

# **Residential Energy Conservation Behaviour of Winnipeg Households**

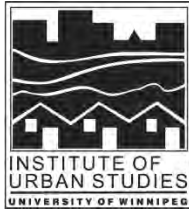
---

**by Robert Fenton  
1983**

---

**The Institute of Urban Studies**





THE UNIVERSITY OF  
WINNIPEG

**FOR INFORMATION:**

*The Institute of Urban Studies*

The University of Winnipeg  
599 Portage Avenue, Winnipeg  
phone: 204.982.1140  
fax: 204.943.4695  
general email: [ius@uwinnipeg.ca](mailto:ius@uwinnipeg.ca)

*Mailing Address:*

*The Institute of Urban Studies*

The University of Winnipeg  
515 Portage Avenue  
Winnipeg, Manitoba, R3B 2E9

**RESIDENTIAL ENERGY CONSERVATION BEHAVIOUR OF WINNIPEG HOUSEHOLDS**

Published 1983 by the Institute of Urban Studies, University of Winnipeg

© THE INSTITUTE OF URBAN STUDIES

Note: The cover page and this information page are new replacements, 2016.

The Institute of Urban Studies is an independent research arm of the University of Winnipeg. Since 1969, the IUS has been both an academic and an applied research centre, committed to examining urban development issues in a broad, non-partisan manner. The Institute examines inner city, environmental, Aboriginal and community development issues. In addition to its ongoing involvement in research, IUS brings in visiting scholars, hosts workshops, seminars and conferences, and acts in partnership with other organizations in the community to effect positive change.

Residential Energy Conservation Behaviour  
of Winnipeg Households

by

Robert Fenton

Institute of Urban Studies

"This project was carried out with the assistance of a grant from Canada Mortgage and Housing Corporation under the terms of the External Research Program. The views expressed are those of the author and do not represent the official views of the Corporation."

PREFACE

*This research has been undertaken at the Institute of Urban Studies of the University of Winnipeg. The work was conducted under the auspices of a grant from Canada Mortgage and Housing Corporation under the terms of the External Research Program.*

*The assistance of CMHC, CHIP, the City of Winnipeg Environmental Planning Department, Winnipeg Hydro, Manitoba Hydro and Province of Manitoba Department of Energy and Mines are gratefully acknowledged.*

*In addition, I wish to thank Ms. C. D. McKee, Ms. C. Sherba and Mr. S. Clatworthy of the Institute of Urban Studies and Mr. J. Hilton and Dr. M. Miller of the University of Winnipeg Computer Science group for their particular assistance. Also, Mrs. K. Uitvlugt must be recognized for her skill and patience in preparing this manuscript.*

*The conclusions and views expressed are those of the author and do not represent the official views of the Corporation. Any errors and omissions remain the responsibility of the author.*

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1.0	INTRODUCTION	1
2.0	ANALYSIS OF THE SURVEY RESULTS	1
2.1	Questionnaire Instrument and Interviewing Pattern	1
2.2	Survey Results - Description	7
2.3	Analysis of the Survey	9
2.3.1	Do energy expenditures constitute a burden to the household?	9
2.3.2	How do different groups compare in their behaviour?	12
2.3.3	Do the levels and types of insulation activity vary among insulators depending on their participation in one of the assistance programs?	14
2.3.4	Is the perception of success in insulation activity for CHIP participants related to the personal characteristics of the household head or the nature of the activities undertaken?	19
2.3.5	Is the perception of problems with either workmanship or insulation materials related to characteristics of the respondent, type of work done, materials used or year of activity?	20
2.3.6	Is the method of learning about the CHIP Grant Program related to the situation of the household? Are there patterns in the method by which the respondent heard of the program and the type of insulating activity undertaken?	21
2.3.7	If the household has undertaken other non-insulation related energy conservation activities in the home, how is the nature of these activities ('structural' vs. 'non-structural') related to the characteristics of the household?	24
	APPENDICES	
	Appendix A	A1
	Neighbourhood Description	
	Appendix B	A13
	Summary of Relationships Tested	
	Appendix C	A19
	The Questionnaire Design	

LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	Neighbourhoods Surveyed	4
2	Profile of Responses to Key Factors	6
3	Analysis of Responses to Are Heating Costs a Major Burden?	11
4	Variations in Insulation Activity by Grant Recipient Category	15

## 1.0 INTRODUCTION

The question of energy conservation practices and activities in the residential sector has taken on new urgency in recent years given rising energy prices and stagnating incomes. Issues of types of insulation behaviour among various socio-economic groups, the success of the insulation activities and the nature of problems encountered in the process of insulating are all relevant to a society for which insulation and energy conservation have become major factors.

As part of an assessment of the Canadian Home Insulation Program undertaken by the Institute of Urban Studies at the University of Winnipeg, more than 700 Winnipeg residences were surveyed in June of 1981 to obtain various data on their energy consumption patterns and their energy conservation activities. This work was undertaken with the assistance of a grant from Canada Mortgage and Housing Corporation under the terms of the External Research Program. This report summarizes the findings of the household survey. The views expressed are those of the author and do not represent the official views of the Corporation.

## 2.0 ANALYSIS OF THE SURVEY RESULTS

### 2.1 Questionnaire Instrument and Interviewing Pattern

The questionnaire instrument was designed to provide information on a range of energy consumption and energy conservation related issues as well as on the socio-economic situation of the household and the

nature and age of the dwelling unit. In addition, households were asked about their knowledge of, and participation in, the government assistance programs: Canadian Home Insulation Program (CHIP) and the Manitoba Home Insulation Program (MHIP).

All respondents were asked information concerning the following issues:

- whether or not they had reinsulated their dwelling since 1975
- whether other energy saving activities had been carried out
- an estimate of the cost of space heating
- whether space heating energy purchases were a burden on their household budget
- awareness of CHIP and MHIP
- background details about the household and its operation.

