# Energy Related Characteristics of Low Income Urban Tenants

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Little is known regarding characteristics of low income tenants as they relate to energy conservation, especially those residing in private rather than public housing. Grier (1977), Newman and Day (1975), and Perlman and Warren (1977) have included low income families in their studies, but have not distinguished between owners and tenants. Identifying energy related characteristics of tenants is the first step in planning programs which enhance energy conservation. Low income tenants cannot afford nor is it appropriate for them to retrofit their dwelling units, thus they must rely on their landlords for major energy improvements. Most weatherization programs benefit the owner rather than the tenant. Behavior adjustments may be more important than structural modifications. Therefore, the characteristics of tenant households and dwelling units must be known before effective programs can be planned.

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Newman and Day (1975) estimated that energy costs in proportion to income are almost four times greater for the poor than for the middle and upper classes. Further, the poor use less energy than others and use it primarily for such necessities as space and water heating, cooking, refrigeration, and lighting. Therefore, these families experience fewer opportunities for cutting back and less elasticity in energy consumption.

Brazzel and Hunter (1979) found that residents of black households spend a greater portion of their disposable incomes for energy than their white counterparts, low income groups spend a substantially higher proportion than middle and upper income groups, and female-headed households spend a significantly higher percentage of disposable income for energy than male-headed households.

### Determinants of Residential Energy Usage

Household members exercise considerable control over energy consumption but are limited by finances, technical capabilities, desired comfort levels, locus of operational control, and quality of the structure. Low

income tenants have fewer options than owners or more prosperous tenants for dealing with many of these factors. Low income households often lack the ability to control consumption. They cannot afford to fix up their dwellings nor can they afford to leave them (Meeks and Ouderkirk, 1978).

Both budgetary impact and the ability to conserve depend upon the amount of energy required to heat the dwelling and, therefore, on the condition of the building. Such attributes as the type of structure, size, type of heating system and fuel, control of temperature, location, and conservation devices are key considerations. The poor are likely to live in rental units and have fewer features to conserve energy. Grier (1977) reported that 43 percent of the dwellings studied had no insulation and about three quarters had no weatherstripping or storm windows. Newman and Day (1975) found that most families had central heat (85 percent) and used natural gas as fuel, but less than half could control space heating with a thermostat. Old, uninsulated, drafty buildings require higher temperatures to maintain comfort levels than do well constructed units. Virtually all low income households have a range, refrigerator, and television. Few have clothes dryers, dishwashers, freezers, or air conditioners (Brown, 1977; Grier, 1977).

*Energy Related Characteristics of Low Income Households*

According to previous studies (Grier, 1977; Newman and Day, 1975; Perlman and Warren, 1977), more than one-half of all low income households are tenants, female-headed, and live in single family dwellings. Approximately one-third of the households are headed by persons over 65 and are composed of blacks. Approximately one-half live outside metropolitan areas, but one-third live in central cities, and about one-third reside in the South (Grier, 1977). On the average, blacks have lower incomes, larger families, drive older cars, and live in older and less energy efficient dwellings than whites (Brazzel and Hunter, 1979).

Since the problems of high cost and uncertain availability of energy supplies are likely to continue in the future, information on energy related characteristics of low income urban tenants is needed. Programs which can be designed to enhance energy use in the existing housing stock could become essential parts of funding for Community Development Block Grants and Rehabilitation Grants. More data on the energy use characteristics for these households is needed before successful programs can be planned.

The purpose of this article is to describe the energy related characteristics of low income tenants in an established urban neighborhood. This group is comprised of tenants who are established in the neighborhood and, due to economic constraints, are likely to remain there. This group is least likely to attend meetings or to be aware of educational programs which encourage energy conserving behaviors.

## Methodology

Low income urban black tenants from a geographically distinct neighborhood in Roanoke, Virginia, were interviewed between June and September 1980. Interviews with 216 households were completed according to a fixed interview schedule by paraprofessional employees of a community-based organization. Parapro- fessionals were trained in interviewing techniques by the senior author. Wherever possible, head of household was interviewed. In order to maintain homogeneity, a geographically distinct low income neighborhood was chosen for the study area. All tenant households who met eligibility requirements in this neighborhood were interviewed. The tenants were reluctant to respond to the demographic segment of the questionnaire, thus the analyses of these characteristics are limited. Response rates are reported on each table and percentages have been calculated from those actually responding.

