowatt/hour (KW/h). Over 68 percent of the respondents' families also had no idea that brand new refrigerators could save up to 40 percent of domestic electricity cost (table 6). Similarly sixty-two percent of respondents' families did not know that replacing old refrigerators with new ones could save the cost of refrigerating in households by half.

Table 6: Family members' knowledge on saving 40% cost using new refrigerators

Response	Frequency	Percent
Strongly disagree	8	7
Disagree	14	12.3
Uncertain	30	26.3
Agree	48	42.1
Strongly agree	14	12.3
Total	114	100.0

It is therefore agreeable that over 85.3 percent of the respondents respondents were ready to replace old refrigerators at a subsidized cost. Only 14.4 percent disagreed (table 7). Thus majority of the respondents supported the Exchange-Rebate Programme.

Table 7: Willingness to patronize rebate facility

Response	Frequency	Percent
Yes	95	85.6
No	16	14.4
Total	114	100.0

Reasons for respondents supporting the exchange rebate facility include the following of new refrigerators:

- Durability
- Less consumption of electricity
- Long term benefits
- Saving electrical energy
- Avoiding repair and maintenance hassles
- High efficiency and performance
- Low cost resulting from rebate facility
- Peace of mind
- Trust in performance
- Better appearance

For those who would not change their old second-hand refrigerators for new ones, low subsidy and ignorance of where to benefit from the facility were the reasons. It appears between GH¢200 and GH¢300 subsidy is not appealing and attractive enough to those who would not be interested in the facility. For a refrigerator of GH¢1000, only 20% rebate is thus granted. Respondents were therefore of the view that increasing this amount could go a long way to attract other users. It also appears the publicity of the facility is neither extensive nor attractive enough to entice many second-hand users. Some of the respondents also thought that more could be done to this effect. It is for these reasons that only 11 percent of those using imported second-hand refrigerators had participated in the facility. Other factors are that only refrigerators bought within the rebate period qualify to be exchanged (as at the time of collecting data). This could be one of the major drawbacks in participating in the project though majority (95 percent) of those who had not taken part in the facility was also not aware of this criterion. This is also an added indication that the publicity of the programme has not permeated enough into the public domain. Others also thought that the facility is fictitious and therefore do not believe it exists in reality. In addition, brands are restricted and that participants may not get their choice of brand.

The study revealed that 49.1 percent of respondents supported the policy of banning the importation of second-hand refrigerators. About 33.6 percent strongly disagreed or disagreed while 17. 3 percent were undecided (refer table 8). Those who did not support banning imported second-hand refrigerators were of the opinion that they are durable and meet the pocket of the ordinary Ghanaian who constitutes the majority of the population. They were also of the view that banning the importation of second-hand fridges will cause unemployment; bring economic hardship to suppliers and buyers. They were of the further view that this will encourage black market dealership with resulting rise in prices.

Table 8: Support for banning importation of second-hand refrigerators

Response	Frequency	Percent
Strongly disagree	22	20
Disagree	15	13.6
Uncertain	19	17.3
Agree	29	26.4
Strongly agree	25	22.7
total	110	100.0

The long term effects of banning the product are however more beneficial. It will cause financial savings to individual and household users. Importers could switch to other products that have no direct or indirect effect on the ozone layer, and the earth's atmospheric (global warming) temperature (USNRC, 2012; Battisti, David & Naylor, 2009). Black market dealership with its consequential increase in the product price will discourage people from patronizing the product.

It appears that majority of the public do not see that banning the importation of second-hand fridges is still in place and that the law supporting it is not being enforced. They are ignorant of the fact that people are still being prosecuted of the offence. This is because over one and a half years after the implementation of the policy, second hand refrigerators are still sold in the open. Key informants in the study revealed that people are still importing these refrigerators though they admitted that the rate has reduced for fear of seizure and prosecution.

