

THE UNIVERSITY OF MANITOBA

EFFECTS OF ENERGY CONSERVATION EDUCATION ON  
BELIEF, AWARENESS AND NON-STRUCTURAL  
CONSERVATION PRACTICES

by

Olivia Sophia Davids

A thesis submitted to the  
Faculty of Graduate Studies  
in partial fulfillment  
of the requirements for the degree of  
Master of Science

Department of Family Studies  
Winnipeg, Canada

April, 1980

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#### ACKNOWLEDGEMENTS

I wish to express my sincere gratitude to my committee members: Dr. Nancy Hook, Chairperson, and Dr. Lois Brockman, Department of Family Studies, Dr. Ken Mount, Department of Statistics, Mr. Leon Feduniw, Department of Interior Design, and Mr. John Hockman, Manitoba Housing and Renewal Corporation. Their guidance, encouragement, understanding and friendship through this unforgettable undertaking will always be greatly appreciated.

I would also like to thank Mrs. Dorothy Ford, a former University of Manitoba Home Economics graduate who is currently a Coordinator and Administrator of family housing for the Winnipeg Regional Housing Authority for her advice and assistance in conducting this research. Her interest in this study, her willingness to assist and kindness will always be remembered. I am deeply indebted to Mrs. Isabel Wettlauffer, Home Economics Curriculum Consultant with the Manitoba Department of Education for her suggestion of the need for the development of energy conservation educational materials and my subsequent decision to centre my research efforts on this topic. It has been a very rewarding experience in more ways than one.

Mr. John Broere, Systems Analyst has been a great help in the computer processing of the data. I extend to him my sincere appreciation for his patience and kindness. Very special thanks to Connie Halwas and Wendy Epp, two recent University of Manitoba Home Economics graduates, without whose unquestioning assistance and support during the data collection and educational process, the scope of the research would have been drastically curtailed. It was a pleasure working with them and their efforts and

suggestions are much appreciated. I would also like to sincerely thank all those families who participated in the study. Their cooperation, friendliness and patience have made this endeavour a successful one. Many thanks to Mrs. Muir and Mr. McLeod, the presidents of the Tenants' Associations in the two sample areas and their executives for their assistance, suggestions and encouragement.

Finally, sincere thanks to my husband, Girmay Yohannes, my parents, Dr. and Mrs. John Davids for their assistance in caring for our young daughter Kimberley, Irene Haigh for her encouragement, interest, and support and my brother Chris Davids. Also, special thanks to Mrs. Vi Patrick who helped me greatly by typing this research paper.

## ABSTRACT

### EFFECTS OF ENERGY CONSERVATION EDUCATION ON BELIEF, AWARENESS AND NON-STRUCTURAL ENERGY CONSERVATION PRACTICES

By

Olivia Davids

The concern about energy shortages expressed at the national and international levels needs to be translated into practical means of alleviating the situation and transmitted to consumers in an effort to encourage conservation. Before educational programs can be designed, it is important to determine existing beliefs about the energy situation and energy conservation practices. A sample of 138 addresses were drawn resulting in interviews with 70 adults, 10 males and 60 females from tenants in physically similar public housing units administered by the Winnipeg Regional Housing Authority in two geographically separated areas of the city of Winnipeg. Both groups responded to a personal interview in July, 1979, designed to provide information about the respondents' status of beliefs, awareness and non-structural energy conservation practices. Two utility meter readings, three months apart, were taken to provide an average daily consumption rate.

The results, based on frequencies of responses to the personal interviews, showed that most people believed that there were no energy shortages in Canada. Those who believed in energy shortages believed that they were mild and caused by human inefficiency as opposed to actual resource depletion. The newspaper and television were the main sources of energy information while government publications, professional people, politicians, friends and schools were perceived as the least reliable

sources of information. Respondents were quite knowledgeable in the more common non-structural conservation measures, but demonstrated a lack of knowledge in those measures which required specific information about energy utilization. An absence of efforts to conserve was noted in thermostat setting, laundry, clothing, transportation and summer space cooling practices, the use of supplementary heating devices and electric lighting.