Eligibility was determined by the number of persons in the household and income according to eligibility standards for subsidy programs established by the Community Services Administration (Calomeris, 1979). Low income households are those with incomes at or below 125 percent of the federal poverty level and constitute the lower 20 percent of all American households (Grier, 1977). Approximately 35.7 million individuals and 7.6 million families were considered low income in 1979 (Calomeris, 1979).

## Findings

*Demographic Characteristics*

All of the respondents in this study lived in an established black neighborhood. As shown in Table 1, residents had lived at their present addresses for an average of eight years and in the neighborhood for over eleven years. Perhaps due to this factor, a large percentage (44.5 percent) of the households contained senior citizens and few had two or more children.

**Table 1 — Demographic Characteristics of Low Income Urban Tenants***

| | $\bar{X}$ | S. D. | N |
|---|---|---|---|
| Stability in Neighborhood | | | |
| Years at Present Address | 8.01 | 7.08 | 211 |
| Years in Neighborhood | 11.61 | 12.13 | 207 |
| Size of Household | | | |
| Adults | 1.62 | .65 | 200 |
| Children | 1.00 | 2.01 | 208 |
| Income Level | $4,000-$4,999 | 1.77 | 178 |

| | Percent | N |
|---|---|---|
| Sex of Head | | 198 |
| Male | 50.0 | |
| Female | 50.0 | |
| Employment Status of Head | | 136 |
| Full Time | 30.1 | |
| Part Time | 18.4 | |
| Unemployed | 51.4 | |
| Education Level of Head | | 114 |
| Did Not Complete High School | 57.0 | |
| High School Graduate | 32.5 | |
| Some College | 10.6 | |

*A total of 216 interviews were completed, but respondents were reluctant to complete the demographic items during the interview. The percentages calculated are based only on the responses.

The mean yearly household income reported was in the category of $4,000-$4,999. According to many writers, employment status, education level, and sex of household significantly influence the amount of family income. Less than one person per household (.68) was employed, 48.5 percent of the heads were employed (30.1 steadily and 18.4 part time), and 50 percent of the Roanoke households were headed by females. The mode education level of head indicated that most of the respondents had some high school and almost one-third had completed high school. However, this data is based on 102 responses to the demograhic items. Those who did not respond to this question may have had less education.

*Characteristics of Dwelling Units*

The type and quality of the structure are major determinants in energy consumption. As shown in Table 2, the respondents lived predominantly in single family residences or in units which were originally designed for a single family and had been converted to two or more apartments. Few of the units were duplexes and none of the households lived in low, medium, or high rise units. The average age of the units was 47.5 years (S. D. 9.62), and slightly more than one-half of the units were in sound condition. A unit was judged to be in sound condition if there were no broken windows, signs of maintenance, and floors and roofs were solid. An energy audit revealed that these units were not insulated, few had storm windows and doors, and caulking and weatherstripping were in poor condition.

Natural gas (44.7 percent) and fuel oil (28.2 percent) were the most frequently used fuels. Most homes utilized a central furnace for the main heating system, but 28.8 percent relied on electric and gas space heaters, and 15.3 percent relied on stoves fired primarily by coal.

*Characteristics Related to Energy Consumption*

Appliance ownership, temperature control, responsibility for fuel cost, use of supplemental systems, and retrofitting measures affect energy consumption. Ownership of small, portable appliances allows the individual more control over energy consumption. The data reported in Table 3 reveals that slightly more than one-fifth had such portable cooking appliances as an electric fry pan, toaster oven, and slow cooker. Since the mean size of household was less than three, use of portable appliances would be appropriate. With the use