4.2 Cross- tabulation analyses

This section deals with cross tabulation analysis and related association tests of some of the measured variables. Firstly, the variable of those who had heard of the exchange rebate of imported second-hand refrigerators was associated with those who would exchange their imported second-hand refrigerators for brand-new ones at a subsidized cost (those who would want to partake in the rebate facility). For those who had heard of the facility, 85.2 percent would take part while 14.8% would not. It appears most of those who have heard would be willing to take part. However, chi-square analysis yielded a minimum expected count of 3.32 and 25 percent expected count less than 5. No relationship could therefore be established between the two variables.

About 48 percent of those who had heard of the rebate facility had exchanged their refrigerators while 59.3 (majority) had not. All the respondents who had not heard of the facility had not changed their refrigerators. However, chi-square analysis using Yates' correction for continuity gave a significant result. Thus, the proportion of those who had heard of the facility is significantly different from those who had changed their imported second-hand refrigerators. This implies that advertisements and publicity have not gone down well with the public or not convincing enough.

A cross tabulation analysis revealed that 80 percent of those using imported second-hand refrigerators would take part in the rebate programme while the remaining 20 percent would not. For those using new refrigerators 90 percent would do so if they were using imported second-hand ones while 10 percent would not. On the average, 85.5 percent were ready to participate in the programme while 14.5 percent would not. Chi-square analysis gave asymptotic significance of 0.226, indicating that the proportion of those using imported second hand refrigerators is not significantly different from the proportion of those who would not want to participate in the programme. This implies that those with imported second hand ones are not significantly different from those who would not want to take part in the facility. The study also showed that the desire to participate is 6 times as not to do so. For those owning imported second-hand refrigerators the rate is 4 times while it is 9 times for those owning new refrigerators.

The study indicated that only 11.1 percent of those using imported second-hand refrigerators had changed them for new ones. For those using new ones, majority 57.6 percent had changed them (but not from the rebate facility); explaining that though they had not taken part in the rebate facility, they had on one occasion or the other purchased a brand new one earlier on. This bracket may belong to the aged and/or middle and higher income earner bracket who have the wherewithal to do so. Chi-square analysis using the continuity correction asymptotic significance of 0.000 found the association between the two variables significantly differently. The proportion of respondents using imported second-hand refrigerators is therefore significantly different from those who had changed their refrigerators, though some had not benefited from the rebate facility. Majority of the respondents, 57.6 percent of those using new ones, supported the use of new refrigerators instead of patronizing used ones.

Table 9 shows the cross tabulation of monthly household electricity cost and those who had changed their old refrigerators. Chi-square analysis gave an indeterminate difference between the proportions of the variables. From the table, 77.3 percent of those who strongly disagreed to banning second-hand fridges were males, 93.3 percent of those who disagreed were male, 72.2 percent males were uncertain, 67.9 percent males agreed to the assertion while 80 percent males strongly agreed.

From the table it appears more males support the policy of banning second-hand refrigerator importation than females. This study appears to support the fact that men could afford patronizing brand new refrigerators than

their female counterparts. This in turn could be attributed to more male in the study belonging to the middle- and high-income earner bracket than female. They therefore have the financial capacity to patronize the rather more expensive new refrigerators than the females. However, the chi-square analysis could not establish any relationship between the two variables.

Table 9: Monthly household bills vrs patronize rebate facility

Response ()	Yes (%)	No (%)	Total
Very low (<GH¢20)	11.8	88.2	100
Low (GH¢21- GH¢30)	46.4	53.6	100
Average (GH¢31- GH¢60)	50.0	50.0	100
High (GH¢61- GH¢90)	20.0	80.0	100
Very high (>GH¢91)	100.0	0.0	100
Total	31.6	68.4	100

The table below (refer table 10) is a cross tabulation of the extent of agreement of importation of banned second-hand refrigerators and cost of electricity. Chi-square analysis gave the minimum expected count of 1.81. No relationship could therefore be established between the two variables.