In summary, this study indicates an absence of belief in energy shortages in Canada and a lack of basic knowledge about the effects of a selected set of non-structural energy conservation measures among a sample of public housing tenants which could possibly explain their energy consumptive orientation. Some insights into the factors affecting the delivery of an effective educational program in energy conservation are discussed.

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## CHAPTER 1

### INTRODUCTION

Natural resources, their abundance or paucity and their consumption, whether efficient or inefficient, have always served as significant indicators of the political, economic and social stages of development of nations. In the past, the transitions from one stage to the next, in part originated in major technological advancements which made alternative natural resources accessible and available for the production of energy. Denis Hayes (1976) describes some changes on the social dimension of nations that are concomitant with changes in the type of resource emphasized at any particular time in the historical development of nations:

Every major energy transition brings with it profound social change. The substitution of coal for wood and wind ushered in the industrial revolution. The petroleum era revolutionized mankind's approach to movement--restructuring our cities and shrinking our world. Now at the twilight of the petroleum age, we face another energy transition in the certain knowledge that it will radically alter tomorrow's society. Each of the energy options available to us today carries with it far-reaching social implications. (p. 6)

As Canadians, movement away from our simple, frugal existence to a highly complex society, has turned our attention away from the environment and its declining supplies of natural resources. We ecstatically embraced the daily comforts occasioned by technological advancement, but neglected to remember that nothing lasts forever. "Today, the ways in which we produce, mechanize, use and energize our homes, bear little resemblance to their antecedents" (Journal of Home Economics, December 1973, p. 20-21). Our relatively rapid progression from the pioneering, frugal ideology to the comforts and luxury of the present time has changed Canada from a nation low in energy use to a nation greatly dependent on energy. Until

recently, the prevailing attitude toward the use of energy resources has been one based on the belief in an interminable resource supply (Morrison, 1975).

In order to appreciate the changing trends with reference to resource use in Canada, this chapter will briefly touch on the following:

1. the status of the international, national and provincial energy resource situation and its relation to the family; and
2. the definition of this research problem and its basic objectives.

#### The International, National, and Provincial Situation

The disquieting effects of the 1973 Middle East unrest have once again come to mind in the wake of the present unstable conditions in Iran and the negative Arab reaction to the signing of the Middle East Peace Treaty. As a consequence of these factors, the production and availability of oil was decreased and the world price of oil raised substantially ("An Energy Strategy for Canada," 1976). Canada depends on the Middle East for 48.2 percent of her oil needs ("Energy Update," 1977) so that this country's oil supply is directly affected by events in the Middle East.

Canada is divided into a western and an eastern region by the Borden Line, an agreement which facilitates the supply of oil to these regions. The western provinces are supplied by Alberta, Saskatchewan and British Columbia, while the eastern region depends upon the Middle East for 48.2 percent of its supply, Latin America for 47.3 percent and Africa and Europe for 4.5 percent of its supply ("Energy Update," 1977). The reason behind Canada's dependence on international oil stems from the formidable problems associated with the transportation of oil from west to east (Breton, 1975). An International Energy Agency meeting,

chaired by Canada's then energy minister, Alastair Gillespie, concluded that "as early as the 1980's the world will not have sufficient oil and other forms of energy available" ("Energy Update," 1977, p. 1). At this meeting oil importing nations including Canada, made a commitment to decrease their demands for imported oil ("Energy Update," 1977).

The Energy Update report (1977) further emphasizes two crucial facts. Firstly, that large new sources of supply are required to fill worldwide demands for oil to complement and later to replace declining oil regions. It is estimated that discoveries of the past fifteen years--in North Africa, West Africa, the North Sea and the North Slope--will fill the world's requirements for only six years. Secondly, the world will be increasingly competing for the oil of Saudi Arabia, the major remaining Middle East source. But the fact of the matter is that Saudi Arabia will not be able to meet world wide demand.

