Residential Consumer End Use Survey

Volume 1- Household Energy & Transport

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EXECUTIVE SUMMARY

BACKGROUND

Jamaica is highly dependent on imported petroleum products for its energy needs. While there has been a decline in the volume since 2003, the cost of the imports continues to climb. For 2005, the cost of mineral fuels imports stood at US$1360.1 million, representing 49.0% of total imports; from another perspective, the cost was 82.0% of total merchandise export earnings. This represents a serious situation with possible negative effects on the economy and pressure on disposable income. The Government promulgated an energy policy in 1995, and the development of a new Energy policy started in 2004 with a Green Paper being tabled in Parliament in March 2006 to promote discussion.

A household energy end use survey was commissioned in June 2006 by the Petroleum Corporation of Jamaica (PCJ) with funding from the United Nations Development Program (UNDP). It was conducted by the Statistical Institute of Jamaica (STATIN) and the Planning Institute of Jamaica (PIOJ). Data generated from the survey would assist in the formulation of more detailed strategies to enhance the achievement of the policy objectives and further address the needs of the sector.

The survey objectives as set out in the Terms of Reference were to:

- Determine the characteristics of energy consumption and efficiencies among residential/household users.
- Determine the awareness of the consumers as to the existence of regulatory agencies, and their perception of the agencies' effectiveness.

METHODOLOGY

The questionnaire was developed by a Steering Committee comprising representatives from PCJ, the Cabinet Office, Ministry of Industry, Technology, Energy and Commerce (MITEC)[1], PIOJ and STATIN. The sample design was a stratified two-stage sample. The target population was the head of the household or any responsible adult who was a member of the household. A total of 1119 households were interviewed in September–October 2006 on several aspects of energy sources used for household activities and energy conservation. Information on the public perceptions of six Regulatory Authorities was also collected in the survey and reported separately in Volume 2. This report (Volume 1) presents the finding of the energy survey.

The analysis of responses to the various questions was done on an overall national basis and then disaggregated by region, urban and rural. For some of the questions the data was also examined by the characteristics of the head of the household, including gender, age,

[1] This Ministry was previously the Ministry of Commerce, Science and Technology

level of education achieved and monthly income. Comparisons were made with a 1997 energy survey[2] and a 1983 energy survey[3].

MAIN FINDINGS

Sources of energy

The findings complemented those of the 1997 energy survey and indicated that lighting was predominantly by electricity though some households mainly in the rural areas, still used kerosene and a few used candles (see Table A). Cooking was mainly with Liquid Petroleum Gas (LPG), though some rural households used firewood or charcoal. Water heating was mostly by electricity, though some in rural areas used firewood; there were also some solar water heaters. Home businesses predominantly used electricity. Candles and kerosene were the major sources of backup lighting while some households also used flashlights and rechargeable fluorescents. Few had a generator.

TABLE A: Distribution of Households by Source and Use of Energy

Question: What are the energy sources used normally for lighting, cooking and water heating in this household?

	% of Households			
	Normal Source of Energy For Household Activities			
	Lighting	Cooking	Water Heating	Home Business
Electricity	90.8	1.3	70.8	85.7
Kerosene	7.9	0.4	0	5.4
LPG	0	86.0	4.6	0
Charcoal	0	5.2	1.5	7.1
Firewood	0	7.1	7.7	1.8
Solar Energy	0	0	15.4	0
Candle	1.3	0	0	0
Generator	0.1	0	0	0
Total	100	100	100	100

Comparison with a 1997 survey revealed an increase in the use of electricity for lighting by 2006, and an increase in the use of LPG for cooking, which coincided with a reduction in kerosene for these purposes and a reduction in the use of firewood and charcoal for cooking. This would indicate an increasing standard of living.

2 **The Results of an Energy Demand/Supply Survey for the Petroleum Corporation of Jamaica** by J.A. Young Research Ltd., May 1997.

3 **Household Energy Use & Transportation 1983** by Derek Gordon & David Barnwell.

Electricity

More urban households had electricity than rural ones. Many households shared a meter, some with as nine other households. Sharing a meter was more prevalent in rural areas (nearly 29% of rural households) but the proportion of four or more additional households sharing a meter was higher for urban households. Only about 9% of household heads were able to read their electric meter regardless of their level of education; however 92% of persons would like to learn to do so. Persons who could read their meter got their information from a wide variety of sources, with brochures, fliers, pamphlets etc. being somewhat more prevalent.

Between the 1997 and 2006 energy surveys, an increasing trend in the proportion of households having electricity was identified. From the data, it appeared likely that a household would not pay for electricity increased when they did not have their own meter. The current survey suggested that at a minimum, about 8.2% of all households did not pay for electricity service that they received, with a higher proportion of urban households. Similarly, a higher proportion of households headed by individuals less than 40 years of ages did not pay for electricity compared to households headed by older persons. These would have implications for JPS' efforts in dealing with theft of electricity and provide directions for which categories of households that were likely to obtain electricity illegally.

Many households (35%-38%) consumed in the range of 301 kWh-500 Kwh of electricity whether in urban or rural areas, with 30% of those in urban areas consuming above 500 Kwh. Electricity consumption was higher in urban than rural areas, averaging 440 Kwh and 323 Kwh respectively. The data provided evidence that the average monthly electricity consumption by households had increased dramatically by up to 100Kwh per household in both urban and rural areas within a decade (1997-2006). Albeit this finding, heads of household tended to consider energy efficiency in their decisions to purchase electrical appliances, more so urban than rural heads of households.

The most common appliances for entertainment were television sets in 93% of households, while about 74% had radios and 40% had component sets/stereos. DVD players and recorders were in nearly 39% of homes. For kitchen appliances, 82% of households had a refrigerator and nearly 35% had a microwave oven; the latter were almost twice as prevalent in urban households. Other high electricity use appliances (in addition to microwave ovens) were not common; electric water heaters were only in 6% of households, deep freezers in 11%, electric stove in 4% and air conditioners in 3% of households. The exception was the electric clothes iron in 88% of households. It was found that 16% had two or more televisions and over 19% had two or more fans.

Comparison of the percentage of households having various appliances in 1997 and 2006 showed little change for radios, or for some of the high electricity users - electric stoves, water heaters and air conditioners. Others showed large increases over the decade, particularly microwave ovens, televisions and washing machines. There was also some increase in refrigerators and electric clothes irons.

It was concluded that the increase in electricity consumption in a decade appeared to be due to a higher percentage of households acquiring electrical appliances. This would be associated with an improving standard of living but pointed to the priority needed for one of the Government's key energy policy objectives - encouraging efficiency of energy use.

Kerosene

The use of kerosene by households had declined compared with results of the 1997 energy survey (30% in 2006 compared to 56.6% in 1997). Rural households were found to use kerosene more frequently than urban households, and households headed by males were more likely not to use kerosene at all. There was also evidence to suggest that households headed by older individuals were more likely to use kerosene, as well as more frequently when they do, than those headed by younger people. Also, households headed by individuals with secondary or tertiary education were less likely to use kerosene, and would use it less frequently if at all they do, than households headed by individuals with only primary education or less. In both urban and rural areas the main place that kerosene was purchased was at grocery shops. Rural households were, on average, found to pay higher prices for the same unit of kerosene than urban households.

There was clearly a different pattern of use for kerosene between urban and rural households. While urban households mainly used kerosene for emergency cooking, rural households used it for multiple purposes including for emergency and regular lighting and to start fire. In all, when compared with the 1997 survey results, the proportions of households using kerosene for these purposes had declined.

Liquid Petroleum Gas (LPG)

The main purpose of LPG use by all households was for cooking, and more households purchased LPG monthly than over any other time period. Findings from the survey indicated that the frequency of use of LPG among urban households was higher than among rural households and among female-headed households than male-headed households. Households headed by persons with tertiary or secondary education were using LPG on a more frequent basis than households with primary or no education. Compared with the 1997 survey, the use of LPG increased to over 88% of households in 2006 from 77%; the 25lb cylinder was still the most popular size of cylinder purchased. As found for kerosene, rural households were observed to pay a higher average price for LPG than urban households for all categories of cylinder size. Retailers and distributors formed the major group from which most households purchased LPG, and both the gender and educational level of the head of household appeared to influence the source of supply of LPG to households.

Charcoal

The use of charcoal and firewood as alternative energy sources is generally viewed as having potentially negative environmental impacts associated with deforestation. At a broader level, use of these fuels as the main source of energy is usually linked to poverty and perceived under-development.

The use of charcoal among Jamaican households over the ten-year period 1997-2006 increased to 49.1% (up by 9 percentage points). Consistent with the findings of the 1997 survey, the majority of charcoal users (55.1%) used it for "home cooking" followed by "special events". Although there was no difference in the overall rate of use by urban and rural households, the latter demonstrated more frequent usage with one in 5 rural households using charcoal on a daily basis compared to one in 10 urban households.

The incidence of charcoal use was higher among female headed households compared to those that were headed by men and there was no significant difference in the use of charcoal by the age of household heads. Charcoal use for home cooking was most prevalent in large households, that is, those having 3-4 persons and 5 and over. There was a general decrease in the use of charcoal for "home cooking" with increasing levels of education. However, with respect to the use of charcoal for "special events", the converse was true.

The survey showed that the annual consumption of charcoal by regular users (daily and weekly) was some 215 million kilograms at a cost of approximately $3.4 billion. Total usage of charcoal would be higher with the inclusion of occasional users.

The main factors associated with the consumption of charcoal were income, education, gender of household head, the size of households and cultural preferences. According to the survey, approximately 50% of households purchased charcoal in small quantities (Butter/cheese, Kerosene, and Paint Tins). This partially reflected the purchase by lower income households with unpredictable income flows. The remaining users, with more stability in income, bought charcoal in larger quantities (Rice/Fertilizer bags, Crocus bags) in an effort to economize. The Rice/Fertilizer bag and the Paint tin were the most common units of purchase for charcoal.

Expectedly, the use of charcoal declined with increasing education level, with use for recreational events being most common among households having tertiary trained persons. Additionally, charcoal was the preferred choice for "special events" probably reflecting the growing popularity of jerk foods among Jamaicans. The frequency of use of charcoal was more common in households that were headed by females and households having more than three persons reflected higher consumption of the fuel.

Firewood

An estimated 41.9% of households used firewood and its use was more common in rural areas, with a pattern of use similar to charcoal. Firewood was mostly used for "home cooking" followed by "special events". This is also in line with the results of the, 1997 Energy Survey. However, while rural households used firewood for "home cooking", most urban households used it for "special events".

Similar to the pattern seen in the use of charcoal, there was an inverse relationship between firewood use and income and education. Generally, the incidence of firewood use was more popular among households with heads over 40 years old.

Given the environmental implications of charcoal and firewood use, policies should create the supporting environment for the improvement of the income of regular users to enable the transition to more sustainable alternatives of fuel. In addition alternative livelihoods should be explored for those that directly depend on the production and sale of charcoal for a living. Further research on the use of these fuels could possibly focus on the adoption of more efficient production using trees with higher energy content thus reducing the quantity of trees required. Assessment of the quantity of charcoal needed to support its growing commercial use (jerking etc.) should also be an important research item in light of the declining forest cover.

Solar Energy

The main household use for equipment operating on solar energy was solar water heaters. However 84.1% of respondents said that they did not heat water for bathing, while the most used method of producing hot water was on a stove. The next most used method was an electric water heater, in 4.6% of households. Solar water heaters were in only 0.9% of households surveyed, being only more prevalent than gas heaters in 0.1% of households. The few solar heaters reported were mainly in urban households.

The main water heater tank size reported was in the range of over 30-50 gallons (over 114 litres -190 litres). Although there were tankless water heaters on the market, none were recorded in the survey.

Some 52.4% of home owners stated that nothing would encourage them to install a solar water heater. More positive answers were "cheaper price" (15.3%) and "more information" (17.9%). "Low interest loans" were mentioned by only a few persons. Responses from urban and rural areas were similar, as well as for male and female. There was a trend of increasing age showing a higher percentage of positive responses for a solar heater if they got a cheaper price or had more information. A larger percentage of the highest income group ($80,000+ monthly) would be encouraged by a cheaper price than the other income groups. Only 6.9% of those in the highest income level would be encouraged to purchase a solar heater by receiving more information, the percentage increasing at lower income levels.

Only five persons stated that their household had a photovoltaic system, representing only 0.4% of respondents. All of these were in urban areas.

The responses to the main reason why persons did not use solar energy to produce electricity were that 37.9% "did not know of it", 32.0% were "not interested", and 21.4% said that it was "too expensive". A higher percentage of rural persons did not know of such systems compared to their urban counterparts, while more urban persons thought that it was too expensive. An equal percentage of both groups were not interested. Persons with higher educational and income levels tended to state that they did not use photovoltaics because it was too expensive, and were less interested in having information.

The comparison with the 1997 survey showed that they reported that 3.1% of households had a form of solar energy equipment, twice as much as the 1.16% of households found in 2006 with solar water heaters and photovoltaic equipment. It was assessed that the 1997 figure was an over-estimation, and the 2006 possibly an under-estimation based on a 10,000 solar heater estimate in 2006 given by the major solar water heater supplier. A comparison of the main reason for not using solar equipment in 1997 and 2006 showed that after a decade, many persons still did not know about it (42.7% and 37.9% respectively) and a higher percentage in 2006 stated that it was too expensive (21.4% compared to 8.8% in 1997).

It was concluded that most persons in Jamaica did not heat water for bathing, while solar water heaters were uncommon and most persons were not interested in acquiring one. It appeared that the public had insufficient information about solar water heaters, and many persons did not know about photovoltaic systems - this information gap would need to be addressed. Persons who seemed to know most about it, mainly those with higher education and income, appeared to think that such systems were too expensive. It may be useful for the public and private sectors to put on an alternative energy expo which could feature solar energy equipment for residential use.

Electricity Generator

Only 1.4% of respondents had used an electric generator in the past three months to provide electricity to the home. Nearly a half of the few generators reported were 10-17 years old while the others were 1-6 years old. Other questions on the generator sizes, purchase price and maintenance cost did not yield enough data to be useful.

Transportation

It was found that the Jamaican public mainly used public transportation since nearly 75% of households did not own a motor vehicle. More urban households owned a motor vehicle than their rural counter parts (31.5% and 18.7% respectively). Households headed by males were seen to have a higher percentage of vehicle ownership (32.3%) compared to those headed by females (16.9%). Some 90.0% of households with the head of household earning above J$80,000 monthly had at least one vehicle.

The most common motor vehicle owned or operated by households was a motor car – 67.8% of households with a vehicle. The next most common vehicle was pick-ups (13.1%), then SUVs (6.2%), mini-vans/buses (6.2%), motorcycles (2.8%) and trucks (2.2%). A higher percentage of rural households owned or operated minivans/buses (13.3%) compared to their urban counterparts (4.8%); otherwise the percentages were similar for other vehicles. Households headed by males were more likely to own pickups and minivans/buses compared to households headed by females.

Some 53.2% of motor cars were over 10 years old, with 15.5% being over 15 years old. The mean age was 10.8 years. About 48.9% of the motor cars had the smallest and most fuel efficient engine size of 1500 c.c. or less. While there were a few diesel engine cars in Jamaica, none were reported in the survey. The usage of the higher octane 90 gasoline by over 30% of cars seemed high. The highest category of expenditure on fuel in the

previous week was $1001-$2000 (42.6% of motorcars). The mean was $2673 for the week. The mean distance traveled in the week previous to the survey was 151.3 km. Some 43.1% of persons did not know.

About 75.0% of the pickups in the survey were over 10 years, with 41.7% being over 15 years old. The mean age was 12.8 years. About 52.4% of the pickups had engines of over 2000 c.c., and 17.9% had diesel engines which are more fuel efficient than gasoline engines. The highest category of expenditure on fuel in the previous week was $1001-$2000 (similar to motor cars). The mean was $2580 for the week. Kilometers traveled by the pickups in the previous week varied, with the predominant distance range being 100 km to less than 300 km – the mean was 127 km. Some 44.1% of respondents said that they did not know.

Sports Utility Vehicles (SUVs) had relatively low age, as only 5.3% were over 10 years old. Some 23.1% of SUVs had large fuel inefficient engines over 2500 c.c. About 15.0% used diesel fuel (similar to pickups). The highest category of expenditure on fuel in the previous week was $2001-$3000, while the category $1001-2000 was also high. Kilometers traveled by the SUV's in the previous week varied, with the predominant distance range being 20 km to less than 50 km, while 27.8% of persons did not know.

Some 50.0% of minivans/buses were over 10 years old, with 18.2% being over 15 years. The mean age was 11.2 years. The main engine size was 1501-2000 c.c., while the predominant fuel used was the more energy efficient diesel. The main category of fuel expenditure reported was $3001-$6000, while there was insufficient information on distance traveled in the past week for reliable analysis, as 59.1% of the respondents did not know.

There was insufficient data on trucks from the survey for reliable analysis.

Motorcycle ages showed 36.4% being over 10 years. The mean age was 10.1 years.

Only 13.2% of respondents stated that fuel economy was "not important" or "not very important" to them when deciding which vehicle to purchase, with little difference between urban and rural based respondents, male and female, and age group. There was a trend of persons with higher education and higher income level placing increasing importance on fuel efficiency.

Overall, travel for leisure purposes was mainly by public transportation (68.6% of respondents), predominantly route taxis by 48.9% of respondents, public buses (15.0%) and private taxis (4.7%). Some 19.7% of households used their own vehicle, while a few used bicycles or walked. Less urban persons used route taxis for leisure travel (31.5%) compared to rural counterparts (67.7%), as the public bus was utilized by more urban persons than rural (25.3% and 3.7% respectively).

When asked what means of transportation they used to get to work, 33.2% of respondents stated that they did not work (this could include pensioners and persons who did not

consider as credible work their "hustling" activities which earned a living), while another 8.7% worked at home and therefore did not need transportation. Public transportation was the main means of transportation to work with 26.3% taking the route taxi and 14% the public buses. The former was about the same percentage as respondents using their own or a company vehicle. About 21.3% walked to work, and another 5.2% rode a bicycle.

The average Jamaican estimate they traveled 14.1 kilometers to work, with the highest proportion being in the 2.1 km -5 km range, and the next highest being the 10.1 km -30 km range. In the urban areas, persons traveled an average of 14.9 km to work while in rural areas it was 13.3 km. The average Jamaican required 46 minutes to get to work. There was not much difference between urban and rural areas.

Children also mainly used public transportation to get to school, predominantly the route taxi (37.2% of households), public buses (18.7%), minivans (3.0%) and private taxis (4.6 %). In total 63.5% of households used public transportation to get their children to school. Another 22.5% had their children walk to school. The household's own vehicle, company vehicle or one owned by a relative or friend were utilized by a combined 12.0% of households. Not many children travelled on school buses or bicycles. The main differences between regions was the utilization of own vehicle by 14.0% of urban households compared to 4.8% of rural, route taxis by 23.9% of urban compared to 53.7% of rural, and public buses by 25.7% of urban compared to 10.0% of rural. Both regions had a similar percentage of children walking.

The mean weekly expenditure on road transportation by the head of household was $1089. The urban based head of household spent somewhat more – a mean of $1180 per week, compared to the rural counterpart $989. The mean weekly expenditure on road transportation by the entire household was $2000. The urban based household spent $2162 per week, while the rural counterpart spent $1833.

The mean weekly expenditure on road transportation by the head of household with a vehicle was reported to be $674 compared to those without a vehicle stating that they spent much more – a mean of $3400 per week. Vehicle owners said they spent a mean of $1477 per week on transportation for the household, while the non-owners on average said J$5040. Owners appeared to be only considering fuel purchases.

Some 36.5% of respondents said that there was nothing that would make them willing to park their vehicle and take public transportation. Reasons that would make others consider this option included "the cost of gas/toll"[4] (28.1% of respondents), "a good and frequent transportation system" (12.7%) or "if their vehicle was at the garage" (8.8%). Only 3.5% gave "bad roads" as a reason, while only 0.4% cited "traffic congestion". An unexpected reason given by 3.5% of respondents was "road blocks/bad weather". A smaller proportion of urban car owners (59.6%) would consider the idea compared to their rural counterparts (70.2%). Those who owned one vehicle were just as likely to consider it as those with two or more; similarly those living near to their work place (0-5

[4] Tolls were being charged only on two Kingston/St Andrew and St. Catherine highways

km) were as likely to consider it as those traveling further to work (over 5 km). Gender differences were not apparent. However, age did seem to be a factor, as those under 40 years old were much more amenable to consider the idea.

Some 47.1% of car owners said that there was nothing that would make them willing to park their vehicle and carpool with a friend or neighbour. Reasons that could make others willing to consider this included "economical" (28.0% of persons), and "if they were going the same place" (9.7%). Traffic congestion was not considered as an important factor since only 0.8% cited this reason. Fewer urban car owners would consider the idea compared to their rural counterparts. Those who owned one vehicle were about as likely to consider it as those with two or more; similarly those living near to their work place (0-5 km) were as likely to consider as those traveling further to work (over 5 km). Gender differences were not large, while age showed a tendency, with the older the persons the less amenable to carpooling.

Comparison with a 1983 study showed that the percentage of households owning or operating a vehicle had moved to 25% from 16% in 23 years. The main change in the types of vehicles was that in 1983, vans were 11.5% of vehicles but were not recoded in 2006, while pickups were not recorded in 1983 and SUVs were not on the market until the 1990's and accounted for 19.5% of vehicles in 2006.The mean age of household cars was 9.3 years in the 1983 study, while in 2006 it was 10.8 years. The percentage of cars over 10 years was 55.2% in 1983 and 48.1% in 2006, while the mean engine size had reduced from 1798 cc to 1624 cc.

It was concluded that the majority of the Jamaican population relied on public transportation, which gave a measure of energy efficiency. It was also found that route taxis were the main means of transportation, particularly in rural areas, and should be considered as practically an essential service. Policies and programmes were needed that target this form of transportation into becoming more fuel efficient.

Another conclusion was that the stock of vehicles owned or operated by households was mainly cars with small engines which were relatively fuel efficient. However over 53% of cars were over ten years old and could be reaching the end of their useful life. This had national implications for the foreign exchange to import spare parts and for the eventual replacement of the cars. The environmental problems of disposal of the discarded cars would also become an issue. In terms of energy, if the owners were unable to meet the high maintenance cost, fuel efficiency (and commuter safety) would fall significantly in the coming years.

Most people placed some importance on fuel efficiency when deciding which vehicle to purchase. This should encourage the Government to continue the customs duty differential system that favours smaller engine cars which are more fuel efficient. Persons owned more vehicles with smaller engines in 2006 compared to 1983. The fuel efficiency gains of the smaller engines would be negated by having more vehicles on the road.

Many person travelled long distances to work, which was energy inefficient. If the goal is to reduce national fuel use for transportation, policies would be needed to increase housing near to job centres. This could be particularly useful in areas of expanding or new economic development such as new hotels.

Energy Conservation

About 79% of households routinely performed energy saving practices. The most identified measure by 73.1% of respondents was the turning off of electric lights and appliances when not in use. About 40.0% said that they ironed less (a few had stopped ironing), while 28.0% reported that they opened the refrigerator less. It was interesting that only 26.6% stated that their households used energy saving bulbs. The purchase of energy efficient appliances was listed by only a few, while some were watching less television.

Some 32.8% of urban households used energy saving bulbs compared to only 20.0% of rural households; also a larger urban percentage said they opened the refrigerator less. Fewer male headed households ironed less to save energy or practiced opening the fridge less compared to female headed households. Heads of households with a tertiary education showed a higher percentage of application of almost all energy saving practices. Also, increasing income levels generally showed an increase in some of the energy saving practices. For example, 85.4% of household heads in the highest income level said that they practiced turning off electric lights and appliances when not in use, graduating down with income level to 64.4% of the lowest income category.

Only 30.1% of respondents had the opinion that enough was being done by households in Jamaica to conserve energy. Only 23.1% thought that enough was being done to promote energy conservation by the Jamaican government. The suggestion given by most respondents (53.1%) as to the steps that should be taken to promote energy conservation by the Jamaican government was that people should be educated on conservation. Only 9.0% of respondents suggested developing local energy sources (including solar and wind), while another 8.1% percentage said energy saving fluorescent bulbs. About 7.2% of respondents suggested the need to end the theft of electricity. Although only mentioned by 13 persons (1.6%), the suggestion of turning off street lights during the day could indicate a problem in some areas.

Only 5.6% of respondents had a water heater in their homes, the predominant type being electric (very energy inefficient), and very few solar heaters. Only 13.5% of respondents said that they knew about the National Housing Trust (NHT) solar water heater loan programme – a higher percentage in urban areas, and in the 40-60 years age group. There appeared to be a trend of increasing knowledge of the programme the higher the education and income levels. Some 39.8% of those respondents with a tertiary education knew, graduating down to 0.0% of those with no/pre-primary education. Similarly 39.3% of those with the highest income level of the head of the household ($80,000 and over monthly) knew about the programme, graduating down to only 8.2% of the lowest income level.

It was concluded that while most households routinely performed energy saving practices, the use of energy saving bulbs by only 26.6% of households indicated that the programme of encouraging their use was not fully successful. This could be due to the relatively high cost. It would be interesting to evaluate if the project of distributing free compact fluorescent bulbs donated by the Cuban Government would result in households buying more of them when the programme ends.

The majority of respondents had the opinion that enough was not being done by households or the Jamaican Government regarding energy conservation. Their main suggestion that people should be educated on this indicated that the extensive programmes conducted by the Government and the electricity company on this subject were not perceived as being sufficient. Focus group studies could be conducted to identify the most effective means of future public education programmes on energy conservation.

There was a low prevalence of water heaters in Jamaican households, which could be due to many persons thinking that they are unnecessary in the hot Jamaican climate, and/or too expensive for the benefits. It was concluded that there may not be much energy savings from a programme to encourage solar water heaters. The NHT solar water heater loan programme was known by only 13.5% of respondents, more so by persons who were urban, middle aged, highly educated and high income earners. The NHT promotion of this programme was not being effective, and other strategies for the promotion would be needed.