**Table 2 — Characteristics of Dwelling Units**

| | Percent | N |
|---|---|---|
| Building Type* | | 215 |
| Single family | 80.0 | |
| Converted to apartments | 15.3 | |
| Duplex | 1.9 | |
| More than two apartments | 1.4 | |
| Condition* | | 214 |
| Sound | 54.2 | |
| Deteriorating | 40.7 | |
| Dilapidated | 4.7 | |
| Type of Fuel — Main System | | 213 |
| Natural gas | 44.7 | |
| Fuel oil | 28.2 | |
| Coal | 15.5 | |
| Electricity | 7.9 | |
| Wood | 0.9 | |
| Bottled gas | 0.9 | |
| None | 1.4 | |
| Other | 1.4 | |
| Type of Heating System | | 213 |
| Furnace | 42.2 | |
| Space heater | 28.8 | |
| Stove | 15.3 | |
| Floor/wall furnace | 11.7 | |
| Portable room heater | 0.9 | |
| Fireplace | 0.9 | |
| None | 1.4 | |
| Supplemental Systems | | 213 |
| Oven on range | 22.7 | |
| Stove | 13.0 | |
| Portable heaters | 10.6 | |
| Fireplace | 3.7 | |

*Building type and condition were assessed by the senior author. Type of fuel and type of heating systems were assessed through the questionnaire.

of an electric blanket, the temperature of the interior can be reduced, but only 5.1 percent of these households owned an electric blanket. About equal numbers had electric or gas ranges and eight used coal for cooking. Only 85 percent used electric or gas heaters to heat water. Few low income households utilized air conditioners, but most relied on fans to cool the interior.

With regard to temperature control, a record of the self-reported actual temperatures in the dwelling unit for daytime, when sleeping, and for times when no one was home is presented in Table 4. Almost one-third of the respondents kept their houses over 73°F during the day, but appeared to reduce the temperature when space was not used. The number of senior citizens in this study probably warrants the higher temperature. The mode temperature range, 69-72°F, was the same for all three time periods, suggesting that temperature set-backs are not utilized to their fullest potential.

Most families reported the presence of a thermostat (72.7 percent). The large percentage of unknown actual temperatures indicates that a thermometer may be necessary in order to give feedback on temperature setbacks. Most respondents control space temperature

**Table 3 — Appliance Ownership of Low Income Urban Tenants, 1980 (N = 216)***

| Appliance | Percent |
|---|---|
| Water Heater | |
| Electric | 47.9 |
| Gas | 37.1 |
| Range | |
| Electric | 46.7 |
| Gas | 46.7 |
| Coal | 1.7 |
| Refrigerator | 96.3 |
| Electric Fan | 80.0 |
| Air Conditioner | 11.2 |
| Television | 94.0 |
| Portable Cooking Appliances | |
| Electric fry pan | 21.4 |
| Toaster oven | 22.3 |
| Slow cooker | 27.4 |
| Electric Blanket | 5.1 |

*Percent based on 100 percent response rate on questionnaire.

**Table 4 — Actual Indoor Temperature Reported by Low Income Urban Tenants, 1980 (N = 216)***

| Temperature (F) | Daytime | Sleeping | Out |
|---|---|---|---|
| 60° or Below | 4.2% | 8.3% | 7.9% |
| 61-68° | 9.3 | 14.8 | 14.4 |
| 69-72° | 34.3 | 37.0 | 33.3 |
| 73-83° | 28.2 | 13.0 | 12.5 |
| Not Known | 24.1 | 26.9 | 31.9 |

*Based on a response rate of 100 percent.

by adjusting the thermostat. Few tenants found opening windows necessary for temperature control and slightly over one-fifth added wood to a stove or furnace.

**Table 5 — Method of Temperature Control Reported by Low Income Urban Tenants, 1980 (N = 216)***

| Method | Percent |
|---|---|
| Adjust Thermostat | 68.8% |
| Add Wood | 21.3 |
| Adjust on/off indicator | 13.4 |
| Adjust floor vents | 6.5 |
| Adjust radiator | 3.7 |
| Open windows | 3.2 |

*Percent exceeds 100 due to multiple methods of control.

One other aspect of energy consumption is the responsibility for energy costs. If one pays directly for the energy used, feedback on the amount of energy used should be a frequent reminder to reduce consumption, and a motivator for retrofitting the dwellings and adjusting behaviors. Over 80 percent of the tenants in this study were responsible for their own energy bills. Programs such as Fuel Assistance are important sources of help and the payments cover a portion of the fuel costs. In this study, only 12.5 percent of the families received fuel assistance, although all would be eligible.