Table 10: Monthly bills vrs support for banning second hand refrigerators

Response	Very low (%)	Low (%	Average (%)	High(%)	Very high(%)	Total
Strongly Disagree	55.0	45	0.0	0.0	0.0	100
Disagree	38.5	53.8	0.0	7.7	0.0	100
Uncertain	57.9	31.6	5.3	5.3	0.0	100
Agree	25.0	53.6	10.7	3.3	7.1	100
Strongly Agree	44.0	16.0	12.0	16.0	12.0	100
Total	42.0	39.0	6.7	6.7	4.8	100

From table 11, 77.7 percent of those who strongly disagreed to banning second-hand refrigerator were males; 93.3 percent of those who disagreed were males; 72.2 percent males were uncertain; 67.9 males agreed to the assertion while 80 percent males strongly agreed. It therefore appears more males support the policy of banning second hand refrigerators than females. Thus, the study appears to support that men could afford to patronize new refrigerators than their female counterparts. This in turn could be attributed to the fact that more males belong to the middle- and high-income earner bracket than the females. They therefore have the financial capacity to patronize the rather more expensive new refrigerators than the female counterparts.

Table 11: Support for banning importation of second- hand fridges and gender

Response	Male (%)	Female (%)	Total (%)
Strongly disagree	77.3	22.7	100
Disagree	93.3	6.7	100
Uncertain	72.2	27.8	100
Agree	67.9	32.1	100
Strongly agree	80.0	20.0	100
Total	76.9	23.1	100

Table 12 shows cross tabulation between the extent to which respondents support banning of second-hand refrigerators and the status of refrigerator in their households. A minimum expected count of 6.81 and a likelihood ratio of 0.000 shows there is a significant difference between the proportions of those who support the ban and those who use imported second-hand refrigerators. Thus, those who use second-hand refrigerators do not support the banning of imported second- hand refrigerators.

Table 12: Support for banning of imported second-hand refrigerators and status of refrigerator

Response	Status of refrigerator		
	Imported Second-hand Ref.(%)	New Ref.(%)	Total (%)
Strongly disagree	95.0	5.0	100
Disagree	60.0	40.0	100
Uncertain	47.0	52.0	100
Agree	31.0	69.0	100
Strongly agree	12.0	88.0	100
Total	45.4	54.6	100

Patronage to the rebate programme can be considered as low considering that only 11.1 percent of those using imported second-hand refrigerator had participated. The aims of encouraging consumers to patronize new and efficient refrigerators appear not be achieved. Though importation of the used ones has reduced, people are still dumping the products into the Ghanaian market. The consequential effects of reducing electricity cost are therefore not being achieved in its entirety, and finally the hunting down of these refrigerators appears to be on a sluggish path. The annual target of $72 savings to fund new products (Energy efficiency regulations, 2008), if care is not taken, would therefore be difficult to be achieved.

It appears CEPS is not pursuing its monitoring effect with the seriousness it deserves. This is because people are still dumping second-hand refrigerators in the market and retailers are selling the products in the open. The advertising of the facility also appear to have been started too late. Many people heard of the project about 12 months after its implementation. Only the savings in electricity cost was highlighted in the advertisement. The other advantages of using new and efficient refrigerators such as reducing ozone layer depletion, global warming and climate change were not publicized in the advertisements.

The nations release of radical catalysts such as OH, Cl. Br and organo-halogen compounds including CFC, BFC's, and HBFC's into the atmosphere and its consequential contribution to the destruction of the ozone layer (NOAA, 2009) must be of concern. The reduction in free catalysts such as chlorine, bromine and hydroxyl atoms, when new and energy efficient refrigerators are used, when communicated to the Ghanaian public, could go a long way to reduce the negative effects of ozone layer depletion (NASA Facts Archive). The role of the energy commission and other stakeholders, such as Ministries in charge of Energy and Environment appear not to be encouraging enough. The positive effect of reduction in global warming and climate change may take relatively too long a time to achieve looking at the rate at which people are shifting to the use of new and efficient systems.