RESIDENTIAL CONSUMER END USE SURVEY REPORT

HOUSEHOLD ENERGY & TRANSPORT

BACKGROUND

Energy Situation

Jamaica is highly dependent on imported products to satisfy its energy needs. Over the period 1996 – 2005, an average of 23.8 million barrels of crude and petroleum products was imported annually. Of the total volume imported, the main user was the Bauxite/Alumina sector, 36.6%, while Electricity Generation, Road Transportation and Shipping & Aviation activities consumed 24.7%, 23.7% and 7.7%, respectively. These activities together, accounted for approximately 93.0% of the country's petroleum consumption.

In 2005, the country's overall energy consumption was 27.9 million barrels (mb) of Fuel Oil Equivalent (FOE) compared with 26.3 mb of FOE in 2004. This resulted from higher consumption from petroleum-based sources, which increased by 7.9 %. The increased consumption pattern occurred despite the recent surges in oil prices on the international market. In 2005, the annual average spot peak price of oil on the international market was US$53.39 per barrel compared with US$ 37.34 per barrel in 2004 and US$28.23 in 2000. The average monthly prices for January – September 2006 reached US$66.05. While price movements are not new, the recent surge marked the fourth wave of increases since 1973[5], the consistent upward movement in the prices of crude oil on the international market, has significantly impacted the country's oil bill. This expenditure moved from US$369.3 million in 1996 to US$1.3 billion in 2005 (Figure A).

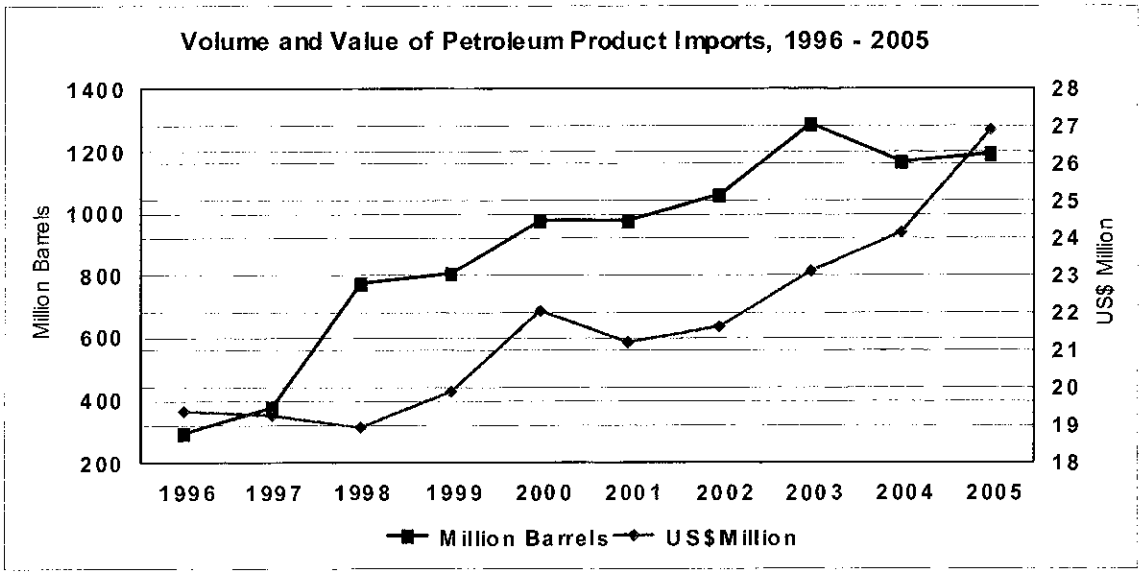

Figure A: Volume and Value of Petroleum Product Imports, 1996-2005

[5] The first was in 1973, the second in 1979 and the third in the early 1990's..

As reflected in Figure A, while from 2003 there has been a decline in the volume of petroleum product imports, there has been a steady rise in the cost of those imports. A dissagregation of the US$1.3 billion spent in 2005 shows expenditure of:

- US$182.7 million on crude oil[6] imports;
- US$691.3 million on refined products imported by Petrojam;
- US$247.3 million by the Bauxite/Alumina sector; and
- US$146.7 million by petroleum marketing companies.

For 2005, the cost of mineral fuels imports stood at US$1360.1 million, representing 49.0% of total imports. With respect to total merchandise export earnings, mineral fuel imports accounted for 82.0%. This represents a serious situation. Such a continuously expanding energy import bill can have ripple effects on the economy resulting in economic growth being stymied, increased balance of payments, foreign exchange and inflationary pressures, as well as pressure on disposable income.

The average billing prices of the petroleum products on the local market, have been trending upwards since 2002 (Figure B), reflecting oil price movements on the international market as well as local exchange rate depreciation. This has had a negative impact on transportation costs. For 2005, average prices of petroleum on the local market ranged from J$18.32 for Fuel Oil to J$40.94 for Unleaded 90.

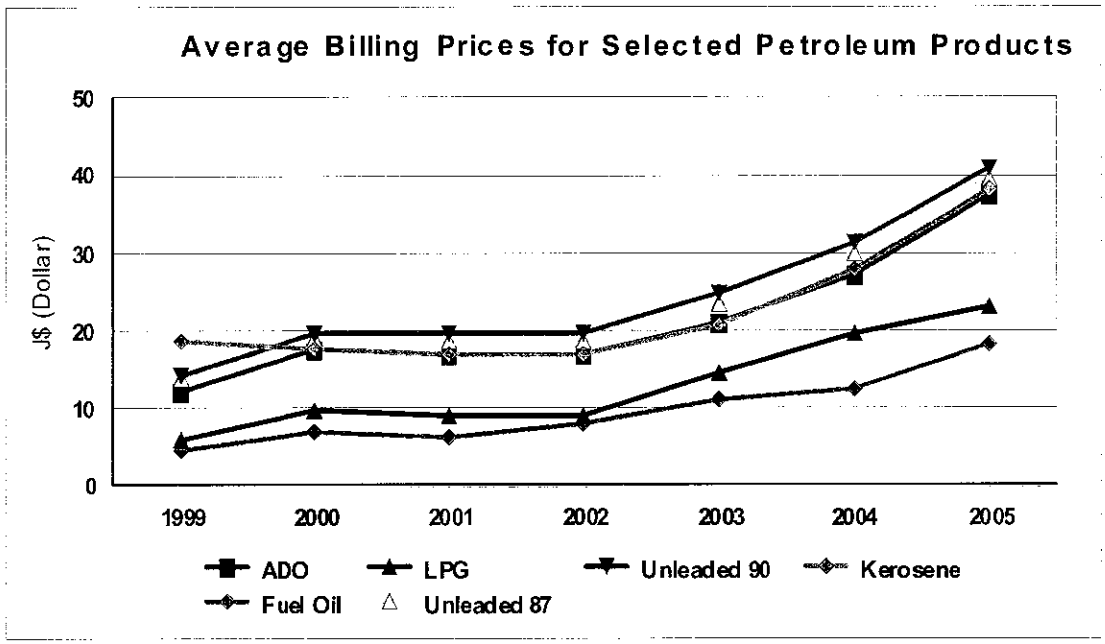

Figure B: Average Billing Prices for Selected Petroleum Products

[6] The average cost per barrel of crude oil purchased by Jamaica in 2005 was US$55.52, compared with US$34.41 in 2004.

Electricity is the main source of lighting for Jamaican households, with approximately 90.0% of the population having access to electricity. Residential customers comprise the largest group of customers, averaging 493,696 in 2005 and consuming a total 22.4 million kWh of electricity.

The country's electricity generating capacity reached 787.6 megawatts in 2005 compared with 678.7 megawatts in 1996. The growth in generating capacity reflected the introduction of additional capacity - the 120-megawatt at Bogue Plant, installed over a two-year period, the 20.7 megawatt wind farm at Wigton in Manchester and capacity injections by private producers. Total electricity generation over the 10-year period 1996 - 2005, grew by 51.7 % to 3 878.0 million kWh. The higher generation reflected the increase in share/contribution of Non-JPSCo sources (private producers) to total output, increasing by 57.6 % to 1067.1 million kWh.

The system's heat rate, which measures the efficiency of converting fuel to electricity[7] has fluctuated over the period, recording 10 336 kilojoules per kilowatt hours (KJ/kWh) in 2005 compared with the 13 452 KJ/kWh reported in 1996. The figures reported in 2005 marked the third consecutive year of improvement, after four consecutive years of deterioration. Total fuel consumption and fuel cost grew by 44.7 % and 411.6 %, respectively, to 52.8 million barrels and $18.8 billion.

Energy Policy

In recognition of the critical role of energy in economic development as well as the need to provide guidance to the local energy sector, the Government in 1995 promulgated an energy policy. The policy was framed within the overall thrust of macro-economic policies geared towards a more market-oriented economy, promoting deregulation, liberalization and privatization. The 1995 energy policy sought to achieve, among other things, the following:

- energy supplies at the least economic cost through a combination of public and private sector activities;
- diversification of the energy base;
- efficiency in energy production;
- reduction in environmental effects and pollution; and
- an appropriate regulatory to protect consumers.

The accomplishments of the 1995 Policy included changes in the market structure, liberalization and deregulation of the petroleum sector, privatization of the electricity sector to involve the liberalization of the electricity generation side of the sector, and the establishment of a regulator.

However, in an attempt to address the ever unfolding realities of the energy sector as well as to further consolidate the gains of the 1995 policy the development of a new Energy policy started in 2004[8]. The major goals of this policy are to increase efficiency, reduce energy costs, ensure diversification and reverse the deterioration in energy intensity in the

[7] An increase in value implies deterioration in the efficiency of conversion.
[8] The Energy Policy Green Paper was tabled in Parliament in March 2006.

non-alumina sector, whilst enhancing the environment. Consequently, the new policy is focusing on; 1) energy conservation; 2) security of supply; 3) upgrading the refining capacity; 4) diversification of the energy base; 5) efficiency in energy use and production; and 6) reduction in adverse environmental effects caused by the use of fossil fuels.

Concomitant with these policy objectives, the government over the years, continued to pursue several demand and supply side initiatives designed to aid the achievement of the objectives. On the supply side, there was the conversion to Unleaded Gasoline, the introduction of renewable energy sources – wind turbine at Munro College and more recently the Wigton wind farm in Manchester; and the PetroCaribe Bilateral Agreement on Energy Cooperation.

Among the Demand Side Management projects were:

- the Energy Efficiency Demonstration Programme which included a) the retrofitting of households with energy-saving devices; b) the provision of incentives for implementation of energy saving devices in new large commercial facilities; and c) the introduction of photovoltaic equipment;
- the promulgation of an Energy Efficiency Building Code; and
- the installation of solar water heaters in hotels, hospitals and households.

Energy Survey

The conducting of an Energy End Use Survey is but one of the more recent steps employed by the government to ensure the design and adoption of appropriate policy options in the energy sector. Data generated from the survey should assist in the formulation of more detailed strategies to enhance the achievement of the policy objectives and further address the needs of the sector.

The Petroleum Corporation of Jamaica (PCJ) contracted the Planning Institute of Jamaica (PIOJ) and the Statistical Institute of Jamaica (STATIN) in June 2006, to conduct a Residential Consumer End Use Survey in Jamaica. The selection of the two institutions was based on them being the most experienced in the conduct of national socio-economic surveys and in the development of national policy. The Institutes also had the advantage of being able to provide continuity for future national energy surveys.

Two similar surveys were carried out in 1983 and 1997. The latter had an emphasis on a policy change being contemplated at the time to eliminate the subsidy on kerosene oil. The 2006 survey would update the information of the 1983 and 1997 surveys, but would have a somewhat different focus.

OBJECTIVES OF THE STUDY

The survey objectives as set out in the Terms of Reference were to:

- Determine the characteristics of energy consumption and efficiencies among residential/household users.
- Determine the awareness of the consumers as to the existence of regulatory agencies, and their perception of the agencies' effectiveness. This part of the survey has been done in a separate report.

METHODOLOGY

Steering Committee

A Steering Committee was established consisting of representatives from the Planning Institute of Jamaica (PIOJ), Petroleum Corporation of Jamaica (PCJ), Statistical Institute of Jamaica (STATIN), and the Ministry of Industry, Technology, Energy and Commerce[9] (MITEC), and chaired by the Energy Consultant in the Jamaica Government Cabinet Office. The Steering Committee formulated the questionnaire.

Questionnaire Development

A pre-test of the instrument was conducted to approximately 10 percent of the sample. Testing was conducted in both urban and rural areas. Feedback from the pre-test was used to determine the final survey instrument before the fieldwork began.

The final households' questionnaire used in the survey is shown in Appendix 5. It had Sections on the various forms of energy sources used by households: Electricity, Kerosene, Liquid Petroleum Gas (LPG), Charcoal, Firewood, Solar Energy and Electricity Generators. There were also sections on Transportation and Energy Efficiency. Finally there was a section on Regulatory Authorities which was not directly related to the energy study.

Sample Design and Selection

The sample design for the Energy Market End Use Survey was a stratified two-stage sample with the first stage being a selection of areas called Enumeration Districts (EDs) and the second stage a selection of dwellings within the selected EDs. The target population was the head of the household or any responsible adult who was a member of the household. Excluded from the sample were non-private households including group dwellings, e.g. military camps, boarding schools, mental institutions, hospitals and prisons.

The sampling frame for the survey was a listing of Enumeration Districts (EDs) for each Parish. For the purpose of data collection, Jamaica is divided into 5,235 EDs. An ED is an independent unit comprising of approximately 100 housing units in the rural areas and 150 in the urban areas. Each ED is designed to be of a size that would ensure an equitable workload for interviewers.

[9] This Ministry was previously the Ministry of Commerce, Science and Technology

The sample design involved the division of the 5,235 EDs into two strata namely urban and rural. For the purpose of this survey ".... a place is classified as urban if it possesses a population of 2,000 or more persons and provides a number of amenities and utilities that in Jamaica indicate modern living"[10]. This method of stratification ensures that each ED falls either into an urban or a rural classification. There are approximately 2,542 urban and 2,693 rural EDs in Jamaica. The division or stratification is required for two basic reasons. First it is a well-established fact that reliable estimates can be obtained from both urban and rural areas if the samples are drawn independently from both areas. Secondly, the urban areas of Jamaica have shown sharp contrast from that of the rural areas for most of the variables that are pertinent to the survey.

The first stage sample was selected using probability proportionate to size (PPS). The measure of size was the dwelling counts of the EDs obtained from the 2001 Population Census. A total of 133 EDs were selected at the national level of which 64 were classified as urban and 69 rural. The second stage was a selection of 1,394 dwellings from the 133 EDS that were selected in the first stage. This comprised of 704 dwellings from the urban areas and 690 from the rural areas. The selection process involved a systematic sampling methodology with a random start without replacement.

Field Work

Interviewing for the survey was conducted September-October, 2006. Questionnaires were completed for 1,119 households of the 1,320 dwellings that were assigned. This produced a response rate of 84.77% (Table B).

Analysis

The analysis of responses to the various questions was done on an overall national basis and then disaggregated by region, urban and rural. For some of the questions the data was also examined by the characteristics of the head of the household, including gender, age, level of education achieved and monthly income. However only 73.9% of the respondents were the actual head of the household. For questions that asked for the opinion of the respondent, only responses from household heads were chosen for disaggregation by the characteristics of the household head. Income levels given by respondents needed to be used with caution because experience with similar socio-economic surveys in Jamaica has shown that some persons were reluctant to give their true income to interviewers.

[10] Population Census 2001 Country Report vol1 (2004) Statistical Institute of Jamaica

Table B. Number of Completed Questionnaires By Parish

Parish	Number Assigned	Number Completed	Response Rate %
Kingston	48	38	79.17
St Andrew	288	234	81.25
St Thomas	48	37	77.08
Portland	48	38	79.17
St Mary	48	48	100.00
St Ann	80	78	97.50
Trelawny	32	26	81.25
St James	88	73	82.95
Hanover	32	29	90.63
Westmoreland	80	67	83.75
St Elizabeth	80	70	87.50
Manchester	96	89	92.71
Clarendon	112	92	82.14
St Catherine	240	200	83.33
Total	**1320**	**1119**	**84.77**

SECTION 1: SOURCES OF ENERGY

Household Use of Energy

The main energy sources identified in the survey were electricity, kerosene, liquid petroleum gas (LPG), charcoal, firewood and solar energy. Households' use of these energy sources differed by type of use as well as by region (Table 1.1). Overall, 90.8% of households in Jamaica normally used electricity for lighting, while 7.9% used kerosene. Only 1.3% used candles. There were a higher percentage of urban households that used electricity for lighting (95.9%) than rural (85.2%), while more rural households used kerosene (12.5%) compared to their urban counterparts (3.6%). An additional 2.2% of rural households used candle for lighting.

Liquid petroleum gas was the major energy source used for cooking by both urban and rural households, 86.0% overall, with 92.8% of urban households and 78.6% of rural ones reported having used LPG for cooking. Charcoal and electricity were the other major energy sources used for cooking by 3.3% and 2.4% of urban households while firewood and charcoal were the other major energy sources used for cooking by 13.7% and 7.3% of rural households.

The choice of energy source for water heating in Jamaica was mainly electricity -70.8% of households that heat water[11] (as will be seen in Section 1F most do not heat water, except to cook), with 15.4% using solar energy and 7.7% using firewood (Table 1.1). Urban and rural households differed as electricity and solar energy were the main sources used for water heating by 76.7% and 18.6% of urban households, respectively, in contrast with 59.1% and 22.7% of rural households using electricity and firewood normally for water heating.

In the case of energy use for home business, exactly equal proportions (85.7%) of urban and rural households normally used electricity. Further, 9.5% and 4.8% of urban households used kerosene and charcoal, respectively, compared with 2.9% and 8.6% of rural households that used these energy sources for home business, and another 2.9% used firewood.

Back-up sources of Lighting

Overall Jamaican households used candles (69.2% of households) and kerosene (67.2%) as the main backup sources of lighting in case of an electric power failure (see Table 1.2). Comparing urban and rural, the backup source used by the majority of urban households was candles (71.4%), followed by kerosene (60.8%) of households, while for rural households, candles were a similar percentage (69.2%) while kerosene was more widely used (75.0%) than in urban households. Flashlights were more common in urban households (29.7% compared to 17.3% rural) as backup sources of lighting, and also rechargeable fluorescent lamps to some extent (12.9% urban compared to 6.1% rural).

[11] presumably an electric water heater

TABLE 1.1: Distribution of Households by Source and Use of Energy
QUESTION: What are the energy sources used normally for lighting, cooking and water heating in this household?

% of Households												
	Source Of Energy for Household Activities											
	Lighting			Cooking			Water Heating			Home Business		
	Urban	Rural	All	Urban	Rural	All	Urban	Rural	All	Urban	Rural	All
Electricity	95.9	85.2	**90.8**	2.4	0.0	**1.3**	76.7	59.1	**70.8**	85.7	85.7	**85.7**
Kerosene	3.6	12.5	**7.9**	0.3	0.4	**0.4**	0.0	0.0	**0.0**	9.5	2.9	**5.4**
LPG	0.0	0.0	**0.0**	92.8	78.6	**86.0**	4.7	4.5	**4.6**	0.0	0.0	**0.0**
Charcoal	0.0	0.0	**0.0**	3.3	7.3	**5.2**	0.0	4.5	**1.5**	4.8	8.6	**7.1**
Firewood	0.0	0.0	**0.0**	1.0	13.7	**7.1**	0.0	22.7	**7.7**	0.0	2.9	**1.8**
Solar Energy	0.0	0.0	**0.0**	0.0	0.0	**0.0**	18.6	9.1	**15.4**	0.0	0.0	**0.0**
Candle	0.3	2.2	**1.3**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	0.0	0.0	**0.0**
Generator	0.2	0.0	**0.1**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	0.0	0.0	**0.0**
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

TABLE 1.2: Distribution of Households by Backup Source of Energy or Lighting and Region

QUESTION: In case of an electric power failure, what are the backup sources of lighting used by this household?

	% of Households *		
Backup Source	**Urban**	**Rural**	**All**
Candle	71.4	66.4	**69.2**
Flashlight	29.7	17.3	**24.1**
Rechargeable Fluorescent	12.9	6.1	**9.9**
Kerosene	60.8	75.0	**67.2**
Generator	1.6	1.8	**1.7**

* Note that households may have more than one backup source of lighting, hence the percentages for each category will sum to more than 100%.

Comparison with Other Surveys

The findings of the energy survey were consistent with the Jamaica Survey of Living Conditions (JSLC) which reported that 89.0% of Jamaican households used electricity in 2004, comparable to 90.8% in 2006. When compared with findings of the 1997 energy survey, there was an increase by seven percentage points in the use of electricity for lighting from the 1997 estimate of 83.8%, and an increase in the use of LPG for cooking to 86.0% in 2006 from 77.4% in 1997. In the case of kerosene, the current survey showed a large decline in the proportion of households using kerosene (7.9%) for lighting compared to the 1997 estimate (44.2%). A similar trend was observed for households using kerosene for cooking with only 0.4% reporting that they used kerosene for cooking in 2006 in comparison with 7.1% of all households in 1997. This corresponded with a reduction in the use of charcoal (down to 5.2% of all households in 2006 from 12.2% in 1997), and of firewood (down to 7.1% from 13.0% in 1997).

Conclusions

A general overview of the main sources of energy used by households clearly pointed to the facts that electricity was widely used by all households for lighting and that LPG was most commonly used energy source for cooking by all households, irrespective of region. A comparison of results of the 1997 energy survey with the findings of current survey suggested that households were substituting electricity for kerosene as the main source of energy for lighting and replacing kerosene, charcoal and firewood with LPG as the main source of energy for cooking. The Rural Electrification Programme (REP) may have played a part in the increase recorded in households having access to electricity. The increase in the use of LPG by households may also have been an indication of an improvement in the standard of living and this has implications for the health of household members and the environment. This is because charcoal and firewood, which

are alternatives to LPG for cooking, generate carbon monoxide and soot/ash which are harmful to people's health, particularly those persons cooking over the fire. In addition, the sourcing of the wood involves the cutting down of trees, which has implications for the environment. This development of increased use of LPG for cooking is well in line with the Government of Jamaica's (GOJ) energy policy that aims at minimizing the adverse environmental effects of the use of energy.

1A. ELECTRICITY

Households with Electricity and Meter

Analysis of survey data on a regional basis indicated that 90.3 % of all households have electricity (Table 1A.1). This is higher for urban households (95.4%) than rural (84.9%). Some 79.1% of households with electricity have an electric meter, with not much different between urban and rural households (77.8% and 80.7% respectively). As much as 23.0% of households with electricity share an electric meter, with the incidence being higher among rural (28.6%) than urban households (18.5%). The number of additional households to a meter ranged between one household and ten households. As shown in Figure 1A.1, The proportion of four or more additional households sharing a meter was higher for urban households (15.5%) when compared with rural (1.6%).

TABLE 1A.1: Distribution of Households' Access to Electricity and Electric Meter by Region

QUESTION: Does this Household Have Electricity? Does this Household have an Electric Meter?

	% of Households		
Response	**Urban**	**Rural**	**All**
(a) Have Electricity			
Yes	95.4	84.9	**90.3**
No	4.6	15.1	**9.7**
(b) Have Electric Meter			
Yes	77.8	80.7	**79.1**
No	22.2	19.3	**20.9**
(c) Share Electric Meter			
Yes	18.5	28.6	**23.0**
No	81.5	71.4	**77.0**

Note: (b) and (c) are the percentages of only those households with electricity. Since some households that have a meter share with one or more other households, (b) and (c) will not add to 100% (see Table 1A.10).

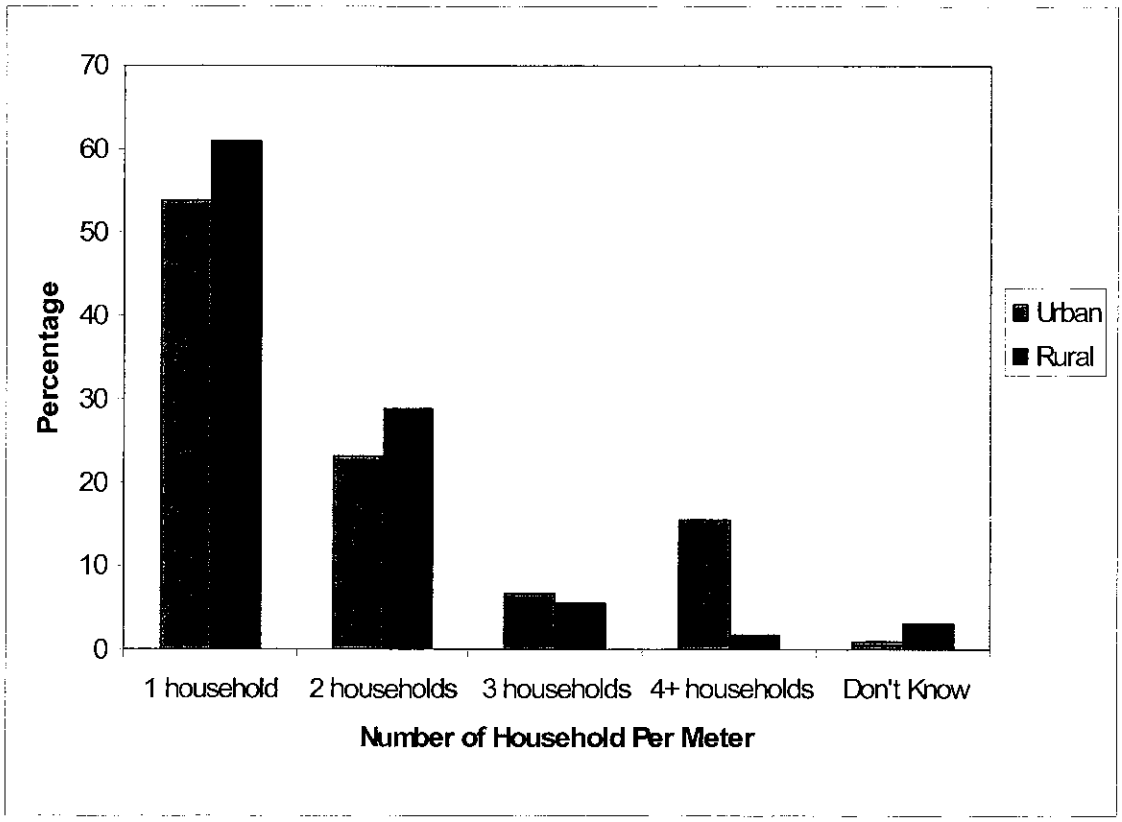

FIGURE 1A.1: DISTRIBUTION OF HOUSEHOLDS SHARING AN ELECTRIC METER BY NUMBER OF HOUSEHOLDS PER METER AND REGION

Households and Electric Meter Reading

Overall, only 9.1% of all heads of households were able to read an electric meter (see Table 1A.2). The proportion of household heads who were able to read an electric meter was higher for urban (12.6%) than rural households (5.1%) and for male-headed households (12.6%) than for female-headed households (5.3%). The ability to read an electric meter increased with the level of education of the head of household (see Table 1A.3) but had no consistent association with the age of head of household (see Table 1A.4). None of the heads of household with no formal education or with only pre-primary education were able to read their electric meter, while as might be expected, the highest proportion of heads of households who were able to read their meter were those with tertiary education (28.9%).