Non-insulating households were also asked to identify the reason they had not reinsulated since 1975.

Households which had insulated but had not participated in CHIP were asked:

- why they had not utilized CHIP
- whether they had utilized MHIP
- whether they wished to receive additional information on CHIP or MHIP

CHIP participants were asked:

- where they had heard of the CHIP program
- the size of the invoice submitted to CHIP



- the size of the grant received from CHIP
- whether work was completed by a contractor or on a do-it-yourself basis
- whether any problems had been encountered with respect to materials or workmanship
- whether MHIP was used to finance the difference between the invoice amount and the CHIP grant.

The survey was administered during June of 1981 in nine different neighbourhoods of Winnipeg. A total of 723 interviews were undertaken.

The neighbourhoods chosen for interviewing and the numbers of questionnaires completed are displayed in Table 1. The Table also indicates the type of neighbourhoods according to the City's designation system and the penetration rate achieved by CHIP.

The neighbourhoods selected included two Major Improvement neighbourhoods, three Rehabilitation and four Conservation neighbourhoods. The distribution of neighbourhood types ensured coverage of the spectrum of neighbourhoods which are the focus of major attention for urban policy interventions. The three neighbourhood types also gave the potential for a large proportion of houses eligible to participate in CHIP.

The neighbourhoods selected provided a mix of high and low CHIP penetration rates as well as a range of socio-economic situations. Appendix A provides a brief profile of the neighbourhoods in which interviewing was undertaken.

Table 1  
Neighbourhoods Surveyed

<u>Neighbourhood Code</u>	<u>Name</u>	<u>Type</u>	<u>Age Code</u>	<u>Number of Observations</u>
1002	Centennial	M	0	50
1015	Minto	C	0	89
1019	Armstrong Point	S	0	13
2003	King Edward	R	0	122
3006	St. John's	R	0	127
3009	Jefferson	C	1	131
* 4001	Chalmers	M	0	75
* 5001	North St. Boniface	M	0	72
6009	Wildwood	C	2	44
				<hr/>
				723

\* N.I.P. Neighbourhoods

Type: M = Major Improvement

C = Conservation

S = Stable

R = Rehabilitation

Age Code: 0 = more than  $\frac{1}{2}$  built prior to 1946

1 = more than  $\frac{1}{3}$  built prior to 1946

2 = more than  $\frac{1}{2}$  built 1946 - 1960

Several key variables relevant to the interview survey are presented in Table 2. Distributions for income per capita, estimates of annual household heating costs, age of dwelling unit and the fuel source used for heating the dwelling unit are outlined there.

As may be seen in the Table, about 45 percent of the respondents have a per capita income of \$5,000 or less. About 30 percent are in the range of \$5,001 - \$7,500. About 12 percent are in the range of \$7,501 - \$10,000 with the remaining 13 percent enjoying per capita incomes in excess of \$10,000.

More than half of the respondents estimate annual heating costs to be less than \$500. Ninety-two percent of respondents estimate annual heating costs to be less than \$750. The highest estimate of heating costs is \$1,800.

The vast majority of housing units surveyed, 92 percent, were built prior to 1961 and hence eligible for grants under the CHIP promotion. More than 60 percent of the units were built prior to the end of the Second World War.

Eighty percent of the dwelling units reported that they utilized natural gas as their primary space heating fuel. The bulk of these units, 68 percent, were forced hot air systems. About 17 percent of the units utilized fuel oil while about 1.5 percent of the units were electrically heated.

Table 2

Profile of Responses  
to Key Factors

Income per Capita

<u>Range</u>	<u>Percent</u>	<u>Cumulative</u>
0 - 2500	5.6	5.6
2501 - 5000	39.6	44.6
5001 - 7500	30.9	75.5
7501 - 10000	11.9	87.4
10001 - 12500	10.5	98.2
12501 - 23000	1.8	100.0

Annual Heating Costs

<u>Range</u>	<u>Percent</u>	<u>Cumulative</u>
0 - 250	4.8	4.8
251 - 500	48.7	53.5
501 - 750	38.1	91.6
751 - 1000	7.9	99.5
1001 - 1800	0.5	100.0

Year House Built

<u>Range</u>	<u>Percent</u>	<u>Cumulative</u>
1881 - 1946	65.3	65.3
1947 - 1960	33.0	98.3
1961 - 1981	1.7	100.0

Primary Space Heating Fuel

<u>Type</u>	<u>Percent</u>	<u>Cumulative</u>
Natural Gas	80.9	80.9
Oil	17.1	98.0
Electricity & Other	2.0	100.0

The survey instrument was administered with an objective of interviewing one house in three in each neighbourhood. Non-responses and refusals to complete the questionnaire were replaced by adjacent houses where possible. Households where the occupant was not responsible for paying the heating bill were treated as non-responses and replaced. Apartment blocks and obvious new construction, the latter not being eligible for CHIP, were excluded from the count of dwellings.

## 2.2 Survey Results - Description

Of the 723 questionnaires returned, 709 were usable for analysis.

A summary of some of the more interesting issues is presented below:

- one-tenth of the respondents were renters; nine-tenths were homeowners
- about half the respondents considered home heating a major burden
- almost two-thirds had added insulation since 1975
- about four-fifths had heard about CHIP
- approximately equal numbers of insulators and non-insulators had heard of CHIP
- about two-thirds of those who had insulated and heard of CHIP used CHIP
- slightly more than two-thirds thought that their insulating efforts had been successful
- non-CHIP respondents were more likely to perceive success
- about two-thirds of respondents who had added insulation used CHIP
- about three-fifths of those using CHIP indicated a response to media advertising; almost one-fifth indicated a response to direct sell methods of contractors
- approximately one-half indicated that they used CHIP because their heating bills were too high

- slightly more than one-tenth of respondents who had not insulated since 1975 indicated that they could not afford to do so
- about half of those not using CHIP indicated that they either had no specific reason for not insulating or that they did not think that their house required insulating
- almost two-thirds of CHIP grants issued to respondents were used to insulate attics; 21% for walls and 15.7% for basement walls
- attic insulation was primarily blown fibres (more than half); but foam insulation accounted for 7% of insulation activity
- walls were primarily insulated with foam (more than half)
- basement walls were primarily insulated with batts (about two-thirds); but foam and rigid materials each accounted for about one-eighth of the households insulated with CHIP grants.