Results of the study show that reduction in savings of electricity by using energy saving refrigerators (McKinsey and Company, 2009) appears to be of no concern to many Ghanaians. Hence, the nation may not achieve its targeted savings of $72 million per annum. It would also be a mirage to manage projects with such savings. The response by respondents indicate that the nation's reduction of carbon dioxide emissions into the atmosphere also appear not to be in good hopes. As a nation, the reduction in financial costs on energy imports, which could positively help improve national energy security (Twin Pillars on Sustainable Energy) therefore, seems to also be in danger. Savings up to GH¢ 200 per annum (Energy Commission, 2013) per household might also not be obtained. Many reasons can be attributed to low patronage of the programme

Firstly, the use of voter ID and passport as a qualification to benefit from the rebate facility (Energy Commission, 2013) appear to be tedious. Knowing a participants house number and residence through his/her mobile phone SMS address could be a simpler and easier means of later examination of an exchanged refrigerator. This could motivate and encourage more people to participate in the programme by reducing time spent during the process of exchange.

Secondly, over 95 percent of Ghanaians do not know about the loan component of the programme (Energy Commission, 2013). Though this could be one of the most attractive aspects of the programme, implementers seem to have shielded it in the advertisements and publicity campaigns.

Thirdly, retailers are limited to only a few relatively large-scale supermarkets in regional capitals. It is probable that many of these second-hand refrigerators might be in district capitals and rural areas. Bringing the rebate facility close to the doorsteps of every Ghanaian will increase the participation rate. They might more likely

patronize than their counterparts in the urban areas since rural dwellers are relatively poorer than their urban counterparts (GLSS, 2014).

If care is not taken the national contribution to global energy savings (Lohr, 2006) might not be achieved. As a signatory to the United Nations Framework Convention on Climate Change (UNFCC), taking this programme more serious now and the future, could help reduce global greenhouse emissions from 2.2 percent per annum (IPCC, 2014) to below 2.0% in relation to pre-industrial levels (UNFCC, 2011).

5. Conclusion

Majority of the respondents (94%) have refrigerators in their home; 68.8% having sent refrigerators for repairs on one occasion or another. Electricity cost ranged from ¢8.00 to ¢155.00 per month.

Majority (83.3%) of respondents also supports the exchange-rebate facility with reasons such as high efficiency and performance, better appearance, electrical energy savings, avoiding repair and maintenance, durability and savings in electricity cost among others of new refrigerators. For those who would not patronize the facility low subsidy, ignorance and low publicity were the major reasons.

Majority of respondents (49.1%) supported banning importation of second-hand refrigerators. Those who did not support were of the opinion that they are durable and less expensive than the new and efficient ones. They were also of the view that banning these refrigerators will cause unemployment and economic hardships unto importers, suppliers, retailers and buyers. It will also encourage black-marketeering. In spite of the implementation of ban on importation of these products, they are still sold on the open market. Implementers of the programme appear to have lapsed in their monitoring activities.

The proportion of respondents (54.3%) who had heard of the facility had not patronized it. Majority of the respondents (80%) would take part in the facility when encouraged while the proportion of those with imported second-hand refrigerators is not significantly different from those who would exchange them for energy efficient ones. However, only 11% of those using imported secondhand ones had patronized the facility.

In terms of banning importation of second-hand refrigerators, those who use them do not support the banning policy. These refrigerators still find their way into the Ghanaian market and sold in the open almost one and a half years after the implementation process.

6. Recommendations

The campaign to entice and encourage people to shift to new and energy-efficient refrigerators must be intensified on radio, television and in newspapers. Drama in local languages should be added to the campaign process; on radio and television, local languages must be employed in addition to the English language. Seminars and workshops should also be organized to train as many as possible people of the literate class. This group will then help disseminate the facility and its positive implications across the wider public divide.