TABLE 1A.2: Distribution of Opinions of Heads of Households on Electric Meter Reading by Region and Gender

Question & Response	% of Households				
	Region		Gender		All
	Urban	Rural	Male	Female	
Able to read electric meter?					
Yes	12.6	5.1	12.6	5.3	**9.1**
No	87.4	94.9	87.4	94.7	**90.9**
Think it is important to be able to read electric meter?					
Yes	97.6	97.2	98.4	96.4	**97.4**
No	2.4	2.8	1.6	3.6	**2.6**
Would like to learn to read electric meter?					
Yes	90.7	93.0	93.6	90.0	**91.7**
No	9.3	7.0	6.4	10.0	**8.3**

Heads of households overwhelmingly reported (97.4%) that they thought it important for people to be able to read their electric meter (Table 1A.2) and this response cut across regional category and gender of household heads with the minimum percentage of a "yes" to this question being 96.4% for female-headed households. This varied by level of education (Table 1A.3), with the proportion of heads of households with no education (87.5%) or with pre-primary education (80.0%) who thought it was important for people to be able to read their electric meter being lower than those with more education (97%-98%). When categorized by age (Table 1A.4), there was no apparent difference in the distribution of opinions of heads of household on the importance of people being able to read their electric meter.

TABLE 1A.3: Distribution of Opinions of Heads of Households on Electric Meter Reading by Level of Education

	% of households				
	Level of Education				
Question & Response	**None**	**Pre-Primary**	**Primary**	**Secondary**	**Tertiary**
Able to read electric meter?					
Yes	0.0	0.0	2.4	6.6	28.9
No	100	100	97.6	93.4	71.1
Think it is important to be able to read electric meter?					
Yes	87.5	80	98.3	97.4	97.6
No	12.5	20	1.7	2.6	2.4
Would like to learn to read electric meter?					
Yes	62.5	70	89.8	93.3	93.3
No	32.5	30	10.2	6.7	6.7

TABLE 1A.4: Distribution of Opinions of Heads of Households on Electric Meter Reading by Age

	% of households		
Question & Response	**Less than 40 years old**	**40 – 59 years old**	**60 years old & above**
Able to read electric meter?			
Yes	5.3	14.1	6.7
No	94.7	85.9	93.3
Think it is important to be able to read electric meter?			
Yes	98.4	97.6	95.8
No	1.6	2.4	4.2
Would like to learn to read electric meter?			
Yes	93.6	94.2	85.8
No	6.4	5.8	14.2

In general, heads of households showed strong interest in learning to read their electric meter, as 91.7% stated that they wanted to (see Table 1A.2). This was consistently high regardless of region or gender. The percentage of heads of household who would like to learn how to read their electric meter also increased consistently with the level of education (see Table 1A.3) from a low of 62.5% of those with no education to a high of 93.3% of those with tertiary education. Interest was generally high among all age groups but was lowest (85.8%) among household heads 60 years and over (see Table 1A.4).

The few household heads who knew how to read their electric meter mainly learnt from "brochures, flyers, pamphlets etc.", with 34.0% of urban household heads and 27.3% of rural household heads learning to read their meter from this group of sources. Family and friends and JPS personnel were other popular sources of learning to read electric meter by 11.3% each of urban household heads, and newspapers 13.2%, while seminars were popular sources for 13.6% of rural household heads (Table 1A.5). On a cautionary note, households' response to this question of the source from which they learnt to read their meter was generally poor because so few knew how to read their meters and the findings here may not represent the national outlook.

TABLE 1A.5: Distribution of Heads of Households' Source of Knowledge of Meter Reading by Region

QUESTION: From what source did you learn to read your electric meter?

Source of Knowledge	% of Household Heads		
	Urban	**Rural**	**All**
Newspaper	13.2	9.1	**12.0**
Brochure etc	34.0	27.3	**32.0**
Friends/Family	11.3	9.1	**10.7**
Seminars	7.5	13.6	**9.3**
Radio	1.9	9.1	**4.0**
Other	13.2	9.1	**12.0**
JPS Personnel	11.3	9.1	**10.7**
Self-Taught	5.7	4.5	**5.3**
School	1.9	9.1	**4.0**
Total	**100**	**100**	**100**

Entity to Which Households Make Electricity Payments

The majority of households (72.7%) made electricity bill payments directly to the Jamaica Public Service Company (JPS) for the electric service that they received (Table 1A.6). The percentages were similar for urban and rural households. Approximately 17% of households made payments for electricity services indirectly through others: relatives, landlords and persons with whom they shared meters. The incidence of such arrangements was higher among rural households (21.3%) than their urban counterparts

(12.3%). The percentage of household heads who reported not paying for electricity service was 10.2%; it was higher for urban (14.7%) than for rural households (4.4%).

TABLE 1A.6: Distribution of Heads of Households by Entity to Which Electricity Payment Was Made and by Region and Gender

QUESTION: To whom does this household pay for the electricity service received?

	% of Heads of Households				
	Region		Gender		
To whom payment is made:	**Urban**	**Rural**	**Male**	**Female**	**All**
Directly to JPS	72.0	73.6	70.3	75.1	**72.7**
Neighbour/relative	5.6	13.5	11.1	6.9	**9.0**
Included in rent	1.2	0.3	1.1	0.6	**0.8**
Household share meter with	5.3	7.2	6.8	5.5	**6.1**
Other	1.0	0.6	0.8	0.8	**0.8**
Do not pay	14.7	4.4	9.5	11.0	**10.2**
Landlord	0.2	0.3	0.5	0.0	**0.3**
Total	**100**	**100**	**100**	**100**	**100**

Direct payment to JPS was the preferred method of payment by 70.3% of male-headed households reported paying directly to the JPS compared to 75.1% of female-headed households (Table 1A.6). A relatively equal proportion of male and female headed households reported that they did not pay for electricity.

The proportion of household heads who reported paying directly to the JPS increased with age (see Table 1A.7), and to some extent, the income level of the household head (Table 1A.8). The incidence of non-payment for electricity was highest among households headed by persons under 40 years old (17.5%) and in households where the income of the head was in the range of $12,000-$23,999 per month.

TABLE 1A.7: Distribution of Heads of Households by Entity to which Electricity Payment Was Made and by Age

	% of Heads of Households		
To whom payment is made:	**Less than 40 years**	**40-59 years**	**60 years and above**
Directly to JPS	55.0	79.2	85.9
Neighbour/relative	15.1	7.3	3.6
Included in rent	1.6	0.7	0.0
Household share meter with	9.2	6.2	2.1
Other	1.2	0.7	0.5
Do not pay	17.5	5.5	7.8
Landlord	0.4	0.3	0.0
Total	**100**	**100**	**100**

TABLE 1A.8: Distribution of Heads of Households by Entity to Which Electricity Payment Was made and Monthly Income

	% of Heads of Households			
To whom payment is made:	**Less than $12,000**	**$12,000-$23,999**	**$24,000-$79,999**	**$80,000 and above**
Directly to JPS	69.6	63.3	80.3	100.0
Neighbour/relative	15.2	14.1	4.7	0.0
Included in rent	0.0	0.6	0.8	0.0
Household share meter with	4.3	7.9	6.3	0.0
Other	2.2	0.6	0.0	0.0
Do not pay	8.7	13.0	7.9	0.0
Landlord	0.0	0.6	0.0	0.0
Total	**100**	**100**	**100**	**100**

There appeared to be an association between a household's sole or joint possession of an electric meter and the entity to which they made payment for the electric service they received (See Table 1A.9). Only 33.6% of households who share an electric meter with another household pay directly to the JPS in contrast with 93.4% of those who have their own electric meter. Although the proportion of households who reported not paying for electricity is not very different for those who share an electric meter (10.3%) and those who do not (8.9%), only 1.3% of those households with an electric meter reported not paying for electricity compared with 40.5% of those who did not have an electric meter. This could imply that households that do not have their own electric meters may be less inclined to pay for electricity.

Apart from households explicitly stating whether or not they pay for electricity, we could independently estimate from the survey that about 8.2% of all households did not pay for electricity. This constituted the proportion of those households who do not share a meter and who reported not having their own meter even though they had electricity service (See Table 1A.10). This estimate represented a lower boundary on the proportion of households that did not pay for electricity when compared with 9.3% of all households that categorically stated that they did not pay for electricity and compared with the JPS estimate that about 12% of electricity generated was lost to theft (households and businesses)[12].

TABLE 1A.9: Distribution of Households by Entity to Which Electricity Payment Was Made and Possession of Electric Meter

	% of Heads of Households			
To whom payment is made:	**Have Electric Meter**		**Share Electric Meter**	
	Yes	**No**	**Yes**	**No**
Directly to JPS	93.4	6.2	33.6	88.0
Neighbour/relative	1.4	31.4	27.6	1.6
Included in rent	1.1	1.0	2.2	0.8
Household share with	2.0	20.0	25.0	0.0
Other	0.5	1.0	0.4	0.6
Do not pay	1.3	40.5	10.3	8.9
Landlord	0.4	0.0	0.9	0.1
Total	100	100	100	100

[12] personal communication from Director of Corporate Communications, JPS

TABLE 1A.10: Distribution of Households by Possession or Sharing of Electric Meter

QUESTION: Does his household have an electric meter?

	% of Households*		
Have Electricity Meter	**Share Electric Meter**		
	Yes	**No**	**All**
Yes	10.4	68.9	**79.3**
No	12.5	8.2	**20.7**
Total	**23.9**	**77.1**	**100**

* Note that percentages represent proportions of the total number of households

Households' Consumption of Electricity

Overall, the mean of monthly payments for electricity was $2960.75, with the mean being higher for urban ($3380.04) than rural households ($2480.34). The highest percentage of heads of urban households (33.7%) reported paying an average of between $3001 and $5000 per month for electricity compared with the majority of heads of rural households (27.8%) who reported paying an average of between $1001 and $2000 per month for electricity (Figure 1A.2) . For both urban and rural households, the average monthly payment for electricity generally increased with family size.

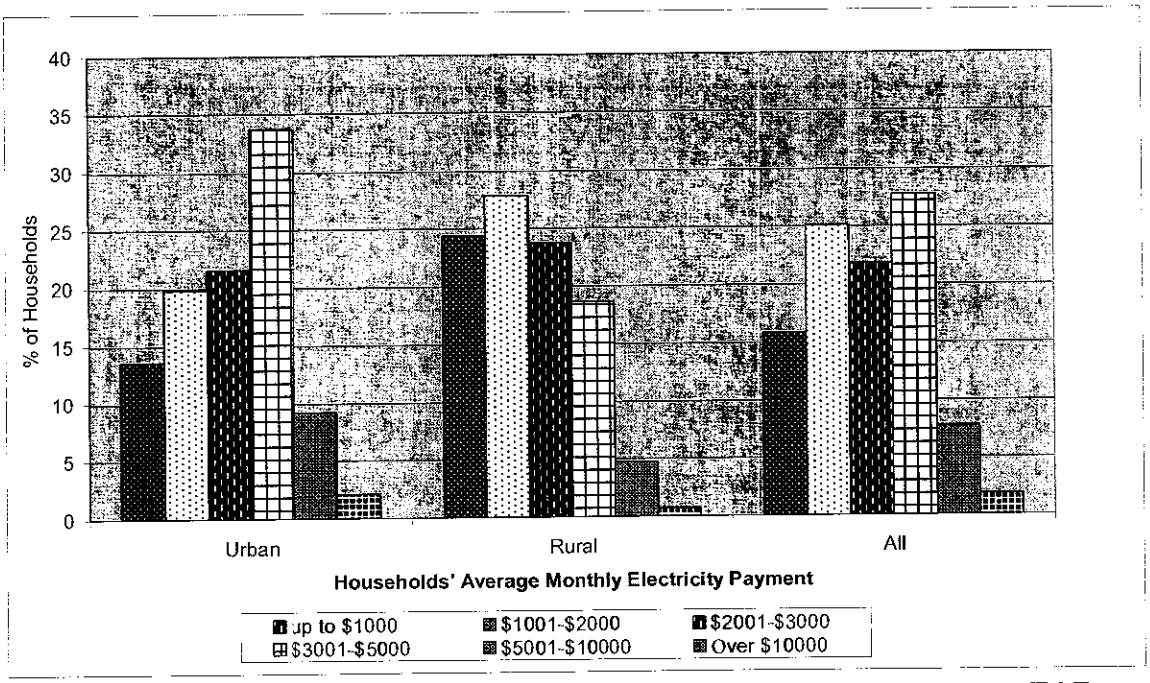

FIGURE 1A.2: DISTRIBUTION OF AVERAGE MONTHLY PAYMENT FOR ELECTRICITY BY REGION

Based on limited record of actual electricity usage as verified by actual electricity bills presented by households, electricity usage within the preceding two months to the start of the energy survey showed a mean of 366 kWh per month. The highest percentage of households (24.7%) used in the range of 201kWh - 300kWh per month (see Figure 1A.3). The mean consumption by urban households was 440 kWh, which was noticeably higher than the mean of 323 kWh by rural households.

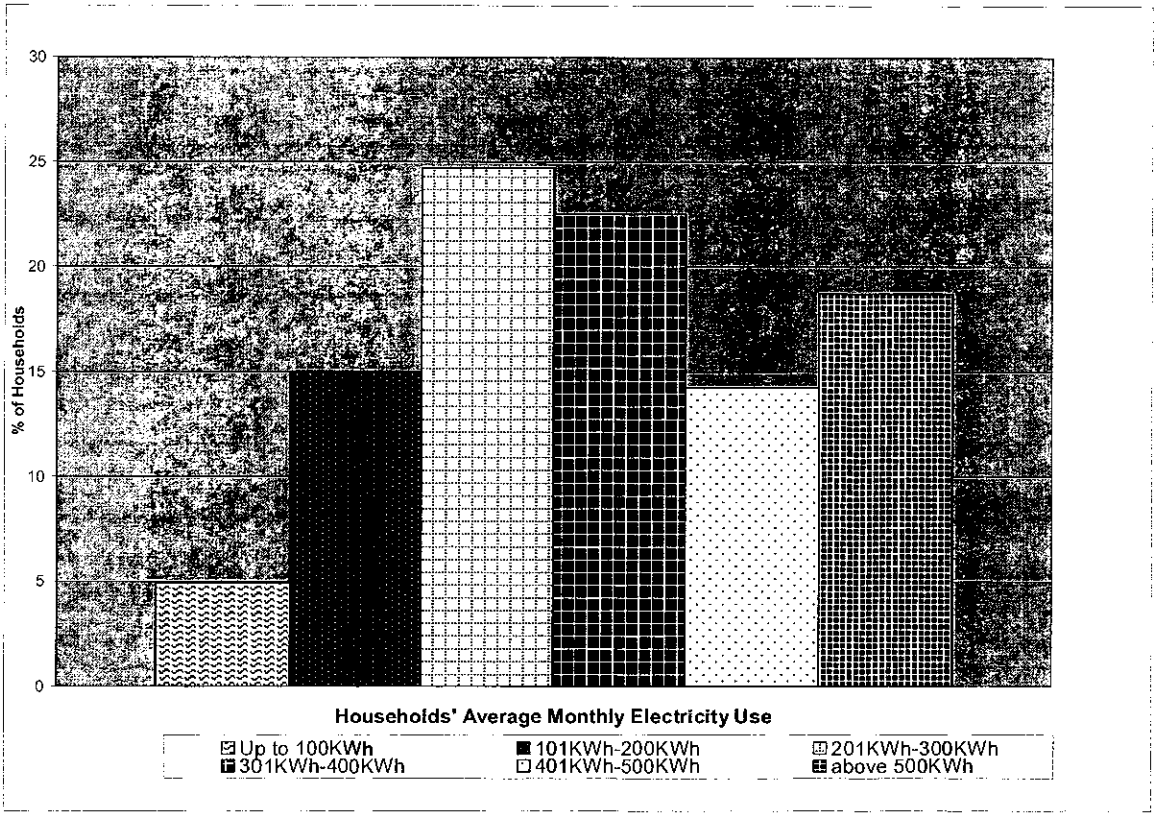

FIGURE 1A.3: DISTRIBUTION OF HOUSEHOLDS' AVERAGE MONTHLY USAGE OF ELECTRICITY

Electrical Appliances

The most common electrical appliances found in households (Table 1A.11) were television sets (93.1% of households), clothes irons (88.0%) and refrigerators (82.0%). While 73.9% of households reported possession of radios, access to the medium of radio was likely to be much higher due to the fact that 40.2% of households reported having component sets/stereos. It was noted that some of the high electricity use appliances were not common, such as deep freezers (10.6%), electric water heaters (6.4%), stoves (4.1%) and air conditioners (3.0%). Computers were in 16.4% of households.

There were major differences between regions. A higher percentage of rural households had radios (80.0% compared to 68.7% urban), while urban households had more component sets and DVD players. For many of the high electricity use appliances, there was a higher percentage among the urban households, including refrigerators (86.5% urban compared to 76.4% rural), clothes iron (93.3% to 81.4%), and microwave ovens (43.7% to 23.5%).

TABLE 1A.11: Proportion of Households Using Electrical Appliances By Region And Average Number Of Appliances Per Household

QUESTION: Does this household use any of the following electrical appliances? If yes, how many of each does the household use?

	% of Households			Average No. per Household With the Appliance
Appliances	**Urban**	**Rural**	**All**	
Radio	68.7	80.0	**73.9**	1.10
Component set/stereo	49.0	29.6	**40.2**	1.04
Television	95.0	90.7	**93.1**	1.22
DVD player & recorder	43.1	33.8	**38.9**	1.07
Hair dryer	13.2	6.2	**10**	1.07
Electric water heater	7.9	4.4	**6.4**	1.00
Refrigerators	86.5	76.4	**82.0**	1.09
Deep freeze	11	10.2	**10.6**	1.01
Computer	20.9	10.8	**16.4**	1.03
Microwave oven	43.7	23.5	**34.6**	1.01
Electric stove	6.2	1.6	**4.1**	1.02
Electric clothes iron	93.3	81.4	**88.0**	1.03
Electric fan	82.2	54.8	**69.9**	1.40
Washing machine	31.5	12.6	**23.1**	1.00
Electric sewing machine	8.3	5.3	**7.0**	1.03
Vacuum cleaner	4.5	1.8	**3.3**	1.00
Food processor	4.5	2.2	**3.5**	1.06
Blender	62	49.9	**56.6**	1.03
Air conditioning	4.3	0.9	**3.0**	1.10

The modal class of all appliances was one per household, while the average number of appliances per household ranged from 1.0 for a few appliances to a high of 1.22 television sets and 1.40 fans per household (see Table 1A.11). For the major electrical appliances used by households, 19.5% and 16.0% of all households had two or more television sets and electric fans per household, respectively (see Table 1A.12).

TABLE 1A.12: Distribution of Household by Number of Major Electrical Appliances Used

	% of Households		
Appliances	**None**	**One**	**Two or more**
Radio	26.2	67.4	6.4
Television	7.0	77.0	16.0
Refrigerator	18.0	79.8	2.2
Electric clothes iron	12.1	85.2	2.7
Electric fan	30.3	50.2	19.5

Consideration of Energy Efficiency of Appliances

Approximately 84% of all households reported that it was important to extremely important to consider electricity consumption when purchasing electrical appliances (Figure 1A.4). Urban and rural households tended to place similar high importance to consideration of electricity consumption when purchasing electrical appliances (see Figure 1A.4), as did male and female heads of households (see Figure 1A.4).

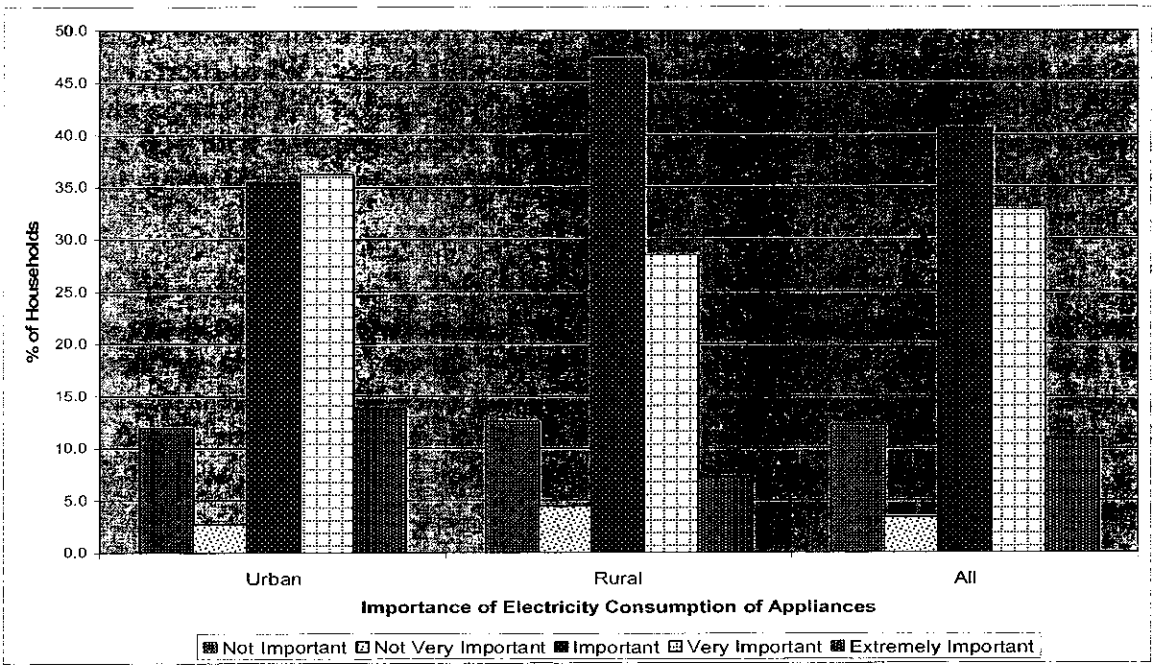

FIGURE 1A.4: DISTRIBUTION OF OPINIONS OF HOUSEHOLD HEADS ON THE IMPORTANCE OF ELECTRICITY CONSUMPTION IN DECISION TO PURCHASE APPLIANCES BY REGION

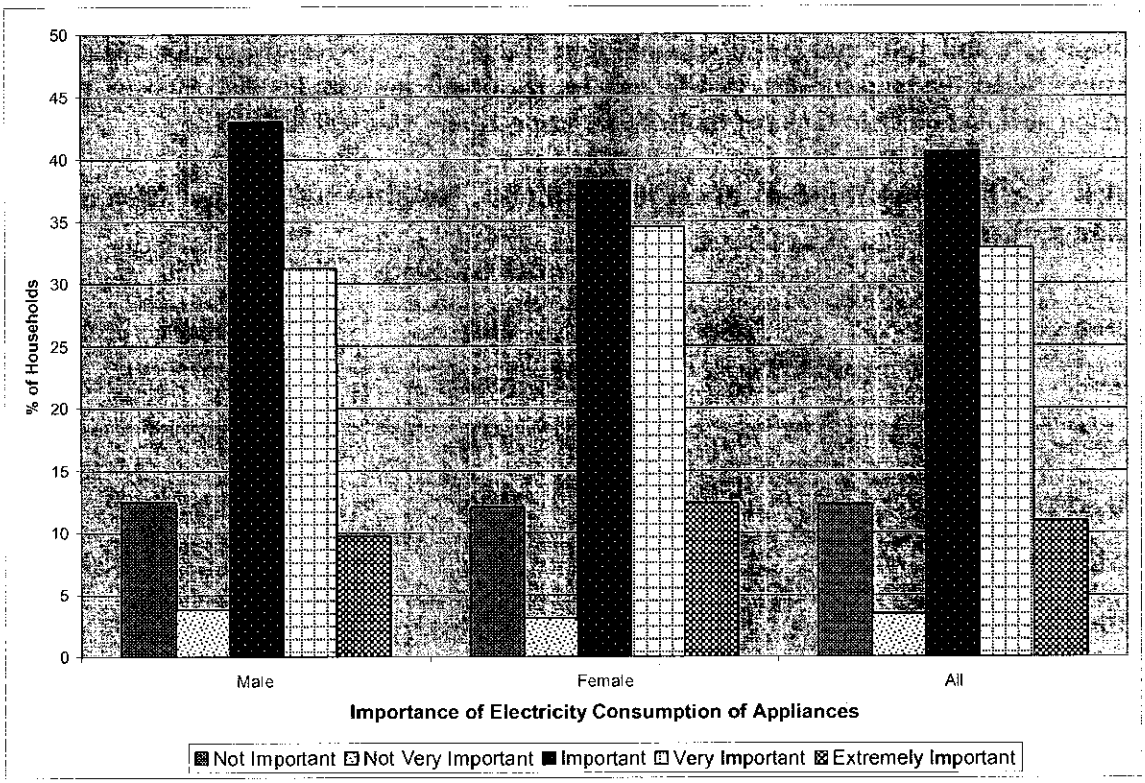

FIGURE 1A.5: DISTRIBUTION OF OPINIONS OF HOUSEHOLD HEADS ON THE IMPORTANCE OF ELECTRICITY CONSUMPTION IN DECISION TO PUECHASE APPLIANCES BY GENDER.

Comparison with Other Surveys

The current energy survey showed an increase in the proportion of all households having electricity, rising to 90.3% in 2006 from 83.8% in the 1997 survey. When compared with the 1997 survey, there appeared to be a marked increase in the average monthly household consumption of electricity to 366 kWh in 2006, compared with 166 kWh in 1997, although the limited sample size of the 2006 data needs to be considered in making the comparison.