One of the more interesting results from the survey has to do with the current debate concerning Urea-Formaldehyde Foam Insulation. At the time of the survey, concerns about UFFI had been aired in the press, but the ban on installation had not been imposed. Respondents were asked whether or not they had experienced problems with workmanship or contractor installed jobs or with insulation materials in general. Only 12 percent of all respondents indicated that they had experienced problems with workmanship in their contracted re-insulation program. Only 3 percent of the respondents indicated that they had encountered problems with the type of insulation used. When the results were sorted to isolate those households where foam had been installed, only 6 percent indicated any problems with their contractor, while slightly less than 4 percent reported any material problems.

## 2.3 Analysis of the Survey

The analysis of the survey data has been undertaken by organizing the survey results around a number of policy questions. These questions deal with the perceptions of energy issues of various groups, the behaviour of the groups, indications of the nature and success of the CHIP delivery process and general issues. The analysis utilized the statistical technique of testing for relationships between pairs of variables when the survey results are sorted to form two-way contingency tables relating the policy issues to the various control variables. The test used the Chi-Squared Distribution.

The balance of this section provides a review of the various policy issues considered and identifies those for which there were significant inter-relationships with the key variables in question. Appendix B presents a summary listing of the relationships examined and the results obtained.

### 2.3.1 Do energy expenditures constitute a burden to the household?

The importance of this question to the socio-economic analysis of energy policy is straightforward. The CHIP program, in addition to encouraging energy conservation, has been oriented to providing the greatest assistance to households with greatest need.

The characteristics of households finding heating costs a burden were investigated by relating 'yes' and 'no' responses to question four, to the neighbourhood type where the respondent's household was located,

to the age of the household head and to the level of heating costs as a ratio of per capita household income. The analysis indicates that the perception of heating costs as a burden is independent of the age of the head of the household. The perception of heating cost burden is not independent of the neighbourhood type or of the level of heating costs per dollar of per capita income. Both of these variables are very highly related to the perception of burden. These relationships are to be expected. Neighbourhood type will not be independent of level of per capita household income because a lower income can be expected in Major Improvement neighbourhoods than in Conservation neighbourhoods. The analysis demonstrates that residents of Major Improvement neighbourhoods are more likely to perceive heating costs as a burden, while those in Conservation neighbourhoods are less likely to hold this perception.

In the case of the other variable, the larger the proportion of per capita household income spent on home heating, the smaller the amount of money available for other purposes. Thus the perception of burden of heating costs may be expected to be more keen.

In addition to the above analysis, the responses to this question of burden were sorted according to the behaviour of the household with respect to insulation and participation in one of the government assistance programs. The categories are illustrated in Table 3. The proportion of respondents perceiving a burden ranged from about 45 percent (Insulators without assistance) to about 61 percent (Non-Insulators).



Table 3

Analysis of Responses to  
Are Heating Costs a Major Burden?

<u>Subgroup</u>	<u>% indicating that heating costs are a burden</u>
1. CHIP only recipients	53.53 ± 6.97
2. CHIP + MHIP recipients	61.29 ± 17.15
3. MHIP only	sample too small
4. Insulators without assistance	45.41 ± 6.97
5. Non-insulators	61.65 ± 5.84
6. All Insulators	50.00 ± 4.73
7. All CHIP	54.39 ± 6.46
8. All MHIP	56.76 ± 15.96

Significance Test

1 vs. 2	NS.	4 vs. 5	Sig $\alpha$ = .05
1 vs. 4	NS.	4 vs. 6	NS.
1 vs. 5	NS.	5 vs. 6	Sig $\alpha$ = .05
1 vs. 6	NS.		
1 vs. 7	NS.		
1 vs. 8	NS.		

Comparison of the proportions of respondents perceiving a burden indicates a significant difference of proportion only between Non-Insulators and each of two groups: Insulators without assistance and All Insulators. Thus it would appear that the fact of insulation activity taking place reduces the probability that the heating costs will be a burden. Participation in one of the assistance programs for insulation does not significantly reduce the probability of heating costs being a burden. This likely reflects the fact that households participating in the assistance programs have lower incomes than those who are not and thus have a keener perception of the burden of heating costs.

#### 2.3.2 How do different groups compare in their behaviour?

The issue considered in this question area includes both behaviour with respect to insulation activity, other energy conservation activity and use of the assistance programs which are available. A particular issue here is whether or not lower income groups are more likely to insulate and whether or not they are more likely to undertake this activity utilizing one of the available assistance plans.

The first relationship considered was whether or not the decision to insulate was related to tenure of occupancy. As might be anticipated there was a significant difference in the likelihood of owners to insulate relative to that of tenants. This difference is apparent even after those tenants who did not pay the heating bill for the dwelling have been excluded.

Comparison of the number of insulators and number of non-insulators grouped according to grouped per capita household income ranges failed to reveal any significant difference between the distribution of the two groups. Roughly half of each of the Insulators (49 percent) and Non-insulators (53 percent) responding are in the lowest group of the income range.

Comparison of the CHIP participants with the insulators who did not utilize one of the assistance programs also failed to reveal a significant relationship with per capita income levels. Again, approximately 48 percent of the CHIP participants are in the lowest group while about 42 percent of the non-participating insulators are in the lowest group.

A similar comparison of CHIP and MHIP participants also failed to reveal a significant relationship with per capita income.<sup>1</sup> The MHIP participants are predominantly in the lowest range of per capita income (71 percent) while about 48 percent of the CHIP participants are in that range.