Despite these signs of imminent danger, there appears to be a trend toward higher consumption of primary energy (petroleum, hydroelectric, natural gas, coal and nuclear energy) in Canada through the seventies ("Energy Update," 1977). Natural gas demands in Canada for 1971 were almost equally divided between the industrial (49 percent) and the residential/commercial sectors (51 percent). Petroleum demands were highest for transportation (48.4 percent), followed by the residential/commercial sector (36 percent) and the industrial sector (15.6 percent) ("Energy in Manitoba," 1974). According to these figures, the residential/commercial sector is a major consumer of natural gas and petroleum.

The use of coal to generate power seems to have regained popularity. In addition, scientists are exploring other alternative sources of energy such as nuclear, solar, wind and biomass power. But, until questions

relating to gas emissions, radioactive wastes, plutonium assimilation and the implementation of technology for alternative resource use can be answered, we will be dependent for the most part on the non-renewable resources ("Renewable Society," no date given). A short poem by Dorothy Winter (1976) encapsulates the attitudinal and practical changes we will have to make in order to conserve our declining energy supply:

You can go by bike, or hike;  
Muscle-powered,  
Take a freighter, train or plane;  
Fossil-powered.  
"But you can't catch me".  
Says the lowly flea,  
And off he goes at 140 g.  
Protein powered. (p. vi)

In response to the energy crisis of 1973, the Federal Government of Canada has adopted a national energy strategy, the objective of which is self-reliance. Self-reliance means the ability to rely on our own domestic supplies as far as possible to avoid arbitrary changes in world prices or prolonged curtailment of supply ("An Energy Strategy for Canada," 1976). In order to reach the major objective of self-reliance, the Canadian Government has delineated nine major factors which could result in greater efficiency of natural resource consumption: (1) appropriate energy pricing; (2) energy conservation; (3) increased exploration and development; (4) increased resource information; (5) interfuel substitution; (6) new delivery systems; (7) emergency preparedness; (8) increased research and development and (9) greater Canadian content and participation ("An Energy Strategy for Canada," 1976, p. 3). Of particular import to this proposed study, is the second factor on the list, energy conservation, an area in which most residents of Manitoba have some control.

The provinces of Canada control energy resources within their boundaries

as laid down in the Canadian Constitution. By the same token, the implementation of Federal energy policies is under provincial jurisdiction ("An Energy Strategy for Canada," 1976). The province of particular interest to this study, is Manitoba. The following are figures for energy supply/demand by major source between 1972 and 1976.

Table 1  
Energy Supply/Demand in Manitoba by Major Source  
(B.T.U.  $10^9$ )<sup>a</sup>

Year	Oil	Natural Gas	Electricity	Total
1972	114,990	74,140	34,811	233,941
1973	120,210	76,821	37,692	234,723
1974	124,980	77,300	40,213	242,493
1975	118,566	74,339	40,878	233,783
1976	119,250	74,620	41,988	235,858

Source: Energy Data for Manitoba, 1976, p. 1 (modified for inclusion here).

<sup>a</sup>To convert from natural units, the following factors were used: 1 barrel of oil = 6 million BTU, 1 mcf of natural gas = 1 million BTU and 1000 kwh of electricity = 3.412 million BTU.

Demand for natural gas increased up until 1974; the peak year for consumption. After 1974 there was a gradual decline in demand for natural gas to a slightly higher level than the 1972 level of demand and to a substantially higher level of demand for oil than the 1972 level of demand

for oil. Electricity consumption continued to increase steadily between 1972 and 1976, showing no sign of decline. The overall demand figures show an increase which peaked in 1974, declined significantly in 1975, but showed somewhat of an increase in 1976, reflecting the increase in oil and electricity consumption.