The use of supplemental heating systems, e.g., stoves, portable heaters, gas or electric ranges, and fireplaces which are often improperly installed and maintained have resulted in severe burns, residential fires, and asphyxiation (Calomeris, 1979). As the price of natural gas and fuel oil increase, low income households are likely to rely more on inexpensive, unvented kerosene space heaters, gasoline and catalytic heaters, and barbeque grills for primary as well as supplementary heat.

The use of gas kitchen ranges for supplemental heat is common among low income families. In this study, 50 percent of all households used some source of supplemental heat, and of these, almost one-half relied on the range oven (Table 2). Ventilation may not be adequate for continuous safe operation of a gas range oven with the door open. Using electric ranges and space heaters may overload electrical circuits in older, inadequately wired houses. In any case, heat build up may be sufficient to cause fires.

Finally, it is important to examine retrofitting measures. Although most dwelling units in this study were in sound condition, they were not insulated, few had storm windows and doors, and caulking and weatherstripping were in poor condition. Further, landlords in this study had done little to improve these units as reported in Table 6. Thus, it appears that rehabilitation and retrofitting are appropriate. The large percentage of senior citizens in the neighborhood also is justification for the need for retrofitting to increase comfort of dwellings as thermostat settings are lowered. The elderly are susceptible to colds and respiratory ailments, arthritis and accidental hypothermia.

In order to gain more information regarding the interrelationship of these characteristics, three one-way analyses of variance (ANOVA) were calculated to determine the relationship of the indoor temperature maintained and the condition of the dwelling unit, the presence of senior citizens, and the fuel used for the main heating system. The results of these three ANOVAs are reported in Table 7. This analysis is limited since nearly one-quarter of the tenants did not report indoor temperatures (Table 4). In all three tests, the results were not significant at the .05 level of significance.

**Table 6 — Retrofitting by Landlords of Low Income Urban Housing**

| | Percent | N |
|---|---|---|
| Added insulation | 2.3 | 218* |
| Weatherstripped | 2.3 | |
| Add storms (plastic/glass) | 4.1 | |
| Replaced broken windows | 11.5 | |
| Nothing | 79.8 | |

*Some respondents reported more than one method.

Therefore, the temperature maintained was independent of the condition of the dwelling, presence of senior citizens, and the fuel used in the main heating

**Table 7 — Results of the One-Way Analyses of Variance Comparing the Indoor Temperature Maintained with Condition of Dwelling, Presence of Senior Citizens, and Fuel Used for Main Heating System**

| Temperature X Condition (N = 154) Source | df | SS | MS | F |
|---|---|---|---|---|
| Temperature | 1 | 2.62 | 2.62 | .104 N.S. |
| Error | 152 | 3832.78 | 25.22 | |
| Total | 153 | 3835.40 | | |

| Temperature X Presence of Senior Citizens (N = 113) Source | df | SS | MS | F |
|---|---|---|---|---|
| Temperature | 1 | 32.20 | 32.20 | 1.243 N.S. |
| Error | 111 | 2871.55 | 25.87 | |
| Total | 112 | 2903.75 | | |

| Temperature X Fuel for Main Heating System (N = 135) Source | df | SS | MS | F |
|---|---|---|---|---|
| Temperature | 1 | 29.40 | 29.40 | 1.257 N.S. |
| Error | 133 | 3111.33 | 23.39 | |
| Total | 134 | 3140.73 | | |

$\alpha = .05$. One-quarter of population did not report indoor temperature maintained, therefore, analyses are based on smaller N's than the 216 completed interviews for the population.

system. Tenants residing in dwellings which were deteriorating or dilapidated did not maintain higher indoor temperatures than tenants in sound units. Since none of the units had insulation, storm windows/doors, or weatherstripping and caulking, heat loss was high regardless of condition. Indoor temperatures in most units were above 68°F and ranged from 60° to 83° F. However, households containing senior citizens did not appear to maintain higher temperatures than those households without senior citizens.