Comparison of the percentage of households having various appliances over the decade showed little change for radios, or for some of the high electricity users -electric stoves, water heaters and air conditioners (Table 1A.13). Others showed large increases, particularly microwave ovens, televisions, washing machines and component sets/stereos. There was also some increase in the prevalence of refrigerators and electric clothes irons. These changes, associated with an improving standard of living, would account for the increasing electricity usage discussed above.

TABLE 1A.13: Comparison of Major Electrical Appliances in Households in 1997 and 2006.

	% of Households	
Appliances	**1997**	**2006**
Radio	74.5	73.9
Component set/stereo	16.8	42.0
Television	74.0	93.1
Refrigerator	69.6	82.0
Electric clothes iron	74.2	88.0
Microwave oven	6.9	34.6
Washing machine	6.4	23.1
Electric stove	3.2	4.1
Electric water heater	2.9	6.4
Air conditioner	1.7	3.0

Conclusions

Between the 1997 and 2006 energy surveys, an increasing trend in the proportion of households having electricity was identified. As access to electricity improves, the present survey pointed to the importance of households having their own electric meters to ensure payment for electricity consumed. The likelihood that a household will not pay for electricity may increase when they do not have their own meter. The survey also indicated that a higher proportion of urban households in comparison to rural households did not pay for electricity. Similarly, a higher proportion of households headed by individuals less than 40 years of age did not pay for electricity compared to households headed by people age 40 years and above. These have implications for JPS' efforts in dealing with theft of electricity and provide insights for which categories of households are likely to consume electricity illegally.

The present survey suggests that the average monthly electricity consumption by households has increased by up to 200kWh per household within a decade. While the limited sample size of the 2006 data needs to be considered in making the comparison, the finding does create a concern about energy use. The increased consumption appeared to be due to a higher percentage of households having electricity, combined with more households acquiring electrical appliances, particularly microwave ovens, televisions washing machines and component sets/stereos, and to some extent, more refrigerators and electric clothes irons. This is associated with an improving standard of living, but points to the priority needed for encouraging energy conservation.

1B KEROSENE

Some 30.0% of all households used kerosene over the previous seven days before the survey. Useage was higher for rural households (41.6%) than for urban households (19.4%). Accordingly, the proportion of households that did not use kerosene was higher for urban households (33.8%) than for rural households (19.6%). Recent use of kerosene by households did not seem to be influenced profoundly by the gender of the household head (See Table 1B.1), although the proportion of male-headed households that did not use kerosene (30.9%) was higher than that of female-headed households (22.2%).

On the other hand, the age of the household head appeared to play a major role in the use of kerosene. For the three most recent categories of use, namely within the past 7 days, past 1-2 months, and past 3-6 months, the proportion of households using kerosene increased with age. For example, within the past 7 days category, the proportion ranged from a low of 21.4% for households with heads less than 40 years of age to 37.2% for households with heads 60 years of age and older. Concurrently, the proportion of households that did not use kerosene decreased with the age of the household head (Table 1B.2).

The educational level of the household head was another characteristic that delineated households in terms of recent usage of kerosene. The percentage of households using kerosene within the past seven days of the survey was highest for households whose heads had no education (43.8%) and lowest for those households whose heads had tertiary education (11.7%). Households headed by individuals with tertiary education also recorded the highest percentage of households that did not use kerosene while those headed by individuals with pre-primary education showed the lowest percentage of households that did not use kerosene (Table 1B.3).

TABLE 1B.1: Distribution of Households' Recent Use of Kerosene by Region and Gender

QUESTION: How recently did this household use kerosene?

	% of Households				
Used Kerosene in:	**Urban**	**Rural**	**Male**	**Female**	**All**
Past 7 days	19.4	41.6	28.8	31.5	**30.0**
Past 1-2 months	26.4	27.1	24.5	29.3	**26.7**
Past 3-6 months	9.9	7.8	8.3	9.6	**8.9**
Past 7-12 months	2.7	0.6	1.5	2.0	**1.7**
Over 12 months	7.7	3.4	5.9	5.3	**5.6**
Don't use	33.8	19.6	30.9	22.2	**27.0**
Total	**100**	**100**	**100**	**100**	**100**

Kerosene was used predominantly by urban households for emergency cooking with 65.6% of them indicating that they used it for this purpose. On their part, a sizeable proportion of rural households used kerosene for multiple purposes including for emergency lighting (49.7%), for lighting (44.3%) and to start a fire (43.9%). Apart from

the use of kerosene for emergency lighting by 60.0% of female-headed households compared with 54.5% of male-headed households, there were no marked differences in the use of kerosene for other purposes when households were grouped by gender of the head of household (Table 1B.4)

TABLE 1B.2: Distribution of Households' Recent Use of Kerosene by Age of Household Head

	% of Households		
Used Kerosene in:	**Less than 40 years**	**40-59 years**	**60 years and above**
Past 7 days	21.4	32.4	37.2
Past 1-2 months	23.6	26.0	31.6
Past 3-6 months	7.5	8.6	11.2
Past 7-12 months	1.9	2.3	0.7
Over 12 months	5.9	6.3	4.3
Don't use	39.7	24.4	15.1
Total	100	100	100

TABLE 1B.3: Distribution of Households' Recent Use of Kerosene by Educational Level of Household Head

	% of Households				
Used Kerosene in:	**None**	**Pre Primary**	**Primary**	**Secondary**	**Tertiary**
Past 7 days	43.8	40.0	43.2	28.3	11.7
Past 1-2 months	31.3	33.3	25.3	27.1	26.3
Past 3-6 months	6.3	0.0	9.2	7.1	15.2
Past 7-12 months	0.0	6.7	1.7	1.9	0.6
Over 12 months	0.0	6.7	3.8	6.3	7.6
Don't use	18.8	13.3	16.8	29.3	38.6
Total	100	100	100	100	100

TABLE 1B.4: Distribution of Households by Purpose of Use of Kerosene by Region and Gender of Household Head

QUESTION: For what purposes does this household use kerosene?

	% of Households				
Use of Kerosene	**Urban**	**Rural**	**Male**	**Female**	**All**
To start fire	29.3	43.9	36.7	37.2	**37.0**
Lighting	27.7	44.3	36.3	36.7	**36.5**
Cooking	2.1	2.8	1.9	3.0	**2.4**
Emergency lighting	65.5	49.7	54.5	60.0	**57.2**
Emergency cooking	11.1	8.4	9.5	9.9	**9.7**

The kerosene lamp was the main kerosene appliance used by households (57.1%). Less than 1% of households surveyed reported using a kerosene stove, while no household indicated using a kerosene-powered refrigerator. Consequently, 82.6% of households that used kerosene on a daily basis used it for lighting while all of the households who purchase kerosene on a daily basis used it for lighting. Quart and gallon were the major units in which households purchased kerosene irrespective of region, with 47.4% and 48.5% of urban and rural households, respectively, reporting that they purchased kerosene in quarts while 37.0% and 38.7% of urban and rural households reported that they purchased kerosene in gallons (Table 1B.5). There were no apparent regional differences in households' choice of a source from which to purchase kerosene (Table 1B.6) and, likewise, there was no noticeable relationship between the unit in which households purchased kerosene and the source of purchase.

TABLE 1B.5: Percentage Distribution of Households by Unit of Quantity of Kerosene Purchase and Region

QUESTION: In what unit of quantity do you purchase kerosene?

	% of Households		
Unit of Purchase	**Urban**	**Rural**	**All**
Pint	12.5	7.9	**10.1**
Quart	47.4	48.5	**48.0**
Gallon	37.0	38.7	**37.9**
Litre	1.0	2.3	**1.7**
Other	1.8	2.1	**2.0**
Don't Know	0.3	0.5	**0.4**
Total	100	100	**100**

TABLE 1B.6: Percentage Distribution of Households by Place of Purchase of Kerosene and Region

QUESTION: Where do you normally purchase kerosene?

	% of Households		
Place of purchase	**Urban**	**Rural**	**All**
Grocery shop	41.3	39.4	**40.3**
Supermarket	7.3	5.1	**6.1**
Gas station	9.6	13.9	**11.9**
Motorized vendor	0.8	6.3	**3.7**
Other retailer/shop	11.2	9.0	**10.0**
Others	27.5	25.1	**26.2**
Don't know	2.3	1.2	**1.7**
Total	100	100	**100**

The accuracy of data on unit price of kerosene and expenditure on kerosene provided by households appears unreliable as there were instances in which the unit price the household indicated that they paid was more than the expenditure, even though the household consumed more than one unit of kerosene. While efforts were made to exclude such records from the calculations of mean unit prices and expenditures, there were still prices and expenditures provided by households that fall outside reasonable range, but for which there is no way of verifying their accuracy. Within these data limitations, mean values of unit prices of kerosene paid by households, and expenditure by household on kerosene, were computed.

For the common units in which households purchased kerosene, rural households consistently paid a higher average unit price than urban households (See Table 1B.7). There were two possible reasons for this price difference. Higher prices paid by rural households may reflect a mark-up due to the higher cost of transporting kerosene to the rural areas or may be a market response to a higher useage of kerosene relative to urban households, or both. Rural households used considerably more pints than quarts or gallons, while urban households used somewhat more quarts. However, for both regions, the preferred unit was not the most economical as rural areas would pay $64 per pint less if they purchased in quart sizes, while urban areas would pay $16.94 per quart less if they purchased in pints. These anomalies apparently reflect the pricing mechanism in the market in response to demand/supply factors.

TABLE 1B.7: Average Quantity of Kerosene Used Per Week and Average Unit Price Paid by Households for Kerosene by Units of Purchase and Region

QUESTION: How many units of kerosene does this household use per week?

	Means					
Unit	**Urban**		**Rural**		**All**	
	Number of units used	**Unit price J$**	**Number of units used**	**Unit price J$**	**Number of units used**	**Unit price J$**
Pint	1.00	40.00	2.13	121.54	**1.87**	**102.35**
Quart	1.78	96.94	1.47	115.11	**1.56**	**109.84**
Gallon	1.47	301.05	1.12	349.50	**1.26**	**330.71**

Comparison with Other Surveys

The current survey indicated that only 30% of all households used kerosene within the previous 7 days of the survey, while the 1997 energy survey reported that 56.6% of households used kerosene regularly. These two figures may not be directly comparable, but a decline in the use of kerosene was consistent with the trend established by JSLC which reported significant declines in the percentage of households using kerosene for lighting from 26.9% in 1994 to 6.9% in 2004. No household reported using a kerosene refrigerator in 2006, while in the 1997 survey the kerosene refrigerator was identified as a kerosene appliance used by about 0.15% of households. Two uses of kerosene - lighting and cooking – showed relatively small change from the 1997 survey. The proportion of all households reporting that they used kerosene for lighting dropped to 36.5% in 2006 from 44.2% in 1997, while kerosene for cooking declined to 2.4% of all households in 2006 from 7.1% in 1997.

Conclusions

The findings of this survey indicated that more rural households used kerosene than urban households and that households headed by males were more likely not to use kerosene at all. There was also evidence to suggest that households headed by older individuals were more likely to use kerosene, as well as more frequently when they do, than those headed by younger people. In addition, households headed by individuals with secondary or tertiary education were less likely to use kerosene than households headed by individuals with only primary education or less.

There was clearly a different pattern of use for kerosene between urban and rural households established in this survey. While urban households used kerosene mainly for emergency lighting, rural households used it for multiple purposes including for emergency and other lighting and to start a fire. Overall, when compared with the 1997 survey results, the proportions of households using kerosene for these purposes have declined.

1C LIQUID PETROLEUM GAS

Overall, LPG was used by 82.8% of households over the previous seven days before the survey (see Table 1C.1), with urban households having a higher proportion (89.4%) than rural households (75.6%). More than twice the percentage of rural households do not use LPG (16.6%) compared to urban (6.9%). When households were grouped by gender of the head of household, 78.7% of male-headed households reported using LPG within the past 7 days of the survey while 87.6% of female-headed households reported doing so (see Table 1C.1). Twice the percentage of male-headed households do not use LPG (16.6%) compared to female-headed (6.9%).

Households whose heads fall in the middle age group had a higher percentage of use of LPG within the past 7 days of survey and a lower percentage of households that do not use LPG than the other two age groups. The level of education of the head of household appeared to have an impact on the use of LPG within the past 7 days of the survey. As shown in Table 1C.2, 94.7% of households whose heads have tertiary education used LPG within the past 7 days of the survey compared to 62.5% and 60.0% of households headed by individuals who had no education or only pre-primary education, respectively. Correspondingly, lower education levels corresponded with a higher percentage of non-user of LPG; this would be a corollary of more using kerosene.

TABLE 1C.1: Distribution of Households' Recent Use of LPG by Region and Gender

QUESTION: How recently did this household use LPG?

	% of Households				
Used LPG in:	**Urban**	**Rural**	**Male**	**Female**	**All**
Past 7 days	89.4	75.6	78.7	87.6	**82.8**
Past 1-2 months	2.6	5.6	4.4	3.5	**4.0**
Past 3-6 months	0.7	1.1	1.1	0.6	**0.9**
Past 7-12 months	0.3	0.2	0.2	0.4	**0.3**
Over 12 months	0.2	0.9	0.7	0.4	**0.5**
Don't use	6.9	16.6	14.9	7.5	**11.5**
Total	**100**	**100**	**100**	**100**	**100**

TABLE 1C.2: Distribution of Households' Recent Use of Kerosene by Educational Level of Household Head

	% of Households				
Used Kerosene in:	**None**	**Pre Primary**	**Primary**	**Secondary**	**Tertiary**
Past 7 days	62.5	60.0	77.1	82.7	94.7
Past 1-2 months	6.3	13.3	6.2	3.7	0.6
Past 3-6 months	6.3	0.0	0.7	1.0	0.6
Past 7-12 months	0.0	0.0	0.0	0.3	0.6
Over 12 months	0.0	0.0	0.7	0.7	0.0
Don't use	25.0	26.7	15.4	11.5	3.5
Total	100	100	100	100	100

Households overwhelmingly use LPG for cooking (see Table 1C.3), with more than 99% of households reported using LPG for this purpose, irrespective of region and gender of the household head.

Some 16.3% of households with an LPG stove had one without an oven (see Table 1C.3). This type of stove was somewhat more prevalent in rural households, but little difference was observed based on the gender of household head.

More than half of any category of households by region or gender of household head purchased LPG on a monthly basis (see Table 1C.3). No noticeable difference was observed between urban and rural households in this respect, while the proportion of female-headed households indicating that they purchase LPG on a monthly basis (63.1%) was higher than that of male-headed households (53.2%).

TABLE 1C.3: Distribution of Households by Purpose of LPG, Appliances Used, Frequency of Purchase, Region and Gender

QUESTION: For what purposes does this household use LPG? What type of LPG appliances do you use in this household? How often this household use LPG?

	% of Households				
LPG	**Urban**	**Rural**	**Male**	**Female**	**All**
Used for:					
Cooking	100	99.8	99.8	100	**99.9**
Water Heater	0.6	2.7	1.2	1.9	**1.5**
Home Business	0.0	0.7	0.4	0.2	**0.3**
Appliance Used:					
Stove with Oven	86.6	80.5	82.1	85.7	**83.8**
Stove without Oven	13.4	19.7	17.9	14.5	**16.3**
Frequency of Purchase of LPG:					
Daily	0	0.3	0.3	0	**0.2**
Weekly	0	1.3	0.6	0.7	**0.6**
Monthly	57.4	58.6	53.2	63.1	**58**
Every 6 weeks	4.3	6.3	5.8	4.6	**5.2**
Every 2 months	18.2	16.4	18.3	16.3	**17.4**
Every 3 months	18.8	13.8	19.3	13.4	**16.4**
Emergency etc	1.2	3.3	2.4	2	**2.2**
Total	100	100	100	100	**100**
Size of Cylinder					
20 lb	3.7	2.5	2.9	3.4	**3.1**
25 lb	62.5	66.1	63.1	65.2	**64.1**
30 lb	17.2	21.3	18.5	19.6	**19**
100 lb	16.6	10.1	15.4	11.7	**13.7**
Total	100	100	100	100	**100**

LPG was most widely purchased in 25lb cylinders by households followed by 30lb, 100lb and 20lb sizes. This order of preference held for both urban and rural households as well as for male- and female-headed households (see Table 1C.3). In addition, 92.9% of all households that reported using LPG used it on a daily basis.

On average, rural households paid a higher unit price for all sizes of LPG cylinders than urban households. The best example was the average unit price of $949.50 paid by urban households for a 20lb cylinder compared to $1101.82 paid by rural households. Urban households with 30lb and 100lb cylinders reported using them for about one and a half weeks longer than rural households that used similar size cylinders (see Table 1C.4).

TABLE 1C.4: Average Unit Price Paid for LPG by Households and Duration of Use by Cylinder Size

QUESTION: What size cylinder does this household use at home?

	Means					
Cylinder size	**Urban**		**Rural**		**All**	
	Unit price ($)	**Weeks lasted**	**Unit price ($)**	**Weeks lasted**	**Unit price ($)**	**Weeks lasted**
20lb	949.50	6.85	1101.82	6.90	**1003.55**	**6.87**
25lb	1144.66	7.71	1154.54	7.56	**1149.27**	**7.64**
30lb	1236.92	8.74	1297.89	7.31	**1268.06**	**8.01**
100lb	3744.17	22.97	3911.78	21.64	**3802.64**	**22.53**

TABLE 1C.5: Distribution of Households by Source of LPG Purchase, Region and Gender of Household Head

QUESTION: From where does this household normally purchase LPG cylinders?

	% of Households				
Normal source of LPG Purchase	**Urban**	**Rural**	**Male**	**Female**	**All**
Retail/distributor	83.5	62.3	72.9	75.1	**73.9**
Supermarket/grocery	8.5	18.8	13.9	12.3	**13.1**
Gas station	3.8	7.6	5.0	6.2	**5.5**
Filling station	2.8	6.5	5.1	3.7	**4.5**
Motorize vendor	0.9	1.2	1.0	1.1	**1.0**
Home vendor	0.2	3.7	2.0	1.5	**1.8**
Don't know	0.2	0.0	0.2	0.0	**0.1**
Total	100	100	100	100	**100**

Retailers and distributors constituted the major group of suppliers of LPG to both urban and rural households, although a higher percentage of urban households (83.5%) purchase from this group when compared to rural households (62.3%). A further 8.5% of urban households purchase LPG from supermarkets and grocery shops, while 18.8% and 7.6% of rural households purchase LPG from supermarkets/grocery shops and gas stations, respectively. The gender of the head of households did not appear to influence the source of supply of LPG to households (See Table 1C.6). The educational level of head of household, on the other hand, played a role in the choice of where households purchase LPG. Sizeable proportions of households headed by individuals with pre primary education or no education (36.4% to 45.5%) purchase LPG from both retailers/distributors and supermarkets/grocery shops, while households headed by individuals with primary, secondary, or tertiary education predominantly (86.0% to 77.1%) purchase LPG from retailers/distributors (See Table 1C.6).

TABLE 1C.6: Distribution of Households by Source of LPG Purchase and Educational Level of Household Head

	% of Households				
Normal source of LPG	**None**	**Pre Primary**	**Primary**	**Secondary**	**Tertiary**
Retail/distributor	45.5	45.5	68.0	77.1	77.0
Supermarket/grocery shop	36.4	45.5	14.5	13.3	6.8
Gas station	0.0	0.0	7.5	4.0	8.7
Filling station	0.0	9.1	5.4	3.4	6.2
Motorize vendor	0.0	0.0	2.1	0.8	0.6
Home vendor	18.2	0.0	2.5	1.2	0.6
Don't know	0.0	0.0	0.0	0.2	0.0
Total	100	100	100	100	100

Comparison with Other Surveys

It was found that 88.5% of all households used LPG in 2006 compared to 77.4% estimated in the 1997 survey. Both studies indicated that the 25lb cylinder was the most popular size of cylinder to purchase LPG; however, the shopping pattern for LPG was observed to have changed, as most households in 2006 purchased LPG from retailers/distributors and supermarkets/grocery shops compared to roadside vendors and gas stations that were used in 1997.

1D. CHARCOAL

Charcoal Usage

The use of charcoal and firewood, both alternative sources of energy, is generally viewed as having potentially negative environmental effects associated with deforestation. At a broader level, use of these fuels as the main source of energy is usually linked to poverty and perceived under-development.

Based on this survey, the main factors affecting charcoal consumption were found to be income, education, gender of household head, the size of households and cultural preferences. Approximately 50% of households purchased charcoal in small quantities (Butter/cheese, Kerosene, and Paint Tins) probably reflecting, in part, the purchase by lower income households with unpredictable income flows. The remaining users, with more stable income, purchased the fuel in larger quantities (Rice/Fertilizer bags, Crocus bags) in an effort to economize. Expectedly, the use of charcoal declined with increasing education level, but use for recreational events was most common among households having tertiary trained heads.

In addition, charcoal was the preferred choice for "special events" largely reflecting the growing popularity of jerk foods among Jamaicans. The frequency of use of charcoal was more common in households that were headed by females, and households having more than three persons reflected higher consumption of the fuel.

Contrary to expectations, the use of charcoal among Jamaican households over the ten-year period 1997-2006 has increased to 49.1% (up by 9 percentage points). Although there is no difference in the overall rate of use by urban and rural households, the latter demonstrated more frequent usage with one in 5 rural households using charcoal on a daily basis compared to one in 10 urban households (Table 1D.1). This was reflected in the recentness of use, with approximately 22.4% of rural households reporting use in the "past 7 days" compared with 17.7 per cent of urban households. Combined weekly and daily use suggested that among charcoal using households 11.3% used charcoal at least once per week; 5.5% of all households used charcoal on a regular basis. The largest proportion of households using charcoal in both regions used the fuel on an "as needed basis" for emergencies and special events. This category was, however, higher in urban areas.

TABLE 1D.1: Recency and Frequency of Charcoal use by Households by Region

QUESTION: How recently did this household use charcoal?

	% of Household	
Time of Use	**Urban**	**Rural**
Past 7 Days	17.7	22.4
Past 1-2 Months	18.5	16.6
Past 3-6 Months	7.0	5.4
Past 7-12 Months	2.1	2.2
Over 12 Months	3.8	2.4
Do Not Use	50.9	50.9
Total	**100**	**100**
Frequency of Use		
Daily	9.8	19.8
Weekly	13.0	15.6
Monthly	11.2	9.5
Emergency/Special events	66.0	55.1
Total	**100**	**100**

The incidence of charcoal use was higher among female headed households (55.5%) compared to those that were headed by men. An estimated 56% of households headed by men did not use charcoal (Table 1D.2).

TABLE 1D.2. Distribution of Household Use and Purpose of Charcoal by Gender of Household Head

QUESTION: How recently did this household use charcoal? What is the main purpose for using charcoal in this household?

	% of Household		
Recency of Use	**All**	**Male**	**Female**
Past 7 days	**19.9**	17.5	22.8
Past 1-2 months	**17.6**	14.2	21.7
Over 2 months	**11.5**	11.9	11
Do not use	**50.9**	56.3	44.5
Total	**100**	**100**	**100**
Purpose			
Home cooking	**55.1**	55.5	54.8
Commercial Cooking	**0.7**	0.4	1.1
Special Events	**34.6**	33.6	35.6
Other	**3.5**	4.9	2.1
Emergency	**3.7**	3.8	3.6
Roast Breadfruit	**1.6**	1.1	2.1
Iron Clothes	**0.7**	0.8	0.7
Total	**100**	**100**	**100**

The majority of charcoal users (55.1%) used it for "home cooking" followed by "special events". Table 1D.2 also shows use of charcoal by category and demonstrates that there is little difference for the main categories of use.

There was no marked difference in the use of charcoal by the age of household heads (Table 1D.3). In terms of household size, the use of this fuel was highest among larger households. For example, the largest portion (58.5%) of households using charcoal for "home cooking" were found to have 3-4 persons followed by households with 5 and over. Conversely, the use of charcoal for "special events" was highest among households consisting of up to 2 persons and lowest among those having 5 persons and over.

Outside of the two main purposes identified in Table 1D.2, use for other purposes was low. This was so even among households who used charcoal on a daily basis. In fact, only a negligible percentage of households used charcoal for ironing clothes, and these were concentrated among large households with 5 persons and above. The limited use of charcoal for domestic activities such as ironing might be associated with the reach of electricity (especially to rural areas) which has been significantly expanded over the past ten years through the Rural Electrification Programme (REP).

The pattern in charcoal use for "home cooking" by the educational level of head of households showed that there was a general decrease in use with increasing levels of education (Table 1D.4). Hence, the highest incidence of charcoal use for home cooking was seen in households where the heads have no formal education, and lowest among those headed by persons with tertiary education. This conforms to the perceived association between charcoal use and poverty as persons with no formal education are likely to make up the bulk of those in poverty. On the other hand, the use of charcoal for "special events" was highest in households headed by persons having tertiary education and is consistent with the known tendency of higher income groups to use charcoal in recreational activities, for example, barbeques.

TABLE 1D.3. Distribution of Households by Purpose of Charcoal Use by Age of Household Head and Size of Household

QUESTION: What is the main purpose for using charcoal in this household?

	% of Households		
Purpose	**<40 years**	**40-59 years**	**60+ years**
Home cooking	55.3	55.4	54.5
Commercial Cooking	0.9	1.3	0.7
Special Events	35.1	34.6	34.6
Other	3.5	2.6	3.5
Emergency	3.9	3.2	3.7
Roast Breadfruit	1.3	1.9	1.6
Iron Clothes	0.0	1.9	0.7
Total	**100**	**100**	**100**

Purpose	**1-2**	**3-4**	**5 & above**
Home cooking	50.0	58.5	56.7
Commercial Cooking	1.7	0.0	0.5
Special Events	36.4	34.7	33.0
Other	4.0	2.3	4.1
Emergency	4.5	3.4	3.1
Roast Breadfruit	2.8	1.1	1.0
Iron Clothes	0.6	0.0	1.5
Total	**100**	**100**	**100**

TABLE 1D.4. Distribution of Households by Purpose of Charcoal Use and Educational Level of Household Head

QUESTION: What is the main purpose for using charcoal in this household?