The following table shows the consumption of petroleum products used in transportation for 1975 and 1976:

Table 2

Consumption of Petroleum Products Used in Transportation (000 barrels)

	1975	1976	1977 <sup>a</sup>
Motor gasoline	9,345	9,874	10,062
Diesel fuel <sup>b</sup>	2,051	2,131	
Aviation gasoline	109	132	136
Aviation Turbo fuel	1,431	1,491	1,364
Total	12,936	13,628	11,562 <sup>c</sup>

Source: Energy Data for Manitoba, 1976, p. 3 (modified for inclusion here).

<sup>a</sup>The 1977 figures are from "Detailed Energy Supply and Demand in Canada," Statistics Canada, 1977.

<sup>b</sup>Manitoba Energy Council Secretariat estimate of diesel fuel used in the transportation sector.

<sup>c</sup>This total excludes the 1977 figure for diesel fuel consumption.

The largest end-use of petroleum products is for motor gasoline. Consumption of this type of gasoline showed an increase of 529,000 barrels between 1975 and 1976 and 188,000 barrels between 1976 and 1977. The amount of motor gasoline consumed is far greater than the amount of diesel fuel, aviation gasoline and aviation turbo fuel consumed.

The following table shows the natural gas sales for 1975 and 1976:

Table 3  
Natural Gas Sales by Sector for 1975 and 1976  
(bcf)

	1975	1976	1977 <sup>a</sup>
<u>Manitoba</u>			
Residential	22.5	22.4	22.0 <sup>b</sup>
Commercial	19.5	18.8	18.8
Industrial	18.3	19.8	19.7
Total <sup>c</sup>	60.3	60.9	60.6

Source: Energy Data for Manitoba, 1976, p. 3 (modified for inclusion here).

<sup>a</sup>These figures are from the Statistics Canada Publication, "Detailed Energy Supply and Demand in Canada, 1977."

<sup>b</sup>Statistics Canada uses the designation "Domestic and Farm" as a close approximation to "Residential" in terms of energy consumption.

<sup>c</sup>Annual totals here differ from those in Table 1 as the latter include gas used in the system and losses/adjustments.

Natural gas sales to the residential sector remained quite stable between 1975 and 1976, while sales to the industrial sector increased slightly. The reason for the stability in sales to the residential sector could be a result of the declining use of natural gas in Manitoba as consumers switched to electricity for space heating. Nevertheless, the residential sector is still the most important market for natural gas for space heating in Manitoba. The following table shows electricity sales in Manitoba:

Table 4

## Electricity Sales by End-Use Sector in Manitoba (000 kwh)

	1975	1976
General		
Loads under 5mkw	3,498,724	3,716,011
Loads 5mkw and over	2,695,575	2,546,937
Domestic	2,597,968	2,865,873
Farm	819,036	908,743
Street lighting	102,228	106,021
Total	9,713,531	10,143,585

Source: Energy Data for Manitoba, 1976, p. 4 (modified for inclusion here).

In 1976 there was a significant increase in the domestic, farm and small general service demand for electricity. In 1976 electricity sales to the domestic sector was second in magnitude to the large general service sector. These tables (2, 3, and 4) indicate the most important users of the main energy resources:

Oil - motor gasoline sector

Natural gas - residential sector

Electricity - large general sector, followed by the domestic sector.

The following table shows oil prices in Winnipeg between 1972 and 1976:

Table 5

Retail Oil Prices in Winnipeg as of December 31st in ¢/gallon

	Regular Gasoline	#2 Fuel Oil
1972	51.0	19.9
1973	55.3	24.1
1974	59.9	32.2
1975	80.1	38.9
1976	82.2	44.4
February, 1980 <sup>a</sup>	108.0	69.1

Source: Energy Data for Manitoba, 1976, p. 5.

<sup>a</sup>Average based on prices quoted by four major oil companies in Winnipeg.