The level of neither early formal education nor other formal education is related to the tendency for a household to be a non-

---

1. The following convention of terminology is used:

not significant	=> $\alpha$	<90%
significant	=> $\alpha$	$\geq$ 90%
highly significant	=> $\alpha$	$\geq$ 95%
very highly significant	=> $\alpha$	$\geq$ 95%

insulator. Neither of these is related to the tendency of an insulating household to be a participant in one of the assistance programs.

The tendency of a household to belong to one of the four identified groups is related, however, to the age of the head of household. In particular, the number of CHIP participants is higher than expected in the 25 - 44 years age group and the 65 years and over age group. MHIP participants appear more frequently than anticipated in the 25 - 44 years group. The insulators who did not take advantage of the assistance programs are more heavily represented than expected in the 45 - 64 years age group. Non-insulators are more prevalent in the 15 - 24 years age group and the 65 years and over age group and less prevalent in the 25 - 44 years group.

2.3.3 Do the levels and types of insulation activity vary among insulators depending on their participation in one of the assistance programs?

Questions on insulation activity were asked of four different groups of households. Those who had participated in CHIP, those who had not heard of CHIP and hence not participated (NOCHIP), those who had heard of CHIP but not participated (NOGRANT), and those who had not used CHIP but who had used MHIP. The latter group yielded only three responses and thus is dropped from further consideration.

Table 4 summarizes the results of the analysis.

The first issue considered in this question relates to the location in the dwelling unit where the insulating activity took place.

Table 4

Variations in Insulation Activity  
By Grant Recipient Category

	<u>Relation ship</u>	<u>CHIP</u>	<u>NOCHIP</u>	<u>NOGRANT</u>
Where Insulated	S			
Attic		G	E	L
Basement walls		L	G	G
Walls		G	L	E
Insulation Type				
Attic	H.S.			
Batts		L	G	G
Loose Fill		G	L	E
Foam		E	E	L
Basement walls	N.S.			
Walls	H.S.			
Batts		L	-	G
Foam		G	-	L
R - value				
Attic	N.S.			
Basement walls	N.S.			
Walls	N.S.			

Key:

N.S. = Not Significant   =>  $\alpha < 90\%$   
 .S = Significant       =>  $\alpha > 90\%$   
 H.S. = Highly Significant   =>  $\alpha > 95\%$

G = Greater than expected  
 L = Less than expected  
 E = At expected level

Relatively few respondents indicated insulation of floors or 'other' and these cells were hence dropped from the analysis. The remaining areas considered were the attic, basement walls and walls.

As shown in Table 4, the statistical test indicates a significant relationship between the part insulated and the group of insulators to which the household belonged. The CHIP grant recipients had a greater than expected tendency to insulate attics and walls (less prevalent than with the attics) and a smaller tendency to insulate basement walls. Those who did not know about CHIP (NOCHIP) had a greater than expected tendency to insulate basement walls and a lower than expected tendency to insulate the above grade walls. The final group (NOGRANT) were less likely to insulate attics than might have been expected while being more likely to insulate basement walls.

The next issue considered was the type of insulation used in each major dwelling part and whether or not these varied according to the group to which the respondent belonged. Again MHIP participants had to be excluded as did participants indicating activities in floors and 'other' parts.

In the case of the attic, Table 4 shows that the statistical test indicates a highly significant relationship. The use of batts was well below the level expected for CHIP grant participants and well above for NOCHIP and NOGRANT respondents. CHIP respondents indicated a higher tendency to use loose fill while NOCHIP respondents indicated a lower tendency to use loose fill. NOGRANT respondents were at approximately

the expected level. The other major observation is that NOGRANT respondents are less likely to have used foam insulation while CHIP and NOCHIP respondents are at approximately the expected level.

The behaviour of respondents with respect to basement wall insulation did not vary significantly according to which group they belonged. The major insulation type in each case was batts. CHIP respondents did indicate use of foam insulation in about 12 percent of the cases.

In the case of above grade walls, the statistical test shows a highly significant relationship. The key observations are that CHIP respondents had a lower than expected tendency to use batts and a higher tendency to use foam. About 55 percent of this group used the latter product.

NOGRANT respondents had a higher than expected tendency to use batts in the walls and a lower than expected tendency to utilize foam. About 57 percent of the respondents in this category report using batts to insulate non-basement walls.

The third issue examined under this question involves the level insulation achieved after the insulating activity measured in terms of 'R-value'. The analysis again covers CHIP, NOCHIP and NOGRANT respondents for the attic, basement walls and non-basement walls of the dwelling unit. Again the results are presented in Table 4.

In terms of the attic, the test indicates no statistically signi-

ficant difference among the behaviour of the three groups of respondents. It is interesting to note however that CHIP respondents report R-values in excess of 'R-20' 63 percent of the time while NOCHIP and NONGRANT respondents report this level achieved only 46 percent and 50 percent of the time respectively.

With respect to basement walls, the statistical test indicates no statistically significant relationship. Overall about 17 percent of the respondents indicate a level of insulation reached in excess of 'R-20'.

In the case of walls above grade, no statistically significant relationship between R-values and group membership is noted. In this situation, more than 25 percent of the respondents feel that their walls are insulated to a level in excess of 'R-20'.

A further examination of the issue of differing insulation activity indicated a highly significant difference in the location of added insulation according to the period in which the house was built. Responses were grouped into four periods: 1881 - 1919, 1920 - 1945, 1946 - 1961, 1962 - 1980. The location of insulation activity was cumulated for attic, basement walls and other walls.

In houses built during 1881 - 1919, attic insulation was lower than expected while insulation of walls was higher than expected (almost 50 percent higher). Basement wall insulation activity was slightly below expected levels.



In houses built during the 1920 - 1945 period, attic and basement wall activity was again lower than expected while other walls were reported to be insulated more often than expected.