	% of Households					
Purpose	**None**	**Pre Primary**	**Primary**	**Secondary Grade 7-9**	**Secondary Grade 10+**	**Tertiary**
Home cooking	66.7	50.0	60.5	60.6	51.6	38.3
Commercial Cooking	0.0	0.0	0.0	0.7	1.3	2.1
Special Events	16.7	37.5	30.2	28.9	36.5	53.2
Other	0.0	12.5	3.1	2.1	5.0	2.1
Emergency	16.7	0.0	2.5	7.0	2.5	2.1
Roast Breadfruit	0.0	0.0	2.5	0.7	2.5	0.0
Iron Clothes	0.0	0.0	1.2	0.0	0.6	2.1
Total	**100**	**100**	**100**	**100**	**100**	**100**

Purchase Patterns

Most users of charcoal bought it, more so in urban households (94.4%) compared to rural households (86.7%). Expectedly, less than 10% of users produced charcoal. Households commonly purchased their charcoal from retail outlets (23.0%), the market (15.4%) and cart vendors (15.6%); other sources included motorized vendors (11.5% of households), home vendors (4.1%) or directly from the coal burner/producer (9.6%).

The frequency of charcoal purchase followed a generally similar pattern to the frequency of use. "Emergencies and special events" being the preferred choice, the majority of households in both regions purchased charcoal on an "as needed basis" (Table 1D.5). Close to 15 % of households made monthly purchase of charcoal. This pattern of purchase was the preferred method among regular users, more so in the rural areas, and suggests, in part, efforts to economize.

TABLE 1D.5: Frequency of Charcoal Purchase by Households by Region

QUESTION: How often does this household purchase charcoal?

	% of Households		
Frequency of Purchase	**ALL**	**Urban**	**Rural**
Daily	**1.9**	2.5	1.3
Weekly	**11.4**	10.1	12.9
Monthly	**14.3**	11.9	17.1
Emergency/Special events	**61.2**	65.1	56.7
Other	**11.2**	10.4	12.1
Total	**100**	**100**	**100**

Quantity of Charcoal Purchased

Charcoal is purchased in quantities and in a variety of containers which are not precisely standardized. These containers are usually the Butter/Cheese tin, Paint tin, Kerosene tin, Rice/Fertilizer bag and the Crocus Bag. The Rice/Fertilizer bag was the most common unit/container (especially in rural areas), followed by the Paint tin (more so in urban areas) (Figure 1D.1). The Rice/Fertilizer bag was the choice of purchase by approximately one third of users and on average a quarter of households bought charcoal in Paint tins (Table 1D.6). The data suggest that some households tend to purchase larger units of charcoal in order to economize and consequently the number and frequency of purchase are minimized. On the other hand, approximately 50 percent of households purchased charcoal in small quantities (Butter/cheese, Kerosene, and Paint Tins) probably reflecting the high usage of charcoal for "Special Events/Emergency" and frequency of purchase by lower income households with unpredictable income flows. Table 1D.7 shows a breakdown of the per kilogram cost using the mean cost per unit and highlights the wide disparity in the per kilogram cost as well the higher unit cost associated with the purchase of small quantities.

Table 1D.6 further amplifies the wide variation between the minimum and maximum costs for each unit of charcoal sold. The variation in mean price across regions was however, less dramatic with the exception of the Butter/Cheese Tin, the smallest container unit, where the cost was almost three times as high in the rural areas as in the urban areas.

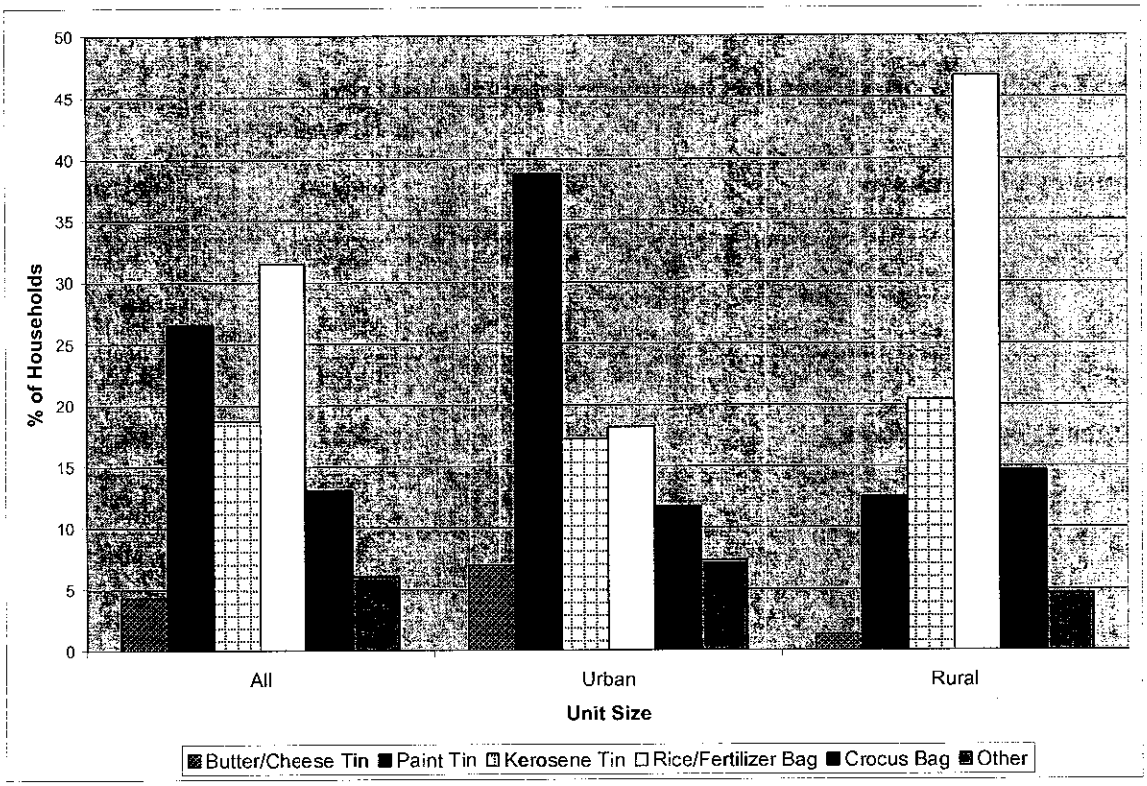

Figure 1D.1: PURCHASE OF CHARCOAL BY UNIT SIZE AND REGION.

TABLE 1D.6: Units and Price of Charcoal Purchase by Households by Region

QUESTION: In what quantity does this household purchase charcoal?

		% of Household		
Unit	**Weight/kg**	**ALL**	**Urban**	**Rural**
Butter/Cheese Tin	1.1	**4.3**	6.9	1.3
Paint tin	2.0	**26.5**	38.7	12.5
Kerosene tin	5.9	**18.7**	17.2	20.4
Rice/Fertilizer Bag	25	**31.5**	18.2	46.7
Crocus Bag	31.8	**13.0**	11.7	14.6
Other		**6.0**	7.3	4.6
Total		**100**	**100**	**100**

Price ($)

Unit	**ALL**	**Urban**	**Rural**
Butter/Cheese Tin – Mean J$	**67.5**	57.2	160
Butter/Cheese Tin – Minimum J$	**40**	40	120
Butter/Cheese Tin – Maximum J$	**200**	100	200
Paint tin – Mean J$	**70.5**	70.6	70
Paint tin – Minimum J$	**25**	30	25
Paint tin – Maximum J$	**240**	240	250
Kerosene tin – Mean J$	**160.4**	175.4	146.3
Kerosene tin – Minimum J$	**50**	50	60
Kerosene tin – Maximum J$	**500**	500	300
Rice/Fertilizer Bag – Mean J$	**354**	370.3	346.6
Rice/Fertilizer Bag – Minimum J$	**150**	200	150
Rice/Fertilizer Bag – Maximum J$	**700**	700	700
Crocus Bag – Mean J$	**421.1**	455	392
Crocus Bag - Minimum J$	**100**	100	250
Crocus Bag - Maximum J$	**600**	600	600

While the price/ size combination of the Rice/Fertilizer Bag was the preferred overall choice, almost a half of rural households which use charcoal purchased this size compared to 18.2 per cent of their urban counterparts. For the urban household, the Paint Tin was the size of choice with 18.7 per cent choosing to purchase that unit.

TABLE 1D.7: Mean Price Per Kilogram of Charcoal

QUESTION: What is the price of each unit of charcoal?

Unit	Weight/kg	Mean Price ($)	Mean Price per Kg All Users ($)	Mean Price per Kg Regular Users[13] ($)
Butter/Cheese Tin	1.1	67.5	61.36	113.63
Paint tin	2.0	70.5	35.25	34.51
Kerosene tin	5.9	160.4	27.19	29.44
Rice/Fertilizer Bag	25	354	14.16	14.14
Crocus Bag	31.8	421.1	13.24	13.51

Volume of Charcoal Used

To assess the volume of charcoal used, respondents were asked to estimate their usage based of the various container units. The estimated annual quantities were derived from valid responses on unit price and weekly quantity. It was estimated from the data that over a one year period, regular users (daily and weekly users) consumed some 215 million kilogram of charcoal at a cost of approximately $3.4 billion (Table 1D.8). Such households were estimated to have consumed an average of 170kg or 6.8 Fertilizer/Rice bags per month. While one-sixth of households reportedly used four Pint Tins of coal each week, close to 20 % used at least one Rice/Fertilizer Bag. Households falling into the regular users' category made up 11.3% of those households which use charcoal but accounted for 32.3 % of the total volume used. The use of charcoal by occasional users will substantially add to the estimated total annual quantity and value.

As would be expected there was a significant increase in the price to purchase the different units of charcoal compared to the previous survey.

TABLE 1D.8: Annual Quantity and Expenditure on Charcoal

Unit	Weight kg/unit	Mean kg/wk	No. of HH Using Daily/wkly	Annual Quantity kg used	Price J$/unit	Annual HH Expenditure (J$)
Butter/ cheese tin	1.1	3.41	1,838	325,763	125.00	35,833,897
Paint tin	2.0	6.14	21,133	6,743,288	69.04	227,605,446
Plastic bag	2.0	4.00	3,675	764,456	117.50	44,911,817
Kerosene tin	5.9	16.55	13,782	11,857,762	173.68	348,523,347
Rice/fertilizer bag	25.0	51.82	50,535	136,167,016	353.41	1,924,911,409
Crocus bag	31.8	77.56	14,701	59,288,811	429.52	800,351,519
Total			**105,664**	**215,147,097**		**3,382,137,436**

[13] Households which use charcoal daily or weekly

Charcoal Use and Income

The income status of charcoal users did not appear to significantly influence pattern of purchase. Of note however, was that only users with monthly income below $24 000 purchased charcoal on a daily basis (Table 1D.9).

TABLE 1D.9: Household Source of Charcoal and Frequency of Purchase by Income of Household Heads

QUESTION: How does this household obtain charcoal? How often does this household purchase charcoal?

	Monthly Income of Household Head ($)				
Source	**ALL**	**<$12,000**	**$12,000-$23,999**	**$24,000-$79,999**	**$80,000+**
Purchase Only	**90.3**	82.2	91.8	96.7	100
Produce Only	**5.8**	10.0	5.5	1.6	0
Purchase & Produce	**2.3**	4.4	1.4	1.6	0
Other	**1.6**	3.3	1.4	0	0
Total	**100**	**100**	**100**	**100**	**100**

Frequency of Purchase	**ALL**	**<$12,000**	**$12,000-$23,999**	**$24,000-$79,999**	**$80,000+**
Daily	**1.7**	2.5	2.2	0	0
Weekly	**10.3**	8.6	11.6	8.3	15.4
Monthly	**14.4**	17.3	13.0	13.3	15.4
Emergency and special events	**62.3**	61.7	61.6	65.0	61.5
Other	**11.3**	9.9	11.6	13.3	7.7
Total	**100**	**100**	**100**	**100**	**100**

The most commonly used units of charcoal across all income brackets were the Paint tin and the Rice/Fertilizer bag, in line with the fact that these were the most popularly purchased units. Households within the less than $12,000 and $24,000-$79,999 monthly income ranges commonly used four Paint tins of charcoal per week which were the highest percentages (25% and 17.6% respectively) across all income ranges for this unit. Households having monthly income in the $12,000-$23,999 and $80,000 and over groups used one and three Rice/Fertilizer bags of charcoal respectively.

Comparison with Other Surveys

The use of charcoal among Jamaican households since the1997 study has increased to 49.1% of households (up by 9 percentage points). Rice/Fertilizer bags and Paint tins were the most common units/containers in which charcoal was purchased in 2006; previously it was the Kerosene tin. The place for charcoal purchase by the largest percentage of households was retail outlets (23.0%) in 2006, compared to cart vendors (34.8%) in 1997. It was estimated that more than 215,000 metric tonnes of charcoal was used annually, compared to the 1997 estimate of about 30,500 metric tonnes, which could have been an under-estimate.

Conclusion

While it was difficult to get a precise estimate for the total annual volume and value of charcoal used in a year, the figures for regular users indicated that the charcoal industry has significant socio-economic value and needs further study.

1E. FIREWOOD

Firewood Usage

The incidence of households using firewood was estimated to be 41.9% and its use was more common in rural areas (Table1E.1). Of the households using firewood, 43.5% in rural areas used firewood on a weekly basis compared to 11.5% in urban areas. Similar to the pattern seen in the use of charcoal, there is a decreasing use of firewood with increasing income; the highest use is among poorer households in the less than $12,000 monthly income range. (Table1E.1).

TABLE 1E.1. Firewood Use by Households by Region and Income of Household Head

QUESTION: How recently did this household use firewood?

	% of Households		
Frequency of Use	**All**	**Urban**	**Rural**
Past 7 days	**26.8**	11.5	43.5
Past 1-2 months	**8.9**	7.0	11.0
Over 2 months	**6.2**	5.0	7.5
Don't use	**58.1**	76.5	38.1
Total	**100.0**	**100.0**	**100.0**

	Monthly Income of Household Head ($)			
Frequency of Use	**<$12,000**	**$12,000-$23,999**	**$24,000-$79,999**	**$80,000+**
Past 7 days	53.0	28.2	14.4	7.3
Past 1-2 months	6.7	11.6	6.7	12.2
Over 2 months	6.0	6.5	4.4	4.9
Don't use	34.2	53.8	74.4	75.6
Total	**100.0**	**100.0**	**100.0**	**100.0**

The majority of firewood users used it for home cooking followed by special events (Figure1E.1). This is consistent with the results of the 1997 Energy Survey. However, while the majority of firewood users among rural households used wood for home cooking, most of their urban counterparts used it for "special events" (Table 1E.2). According to Table 1E.2, households with income less than $24,000 monthly used

firewood mainly for home cooking while households with incomes above used it mainly for "special events".

TABLE 1E.2: Purpose of Firewood Use by Location and Income of Household Head

QUESTION: What is the main purpose for using firewood in this household?

	% of Households		
Purpose	**All**	**Urban**	**Rural**
Home cooking	46.1	23.4	55.4
Special events	40.3	57.7	33.1
Roast Breadfruit	4.7	8.0	3.3
Other	9.0	10.9	8.1
Total	**100.0**	**100.0**	**100.0**

	Monthly Income of Household Head ($)			
Purpose	**<$12,000**	**$12,000-$23,999**	**$24,000-$79,999**	**$80,000+**
Home cooking	54.1	54.7	28.3	20.0
Special events	33.7	33.6	52.2	60.0
Roast Breadfruit	3.1	4.7	10.9	10.0
Other	9.2	7.0	8.7	10.0
Total	**100.0**	**100.0**	**100.0**	**100.0**

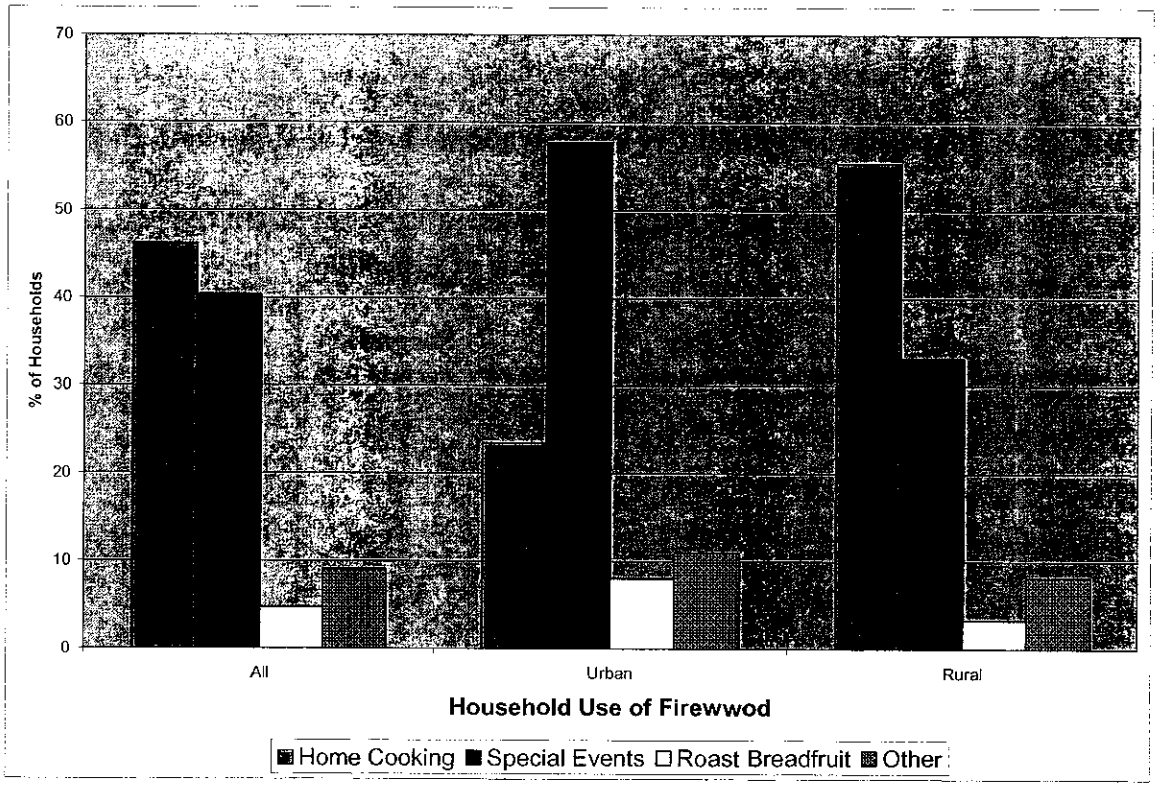

Figure 1E.1. USE OF FIREWOOD BY REGION

Firewood use was most popular among persons over 40 years old. This older group was most likely to use firewood for home cooking while its use was highest in the less than 40 age group for "special events". Additionally, there was no apparent difference in the use of firewood among households with up to four persons; however, there was a notable rise in the use of firewood by households having more than five persons.

As observed in the use of charcoal, there was a general decline in the use of firewood with increasing education levels (Table 1E.3). The highest users were persons with no formal education and the lowest were persons who were tertiary trained. Furthermore, persons having no formal education used firewood mostly for home cooking while tertiary trained persons used it mainly for special events. Other uses of firewood include roasting breadfruit and ironing clothes.

TABLE 1E.3: Purpose of Firewood Use by Educational Level of Household Head

QUESTION: What is the main purpose for using firewood in this household?

	Level of Education					
Purpose	**None**	**Pre Primary**	**Primary**	**Secondary Grade 7-9**	**Secondary Grade 10+**	**Tertiary**
Home cooking	66.7	50.0	60.5	60.6	51.6	38.3
Community Cooking	0.0	0.0	0.0	0.7	1.3	2.1
Special Events	16.7	37.5	30.2	28.9	36.5	53.2
Other	0.0	12.5	3.1	2.1	5.0	2.1
Emergency	16.7	0.0	2.5	7.0	2.5	2.1
Roast Breadfruit	0.0	0.0	2.5	0.7	2.5	0.0
Iron Clothes	0.0	0.0	1.2	0.0	0.6	2.1
Total	100.0	100.0	100.0	100.0	100.0	100.0

There appears to be a gender difference in the use of firewood. The weekly use of firewood was higher in female-headed households (22.8%) than in those headed by males (17.5%). In addition, a higher percentage of male-headed households used firewood for home cooking compared to female headed households. On the other hand, more female headed households used firewood for special events than ones that were headed by males. The majority of firewood using households collected it less than one mile from their homes and mainly from their "own" properties. Table 1E.4 shows that one in five users collected wood from the property of others (private property and government land).

TABLE 1E.4: Distribution of Household by Source of Firewood

QUESTION: From where does this household normally collect firewood?

	% of households		
	Urban	**Rural**	**Total**
Own land - Backyard	72.6	68.5	**69.7**
Own land - Other location	5.2	10.3	**8.8**
Private property	16.3	17.6	**17.2**
Government land	3.7	2.7	**3.0**
Other	2.2	0.9	**1.3**
Total	100.0	100.0	**100.0**

Conclusions

The incidence of households using firewood was estimated to be 41.9 per cent and its use is more common in rural areas. Similar to the pattern seen in the use of charcoal, there is a decreasing use of firewood with income. The majority of firewood users used it for home cooking followed by special events. There seems to be a gender difference in the use of firewood where female headed households use firewood on a more frequent basis. Generally, the incidence of firewood use was more popular in persons over 40 years old. As observed in the use of charcoal, there was a general decline in the use of firewood with increasing education levels

Given the environmental implications of charcoal and firewood use, policies should create the supporting environment for the improvement of the income of regular users to enable the transition to more sustainable alternatives of fuel. In addition, alternative livelihoods should be explored for those that directly depend on the production and sale of charcoal for a living.

With the prominence and increasing incidence of food festivals and other recreational events at which "jerk" foods are being promoted, it is anticipated that reduction in the use of charcoal and firewood might not keep pace with the expanded access to electricity and LPG. This points to the need for further research on the adoption of more efficient charcoal production and fuelwood using trees with higher energy content thus reducing the quantity of trees required. Assessment of the quantity of charcoal needed to support its growing commercial use (jerking etc.) should also be an important research item in light of declining forest cover.

1F. SOLAR ENERGY

The use of solar energy is being encouraged since in its operation it does not require any fuel material or produce any waste products, and the equipment generally needs minimal maintenance. It is non-polluting and therefore environmentally friendly. The sunlight used for its operation is free, though there is a high initial investment cost for the equipment.

Water Heating

Currently, the main household use for equipment operating on solar energy is solar water heaters. The survey sought to determine the prevalence of these heaters. When asked what was used to heat water for bathing, 84.1% of respondents said that they did not heat water for bathing (Figure 1F.1). The most used method of producing hot water for this purpose was heating the water on a stove – 8.1% of households. This is very energy efficient mainly because only small quantities of water are heated and there is no waste. The next most used method was the electric water heater, in 4.6% of households. This is energy inefficient as the heater uses much electricity to heat a large quantity of water and often the heater continues to operate even when hot water is not needed. It will be very beneficial to the energy conservation programme if these electric heaters could be replaced by the solar type. Solar water heaters were found in only 0.9% of households, being only more prevalent than gas heaters in 0.1% of households.

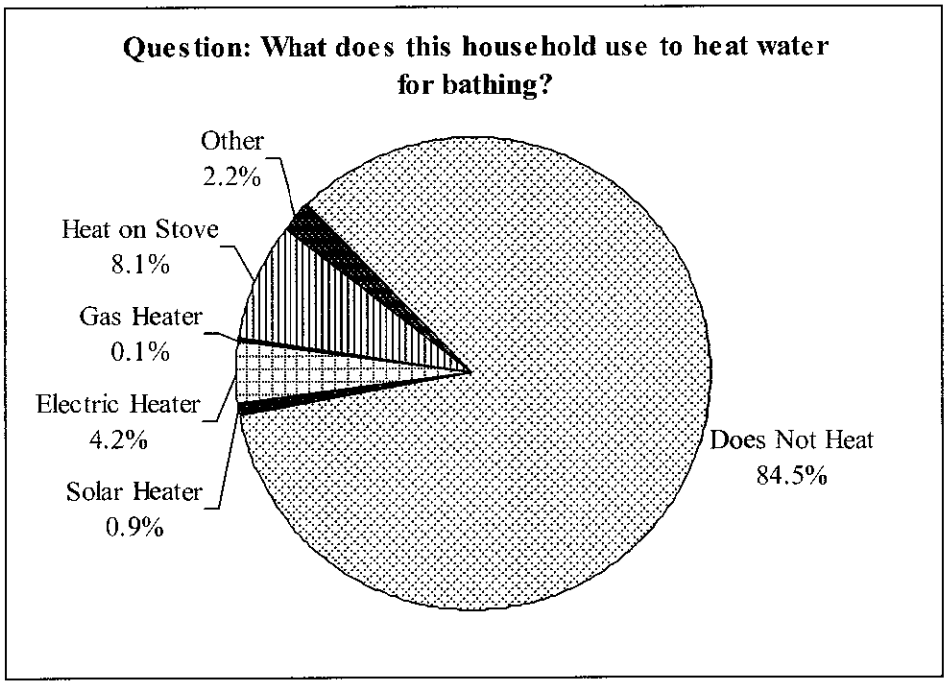

FIGURE 1F.1: SOURCE OF HEATING WATER FOR BATHING BY HOUSEHOLDS

When the data was disaggregated by region (Table 1F.1), it was found that urban and rural areas were similar in the percentage of households that did not heat water for

bathing (84.9% and 83.4% respectively). There appeared to be twice as many households in urban areas with electric heaters as rural (6.0% and 3.0% respectively). The few solar heaters reported were mainly in urban households (1.4% compared to 0.4% of rural).

TABLE 1F.1 Source of Heating Water for Bathing by Region

QUESTION: What does this household use to heat water for bathing?

	% of Households	
	Urban	**Rural**
Solar heater	1.4	0.4
Electric heater	6.0	3.0
Gas heater	0.2	0.0
Heat on stove	6.7	9.5
Other	0.9	3.7
Does not heat	84.9	83.4
Total	**100.0**	**100.0**

Size of Water Heater Tanks

The survey sought to determine the size of the water heater tanks in households. Among respondents who knew the size of their water heater tanks, the main tank size reported by 43.8% was in the range of over 30-50 gallons (115-190 litres). Some 22.9% of households reported having tanks with a small capacity of 10 gallons (about 38 litres) or less. Only 8.3% were the largest size of over 50 gallons (over 190 litres). No tankless water heaters were recorded in the survey.