Table 6 shows the prices of natural gas between 1973 and 1977:

Table 6  
Natural Gas Prices

	Winnipeg City Gate Price ¢/mcf
June 1973	34
Sept. 1973	36
Nov. 1973	41
Sept. 1974	42
Nov. 1974	66
Nov. 1975	101
July 1976	111
Jan. 1977	119
Feb. 1980 <sup>a</sup>	130

Source: Energy Data for Manitoba, 1976, p. 5 (modified for inclusion here). These tables indicate rather significant price increases for gasoline, fuel oil and natural gas since 1973. Electricity prices have shown similar increases in the various sectors since 1973 ("Energy Data for Manitoba," 1976).

A proposed major factor contributing to the increased demand for energy resources in Manitoba, is the increase in the standard of living.

<sup>a</sup>Telephone conversation with personnel at the Greater Winnipeg Gas Company, February, 1980.

Increasing disposable incomes have, for example, usually been associated with increases in both the stock and use of private automobiles, purchase of household appliances such as frost-free refrigerators, colour television sets, dishwashers, and small electrical appliances and increased use of plastics and other petro-chemical products. These goods and activities--and the production processes implied by them--have required increasing energy supplies in Manitoba ("Energy in Manitoba," 1974, p. 6).

Manitoba relies almost solely on imports in order to meet its requirements for natural gas and petroleum. Even though Manitoba is fairly self-sufficient in electricity production through hydroelectric generation, the costs of immediate widespread conversion to this energy source in residential/commercial space heating, for example, would be formidable. Also, electricity cannot replace certain other natural resources such as are used in industry and transportation ("Energy in Manitoba," 1974). The increases in utility rates faced by Manitobans since the early seventies are indicative of increased world prices, which have had and are having a chain effect upon the cost to the consumer.

The relatively fast per capita rate of growth in energy demands, the decreasing availability and thus increased cost of energy resources, and the significance of the residential/commercial sector as the major consumer of energy in Manitoba, suggests that a study of household energy conservation practices is in order. Such a study would provide the information needed to formulate meaningful energy conservation programs aimed at changing the energy consumptive attitudes and behaviour of consumers in order to preserve supplies and stabilize prices.

#### Definition of the Research Problem

This study is concerned with residential energy conservation practices, more specifically, the non-structural energy conservation practices of tenants in public housing in the city of Winnipeg, Manitoba. Public

housing constitutes approximately 2.6 percent<sup>1</sup> of the total housing accommodations in Winnipeg. Therefore, tenants in public housing do have a sizeable effect on the total energy consumption rates for Winnipeg. It is necessary to confine this study to non-structural energy consumption/conservation patterns, because these are areas in which the tenants do have some control. Rent is subsidized by the government and includes apartment rent and in some cases utility and parking expenses, calculated according to the family's income. In other words, the tenants may not be responsible for paying their own utility and parking bills. Other research (Kilkeary and Thompson, 1975) has shown that where tenants are not directly responsible for paying their own utility bills, they tend to consume more energy and use fewer conservation measures than would otherwise be the case. If this is the case in Winnipeg, an energy conservation education program is in order, because the government cannot afford to subsidize waste.

The main sources of space heating fuel for public housing in Winnipeg are electricity (60 percent) and natural gas (40 percent) (Personal communication with John Hockman, 1979). Coupled with the increasing prices of these commodities, space heating is the largest user of energy resources in Manitoba ("Energy in Manitoba," 1974). McCallum (1976) states that homes today are often overheated. A saving of about 10 percent on heating fuel requirements can be accomplished by maintaining the inside temperature at 20°C (68°F) rather than 22°C (72°F) ("Living in Times of

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<sup>1</sup>Calculation based on the City of Winnipeg projection of total housing stock for 1981 which is 214,612 including public housing units. (Telephone conversation with Larry Loreth, Environment and Planning, February, 1980). The total number of public housing units in Winnipeg is estimated to be 5,500 (Conversation with Mr. John Hockman, Manitoba Housing and Renewal Corporation, 1979).