In houses built during 1946 - 1961, attic insulation and basement wall insulation is observed more frequently than expected while other wall insulation is observed less frequently than expected.

The number of houses in the 1962 - 1980 group is very small. In this case attic insulation was observed less frequently than expected.

2.3.4 Is the perception of success in insulation activity for CHIP participants related to the personal characteristics of the household head or the nature of the activities undertaken?

This issue was investigated within the context of a number of different possible determinants of the perception of success of the insulation activity. In virtually all cases, the statistical test indicates that the perception of success is independent of the determinant considered. In the few cases where some statistical significance is indicated, the result is weakened by the existence of a large number of cells with low expected frequencies. The potential determinants of perception of success are:

- age of head of household
- per capita household income
- level of early formal education
- level of other formal education
- whether or not heating bills were perceived to be a burden
- part of dwelling unit insulated
- level of R-value achieved after the insulation activity
- level of expenditure on re-insulation
- frequency of undertaking ancillary energy conservation activities

Similar investigations were undertaken for non-participants in CHIP. The results for these tests also indicated that perception of success is not related to the above determinants.

An alternative view of this question was obtained when the population who considered their insulation activities a success was investigated with respect to their participation or non participation in CHIP and whether or not home heating costs were a burden. The statistical test in this case failed to reveal a statistically highly significant relationship between the variables.

Again, for respondents who view their insulation campaign successful, no statistically significant relationship could be found between CHIP participants and non-participants with respect to the potential determinants such as education levels and income class.

2.3.5 Is the perception of problems with either workmanship or insulation materials related to characteristics of the respondent, type of work done, materials used or year of activity?

On the issue of workmanship problems, the incidence of perceived problems is independent of several determinants including:

- the method by which the participant heard of CHIP
- the part of the house insulated
- the type of insulation used.

The incidence of perceived workmanship problems is statistically related to the year in which the insulation work was carried out over the period 1977 - 1981. The frequency of problems is greater than expected in both 1981 and 1978. This observation perhaps reflects the transient behaviour of many insulation installers.

The incidence of perceived workmanship problems is also statistically related to the neighbourhood type. The observed frequency of perceived problems is below expected levels in Conservation neighbourhoods (about 50 percent lower). The observed frequency is above expected levels in Rehabilitation neighbourhoods (about 50 percent higher). Investigation of possible reasons for this observation is beyond the scope of this analysis.

In terms of problems related to the type of material used for insulation, the incidence of problems is independent of the following determinants:

- the method by which the participant heard of CHIP
- the part of the house insulated
- the type of insulation used
- the neighbourhood type
- the year in which the work was undertaken during the period 1977 to 1981.

2.3.6 Is the method of learning about the CHIP Grant Program related to the situation of the household? Are there patterns in the method by which the respondent heard of the program and the type of insulating activity undertaken?

With reference to the socio-economic situation of the respondent's household, the method of learning about CHIP is independent of all variables with the exception of Neighbourhood type. In the case of Conservation neighbourhoods, respondents indicated word-of-mouth, radio and print media more frequently than expected. The greatest deviation between observed and expected for this group is in the radio media where the observed frequency is more than 20 percent higher than expected.

In Major Improvement neighbourhoods, word-of-mouth, television and print media are indicated more frequently than expected. The major difference in this category is in the television category with an observed frequency of about 50 percent greater than expected. In the 'contractor' category, the observed frequency is about 50 percent below the expected frequency.

In the Rehabilitation neighbourhoods, the observed frequencies of 'contractor' and 'other' means are higher than expected. The 'contractor' means is observed almost 20 percent more while 'other' means is observed almost 50 percent more.

The socio-economic variables to which the method of information is not related are: Age of Household head, Income per capita, Early Education, and Other Formal Education.

The method of learning about CHIP is also not independent of the location of the insulation activity or of the ratio of the size of the invoice to the amount of the CHIP grant. The former is very highly significant while the latter is significant.

In the case of the location of insulation activity the observed number of insulated attics for which the CHIP information is indicated to have come from the contractor is 25 percent greater than expected while for the same location the number reporting CHIP information from magazines is 30 percent below the expected level and for newspapers almost 20 percent below the expected level.

For those reporting the insulation of basement walls, the observed frequency of contractor information is 50 percent below the expected level. The frequencies for magazines and newspapers are 200 percent and 100 percent greater than expected respectively for those who have insulated the basement walls.

In the case of other walls, the number of households reporting contractor sources of information is more than 20 percent below the expected level. The number reporting magazines as the source of information is too small to reflect meaningful differences. The number reporting newspapers is only slightly below the observed level.

In the case of the 'ratio of the size of the invoice to the size of the CHIP grant' compared to the method of learning about CHIP, the distribution of the results is not independent. 'Contractor' information sources are indicated in a much higher number than expected for the relatively smaller jobs and in much lower numbers than expected for relatively larger jobs. The observed number is 25 percent greater than expected for 'contractor' sources for the lowest ratio range. The observed number is 50 percent lower than expected for the middle ratio range and 40 percent lower for the highest ratio range.

The second most important source of information, television, is observed less frequently than expected for the lowest ratio range (20 percent) and more frequently than expected for the middle and highest ratio range (50 percent and 75 percent respectively).

2.3.7 If the household has undertaken other non-insulation related energy conservation activities in the home, how is the nature of these activities ('structural' vs. 'non-structural') related to the characteristics of the household?

---

Respondents were questioned about any activities that they might be undertaking in the home in addition to insulating. The type of activities that might be anticipated to be listed in response to this question are:

- turning down the heat, turning off unnecessary lights, using less hot water, trying not to use appliances as much
- new type of heating system, new furnace, weather stripped, added storm doors, replacement windows.

The former category are considered to be non-structural conservation activities while the latter are considered to be structural activities.