Table 1F.2: Size of Water Heater Tank Used in Household

QUESTION: What is the size of the water heater tank used in your household?

	% of Tanks
Up to 10 gallons (38 litres)	22.9
Over 10-20 gallons (76 litres)	18.8
Over 20-30 gallons (114 litres)	6.3
Over 30-50 gallons (190 litres)	43.8
Over 50 gallons (190 litres)	8.3
Total	**100.0**

Reasons to Install a Solar Water Heater

Persons were asked what would encourage them to install a solar water heater now. Only the responses from home owners were examined since it would not be expected that persons who were renting would install solar water heater equipment on the roof of the landlord's building. The results are shown in Table 1F.3. The main response from 52.4% of persons was that nothing would encourage them to install a solar water heater. More positive answers were "cheaper price" (15.3%) and "more information" (17.9%). "Low interest loans" was mentioned by a few household heads (1.2%). Some 18.3% had other responses including that the climate would have to get colder, and for health reasons.

TABLE 1F.3: Reasons to Encourage Installing a Solar Water Heater

QUESTION: What would encourage you to install a solar water heater now? (Home owners only)

	% of Households*				
	Cheaper Price	**Low Interest Loan**	**More Information**	**Other**	**Nothing**
ALL	15.3	1.2	17.9	18.3	52.4
Location					
Urban	17.3	2.7	15.9	17.3	51.8
Rural	13.8	0.0	19.4	19.1	52.8
Gender					
Male	17.0	1.0	16.2	13.1	51.3
Female	13.1	1.3	20.0	41.6	53.8
Age					
<40 yrs	11.4	1.7	13.7	21.7	54.9
40-59yrs	15.6	0.8	18.3	15.6	52.5
60+ yrs	17.6	1.2	20.4	18.8	50.6
Monthly Income of Household Head					
<$12,000	14.1	1.0	26.3	19.2	50.5
$12,000-$23,999	10.6	0.7	18.5	18.5	55.0
$24,000-$79-999	14.7	2.9	16.7	21.6	49.0
$80,000+	27.6	3.4	6.9	37.9	27.6

* Some variables may add to over 100% as respondents could give multiple answers

The data was disaggregated for several variables. Responses from urban and rural areas were similar, as well as for male and female. There was a trend of increasing age showing a higher percentage of positive responses for a solar heater if they got a cheaper price or had more information. With more information, 13.7% of those less than 40 years old, 18.3% of those 40-59 years, and 20.4% of those over 60 years could be encouraged to install a solar heater. The highest income group had the lowest percentage of those who said that "nothing" would encourage them - 27.6% compared to 49-55% for the other income groups. A larger percentage of highest income group would be encouraged by a

cheaper price than the other income groups – 27.6% of the highest income group compared to 10-14%. There was a trend of the higher the income level the lower the percentage of persons who would be encouraged to purchase a solar heater by receiving more information. Table 1F.4, highlights the fact that only 6.9% of those in the highest income level had this response, and the percentage increased with decreasing income levels moving to 26.3% of those who reported earning the least amount.

Solar Energy to Produce Electricity

Only five persons stated that their household had a photovoltaic system, representing only 0.4% of respondents. All of these were in urban areas.

Persons were asked why they did not use solar energy to produce electricity. The responses to the set answers in the questionnaire were that 37.9% did not know of it, 32.0% were not interested, and 21.4% said that it was too expensive (Figure.1F2).

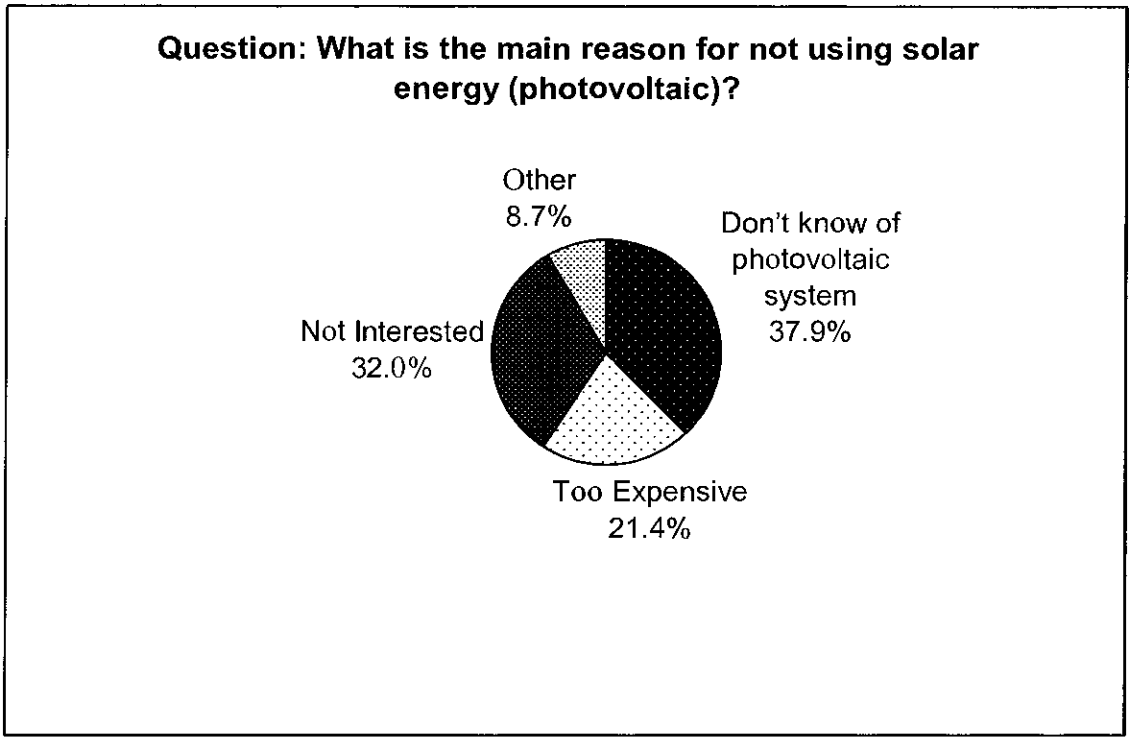

FIGURE 1F.2: REASONS FOR NOT USING SOLAR ENERGY TO PRODUCE ELECTRICITY.

As shown in Table 1F.4, it was found that a higher percentage of rural persons did not know of solar energy systems for producing electricity compared to their urban counterparts (41.4% and 33.3% respectively). On the other hand, more urban persons thought that it was too expensive (26.5% urban compared to 17.5% of the rural respondents). An equal percentage of both groups were not interested. A higher percentage of females than males gave their reason for not using photovoltaics as not knowing about it (42.9% to 33.9%).

TABLE 1F.4 Reasons for Not Having Solar Energy System to Produce Electricity

QUESTION: What is the main reason for not using solar energy (photovoltaic)?

	Don't Know of Solar	Too Expensive	Not Interested	Other
All	37.9	21.4	32.0	8.7
Location				
Urban	33.3	26.5	32.4	7.8
Rural	41.4	17.5	31.7	9.4
Gender of Head of Household				
Male	33.9	23.5	32.1	10.5
Female	42.9	18.8	31.8	6.5
Age of Head				
< 40 years	36.4	22.2	29.5	11.9
40 – 60	36.2	24.9	30.9	7.9
> 60 years	40.5	17.4	34.7	7.3
Education Level of Head				
None/Pre-primary	44.6	15.4	40.1	0
Primary	48.4	12.7	31.2	7.7
Secondary	35.8	22.2	33	9
Tertiary	20.9	39.1	28.2	11.8
Income Level of Head (monthly)				
< $12,000	46.5	22.2	26.3	5.1
$12,000 – 23,999	41.2	16.3	32	10.5
$24,000 – 79,999	29.8	26	32.7	11.5
$80,000 & over	6.7	56.7	30	6.7

The reasons given varied, but both education and income levels showed distinct trends. About 44.6% of those with the least education (none/pre-primary) stated that their reason as being that they didn't know about photovoltaics, with the percentage being similar for primary (48.4%), reducing to 35.8% for secondary and down to only 20.9% of persons with a tertiary education. On the other hand, 39.1% of those with a tertiary education gave their main reason for not using photovoltaics as it being too expensive, compared to 12%-22% of the other three less educated groups (who possibly didn't know about the high cost). It was found that there was a trend of the higher the income level the less percentage of persons who gave their reason as not knowing about photovoltaics; 46.5%

of those in the lowest income level (<$12,000 monthly) gave this reason, trending down with increasing income group, to only 6.7% of the highest income group.

Comparison with Other Surveys

The 1997 energy survey stated that 3.1% of households had a form of solar energy equipment, which was extrapolated to being 17,017 households. This was much higher than the 0.9% found with solar water heaters in this 2006 survey. When adding those households found with photovoltaic equipment that did not have a solar heater, the total was only 1.2% of households having a form of solar energy equipment in 2006, extrapolated to 8681 households. This is about a half of the 1997 figure. However, the major solar water heater supplier in Jamaica has estimated that there were about 10,000 solar water heaters in homes in Jamaica in 2006[14]. Based on this, the 1997 estimate would be far over the actual situation at that time, and the 2006 figure may be an under-estimate.

A comparison can also be made of the responses to the question of why persons were not using solar energy equipment. The percentages of persons giving the various reasons were similar for the two surveys, except that in 2006 a higher percentage of persons stated that it was too expensive (8.8% in 1997, and 21.4% in 2006). This wide disparity may have been due in part to the 1997 survey asking about solar equipment in general, which would be mainly solar water heaters especially at that time, whereas the 2006 survey asked specifically about photovoltaics which are substantially more expensive than solar water heaters.

TABLE 1F.5 Comparison of the Main Reason for Not Using Solar Energy Equipment in 1997 and 2006

	% of Households	
	1997 Survey	**2006 Survey**
Don't know about it	42.7	37.9
Not interested	28.2	32.0
Too expensive	8.8	21.4

Conclusions

Most persons in Jamaica do not heat water for bathing. Solar water heaters were uncommon and most persons were not interested in acquiring one. There appears to be insufficient information about solar water heaters and this would need to be addressed.

Many persons did not know about photovoltaic systems and this information gap would also need to be addressed. Persons who seemed to know most about it, mainly those with higher education and income, appeared to think that such systems were too expensive. It may be useful for the public and private sectors to put on an alternative energy expo which could feature solar energy equipment for residential use.

[14] Personal communication from Managing Director, Jamaica Drip Ltd.

1G. ELECTRIC GENERATOR

Gas or diesel electricity generators are used by some households to provide electricity when there is a disruption in the public supply, as occurs occasionally for short periods due to problems at the utility company, or for extended periods after storm damage to transmission lines.

Respondents were asked if the household had used an electric generator in the past three months to provide electricity to the home; only 16 persons answered in the affirmative, representing 1.4% of respondents. This corresponded with the finding that only 1.4% of households had a generator. Twelve of the generators were purchases, with none being rented/leased or part of the dwelling; four respondents gave answers classified as "other", with three stating that their generators were gifts. Five of the twelve owners said that their generators were obtained between 1989 and 1997 (10-17 years old) while six obtained theirs between 2000 and 2005 (1-6 years old). Other questions on the generator sizes, purchase price and maintenance cost did not yield enough data to be useful.

Comparison with Other Surveys

No data on electricity generators was reported by the 1997 survey.

Conclusions

It was concluded that very few households had electricity generators. This could be a measure of the expense of purchasing and operating an electricity generator, especially when the public power outages were mostly for only short periods.

SECTION 2. TRANSPORTATION

The transport sector is a significant consumer of energy, accounting for 23% of national fuel consumption. Currently, all fuel is imported and it is therefore a significant user of foreign exchange. While there are plans to phase in ethanol for Methyl tertiary-butyl ether (MTBE) as a gasoline additive, the overall fuel consumption will remain a foreign exchange burden to the economy. The wide-scale use of ethanol from locally grown sugarcane for fuelling vehicles would help to ameliorate the situation while benefiting the sugarcane industry and the rural economy.

This section presents data on vehicle ownership and vehicle characteristics. The opinions of heads of households are compiled on the importance of fuel efficiency when deciding to purchase a vehicle. Data is also presented on how persons travel for leisure and to work and school, time and distance travelled, and expenditure on transportation. In addition, the opinions of the vehicle owners are examined on what would make them park their vehicle and take public transportation or carpool.

Vehicle Ownership

It was found that nearly 75% of households stated that they did not own a motor vehicle (Fig. 2.1 and Table 2.1). About 19.4% of households owned or operated one motor vehicle, while 4.7% had two, and 1.2% had three or more vehicles.

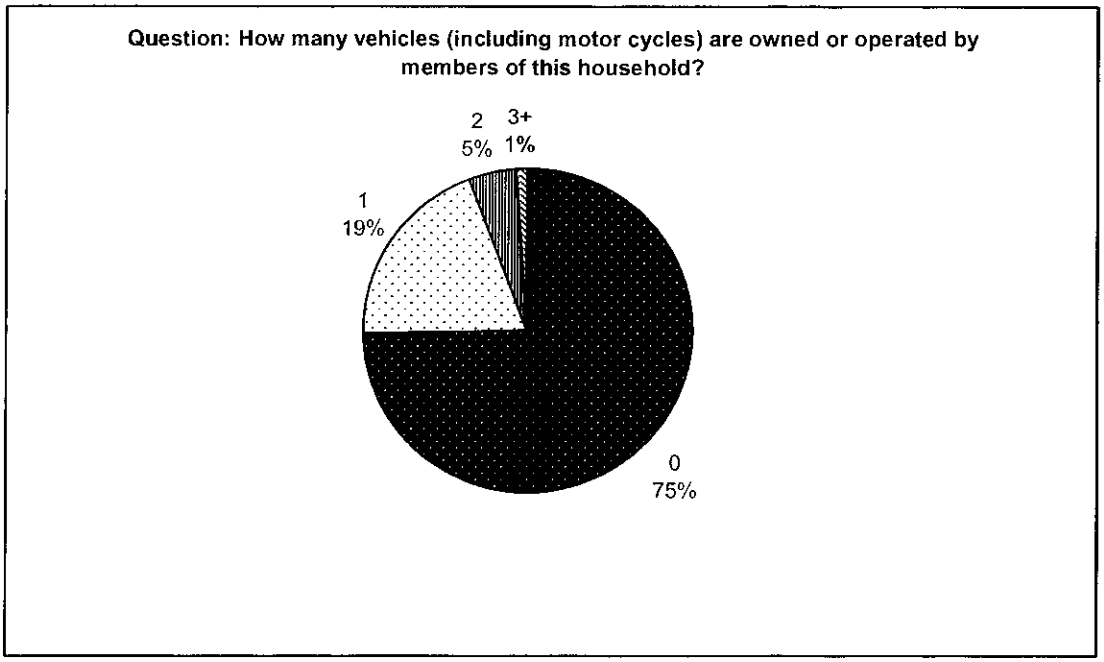

FIGURE 2.1: NUMBER OF VEHICLES OWNED BY HOUSEHOLDS

There were differences in vehicle ownership by region (Table 2.1). The study found that a larger percentage of urban households owned one or more vehicles than their rural counterparts (31.5% and 18.7% respectively). This could be due to many factors, including a greater percentage of low income households in rural areas (Table 2.1).

TABLE 2.1: Distribution of Vehicle Ownership by Region, Gender and Income Level of Household Head.

QUESTION: How many vehicles are owned or operated by members of this household?

	% of Household					
No. of Vehicles	**0**	**1**	**2**	**3**	**4**	**Total**
All	74.7	19.4	4.7	0.8	0.4	100
Region						
Urban	68.5	23.8	6.2	1.0	0.5	100
Rural	81.3	14.7	3.0	0.6	0.4	100
Gender of Head of Household						
Male	67.7	24.0	6.4	1.3	0.7	100
Female	83.1	14.0	2.6	0.2	0.2	100
Income Level of Head (Monthly)						
<$12,000	85.9	12.8	0.7	0.7	0.0	100
$12,000-$23,999	83.8	14.8	1.4	0.0	0.0	100
$24,000-$79,999	54.4	34.4	10.0	0.6	0.6	100
$80,000 & over	10.0	47.5	22.5	12.5	7.5	100

When vehicle ownership was examined by the monthly income of the household head (Table 2.1), it was found that for income levels below $24,000 monthly, 14%-16% of households had a vehicle. In contrast, when the monthly income was above J$80,000, some 90.0% of these households had at least one vehicle, and 42.5% had two or more. There were also differences based on the gender of the household head. Households headed by males were seen to have a higher percentage of vehicle ownership (32.3%) compared to those headed by females (16.9%). This could be due to many factors, including the fact that households headed by males have a higher mean income.

Vehicle Characteristics

The most common motor vehicle owned or operated by households was motor cars – 67.8% of such households (Table 2.2). Regarding other types of vehicles, there were more households with pick-ups (13.1%) than SUVs (6.2%), mini-vans/buses (6.2%), trucks (2.2%) or motorcycles (2.8%)

When examined by region, it was seen that there was not much difference between urban and rural households in the type of vehicles owned. The exception was that a higher percentage of rural households owned or operated minivans/buses (13.3%) compared to their urban counterparts (4.8%); consequently, rural households had a proportionally lower percentage of motor cars than urban households (62.8% and 70.5% respectively).

Households headed by males were more likely to own pickups and minivans/buses. Consequently, there was a lower percentage of households headed by males who had a motorcar (63.5%) than those headed by females (78.5%). The lowest income level had the largest percentage of persons owning or operating a minivan/bus, while the highest income level had the largest percentage of households owning or operating Sports Utility Vehicles (SUVs) (19.6%).

TABLE 2.2: Motor Vehicle Ownership by Region, Gender and Income Level of the Head of Household

QUESTION: What types of vehicles are owned by members of this household?

	% of Household						
Type of Vehicle	**Motor Car**	**Motor Cycle**	**Pickup**	**SUV**	**Minivan/ Bus**	**Truck**	**Total**
All	67.8	2.8	13.1	6.2	7.7	2.2	100
Region							
Urban	70.5	1.9	13.8	7.1	4.8	1.9	100
Rural	62.8	4.4	12.4	4.4	13.3	2.7	100
Gender of Head of Household							
Male	63.5	2.6	15.2	6.5	9.6	2.6	100
Female	78.5	3.2	8.6	5.4	3.2	1.1	100
Income of Head (Monthly)							
<$12,000	77.3	0.0	9.1	0.0	13.6	0.0	100
$12,000-$23,999	71.7	6.5	13.0	2.2	2.2	4.3	100
$24,000-$79,999	77.8	1.1	7.8	3.3	8.9	1.1	100
$80,000	53.6	1.8	14.3	19.6	5.4	5.4	100

The data on the various types of vehicles was analysed by the age of the vehicle, the engine size (c.c. rating) and kilometers travelled in the past week (Table 2.3 A & B).

TABLE 2.3 A: Vehicle Characteristics

	% of Vehicles				
	Motorcar	**Pick-up**	**SUV**	**Mini-van/ Bus**	**Motorcycle**
Age of Vehicle					
0-5 years	13.8	8.3	47.4	9.1	27.3
6-10 years	33.1	16.7	47.4	40.9	36.4
11-15 years	37.7	33.3	5.3	31.8	9.1
>15 years	15.5	41.7	0.0	18.2	27.3
Total	100	100	100	100	100
Mean Age of Vehicles	**10.8**	**12.6**	**5.2**	**11.2**	**10.1**
Engine Size (c.c.)					
Up to1500	48.9	9.5	0.0	9.1	
1501-2000	46.1	38.1	69.2	54.5	
2001-2500	3.3	28.6	7.7	9.1	
>2500	1.7	23.8	23.1	27.3	
Total	100	100	100	100	
Mean Engine Size	**1633**	**2291**	**2184**	**2131**	**451**
Type of Fuel					
Gas 87	69.1	56.4	50.0	34.8	
Gas 90	30.9	25.6	35.0	8.7	
Diesel	0.0	17.9	15.0	56.5	
Total	100	100	100	100	

TABLE 2.3 B: Vehicle Characteristics

	% of Vehicles				
	Motorcar	**Pick-up**	**SUV**	**Mini-van/ Bus**	**Motorcycle**
$ on Fuel in Past Week					
$0-$1000	17.5	20.0	10.5	5.3	50.0
$1001-$2000	42.6	33.3	31.6	21.1	10.0
$2001-$3000	17.1	23.3	42.1	21.1	40.0
$3001-$6000	16.2	20.0	15.8	42.1	0.0
> $6000	6.5	3.3	0.0	10.5	0.0
Total	100.0	100.0	100.0	100.0	100.0
Mean Amount Spent	**$2673**	**$2580**	**$2447**	**$4247**	**$1450**
Km Travelled in Past Week					
<20 km	17.9	21.1	0.0	33.3	0.0
20 km - <50 km	25.3	15.7	53.8	0.0	50.0
50 km - <100 km	13.9	21.1	15.3	22.2	12.5
100 km - <300 km	27.5	31.5	23.1	0.0	12.5
300+ km	15.4	10.6	7.7	44.5	25.0
Total	100.0	100.0	100.0	100.0	100.0
Don't know *	43.1	44.1	27.8	59.1	11.1
Mean km Travelled	**153 km**	**127 km**	**113 km**	**245 km**	**149 km**

* % of all respondents

Motor cars

It was noteworthy that 53.2% of motor cars recorded were over 10 years old, with 15.5% being over 15 years old (Table 2.3A). The mean age of motor cars was 10.8 years. It was also interesting that 48.9% of the motor cars had the smallest and most fuel efficient engine size of 1500 c.c. or less. The great majority of motorcars (95%) had an engine size of 2000 c.c. or less; the mean engine size was 1633 c.c.

Fuel used by cars was either 87 octane gasoline (69.1%) or 90 octane gasoline (30.9%). No diesel engine cars were reported in the survey. The usage of the higher octane gasoline by over 30% of cars may be high and some owners could be unnecessarily paying more than they need to for this higher priced fuel. Diesel car engine technology has advanced to the point where currently their performance and noise levels are similar to gasoline engines, and they are more fuel efficient. As done in Europe, car owners should be encouraged to purchase diesel engine cars.

Responses to expenditure on fuel in the previous week were varied (Table 2.3B). The largest category was $1001-$2000 for 42.6% of motorcars, with the mean being $2673 for the week. When respondents were asked how many kilometers were travelled in the week previous to the survey, a wide range of distances were given, with the mean being 153 km. Some 43.1% of persons did not know. There was not much noteworthy information from the data on distance travelled, except that 17.9% did little travelling of less than 20 km for the week.

Pickups

It was found that 75.0% of the pickups recorded were over 10 years, with 41.7% being over 15 years old. The mean age was 12.8 years. About 52.4% of the pickups had engines of over 2000 c.c., with the mean being 2291 c.c. However 17.9% had diesel engines which are more fuel efficient than the more prevalent gasoline engines in motor cars. It was noteworthy that 25.6% of the pickups were using 90 octane gasoline; possibly some of these pickups could use the less expensive 87 octane gasoline without deleterious effects.

Responses to the question of the expenditure on fuel in the previous week were varied with the largest category being $1001-$2000 (similar to motor cars). The mean was $2580 for the week. The predominant distance travelled by the pickups in the previous week was in the range 100 km to less than 300 km, while 44.1% of respondents said that they did not know. The mean was 127 kilometers.

Sports Utility Vehicles (SUVs)

In general, the SUVs were relatively new vehicles with 47.4% being five years or less. Only 5.3% of the SUVs reported were over 10 years old; the mean age was 5.2 years. With regard to engine size, none were 1500 c.c., which is expected as such a small engine would be underpowered for these generally large bodied vehicles. The majority (69.2%) was in the range of over 1500 c.c. to 2000 c.c., but 23.1% of SUVs had large fuel inefficient engines over 2500 c.c. The survey found that all three types of fuel were being used for SUV's, the predominant one being 87 octane gasoline, while 15.0% used diesel fuel (similar to pickups).

The largest category of expenditure on fuel in the previous week was $2001-$3000 for 42.1% of SUV's, while the mean was $2447, which is somewhat unexpected for these fuel inefficient vehicles. The average distance travelled in the week previous to the survey was 113 km, though most SUVs travelled in the range 20 km to under 50 km in that week, which meant short journeys of inefficient fuel use.

Minivans/buses

Some 50.0% of minivans/buses recorded were over 10 years old, with 18.2% being over 15 years. The mean age was 11.2 years. The mean engine size was 2131 c.c., while the predominant fuel used was the more energy efficient diesel. The main category of fuel expenditure reported was $3001-$6000, with a mean of $4247, which could mean that many of the minivans/buses were being used for public passenger transportation. There was insufficient information on distance travelled in the past week for reliable analysis, as 59.1% of the respondents did not know.

Motorcycles

The ages of the motorcycles reported by the survey were well-distributed, with 27.3% being five years old or less, but 36.4% being over 10 years. The mean age was 10.1 years. There was insufficient data on the other parameters for reliable analysis.

Trucks

The data on trucks was insufficient for reliable analysis.

Additional Motor Car Analysis

Motorcars were the only category of vehicles with enough data for more detailed analysis (Table 2.3). The data show that a high proportion of cars with small 1500 c.c. engines were over 10 years old (51.7%), while the cars with the over 2000 c.c. (fuel inefficient) engines had only 38.9% in this old age. However, both categories had nearly 17% of cars being over 15 years. A part of the explanation for the old small engine cars could be that the smaller cars included the secondhand Japanese imports which in 2006 were very prevalent in Jamaica. Before 2005, when imports were restricted to models of three years old or less, many of the imports were older than three years when they arrived in Jamaica.

TABLE 2.4 Percentage Distribution of Motorcars by Engine Size and Age of Car

	% of Vehicles		
	Engine Size (cc Rating)		
Motorcar Age (years)	**Up to 1500 cc**	**1501-2000 cc**	**>2000 cc**
0-5	6.7	17.6	38.9
6-10	38.2	33.8	22.2
11-15	38.2	40.5	22.2
>15	16.9	8.1	16.7
Total	**100**	**100**	**100**

Importance of Fuel Efficiency

Respondents were asked how important was fuel economy when deciding which vehicle to purchase. It was encouraging from a fuel conservation standpoint to find that only 13.2% of respondents stated that fuel economy was "not important" or "not very important" to them (Table 2.5). Most persons said that fuel economy was "important" or "very important". The data did not show much difference between urban and rural.