Various advantages in the use of new and energy-efficient refrigerators must be added in the advertising process. For example, the destruction of the ozone layer and its consequential effects such as skin cancer should be explained. Global warming and climate change effects such as flooding, coastal area inundation, powerful storms, loss of ecosystems and biological species should be explained in various advertisements for people to understand the other negative effects of using imported second-hand fridges.

It might be more advantageous if more retailers are added to the existing ‘big’ stores to participate in the retailing process. These ‘big’ stores are found only in big towns and cities. The rural dweller may find it difficult to send her/his refrigerator to these stores to be exchanged. People must be assured of the reality of the process; that it is neither fictitious nor camouflage. The subsidy could be increased from ¢200 and ¢300 to ¢300 and ¢450 to attract more people to patronize the facility. Though this may cost the facilitators, it is hoped that the benefits may far outweigh the costs in the long term.

CEPS and the Energy Commission should intensity their monitoring activities at the harbor and retail shops that still sell imported second-hand refrigerators. They should publicize actions taken against culprits to serve as

deterrent to those who might engage in this illicit act. Those who condone and connive should be dealt with according to law and this must be made known to the public as much as possible.

References

Andino, J. M. (1999). Chlorofluorocarbons (CFCs) are Heavier than Air, so How do Scientists Suppose That These Chemicals Reach the Altitude of the Ozone Layer to Adversely Affect it? *Scientific American*. http://www.scientificamerican.com/article/chlorofluorocarbons-cfcs/ 10/12/14.

Antwi-Adjei, E. and Nyarko, K. (2014) Refrigerating Appliance and Energy-efficiency Project. A Seminar Presented at the Conference Room of Dr. John Kofi Borsah Library Complex, Cape Coast Polytechnic, Cape Coast, Ghana.

Battisti, D. S. and Naylor, R. L. (2009) Historical Warnings of Future Food Insecurity with Unprecedented Seasonal Heat. *Science* 323 (5911): 240-4 doi:10.1126/science.1164363.PMID19131626. 09/09/14.

Cape Coast Polytechnic (2014) *Planning Office: Cape Coast Polytechnic*, Cape Coast, Ghana.

Diesendorf, M. (2007) *Greenhouse Solutions with Sustainable Energy*. UNSW Press, p.86.

Dimas S. (2007) *All liquids as Well as Gases must be Recycled from Fridges, says EU Commissioner.* Materials Recycling Week. http:/www.wastebook.org/refrig.htm. 09/09/14.

Dobson, R. (2005). Ozone Depletion will Bring Big Rise in Number of Cataracts. *BMJ* 331 (7528): 1292–1295. doi:10.1136/bmj.331.7528.1292-d. PMC 1298891. 10/12/14.

Ecosavings, (2010) *Ecosavings*. http://www.Electrolux.com. 09/09/14.

EESI (2010). *Energy-Efficient Buildings: Whole Building Design to Reduce Energy Consumption in Homes and Offices.* Environmental and Energy Study Institute (EESI). http://www.eesi.org/articles/view/energyenergy-efficient-buildings-whole-building-design-to-reduce-energy-consumption- in-homes-and-offices. 10/12/14.

EIA/EGGUS (1996) *Halocarbons and Other Gases.* Energy Information Administration/Emissions of Greenhouse Gases in the United States (EIA/EGGUS). http://en.wikipedia.org/wiki/Ozone_layer. 10/12/14.

Energy Commission (2013) *Rebate Programme*. http://www.enquiry@energyguid.org.gh. 09/09/14.

Essel, I. (2014 May, 2nd) Govt, Organized Labour Agree on 10% COLA; GHc6 Minimum Wage, http://www.myjoyonline.com. 10/12/14.

GLSS (2014) Ghana Living Standards Survey, 2014.