The distinction between structural and non-structural behaviour is one of the more significant differentiations identified in this study. Of the five variables considered, only the age of the household head proved not to be statistically significant.

Respondents who had received a CHIP grant were less likely to undertake additional structural activities than was expected. Observed structural activities were about 4 percent below the expected level. Non-CHIP grant recipients were correspondingly observed undertaking structural activities 7 percent more often than expected. The relationship is significant at the 90 percent probability level.

The choice between structural and non-structural activities is very highly significantly related to whether or not insulation has been

added. Respondents who have added insulation are more likely to undertake other structural conservation activities than expected. Non-insulators are less likely to undertake structural activities than expected.

The level of early education is a significant factor observed in behaviour. High school graduates are less likely to undertake structural activities than expected (about 6 percent). Respondents with some high school are more likely to undertake structural activities (about 7 percent).

The level of other formal education attained by the household head is also very highly significantly related to the choice between structural and non-structural energy conservation activities. Trade school or community college respondents report structural activities about 14 percent more frequently than expected. All other levels report structural activities less frequently than expected.

The test of the perception of heating bills as a burden and the choice of structural or non-structural activities shows a very highly significant relationship between the two factors. The observed number of respondents reporting both a burden and structural activities is about 8 percent lower than expected. The number reporting not a burden and structural activities is about 18 percent above the expected frequency.

The choice of structural or non-structural activities is very

highly significantly related to the level of per capita household income at the 99 percent probability level.

The lowest income group are observed to undertake structural activities at about the expected rate. The second level group undertake structural activities about 3 percent less frequently than expected. The third level group undertake structural activities about 6 percent more frequently than expected. The two highest income groups are relatively small.



APPENDIX A  
Neighbourhood  
Description

Neighbourhood Description

Centennial: 1002

Location: Core Area

Age Code: 0

Neighbourhood Type: Major Improvement

	<u>Age Group</u>				
Population Distribution	<u>0-14</u>	<u>15-24</u>	<u>25-44</u>	<u>45-64</u>	<u>65+</u>
Per cent	21.4	16.6	25.1	20.8	16.1

	<u>Type</u>			
Assessment	<u>Single</u>	<u>Semi</u>	<u>Row</u>	<u>Apartment</u>
Dollars	2243	1328	1326	2674
Tenure (%)				
Owner-occupied	55.3	14.8	-	1.4
Tenant	44.7	85.2	100	98.6
Total	42.7	11.1	2.6	43.6

Residential Building Condition	<u>Good</u>	<u>Fair</u>	<u>Poor</u>	<u>Very Poor</u>
Per cent	36.0	55.0	.08	.01

Sources: Age Code - I.U.S.

Balance - City of Winnipeg, Department of Environmental Planning

Minto: 1015

Location: West End

Age Code: 0

Neighbourhood Type: C

	<u>Age Group</u>				
Population Distribution	<u>0-14</u>	<u>15-24</u>	<u>25-44</u>	<u>45-64</u>	<u>65+</u>
Per cent	17.5	19.0	24.6	22.5	16.3

	<u>Type</u>			
Assessment	<u>Single</u>	<u>Semi</u>	<u>Row</u>	<u>Apartment</u>
Dollars	3297	2407	2666	4204

Tenure (%)				
Owner-occupied	90.2	34.8	-	3.3
Tenant	9.8	65.2	100.0	96.7
Total	80.0	10.6	0.5	8.9

Residential Building Condition	<u>Good</u>	<u>Fair</u>	<u>Poor</u>	<u>Very Poor</u>
Per cent	66.0	32.0	.02	-

Armstrong Point: 1019

Location: Core (Periphery)

Age Code: 0

Neighbourhood Type: S

	<u>Age Group</u>				
Population Distribution	<u>0-14</u>	<u>15-24</u>	<u>25-44</u>	<u>45-64</u>	<u>65+</u>
Percent	14.5	19.3	24.9	26.8	14.5

	<u>Type</u>			
Assessment	<u>Single</u>	<u>Semi</u>	<u>Row</u>	<u>Apartment</u>
Dollars	7493	3179	-	2755
Tenure (%)				
Owner-occupied	85.0	28.6	-	64.5
Tenant	15.0	71.4	-	35.5
Total	64.5	22.6	-	12.9

Residential Building  
Condition N.A.

King Edward: 2003

Location: St. James

Age Code: 0

Neighbourhood Type: R

	<u>Age Group</u>				
Population Distribution	<u>0-14</u>	<u>15-24</u>	<u>25-44</u>	<u>45-64</u>	<u>65+</u>
Per cent	17.5	22.7	24.0	23.9	11.9

	<u>Type</u>			
Assessment	<u>Single</u>	<u>Semi</u>	<u>Row</u>	<u>Apartment</u>
Dollars	2832	3280	-	3773
Tenure (%)				
Owner-occupied	86.2	27.6	-	1.2
Tenant	13.8	72.4	-	98.8
Total	82.5	1.2	-	13.7

Residential Building Condition	<u>Good</u>	<u>Fair</u>	<u>Poor</u>	<u>Very Poor</u>
Per cent	22.0	42.0	33.0	.03

St. John's: 3006

Location: North End

Age Code: 0

Neighbourhood Type: R

	<u>Age Group</u>				
Population Distribution	<u>0-14</u>	<u>15-24</u>	<u>25-44</u>	<u>45-64</u>	<u>65+</u>
Per cent	21.2	18.7	25.7	19.5	15.0

	<u>Type</u>			
Assessment	<u>Single</u>	<u>Semi</u>	<u>Row</u>	<u>Apartment</u>
Dollars	3035	2185	3258	2425
Tenure (%)				
Owner-occupied	79.3	32.6	16.7	4.2
Tenant	20.7	67.4	83.3	95.8
Total	53.3	24.1	0.2	22.5

Residential Building Condition	<u>Good</u>	<u>Fair</u>	<u>Poor</u>	<u>Very Poor</u>
Per cent	31.0	58.0	10.0	.01

Jefferson: 3009

Location: North End

Age Code: 1

Neighbourhood Type: C

	<u>Age Group</u>				
Population Distribution	<u>0-14</u>	<u>15-24</u>	<u>25-44</u>	<u>45-64</u>	<u>65+</u>
Per cent	14.0	18.4	22.4	28.1	16.9

	<u>Type</u>			
Assessment	<u>Single</u>	<u>Semi</u>	<u>Row</u>	<u>Apartment</u>
Dollars	4233	3907	4921	3633
Tenure (%)				
Owner-occupied	94.0	37.5	62.5	0.8
Tenant	6.0	64.3	37.5	99.2
Total	67.5	3.6	0.4	28.5

Residential Building Condition N.A.