TABLE 2.5: Distribution of Households by the Importance of Fuel Efficiency in Purchasing a Vehicle

QUESTION: When deciding to which vehicle to purchase how important is fuel efficiency?

	% of Respondents				
	Not Important	**Not Very Important**	**Important**	**Very Important**	**Extremely Important**
All	10.3	2.9	22.2	48.9	15.7
Region					
Urban	8.6	2.5	22.5	49.3	17.1
Rural	13.3	3.6	21.7	48.2	13.3
Gender of Head of Household					
Male	12.3	2.5	16.4	54.1	14.8
Female	7.9	3.5	29.2	42.6	16.8
Age of Head					
<40 years	9.0	3.2	21.3	47.7	18.7
40-60 years	9.1	2.9	22.3	49.1	16.6
>60 years	13.8	2.6	23.3	50.0	10.3
Education Level of Head					
None/Pre-primary	26.6	0	21.1	52.2	0
Primary	13.6	5.7	23.9	51.1	5.7
Secondary	11.5	3.5	23.5	45.9	15.6
Tertiary	4.0	0	17.0	54.0	25.0
Income Level of Head (monthly)					
<$12,000	20.8	9.4	20.8	37.7	11.3
$12,000-23,999	11.2	2.8	20.6	56.1	9.3
$24,000-79,999	3.5	1.2	15.1	55.8	24.4
$80,000	3.6	0	21.4	42.9	32.1

The data showed some differences between males and females (Table 2.5), with 54.1% of males stated that fuel efficiency was "very important" when deciding to purchase a car, compared to 42.6% of females. On the other hand, 16.4% of males rated this as just "important", compared to 29.2% of females. There was little difference in opinion between the different age groups.

There was a tendency for a greater importance to be placed on fuel efficiency when deciding which car to purchase with the higher education level of the household head. There was a similar tendency with regard to the level of monthly income, as only 3.6% of the highest monthly income household heads said that it was "not important" or "not very important", which contrasted with 30.2% of the lowest income level having this opinion.

Modes of Transportation

The survey determined the utilisation of the diverse modes of transportation available in Jamaica. The patterns were found to vary depending on the purpose of the travel.

Leisure Travel

It was found that when respondents were traveling for leisure purposes, the main means of conveyance was some form of public transport (Table 2.6), totaling 68.6% of households. (Table 2.6). The predominant transportation was the route taxi which was used by 48.9% of respondents. Other public transport such as public buses (15.0%) and private taxis (4.7%) were also important. These findings are consistent with another finding discussed earlier (fig.2.1) that almost 75% of households did not own or operate a motor vehicle, and again points to the importance of public transportation for the majority of Jamaicans. Some 19.7% of households used their own vehicle, but very few used a company vehicle or went with a relative or friend in their vehicle. Motorcycles did not seem to be popular; the use of bicycles was more prevalent and walking even more so.

TABLE 2.6: Transportation for Leisure Travel
QUESTION: When you are not traveling to work how do you normally travel?

	% of persons		
	All	**Urban**	**Rural**
Own Vehicle	**19.7**	24.3	14.7
Company Vehicle	**0.4**	0.5	0.4
Minivan	**1.2**	1.7	0.6
Private Taxi	**4.7**	5.3	3.9
Route Taxi	**48.9**	31.5	67.7
Public Bus	**15.0**	25.3	3.7
Motor Cycle	**0.3**	0.0	0.6
Bicycle	**2.6**	3.4	1.7
Walk	**5.5**	6.0	4.9
Other	**1.3**	1.4	1.3

There were some differences seen between persons in the urban and rural areas. Some 24.3% of those in urban areas used their own vehicle when travelling for leisure, while only 14.7% of their rural counterparts did so. Less urban persons used route taxis for this purpose (31.5%) compared to rural ones (67.7%), as the public bus was utilized by more urban persons than rural (25.3% and 3.7% respectively). The latter is due to there being no organised bus services in rural areas, as the traditional 'country bus' has been displaced by the route taxis.

Travel to Work

Respondents were also asked the means of transportation that they used to get to work. About 33.2% of respondents stated that they did not work (this could include pensioners and persons who did not consider as credible work their "hustling" activities which earned a living), while another 8.7% worked at home and therefore did not need transportation (Table 2.8). The analysis focused on respondents who stated that they traveled to work.

Among those respondents, it was found that the pattern of utilization of the various forms of transportation to get to work differed from leisure travel. Public transportation was again the main means of conveyance (43.1%) but a higher percentage of persons used their own vehicle compared to leisure travel (Table 2.8). An interesting finding was that 21.3% walked to work, and another 5.2% rode a bicycle.

Table 2.7: Transportation for Travel to Work
QUESTION: How do you normally travel to work?

	% of all persons			% persons travelling to work		
	Urban	**Rural**	**All**	**Urban**	**Rural**	**All**
Do not work	32.7	33.8	33.2			
Work at home	6.5	11.0	8.7			
Own vehicle	18.2	9.5	14.1	30.0	17.2	24.2
Company vehicle	1.5	0.6	1.1	2.5	1.0	1.8
Minivan	1.7	0.6	1.2	2.8	1.0	2.0
Private taxi	1.5	1.7	1.6	2.5	3.0	2.8
Route taxi	12.6	18.3	15.3	20.7	33.1	26.3
Public bus	14.3	1.5	8.1	23.5	2.7	14.0
Motor cycle	0.0	0.6	0.3	0.0	1.0	0.5
Bicycle	2.4	3.7	3.0	4.0	6.8	5.2
Walk	7.6	17.5	12.4	12.5	31.8	21.3
Other	0.9	1.3	1.1	1.4	2.4	1.8

There were several regional differences, as a greater percentage of urban persons used their own vehicle or public buses to get to work. On the other hand a greater percentage

of rural persons used route taxis (20.7% urban, 33.1% rural) or walked (12.5% urban, 31.8% rural).

Ideally workers should live near to where they work if they want to minimize the financial cost and time to get to work. This would also be beneficial for energy conservation. However there are other factors to be considered, including the cost, availability and suitability of housing near to the workplace. Personal preferences are also important as some persons want to get a far as possible from the workplace when they are home. It was found that the average Jamaican traveled 14.1 kilometers to work. The range is shown in Table 2.8.

TABLE 2.8: Distance and Time to Travel to Work

QUESTION: What is the one-way distance from your home to your work place? Normally how long does it take to travel to work?

	% of Persons		
	Urban	**Rural**	**All**
Distance Travelled			
None	7.2	9.6	**8.3**
up to 2km	16.6	21.8	**19.1**
2.1-5km	29.3	21.1	**25.4**
5.1-10km	15.2	16.1	**15.6**
10.1-30km	22.1	23.4	**22.7**
>30km	9.7	8.0	**8.9**
Mean Distance to work	**14.9 km**	**13.3 km**	**14.1 km**
Travel Time			
<0.25hr	24.7	25.9	**25.2**
0.25hr-o<0.5hr	25.9	24.8	**25.4**
0.5hr-<1.0hr	31.6	23.0	**27.7**
1.0hr-<2.0hrs	14.5	20.4	**17.2**
2+hrs	3.3	5.8	**4.5**
Mean Time to work	**48 minutes**	**43 minutes**	**46 minutes**

Table 2.8 also shows that in the urban areas, workers traveled an average of 14.9 kilometers to work while in rural areas the distance travelled was 13.3 kilometers. It was expected that the urban persons would travel less, as they are living and working in the same city/town and therefore traveling only short distances. However there is the example of the Portmore community which is urban but a large proportion of the residents travel some distance to their jobs in Kingston. An examination of the range showed that it was similar between urban and rural persons.

The time taken to travel to work varied considerably as shown in Table 2.8, with the average Jamaican requiring 46 minutes. There was not much difference between regions.

Travel to School

The survey also sought to determine what forms of transport children utilized to get to school. It was found that the main means of conveyance was some form of public transportation (63.5% of households) as shown in Table 2.9. The predominant transportation was the route taxi which was used by children from 37.2% of households; public buses (18.7%), minivans (3.0%) and private taxis (4.6 %) were also important. The household's own vehicle, company vehicle or one owned by a relative or friend were utilized by a combined 12.0% of households to convey the children to school. Some 22.5% of households have their children walk to school, while not many children travelled on school buses or bicycles.

The main differences between regions was the higher utilization of own vehicle and public buses by urban children, and conversely, greater use of route taxis by rural children (53.7% of rural households). Both regions had a similar percentage of children walking to school.

TABLE 2.9: Transport to School
QUESTION: How do they (students in household) normally travel to school?

	% of Households		
	Urban	**Rural**	**All**
Own vehicle	14.0	4.8	**9.9**
Company vehicle	1.8	0.7	**1.3**
Minivan	2.1	4.1	**3.0**
Private taxi	5.1	4.1	**4.6**
Route taxi	23.9	53.7	**37.2**
Public bus	25.7	10.0	**18.7**
Motor cycle	0.0	0.6	**0.3**
Bicycle	0.3	0.4	**0.3**
Walk	24.5	20.0	**22.5**
Other	0.9	0.0	**0.5**

Weekly Expenditure on Transportation

The survey found that the mean weekly expenditure on road transportation by the head of the household was $1089. The range was very wide, as shown in Table 2.10, with the category $101-$500 having the most respondents of 43.1%. The comparison between urban and rural showed that on average, the urban based head of household spent somewhat more - J$1180 per week, while the rural counterpart spent J$989.

The mean weekly expenditure on road transport by the entire household was J$ 2000, almost twice that of the head of the household. As with the data for the head of the household only, the range was broad, as shown in Table 2.10. The comparison between urban and rural showed that on average the urban based household spent J$2162 per week, while the rural counterpart spent J$1833. There were no notable differences in the distribution.

TABLE 2.10: Weekly Expenditure on Transport by Heads of Households & Households by Region

QUESTION: On average how much does this household spend on road transportation per week?

	Spending on Transport					
	% Heads of Household			**% of Households**		
	Urban	**Rural**	**All**	**Urban**	**Rural**	**All**
$ per week						
Up to $100	8.3	4.8	**6.6**	2.4	2.0	**2.2**
$101-$500	38.0	48.6	**43.1**	18.8	23.4	**21.1**
$501-$1000	21.9	22.1	**22.0**	17.5	20.1	**18.8**
$1001-$2000	16.6	14.2	**15.5**	27.0	25.4	**26.2**
$2001-$5000	13.6	8.8	**11.3**	27.4	24.6	**26.0**
>$5000	1.7	1.5	**1.6**	6.9	4.5	**5.7**
Mean $ spent per week	**$1180**	**$989**	**$1089**	**$2162**	**$1833**	**$2000**

Analysis of expenditure on transportation was also done by whether the household owned/operated a motor vehicle (Table 2.11). The mean weekly expenditure by the head of household with a vehicle was J$674 compared to those without a vehicle being $3400 per week. The differences include the finding that 52.6% of the owners said they spent

$101-$500, while 52.9% of the non-owners said that on average they spent in the range of $2001-$5000. Examination of the expenditure of households showed that vehicle owners on average spent $1477 per week on transportation, while the non-owners expenditure was J$5040. A possible explanation of this wide disparity is that vehicle owners were only considering the cost of fuel, and not the other costly expenses that are not incurred on a weekly basis, such as insurance, maintenance, tyres etc.

Table 2.11: Weekly Expenditure on Transport by Heads of Households & Households – Owns / No Vehicle

	Spending on Transport			
	% Heads of Households		% of Households	
$ per week	Owns a vehicle	Does not own a vehicle	Owns a vehicle	Does not own a vehicle
Up to $100	8.7	0.0	3.0	0.0
$101-$500	52.6	2.9	26.7	5.0
$501-$1000	23.7	5.9	21.7	0.0
$1001-$2000	11.4	26.5	27.1	8.3
$2001-$5000	3.4	52.9	19.6	48.3
>$5000	0.2	11.8	2.0	38.3
Mean $ spent per week	**$674**	**$3400**	**$1477**	**$5040**

2.6 Reasons to Park Vehicle for Public Transportation

If a significant number of vehicle owners opted to park their vehicles and take public transportation or carpool, national fuel consumption would be reduced and traffic congestion in the urban areas would decrease.

The survey asked respondents who owned or operated a vehicle what reasons would make them willing to park their vehicle and take public transportation. Answers were categorised as shown in Table 2.12. The main answer by 36.5% of respondents was that there was nothing that would make them willing to do this. Such a response would be expected, since many persons prefer the convenience of getting around in their own vehicle. However, other respondents gave several reasons that could make them willing to park their vehicles and take public transportation. The main one was coded as the cost of gas/toll (the latter charged only on two Kingston to St. Catherine highways). This reason was given by 28.1% of respondents. Others said they would be willing if there was a good and frequent transport system (12.7%) or if their vehicle was at the garage (8.8%). In spite of many complaints by the public about bad road conditions, the survey found that only 3.5% gave this as a reason to want to take public transportation. Also, in

spite of much traffic congestion in the urban areas, this was not given as a reason (0.4%). An unexpected reason given by 3.5% of respondents cited road blocks/bad weather.

TABLE 2.12: Reasons Given That Would Encourage Individuals To Park Their Vehicles And Take Public Transportation

QUESTION: What would make you park your vehicle and take public transportation?

Reason	Frequency	Percent
Nothing	95	36.5
Cost of Gas/Toll	73	28.1
Good & frequent transport system	33	12.7
If vehicle is at garage	23	8.8
Bad roads	9	3.5
Road blocks/bad weather	9	3.5
If it offers more convenience	4	1.5
If sick & cannot drive	3	1.2
Travelling long distance or heavy load	3	1.2
If I am broke	2	0.8
To avoid congestion	1	0.4
If bus comes to gate & has AC	1	0.4
Fitness concern	1	0.4
Insurance too expensive	1	0.4
Special Occasion	1	0.4
For fun/Socializing	1	0.4
Total	**260**	**100**

The data was further analysed by several variables as to whether the respondents would consider parking their vehicles and taking public transportation (Table 2.13). Overall 63.5% indicated that for various reasons they would consider doing so. Disaggregation by region showed that a smaller proportion of urban car owners would consider the idea compared to their rural counterparts. Those who owned one vehicle were just as likely to consider it as those with two or more; similarly those living near to their work place (0-5 km) were as likely to consider as those traveling further to work (over 5 km). Gender differences were not apparent but age did seem to be a factor, as those under 40 years old were much more amenable to consider the idea.

TABLE 2.13: Distribution of Heads of Households' Attitudes to Parking Their Vehicles and Taking Public Transportation by Region, Number of Vehicles Owned, Distance From Work, Gender and Age.

QUESTION: What would encourage you to park your vehicle and take public transportation?

	% of Households	
	Nothing	**Would Consider**
All	36.5	63.5
Region		
Urban	40.4	59.6
Rural	29.8	70.2
Number of Vehicles Owned		
1	35.7	64.3
2 +	37.7	62.3
Distance from Home to Work		
0-5km	31.4	68.6
>5 km	35.6	64.4
Gender		
Male	36.5	63.5
Female	30.9	69.1
Age		
< 40 years	26.2	73.8
40 – 60 years	31.6	68.4
> 60 years	56.8	43.2

Reasons to Park Vehicle and Carpool

Respondents who owned or operated a vehicle were asked what reasons would make them willing to park their vehicles and carpool with a friend or neighbour. The main answer by 47.1% of respondents was that there was nothing that would make them willing to do this ((Table 2.14). This is not unexpected since many persons find it inconvenient to fit into the schedule of others for carpooling. However other respondents gave several reasons that could make them willing to park their vehicles and carpool. The main positive responses were coded as "economical", while some others said they would be willing if they were going the same place. It was interesting that traffic congestion was not considered as an important factor.

TABLE 2.14: Reasons Given That Would Encourage Heads of Households to Carpool

QUESTION: What would make you park you vehicle and car pool?

Reason	Frequency	% of Respondents
Nothing	121	47.1
Economical	72	28.0
When we are going to the same place	25	9.7
Fun/Socializing	9	3.5
For Convenience	7	2.7
If have Neighbour to pool with	4	1.6
If vehicle at garage	4	1.6
Don't know about car pooling	2	0.8
Willing to take to work and back	2	0.8
If car don't have seating capacity	2	0.8
Congestion on roads	2	0.8
Car pooling now	1	0.4
Have no gas in vehicle	1	0.4
If had a job	1	0.4
To prevent vehicle being stolen	1	0.4
If person is reliable	1	0.4
Going to visit families	1	0.4
Parking space	1	0.4
Total	**257**	**100**

The data was further analysed by several variables as to whether the respondents would consider parking their vehicles and carpooling with a friend or neighbour (Table 2.15).

TABLE 2.15: Distribution of Heads of Households' Attitudes to Carpooling by Region, Number of Vehicles Owned, Distance From Work, Gender and Age.

QUESTION: What would make you willing to park your vehicle and carpool with a friend or neighbour?

	% of Households	
	Nothing	**Would Consider**
All	47.1	52.9
Region		
Urban	50.3	49.7
Rural	41.3	58.7
Number of Vehicles Owned		
1	45.1	54.9
2 +	50.8	49.2
Distance from Home to Work		
0-5km	40.8	59.2
>5 km	40.4	59.6
Gender		
Male	44.3	55.7
Female	50.0	50.0
Age		
< 40 years	39.1	60.9
40 – 60 years	46.8	53.2
> 60 years	57.1	42.9

Overall 52.9% indicated that for various reasons they would consider carpooling. Disaggregation by region showed that a smaller proportion of urban car owners would consider the idea compared to their rural counterparts. Those who owned one vehicle were about as likely to consider it as those with two or more; similarly those living near to their work place (0-5 km) were as likely to consider it as those travelling further to work (over 5 km). Gender differences were not apparent but age showed a tendency of the older the persons the less amenable to carpooling.

Comparison with Ministry of Transport and Works

The Ministry of Transport and Works (MOTW) in their publication "*Annual Transport Statistics Report: Jamaica in Figures 2004-2005*" (page 94) gave the number of private cars as 180,260 and taxis as 17,735. By comparison, the number of cars (including SUVs)

was calculated from the energy survey 2006 data in Table 2.1 and 2.2 using the methodology shown below. This calculation produced an estimate of 181,634, which is essentially the same as the MOTW figure for private cars, and only 9.0% less if all taxis are counted as household vehicles.

TABLE 2.16: Calculation of the Number of Private Cars (including SUVs)

No. of Vehicles	% of households	Weighted
1	19.4	19.4
2	4.7	9.4
3	0.8	2.4
4	0.4	1.6
Vehicles per 100 households	32.8	

No. of households	748,329
Estimated No. of vehicles (all types)*	**245,452**
% of vehicles which are care cars	67.8%
% of vehicles which are SUVs	6.2%
Total % of cars & SUVs	74.0%
Estimated No. of cars & SUVs**	**181,634**
Ministry of Transport & Works***	
- No. of private cars	**180,620**
- No. of taxis	**17,735**

*Estimated No. of vehicles = vehicles/100 households x No. of households.
**Estimated cars & SUVs = estimated no. of vehicles x Total % of cars & SUVs
*** Ministry of Transport & Works, Annual Transport Statistics Report: Jamaica in Figures 2004-2005. Page 94

Comparison with Other Surveys

A previous study "Household Energy Use & Transportation 1983" by Derek Gordon & David Barnwell provided a useful comparison of transportation statistics with the 2006 study. This is shown in Table 2.17. However it must be pointed out that vehicle import restrictions had been imposed by the Government in the year preceding the 1983 study. The percentage of households having a vehicle at their disposal moved to 25% from 16% in 23 years. The estimated number of households with a vehicle had increased to approximately 187,000 from about 80,000.

Between 1983 and 2006 somewhat more households had one or more vehicles (Table 2.17). The distribution of vehicles by type did not changed much, as cars totalled 67.8%

of all vehicles in 2006 while they were 74.9% in 1983 (Table 2.18). The main change was that in 1983, vans amounted to 11.5% of vehicles but were not recorded in 2006, while pickups were not recorded in 1983 and SUVs were not on the market until the 1990's but accounted for 19.5% of vehicles in 2006.

TABLE 2.17: Comparison of Car Ownership by Households in 1983 & 2006

	1983		2006	
Vehicles Owned or Operated by Households	**% of Households**	**% of Vehicle Owning Households**	**% of Households**	**% of Vehicle Owning Households**
None	84.2		74.7	
One	12.9	81.4	19.4	76.7
Two	2.5	15.9	4.7	18.6
Three or more	0.4	2.7	1.2	4.7
Total	100.0%	100.0%	100.0%	100.0%

Table 2.18: Comparison of Household Vehicle Types in 1983 & 2006

Vehicle Type	**% of Vehicles**	
	1983	**2006**
Car	74.9	67.8
Van	11.5	---
Pickup	---	13.3
Sports Utility Vehicle (SUV)	---	6.2
Truck	4.1	2.2
Minibus/minivan/bus	1.8	7.7
Motorcycle	5.3	2.8
Other	2.4	
Total	100.0%	100.0%

The mean age of household cars was 10.8 years in 2006 compared with 9.3 years in 1983 (Table 2.19). It should be noted that data in the 1983 report seemed to indicate that the mean age would actually be over 10 years. The percentage of cars over 10 years was not much different in the two time periods; however, the mean engine size had reduced from 1798 cc to 1624 cc., a 9.7% reduction.

Table 2.19: Comparison of Household Car Statistics in 1983 & 2006

Vehicle Characteristic	**% of Cars**	
	1983	**2006**
Car Age		
0 – 5 years	16.4	13.8
6 – 10 years	28.4	33.1
11-15 years	42.8	37.7
Over 15 years	12.4	15.5
Total	100.0	100.0
Mean Age	**9.3 years**	**10.8 years**
Engine Size (c.c.)		
Under 1500 c.c.	30.8	Different grouping
1500 – 1999 c.c.	48.6	Different grouping
2000 – 2999 c.c.	11.9	Different grouping
3000 c.c. & over	8.7	Different grouping
Total	100.0	
Mean	**1798 c.c.**	**1633 c.c.**

Conclusions

The study demonstrated that the public transportation system was relied upon by the majority of the Jamaican population, which gave a measure of energy efficiency in the transportation sector. On the other hand, planners needed to recognize that there was a large reservoir of persons who may acquire vehicles in the future if their economic situation improved and they wanted the convenience of their own transport. The potential was there for much higher national fuel consumption if this occured.

Since about 68% of households utilized public transport for leisure trips and 43% for getting to work, the majority of the population was using the more energy efficient transportation rather than private cars. However the route taxi had become the main means of transport, which was less energy efficient than buses. For example, a regular

Jamaica Urban Transport Corporation (JUTC) bus at full capacity could carry 80 passengers, while an articulated bus could accommodate 110 passengers. In contrast, a route taxi was only licensed to carry four passengers and was therefore less efficient in energy use as well as road space. However route taxis had displaced buses island-wide except for the Kingston Metropolitan Area (KMA) which was served by the Jamaica Urban transit Company (JUTC) buses and Montego Bay which had the Montego Bay Metro bus service. Both of these bus systems were highly subsidized by the Jamaican government. Since it seemed unlikely that the traveling public could be persuaded or forced to revert to buses, route taxis would have to be recognised as an essential service by the policy makers and transport planners (rather than just tolerated). Policies and programmes were needed that target this form of transport into becoming more fuel efficient. This could include incentives for diesel engine taxis, and those with three rows of seats or mini-vans. However, these vehicles were more expensive than the small cars being imported second-hand from Japan for use as route taxis, and the incentive would have to be considerable.

The stock of vehicles owned or operated by households was mainly cars with small engines which were relatively fuel efficient. However 53% of cars and 75% of pickups were found to be over ten years old, and could be reaching the end of their useful life. This had national implications for the foreign exchange to import spare parts and for the eventual replacement of the cars. The environmental problems of disposal of the discarded cars would also become an issue. In terms of energy, if the owners were unable to meet the high maintenance cost, fuel efficiency (and commuter safety) would fall significantly in the coming years.

Most people placed some importance on fuel efficiency when deciding which vehicle to purchase. This would encourage the Government to continue the customs duty differential system that favoured smaller engine cars which are more fuel efficient. Persons owned more vehicles with smaller engines in 2006 compared to 1983. The fuel efficiency gains of the smaller engines would be negated by having more vehicles on the road.

Many person travelled long distances to work, which was energy inefficient. If the goal was to reduce national fuel use for transportation, policies would be needed to increase housing near to job centres. This could be particularly useful in areas of expanding or new economic development such as new hotels.

SECTION 3. ENERGY EFFICIENCY

Energy Saving Practices

The government has encouraged energy saving practices in homes through media programmes to educate the populace, and has promoted the use of energy saving light bulbs by removing custom duties, as well as through a 2006 programme of distributing free fluorescent bulbs donated by the Cuban Government.

The survey sought to determine the energy saving practices of households. About 79% of the respondents said they routinely performed such practices (Table 3.1). This is a very encouraging statistic for the energy conservation campaign.

TABLE 3.1 Distribution of Households Carrying Out Energy Saving Practices

QUESTION: Does this household routinely perform any energy saving practices?