The analysis of temperature maintained by type of fuel was limited to comparing tenants who used oil or natural gas as the main fuels. A valid analysis could not be completed with tenants who used other fuels because the sample size was too small. No difference was seen in the temperature maintained between those who used fuel oil and those who used natural gas, although the price of fuel oil due to deregulation was much higher than natural gas. Since over 80 percent of these tenants were responsible for their own utility costs, one would expect cost to encourage conservation. Apparently this was not the case.

Although senior citizens did not tend to maintain higher temperatures, they were more apt to live in units in sound condition than households without senior citizens as revealed by the chi-square test reported in Table 8. The data reported in Table 9 reveals that sex of household head is independent of condition. Therefore, female-headed households are as likely to live in sound units as male-headed households.

## Conclusions

These tenants lived in an established neighborhood which over the years had filtered down from a middle

**Table 8 — Results of Chi-square Test of Independence for Presence of Senior Citizens and Condition of Dwelling**

| | Presence of Senior Citizens | | |
|---|---|---|---|
| | Yes | No | Total |
| **Condition** | | | |
| Sound | 38(44.83) | 43(36.17) | 81 |
| Deteriorating/ Dilapidated | 50(43.17) | 28(34.83) | 78 |
| Total | 88 | 71 | 159 |

Chi-sq. = 4.75, df = 1, significant at $\alpha = .05$.

**Table 9 — Results of Chi-square Test of Independence for Sex of Household Head and Condition of Dwelling**

| | Sex of Household Head | | |
|---|---|---|---|
| | Female | Male | Total |
| **Condition** | | | |
| Sound | 55(50.43) | 48(52.57) | 103 |
| Deteriorating/ Dilapidated | 39(43.57) | 50(45.43) | 89 |
| Total | 94 | 98 | 192 |

Chi-sq. = 1.75, df = 1, not significant at $\alpha = .05$.

class, well-kept neighborhood to the lowest income neighborhood in this city. Absentee landlords were responsible for these units and had completed very few energy improvements over the years. The tenants had rented these units for a mean of eight years. Therefore, many of the senior citizens had rented these dwellings prior to becoming senior citizens. Based on the author's experience interviewing these tenants, many cared for the units as their own. Also, the analysis of this data is based on self-reported temperatures, thus may not be accurate.

As energy prices increase, the poor are likely to resort to producing heat by a variety of unsafe mechanisms. Based on these findings, effective programs can be planned to encourage energy conservation. Programs for low income tenants should include information on safety and use of supplemental heating systems. In order to reduce energy consumption, energy conserving behaviors such as layering clothing so that less heat is required, turning the thermostat down when family members are out or asleep, using electric blankets, closing off unused rooms, blocking cracks under doors, using draperies or other window coverings to keep the heat in, switching off unused lights, and reducing hot water usage should be conveyed.

Since landlords had done little to retrofit these units, low cost techniques and more energy conserving behaviors are effective adjustments. As tenants move more frequently than owners, the self-help approach and use of portable techniques would be appropriate. Learned skills could then be applied to each successive dwelling. Simple, low cost, retrofit measures such as adding caulking, weatherstripping, and cardboard doorsweeps, taping cracks, taping around outlet boxes and switch plates, installing plastic storm windows, and cardboard insulation window panels should be emphasized.

Adding insulation to these units would exceed the financial means of these tenants; therefore, landlords need to be involved in the process and encouraged to retrofit. Since most tenants pay for their own utilities, tax incentives may be the only encouragement to landlords. Both owners and renters are eligible for the federal tax credit for certain energy conserving materials and equipment. In addition to this credit, landlords may qualify for tax incentives for rehabilitation improvements on low income rental housing. If started before 1982, these improvements can be depreciated using a five-year useful life with no salvage value (U. S. Department of Treasury, 1979).

Since approximately one-half of all low income households are tenants, their energy related characteristics are of interest to the practitioner planning energy conservation programs. The tenants in this study all lived in buildings which were built for single families and nearly 50 years old. Since landlords had done little to improve these buildings, the tenant must rely on his own initiative for making low cost/no cost structural modifications and adjust energy related behaviors.

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