Chalmers: 4001

Location: East Kildonan

Age Code: 0

Neighbourhood Type: M

	<u>Age Group</u>				
Population Distribution	<u>0-14</u>	<u>15-24</u>	<u>25-44</u>	<u>45-64</u>	<u>65+</u>
Per cent	19.9	23.1	25.6	18.9	12.5

	<u>Type</u>			
Assessment	<u>Single</u>	<u>Semi</u>	<u>Row</u>	<u>Apartment</u>
Dollars	2648	3251	3252	3458
Tenure (%)				
Owner-occupied	84.4	34.8	11.8	2.2
Tenant	15.6	65.2	88.2	97.8
Total	60.9	5.4	1.2	32.6

Residential Building Condition	<u>Good</u>	<u>Fair</u>	<u>Poor</u>	<u>Very Poor</u>
Per cent	21.0	61.0	15.0	.03



North St. Boniface: 5001

Location: St. Boniface

Age Code: 0

Neighbourhood Type: M

	<u>Age Group</u>				
Population Distribution	<u>0-14</u>	<u>15-24</u>	<u>25-44</u>	<u>45-64</u>	<u>65+</u>
Per cent	22.1	22.1	25.0	19.5	11.3

	<u>Type</u>			
Assessment	<u>Single</u>	<u>Semi</u>	<u>Row</u>	<u>Apartment</u>
Dollars	3074	2013	4100	2444
Tenure (%)				
Owner-occupied	77.2	22.8	-	8.1
Tenant	22.8	72.2	100	91.9
Total	51.9	14.2	0.6	8.1

Residential Building Condition N.A.

Wildwood: 6009

Location: Fort Garry

Age Code: 2

Neighbourhood Type: C

	<u>Age Group</u>				
Population Distribution	<u>0-14</u>	<u>15-24</u>	<u>25-44</u>	<u>45-64</u>	<u>65+</u>
Per cent	21.9	17.7	27.7	24.3	8.4

	<u>Type</u>			
Assessment	<u>Single</u>	<u>Semi</u>	<u>Row</u>	<u>Apartment</u>
Dollars	4199	4100	-	-
Tenure (%)				
Owner-occupied	98.9	50.0	-	-
Tenant	1.1	50.0	-	-
Total	99.4	0.6	-	-

Residential Building Condition N.A.

APPENDIX B

Summary of Relationships  
Tested

Summary of Relationships Tested

<u>Major Issue</u>	<u>Determinant</u>	<u>Sample Size</u>	<u>DF</u>	<u><math>\chi^2</math></u>	<u>Significant</u>
Burden	Neighbourhood Type	699	2	26.43	Yes; $\alpha = .05$
	Age of Head	691	3	1.68	No
	Heating Cost ÷ Income	545	4	31.37	Yes; $\alpha = .05$
Added Insulation	Tenure	724	1	29.95	Yes; $\alpha = .025$
	Income	630	4	4.96	No
CHIP Participation	Income	369	4	1.72	No
CHIP vs. MHIP	Income	232	4	9.28	No
CHIP vs. MHIP vs. NOPROG vs. Non Insulators	Age	726	9	19.62	Yes; $\alpha = .05$
	Early Education	687	6	12.59	No
	Other Education	681	9	12.57	No
Part Insulated	CHIP vs. NOCHIP vs. NOGRANT	577	4	8.43	Yes; $\alpha = .1$
R-value	CHIP vs. NOCHIP vs. NOGRANT				
Attic		203	6	6.51	No
B. Walls		70	4	3.03	No
Walls		46	4	4.50	No
Type of Insulation	CHIP vs. NOCHIP vs. NOGRANT				
Attic		352	8	26.74	Yes; $\alpha = .05$
B. Walls		105	6	8.64	No
Walls		111	6	18.73	Yes; $\alpha = .05$

<u>Major Issue</u>	<u>Determinant</u>	<u>Sample Size</u>	<u>DF</u>	<u><math>\chi^2</math></u>	<u>Significant</u>
Success	Age	234	4	3.83	No
	Income	212	4	3.12	No
	Early Education	218	2	3.40	No
	Other Education	218	3	3.02	No
	R-value	212	4	3.27	No
	Expenditure	159	4	7.77	No
	Other Activities	661	13	12.1	No
	Where Insulated	344	4	8.01	No
	Burden	232	1	0.74	No
Success and CHIP vs. Success and NOCHIP	Burden	259	1	2.66	No
	Early Education	249	2	1.60	No
	Other Education	248	2	1.61	No
	Income	228	4	6.20	No
	All	356	1	5.46	Yes; $\alpha = .05$
Workmanship Problems	Where Heard	290	5	0.74	No
	Part Insulated	281	3	1.03	No
	Type of Insulation	249	3	5.24	No
	Neighbourhood Type	194	2	6.64	Yes; $\alpha = .05$
	Year Done	257	4	16.04	Yes; $\alpha = .05$
	Material Problems	Where Heard	523	5	4.41
Part Insulated		503	3	2.56	No
Type of Insulation		433	3	1.34	No
Neighbourhood Type		344	2	3.17	No
Year Done		414	4	4.35	No