Gupta, S. Henningsen, J, A. and Wallace, M. J. et. al. (2007) Percutaneous Biopsy of Head and Neck Lesions with CT Guidance: Various Approaches and Relevant Anatomic and Technical Considerations, *Radiographics,* 27:371-390.

Hebden, S. (2006) *Invest in Clean Technology says IEA Report*. http://www.Scider.net. 09/09/14.

IPCC (2013) *Climate Change, Warming of the Climate System is Unequivocal. The Physical Science Basis – Summary for Policymakers, Observed Changes in the Climate System.* P2. In IPCC AR5 WG1.

IPCC (2014) *Climate Change, Mitigation of Climate Change - Summary for Policymakers, Trends in Stocks and Flows of Greenhouse Gases and their Drivers.* P6. In IPCC AR5 WG3.

IPCC (2007) *Climate Change Synthetic Report - Treatment of Uncertainty*. P2. In IPCC AR4 WG4.

Jansen, E., Overpeck, J., Briffa, K. R., Duplessy, J. C., Joos, F., Masson-Delmotte, V., Olago, D., Otto-Bliesner, B., Peltier, W. R., Rahmstorf, S., Ramesh, R., Raynaud, D., Rind, D., Solomina, O., Villalba, R., and Zhang, D. (2007) Palaeoclimate. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K. B., Tignor M. and Miller H. L. (Eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Lohr, S. (2006 November, 29th) *Energy Use can be Cut by Efficiency Survey, says the New York Times.* www.nytimes.com/2006/11/29/business/29energy.html. 09/09/14.

McKinsey and Company (2009) *Pathway to a Low-carbon Economy*. Version 3 of the Global Greenhouse Gas Abatement Cost Curve, p7.

Montreal Protocol, (2007) *US EPA Ozone Depletion Glossary*. http://www.epa.gov/ozone/defns.html#hcfc. 10/12/14.

Prindle, B. and Eldridge, M. (2007) *The Twin Pillars of Sustainable Energy: Synergies between Energy Efficiency and Renewable Energy Technology and Policy.* American Council for an Energy-Efficient Economy. **[**Eckhardt, M. and Frederick, A. (Eds)]American Council on Renewable Energy, ACEEE Report Number E074. 10/12/14

Rhein, M, et al (2013) Observations: Ocean. In Stocker, T. F. et al (Eds), *Climate Change* 2013: the Physical Science Contribution of Working Group I to the Fifth Assessment Report of the International Panel on Climate Change. Cambridge University Press. Cambridge.

Riebeek, H, (2010) Global Warming. NASA Earth Observatory. Greenbelt, MD. http://earthobservatory.nasa.gov/Features/GlobalWarming/. 10/12/14.
The New Stateman, (2013 May, 20th) Energy Commission Starts National Rebate Refrigerator Programme. *The New Statesman*. P1.
The Vienna Climate Change Talks (2007) http://unfccc.int/files/press/news_room/press_releases_and_advisories/applicants/pdf/20070831_vienna_closing-press_release.pdf. 09/09/14.
UNEP (2008) *The Multilateral Fund for the Implementation of the Montreal Protocol*, United Nations Environment Programme (UNEP), Fifty-fourth Meeting, Montreal, 7-11 April 2008. www.multilateralfund.org/Our%20Work/.../7.%20Policy71-ChapterVI.pdf. 10/12/14.
UNFCCC (2005) *Sixth Compilation and Synthesis of Initial National Communication from Parties not Included in Annex I to the Convention*. Note by the Secretariat. Executive Summary (PDF) United Nations Framework Convention on Climate Change, Geneva, Switzerland. United Nation's Office at Geneva.
UNFCCC (2011) *Status of Ratification of the Convention of the United Nations Framework Convention on Climate Change* UNFCCC Secretariat; Bonn Germany.
USEPA (2008) *Ozone Depletion Glossary*, 2008-09-03. http://www.epa.gov/ozone/defns.html#hcfc. 10/12/14.

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