Scarcity," 1976). These factors provide us with some indication of where and how energy consumption can be decreased.

#### Purpose of this Research

The purpose of this research was to determine whether exposure to an energy conservation education program would establish or increase awareness of the energy problem; whether it would increase belief in the reality of the problem; and, whether it would increase energy conservation practices via non-structural means.

#### Specific Objectives

1. To assess current non-structural energy consumption/conservation practices of tenants in public housing in Winnipeg by way of a pre-assessment personal interview.
2. To present an energy conservation educational program to these tenants in public housing.
3. To evaluate the program in terms of changes in energy consumption/conservation behaviour in public housing tenants.
4. To evaluate the program in terms of changes in awareness of the energy shortage and belief in the reality of the shortage.
5. To obtain utility data for the respondents as a reliability check on the evaluation responses.

## CHAPTER 2

### REVIEW OF LITERATURE

This chapter will review research literature related to factors in residential energy use. The purpose of this chapter is to clarify the relationship and context of the proposed research with prior studies.

The fact that the energy crisis of 1973 with the resultant and continuing foreign oil price increases and decreased availability, had a greater effect on the United States than it did on Canada (Laxer, 1975), is in part indicated by the greater volume and variety of energy-related literature and research available from the United States. Canadian literature and research to date deals mainly with the development of domestic supplies, energy demand studies with reference to government policy making, energy policy at the provincial, national and international levels, the economics of energy, energy industries and energy and environmental factors. In Canada there has not as yet been much investigation into the everyday behavioural aspects of household energy consumption and conservation. Nevertheless, this aspect of research is gaining ground in this country as a result of the rapid escalation of international oil prices, decreased availability and a general decline in world supplies of fossil fuels.

Generally speaking, before any voluntary or coerced changes in behaviour can occur, it is necessary to establish both an awareness and a belief that a problem exists and that such changes in behaviour will modify or lessen the impact of that problem (Kiesler, Collins and Miller, 1969). Since it is the purpose of this study to monitor behaviour change in terms of energy conservation, it becomes necessary to determine the

status of the awareness and belief in the energy shortage in the research sample. The premise that behaviour change is somewhat related to an awareness and belief in the problem, is given credence by the fact that much of the research reviewed either contained awareness and belief components in their instruments, or concentrated solely on beliefs and attitudes toward the energy situation (Bartell, 1974; Bultena, 1976; Cunningham and Lopreato, 1976; Doering, 1974; Gottlieb and Matre, 1974, 1976; Heberlein, 1974, 1975; Hogan, 1976; Honnold and Nelson, 1976; Morrison and Gladhart, 1976; Morrison, 1975; Murray, Minor, Bradburn, Cotterman, Frankel and Pisarski, 1974; Novic and Sandman, 1974; Thompson and Mactavish, 1976; Warren, 1974; and Winett and Nietzel, 1975).

In order for a catalysis in behaviour to occur, that is, a change from energy consumptive to energy conservative behaviour, via an energy conservation educational program, an initial assessment of the present behaviour is required to serve as a baseline for designing the catalyst as well as for determining whether any change has in fact occurred. Researchers have also made initial assessments of energy consumptive/conservative behaviour as a component of their research or others have concentrated their efforts on these assessments as a basis for educational programs, policy-making or further study (Cunningham and Lopreato, 1977; Fox, Fraker, Grot, Harrie, Schorske and Socolov, 1973; Gladhart, 1976; Hogan, 1976; Kilkeary, 1975; Morrison and Gladhart, 1976; Morrison, 1975; Murray, Minor, Bradburn, Cotterman, Frankel and Pisarski, 1974; Newman and Day, 1975; Walker and Draper, 1975; and Warren, 1974).

One commonly used method for attempting to change behaviour, is exposure to energy conservation information and/or energy conservation educational programs. A number of researchers have applied energy