<u>Major Issue</u>	<u>Determinant</u>	<u>Sample Size</u>	<u>DF</u>	<u><math>\chi^2</math></u>	<u>Significant</u>
Where Heard	Neighbourhood Type	547	10	20.26	Yes; $\alpha = .05$
	Invoice ÷ CHIP	298	12	20.44	Yes; $\alpha = .1$
	Where Insulated	4421	24	376.82	Yes; $\alpha = .001$
	Age of Head	542	12	11.18	No
	Early Education	524	12	15.94	No
	Other Education	518	18	28.15	No
	Income	456	14	20.9	No
Nature of Other Activities (Struct. vs. Non Struct.)	Add Insulation	1173	1	21.76	Yes; $\alpha = .001$
	CHIP	965	1	2.77	Yes; $\alpha = .1$
	Age of Head	1758	3	6.136	No
	Early Education	1700	2	5.05	Yes; $\alpha = .1$
	Other Education	1676	3	14.53	Yes; $\alpha = .01$
	Burden	1742	1	10.24	Yes; $\alpha = .1$
	Income	1561	4	3.81	Yes; $\alpha = .01$
Where Insulated	Yr. Built	554	6	13.29	Yes; $\alpha = .05$
Why no CHIP	Income	214	18	30.62	Yes; $\alpha = .05$
	Age of Head	246	21	14.35	No
	Early Education	243	14	20.25	No
	Other Education	240	21	30.95	No
	Neighbourhood Type	248	14	22.60	No

APPENDIX C

The Questionnaire  
Design

### The Questionnaire Design

The questionnaire was designed to elicit information on knowledge, sources of knowledge and types of behaviour from several subsets of respondents. The stratification of the set of respondents resulted in five subsets being created. The simplest way to visualize the subsets is by stratifying according to whether or not the respondent had utilized a CHIP grant. If the respondent had obtained a CHIP grant de facto he had recently insulated and further knew about the CHIP grant program.

If the respondent had not obtained a CHIP grant he might fit into one of four subcategories according to whether or not insulation activities had taken place and whether or not the respondent had previous knowledge of the CHIP grant program.

In summary, the following five subsets were created:

- USED CHIP            - insulated and knowledge of CHIP
- NOT USED CHIP    - not insulated and no knowledge of CHIP
- not insulated and knowledge of CHIP
- insulated and no knowledge of CHIP
- insulated and knowledge of CHIP

Respondents were then asked a series of questions appropriate to their particular subset. The nature of these questions is summarized below according to the category to which the respondent belonged.



### USED CHIP Grant

If the respondent had received a CHIP grant, the interviewer questioned the individual to determine:

- in which year the respondent applied for a CHIP grant
- the amount of invoice submitted to chip and the amount of grant they received
- if the respondent had used the Manitoba Home Insulation Program to cover the difference between the invoice submitted to CHIP and the grant received
- an estimate of how much was spent on energy conservation in the home in the past 5 years
- the part(s) of the home which were insulated
- the approximate 'R' value of each insulated part
- the type of insulation used
- whether or not a contractor was hired to undertake the work; and
- the year(s) each part of the house was insulated.

In the occasion that a contractor was hired to undertake the work needed under the proceeds provided by the Manitoba Home Insulation Program or the funding of a CHIP grant, the interviewer was interested in knowing if the respondents:

- had experienced any problems with the workmanship
- experienced any problems with the type of insulation used
- had reasons why they decided to insulate
- had done anything else on their own to save energy in the home
- had spent over and above the amount given by the Hydro loan or CHIP grant, and
- had thought that their heating bill would have been higher without the efforts undertaken.

### NOT USED CHIP Grant

Two categories of respondents had not used a CHIP grant. They were asked questions appropriate to their category as enumerated below:

Not Insulated

(Both not know-CHIP and know CHIP)

In this case the interviewer enquired:

- what were the reasons for not insulating
- whether they had done anything else to attempt to reduce energy costs in their home

This group was further differentiated into two groups according to their knowledge or lack thereof concerning the CHIP program. Those who knew about the program were asked:

- where they had heard about the program
- why they had not utilized the program

Insulated

(Both not-know and know CHIP)

If, on the other hand, the respondents had insulated their homes, they were asked whether or not they had any knowledge of the Canadian Home Insulation Program. In the case where the respondents were not aware of the program, they were asked:

- what they had done in their home to save energy
- what part(s) of the home were insulated
- what the approximate 'R' values were of each insulated part
- the type of insulation which was used
- whether a contractor was hired or if the individual had completed the work himself, and
- the year each part(s) were insulated.

Those respondents who were aware of the CHIP program, were asked where they had heard of the program. For those respondents who had not received a CHIP grant, they were queried as to:

- the reasons for not participating in the program

- whether or not they were doing anything in their home to save energy
- had received a loan under the Manitoba Home Insulation Program, and if they would like more information about the program.

If the respondents had not received such a loan, they were asked if there was any special reason for not utilizing the Manitoba Home Insulation Program (Hydro Loan Program). On the other hand, if the respondent had received a loan under this program, the interviewer was interested in knowing what type of materials, such as storm doors, insulation, etc., were purchased with the loan. Whether or not the respondents had taken advantage of the loan provided by the Manitoba Insulation Program to purchase insulation or other materials, the interviewer asked questions which pertained to:

- the parts of the house which were insulated
- the approximate 'R' values of each insulated part
- the type of insulation used
- whether or not a contractor was hired to do the work, and
- the year(s) the materials were added.

#### ALL RESPONDENTS

The questionnaire concluded with the questions to all respondents which reflected the general characteristics of their home. These questions included:

- the number of people living in the household
- the past year's total income (approximate) of household
- age of the head of household
- level of education of the head of the household
- the manner in which the house was heated: oil, gas, electricity or other
- how much money (approximate) was spent in the last year to heat the home