	% of Households					
	Turn off light & appliances	**Energy efficient appliances**	**Use energy saving bulbs**	**Iron less**	**Open fridge less**	**Other**
All	73.1	4.7	26.6	40.0	28.0	2.9
Region						
Urban	76.5	4.8	32.8	42.4	32.4	3.1
Rural	69.4	4.7	20.0	37.5	23.1	2.8
Gender of Head of Household						
Male	69.7	4.6	25.0	34.7	23.9	3.1
Female	77.2	4.9	28.5	46.5	32.9	2.8
Age of Head						
< 40 years	72.7	4.3	23.9	35.1	24.1	2.1
40 – 60	74.4	6.3	29.6	44.8	30.8	3.8
> 60 years	71.7	3.0	25.7	39.1	28.6	2.6
Education Level of Head						
None	37.5	0.0	6.3	12.5	0.0	0.0
Pre-primary	73.3	0.0	20.0	33.3	40.0	0.0
Primary	67.1	2.7	18.2	38.0	26.0	3.1
Secondary	72.5	3.9	24.2	39.0	26.3	2.7
Tertiary	86.0	10.5	51.5	46.2	35.7	4.7
Income Level of Head (monthly)						
< $12,000	64.4	1.3	18.1	38.3	28.7	1.3
$12,000 - $23,999	68.6	7.6	19.5	35.4	26.4	1.8
$24,000 - $79,999	81.7	6.1	40.0	50.6	32.2	7.8
$80,000 & over	85.4	17.1	58.5	34.1	17.1	2.4

Respondents were asked to state all the energy saving practices their households routinely performed. Results are shown in Table 3.1. Each person could give several energy saving practices and as a result the percentages for any variable may add up to more than a 100%. The most identified measure was the turning off of electric lights and appliances when not in use. Many said that they ironed less (three persons said that they had stopped ironing), while some reported that they opened the refrigerator less. It was interesting that 26.6% stated that their households used energy saving bulbs, which seemed to be low in view of Government programmes to encourage their use. Perhaps this was due to their high cost compared to incandescent bulbs, even though fluorescent bulbs save money in the long run. The purchase of energy efficient appliances was listed by only a few. Among the other interesting practices given by very few but worth mentioning was watching less television.

Disaggregation of the data revealed some interesting results (Table 3.1). With respect to region, the percentages of households performing the various energy saving practices were similar for urban and rural, except that 32.8% of urban households used energy saving bulbs compared to only 20.0% of rural households; also a larger urban percentage said they opened the refrigerator less. There were gender differences, as fewer male headed households ironed less to save energy or practised opening the refrigerator less. The age of the head of the household did not show much difference in energy saving practices.

Educational levels appeared to have some influence, as heads of households with a tertiary education showed a higher percentage of application of almost all energy saving practices, including turning off electric lights and appliances when not in use, purchasing energy efficient appliances and using energy saving bulbs. There even seemed to be a tendency of the more educated practising ironing less as an energy saving measure.

Increasing income levels also generally showed an increase in those energy saving practices. The exception to this was that the highest income had the lowest percentage of all the income groups in the practice of ironing less.

Is Enough Being Done For Energy Conservation?

Respondents were asked if they thought that enough was being done by households in Jamaica to conserve energy. As shown in Figure 3.1, only 30.1% had the opinion that enough was being done.

When asked if they thought that enough was being done to promote energy conservation by the Jamaican Government, only 23.1% responded in the affirmative (Figure 3.2 and Table 3.2).

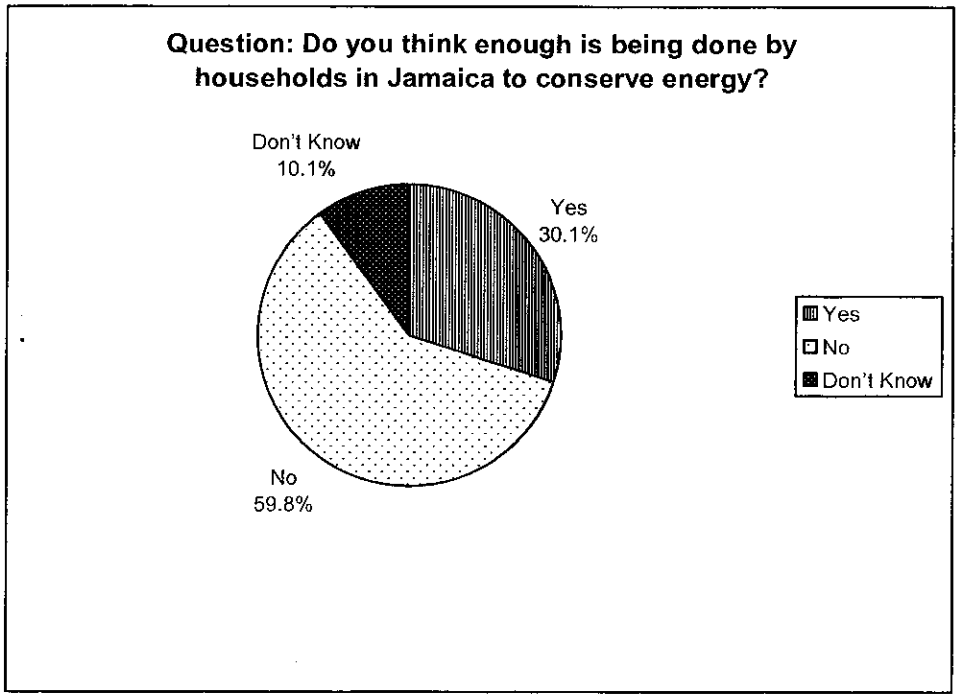

FIGURE 3.1: PUBLIC'S EVALUATION OF ENERGY CONSERVATION IN JAMAICAN HOUSEHOLDS

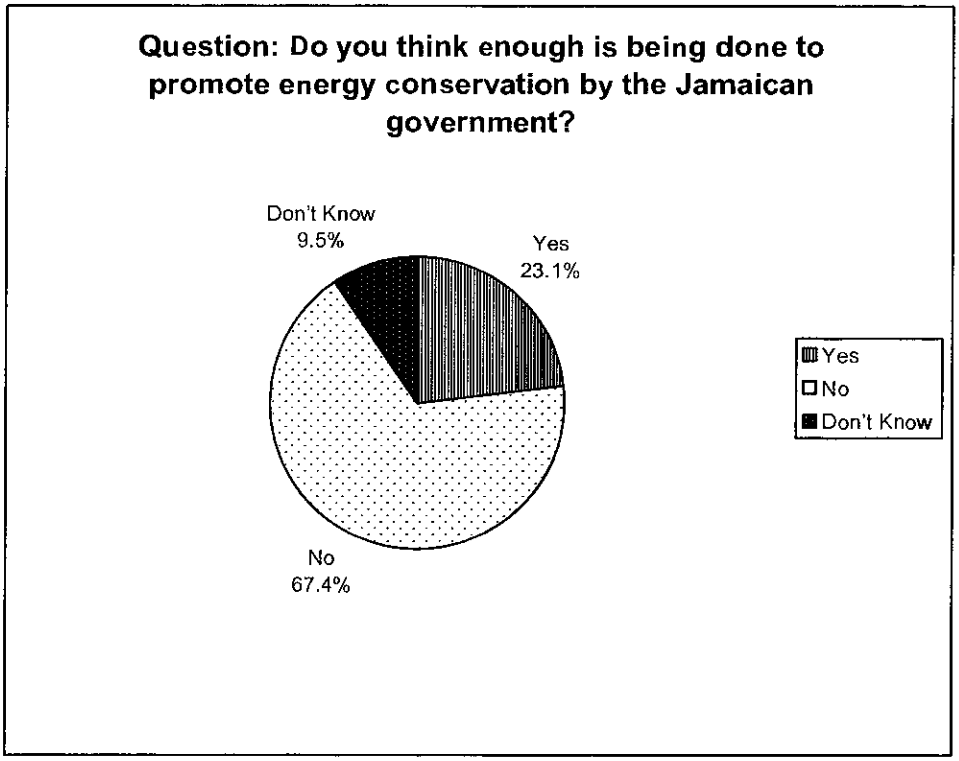

FIGURE 3.2: PUBLIC'S EVALUATION OF ENERGY CONSERVATION PROMOTION BY THE JAMAICAN GOVERNMENT

When the data was disaggregated by region and gender, there was not much difference in the percentages of persons that had a positive opinion, either between urban and rural respondents, or between male and female. However a larger proportion of middle aged persons had a positive view (29.5%) compared to younger (17.7%) and older persons (20.4%). Clear trends could be seen in educational and income levels, with increasing percentages of persons with a negative view of efforts by the Jamaican Government to promote energy conservation as the educational and income levels increased. In the lowest education level 51.3% had a negative view, and this percentage increased with educational level to 76.6% of persons with tertiary education. Similarly, 61.7% of those with the lowest income had a negative view and this percentage increased with income level to 75.9% of those in the highest income group.

TABLE 3.2: Public Opinion on Energy Conservation Promotion by the Jamaican Government

QUESTION: Do you think enough is being done to promote energy conservation by the Jamaican Government?

	% of Respondents		
	Yes	**No**	**Don't know**
All	23.1	67.5	9.5
Region			
Urban	23.5	69.1	7.4
Rural	22.6	65.7	11.8
Gender of Household Head			
Male	20.9	68.6	10.5
Female	23.0	67.0	10.0
Age of Head			
< 40 years	17.7	71.4	11.0
40 – 60	29.5	65.2	5.3
> 60 years	20.4	64.0	15.6
Education Level of Head			
None/ pre-primary	27.9	51.3	20.8
Primary	21.2	64.2	14.6
Secondary	25.4	65.4	9.2
Tertiary	18.8	76.6	4.7
Income Level of Head (monthly)			
< $12,000	25.2	61.7	13.0
$12,000 – $23,999	22.7	69.1	8.2
$24,000 – $79,999	21.4	75.6	3.1
$80,000 & over	20.7	75.9	3.4

Suggestions were given as to the steps that should be taken to promote energy conservation by the Jamaican government. These are listed in Table 3.3. The percentages add up to more than 100% as the respondents could give multiple answers.

TABLE 3.3: Public's Suggestions for Energy Conservation Promotion by the Jamaican Government

QUESTION: What steps should be taken to promote energy conservation by the Jamaican Government?

Suggestions	% Respondents
Educate people on conservation	53.1
Develop solar/wind/local energy sources	9.0
Better JPS billing	3.2
Government to take back JPS	3.0
Energy saving fluorescent bulbs	8.1
End electricity theft	7.2
Other	9.5
Government doing enough	3.9
Flat rate electricity bills	1.5
Turn off street lights during the day	1.6
Total	**100**

The suggestion given by most respondents (53.1%) was that people should be educated on conservation. This may indicate that the public education programmes by the government and the electricity company, Jamaica Public Service (JPS) have not been reaching their intended targets. The other suggestions came from much fewer persons. Some 9.0% of respondents suggested developing local energy sources (including solar and wind), while another 8.1% percentage said energy saving fluorescent bulbs. The latter could be interpreted as a shortcoming of the programme to educate on the use of these bulbs in homes, or it could be that enough is being done in this area and it was therefore not considered as needing to be mentioned. Another suggestion given by 7.2% of respondents was the need to end the theft of electricity, which has become a problem of some magnitude in Jamaica. Although only mentioned by 1.6% persons, the suggestion of turning off street lights during the day could indicate that this energy wasting problem of street lights not turning off automatically at dawn is occurring in some areas. There would seem to be a need for a programme to repair defective street lights. The suggestion that flat rate electricity bills should be introduced, which would be expected to increase energy use, indicated that some respondents did not understand the question or were trying to air their personal issues of high electricity bills.

NHT Solar Water Heater Loan Programme

On April 1, 2006, the National Housing Trust (NHT) started a special loan programme for contributors to get low interest loans to purchase solar water heaters (see details in Appendix 4). This would enable householders to enjoy hot water for bathing etc., while saving on the cost of electricity or LPG to heat the water. The country would also save on the importation of fuel for the source of energy.

The survey identified that only 5.6% of respondents had a water heater in their homes (Table 3.4). The predominant type was an electric water heater which is the high user of electricity and therefore energy inefficient. Owners of this type of unit should be targeted to change over to a solar system, as well as encouraging new purchasers of water heaters to 'go solar'.

TABLE 3.4: Prevalence of Water Heaters in Households

	% of Respondents
Households:	
with water heater	5.6%
no water heater	94.4%
Total	**100.0%**
Type of Water Heater	
Solar heater	16.1%
Electric heater	82.3%
Gas heater	1.6%
Total	**100.0%**

It was found that only 13.5% of respondents said that they knew about the NHT solar water heater loan programme (Figure 3.4 & Table 3.5). This is disappointing and points to the need for more promotion by the NHT of this useful programme. When disaggregated by region (Table 3.5), more urban respondents knew of the programme than their rural counterparts. Gender was not a factor; however age was, as only 8.8% of the oldest group knew compared to 18.9% of the middle group. There appeared to be a tendency of increasing knowledge of the programme the higher the education and income levels. Some 39.8% of those respondents with a tertiary education knew, graduating down to 0.0% of those with no/pre-primary education. Similarly 39.3% of those with the highest income level of the head of the household knew about the NHT solar water heater programme, graduating down to only 8.2% of the lowest income level.

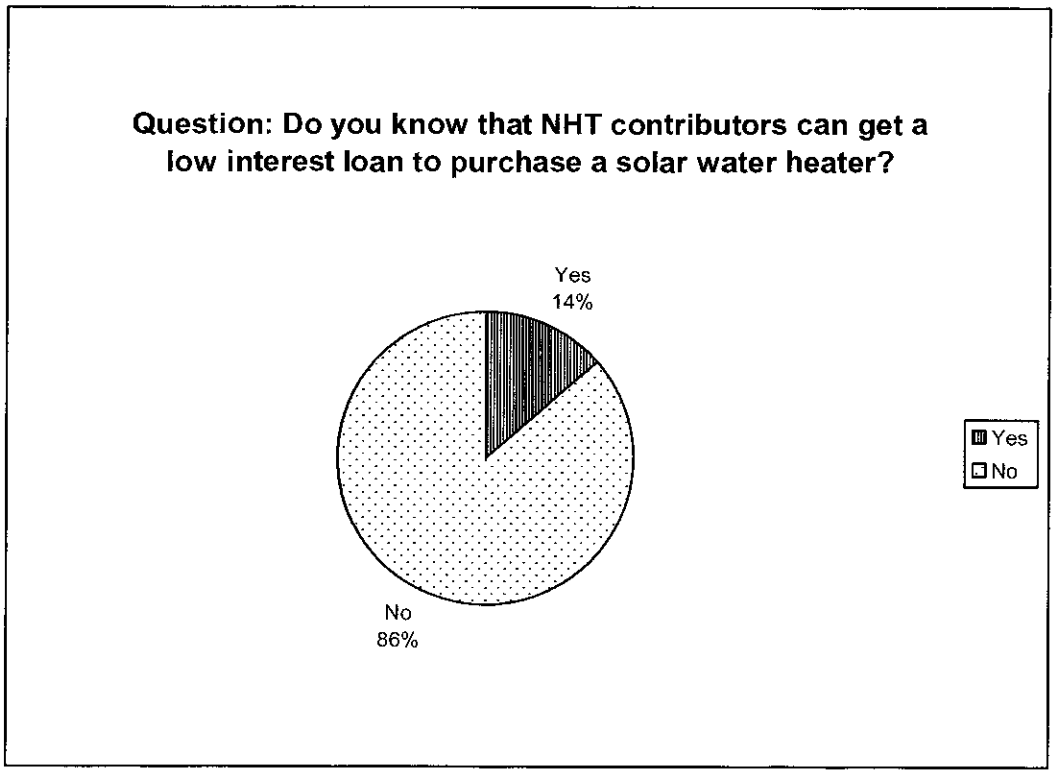

FIGURE 3.3: PUBLIC KNOWLEDGE OF NHT SOLAR WATER HEATER LOAN PROGRAMME

Table 3.5: Public Knowledge of National Housing Trust Loan Programme for Solar Water Heaters

QUESTION: Do you that NHT contributors can get a low interest loan to purchase a solar water heater?

	% of Respondents	
	Yes	**No**
All	13.5	86.5
Region		
Urban	17.1	82.9
Rural	9.6	90.4
Gender of Household Head		
Male	14.6	85.4
Female	14.7	85.3
Age of Head		
< 40 years	14.5	85.5
40 – 60	18.9	81.1
> 60 years	8.8	91.2
Education Level of Head		
None/ pre-primary	0.0	100.0
Primary	8.3	91.7
Secondary	11.1	88.9
Tertiary	39.8	60.2
Income Level of Head (monthly)		
< $12,000	8.2	91.8
$12,000 – $23,999	13.4	86.6
$24,000 – $79,999	21.4	78.6
$80,000 & over	39.3	60.7

Conclusions

Most households routinely performed energy saving practices, particularly turning off electric lights and appliances when not in use, and ironing less. However the use of energy saving bulbs by only 26.6% of households indicated that the programme of encouraging their use was not fully successful. This could be due to the relatively high initial cost. It would be interesting to evaluate if the project of distributing free compact fluorescent bulbs donated by the Cuban Government would result in households buying more of them.

The majority of respondents had the opinion that not enough was being done by households or the Jamaican Government regarding energy conservation. Their main suggestion that people should be educated on this indicates that the extensive programmes conducted by the Government and the electricity company on this subject were not perceived as being sufficient. Focus group studies could be conducted to identify the most effective means of future public education programmes on energy conservation.

There was a low prevalence of water heaters in Jamaican households, which could be due to many persons thinking that they are unnecessary in the hot Jamaican climate, and/or too expensive for the benefits. This indicated that there may not be much energy savings from a programme to encourage solar water heaters. It would appear that the NHT promotion of this programme was not being effective was known by only 13.5% of respondents, and other strategies for the promotion would be needed.

APPENDICES

APPENDIX 1

Demographic Analysis

Population Structure

The sample in the Energy Survey (ES) recorded that males and females 18 years and over accounted for over 60 per cent of the total population in both urban and rural areas (see Table 1). The proportions of the female population 18 years and over were slightly higher than the corresponding proportions for the male population in both urban and rural areas.

With reference to the child population under 18 years, the proportions for male children were higher when compared with the proportions for females under 18 years in both urban and rural areas. A comparison of the structure and distribution of the population as recorded by the ES to that of the 2001 Population Census indicates that while some variations exist, the results of the Survey were fairly accurate (see Table 2).

Table 1
Percentage Distribution of Household Members
By Age Group, Sex and Region

Age Group	Male			Female		
	Total	Urban	Rural	Total	Urban	Rural
0-5 years	11.9	10.8	13.1	10.4	10.6	10.2
6-11 years	13.8	14.7	12.8	13.7	14.7	12.6
12-17 years	12.3	12.1	12.6	11.0	10.6	11.4
18 years and over	62.0	62.4	61.6	64.9	64.1	65.8
Total	**100**	**100**	**100**	**100**	**100**	**100**

Table 2
Percentage Distribution of the Population by Age, Sex and Region,
Population Census, 2001

Group	Male			Female			Jamaica
	Total	Urban	Rural	Total	Urban	Rural	
0-5 years	14.3	14.0	14.5	13.5	12.3	14.8	13.8
6-11 years	13.8	13.3	14.2	13.0	12.0	14.2	13.4
12-17 years	13.5	13.4	13.7	13.0	12.7	13.4	13.2
18 years & over	58.4	59.3	57.6	60.5	63.0	57.6	59.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

N.B. Multipliers were derived from the 2001 end of year population and used to split the 5 year age groups into single years of age for the 2001 Population Census to coincide with the age distribution for the Survey.

Household Headship and Structure

The ES recorded that 45.4 per cent of all households in Jamaica were headed by females (see Table 2). This estimate is similar to that recorded in the Jamaica Survey of Living Conditions (see JSLC, PIOJ/STATIN, 2005).

Table 3
Percentage Distribution of Gender of Household Head

	Percentage of Household
	ALL
Male	54.6
Female	45.4
Total	**100**

Mean household size was recorded at 3.5 persons for both national and regional levels (see Table 3). This finding is not consistent with that for the JSLC which has consistently recorded a higher mean number of persons per household in Rural Areas compared with the Kingston Metropolitan Area (KMA) and Other Towns (note KMA and Other Towns classified as Urban).

Table 4
Household Composition

	ALL	URBAN	RURAL
Mean Total Household Size	3.5	3.5	3.5
Mean No. of Adult Males	1.2	1.2	1.2
Mean No. of Adult Females	1.3	1.3	1.3
Mean No. of Children	1.9	1.9	1.9

Mean household size by sex of household head revealed that male-headed households contained a smaller mean number of persons compared with households headed by females (see Table 4). This finding was the same for both urban and rural areas.

Table 5
Household Composition by Sex of Household Head & Region

Sex of Household Head	Urban	Rural	Total
Male			
Mean Total Household Size	3.2	3.3	3.3
Mean No. of Adult Males	1.3	1.3	1.3
Mean No. of Adult Females	1.1	1.1	1.1
Mean No. of Children	1.7	1.6	1.7
Female			
Mean Total Household Size	3.8	3.9	3.8
Mean No. of Adult Males	1.0	0.9	1.0
Mean No. of Adult Females	1.5	1.6	1.5
Mean No. of Children	2.1	2.3	2.2

With respect to household composition, male-headed households contained a smaller mean number of children and adult females compared with households headed by females. However, while male-headed households contained a greater mean number of adult males, female-headed households consisted of a greater mean number of adults females.

Comparison with the Jamaica Survey of Living Conditions (JSLC)

The Energy Survey and the JSLC cannot be compared on most of the demographic variables. In some instances, the questions may be similar but the response categories are different (see questions on the family, occupation and education). The surveys also used different categorizations for age, children and urban population. Recoding and other adjustments could not solve some of the difficulties.

APPENDIX 2

OTHER HOUSEHOLD CHARACTERISTICS BY REGION

Characteristic	Percentage of Households		
	ALL	Urban	Rural
Level of Education			
None	1.5	0.7	2.3
Pre Primary	1.4	0.7	2.1
Primary	26.9	20.5	34.0
Secondary Grade 7-9	25.1	21.4	29.2
Secondary Grade 10+	29.3	34.2	23.9
Other tertiary[15]	9.5	13.7	4.9
University	5.8	8.2	3.2
Total	**100**	**100**	**100**
Monthly Income			
Less than $12,000	23.0	14.5	31.0
$12,000-$23,999	42.8	42.8	42.9
$24,000-$79,999	27.8	33.4	22.6
$80,000 and above	6.3	9.3	3.6
Total	**100**	**100**	**100**
Home ownership			
Owned	63.2	53.4	73.8
Leased/Rented	22.2	31.0	12.7
Rent Free	14.5	15.5	13.5
Other	0.1	0.2	0.0
Total	**100**	**100**	**100**

[15] Other Tertiary - post secondary other than University e.g. teachers' and community colleges, Human Employment and Resource Training (HEART) vocational training.

APPENDIX 3

Bibliography of Energy Related Reports & Publications

- **Energy Policies and Multitopic Household Surveys – Guidelines for Questionnaire Design in Living Standards Measurement Studies-** O'Sullivan, Kryan & Barnes F. Douglas. Energy and Mining Sector Board Discussion Paper No.17, April 2006

- **Green Paper: The Jamaica Energy Policy 2006-2020** issued in February 2006 – www.mct.gov.jm

- **Jamaica Survey of Living Conditions 2004 and 2005** - Joint publications of the Statistical Institute of Jamaica (STATIN) and the Planning Institute of Jamaica (PIOJ).

- **Green Paper on National Transport Policy issued to Cabinet in October 2005** - www.mtw.gov.jm/transport

- **NHT & Solar Water Heater Loans** – www.nht.gov.jm

- **Jamaica's Energy – Old Prospects New Resources-** Wright, Raymond Dr., PCJ, 36 Trafalgar Road, Kingston 10, 1996

- **The Results of an Energy Demand/Supply Survey for the Petroleum Corporation of Jamaica- Volume 1 & 2**- J.A Young Research Ltd., 2A Kensington Crescent Kingston 5; May 22, 1997.

- **Post-Implementation Impact Assessment Jamaica Demand Side Management Demonstration Project (prepared for: World Bank –GEF Coordination Team),** Prepared by Marbek Resource Consultants in association with Angelhoeve Associates Incorporated. 300-222 Somerset Street Wets Ottawa, Ontario K2P 2G3, June 23, 2005

- **Household Energy Use and Transportation 1983: A Preliminary Report.** Prepared by Derek Gordon and David Barnwell. Prepared for: The Ministry of Mining and Energy and Social Policy Research Institute Ltd.

APPENDIX 4

National Housing Trust
...the key to your home

Solar Water Heater Loan

The Solar Water Heater loan is to provide financing to Individual NHT contributors and recognized institutions for the installation and retrofitting of solar heating systems. The loan limit is $100,000.00.

The following conditions apply to this loan:

NHT Contributors

- It is available to any NHT contributor who can provide a title for a residential property.
- The applicant does not have to install the system on the house of the collateral/security.
- The interest rate charged on the loan is 3%.
- There is a service charge of 5%.
- The maximum time to repay the loan is five years.

Institutions

The institution should:

- Be NHT compliant. This means that all outstanding annual returns should have been submitted and contributions paid on behalf of employees/employers.
- Have been established for at least five years.
- Show proof of income and ability to repay the loan.
- Demonstrate that it has the capacity to repay the loan without a negative impact on its operations.
- Possess documentation that clearly outlines persons with authority to conduct legal/business transactions on the institution's behalf.
- Prove that the constitution of the entity gives it the authority to borrow.
- The interest rate charged on the loan is 3%.
- There is a service charge of 5%.
- The maximum time to repay the loan is five years.

APPENDIX 5

ENERGY SURVEY QUESTIONNAIRE

FORM EMS06

STATISTICAL INSTITUTE OF JAMAICA
7 Cecelio Ave., Kingston 10
Tel. 926-5311. Fax 926-1138
E-mail:info@statinja.com

CONFIDENTIAL (*STATISTICS ACT*)

ENERGY MARKET END USE SURVEY

FOR HOUSEHOLDS

SERIAL No. ☐☐☐☐

IDENTIFICATION

PARISH	CONSTITUENCY	ED. NO.	DWELLING NO.	HOUSEHOLD NO.	URBAN/RURAL
☐☐	☐☐	☐☐☐	☐☐☐	☐☐	☐

My name is ..... and I am an interviewer with the Statistical Institute of Jamaica. We are conducting a study on Energy usage in Jamaica and the conservation methods that are currently being practiced.

We plan to interview over 1,200 individuals in Jamaica for this study and you have been randomly selected to take part. This interview is completely anonymous and confidential and at the end of the study we will not be able to link your answers to your name or address. At any time during the interview you can feel free to stop me to ask questions. Please answer the questions as honestly as possible.

First name ☐☐☐☐☐☐☐☐☐☐

Last name ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

DATE OF INTERVIEW: ____ ____ ____
YYYY MM DD

NAME OF INTERVIEWER: _____

SIGNATURE: _____ **DATE:** _____

NAME OF SUPERVISOR: _____

SIGNATURE: _____ **DATE:** _____