

THE EVOLUTION TOWARD R-2000  
 PAST EXPERIENCE AND CURRENT DIRECTIONS OF THE CANADIAN  
 ENERGY CONSERVATION EFFORT

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I am very pleased to be here and to have the opportunity to describe to you the activities undertaken by the Canadian federal government in energy conservation since 1973. There is a great deal that I would like to cover but the available time is extremely short, so I will concentrate on a quick overview of past experiences and focus on our current directions, particularly in the buildings sector.

The Canadian federal government has formally been involved in supporting energy conservation initiatives for over 11 years, and this is a long enough period to provide at least a preliminary assessment of how effective we have been. During that 11 years period, there has been reasonable continuity of government support and we have implemented a number of very successful programs. It would not be correct, however, to imply that all of our programs were ideally structured or that all of the resources allocated were used in the most effective manner possible. I think it would be fair to say that, in the early years of the conservation effort, the proposals for new initiatives submitted to and approved by government arose from idealism, enthusiasm and opportunism more than they did from a well conceived strategy. This lack of overall strategy is evident when one considers the current mix of programs both in terms of their coverage of in use sectors and in terms of the type of assistance and support that they provide.

Figures 1 through 3 present an overview of the potential impact of conservation measures in the building sector on the overall energy demand in Canada.

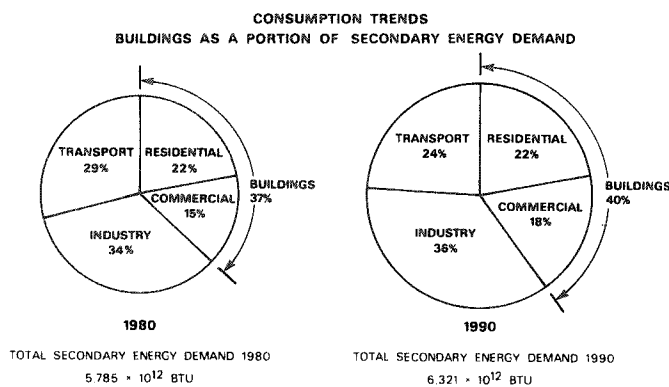
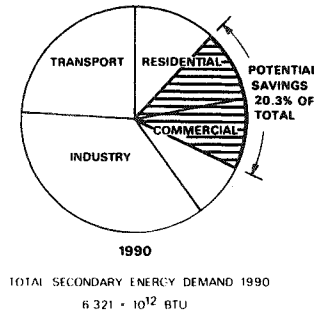


Figure 1 indicates that the energy consumed in the building sector within Canada is increasing toward 40% of projected secondary energy demand by 1990.

Figure 2 summarizes the potential energy savings that could be achieved if economically justified energy conservation measures were implemented throughout the building stock.

ECONOMICALLY JUSTIFIED ENERGY SAVINGS IN BUILDINGS



Note that the potential savings amount to 20% of the total secondary energy consumption in Canada and that this potential saving could be achieved at a lower overall cost than purchasing conventional energy supplies at current prices.

The potential is large, the cost is low, but private sector activity levels to achieve the savings are also relatively low. In some areas, government programs have been developed but, because opportunities for implementing conservation programs did not arise evenly across all building types, Canada's programs have not uniformly addressed the potential savings.

PROJECTED SECONDARY ENERGY DEMAND

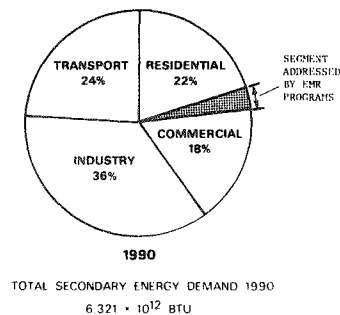


Figure 3 illustratively depicts the fact that government programs do not comprehensively address the potential savings.

The short fall in coverage by government programs occurs in two ways. First, the program does not address all end use sectors. Second, the government activities emphasized consumer subsidies and largely ignored industry and technology development and the increasing of consumer awareness.

RELATIVE POTENTIAL ENERGY SAVINGS

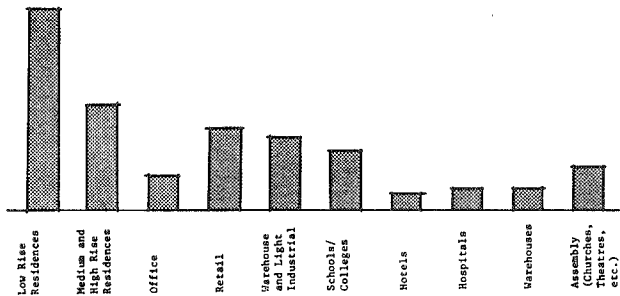


Figure 4 indicates the potential savings that can be achieved cost-effectively in various building types.

RELATIVE LEVEL OF FEDERAL EFFORT

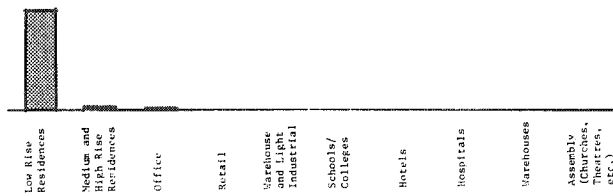


Figure 5 shows the relative level of the Canadian federal government's effort in dealing with the same building types.

Figure 5 demonstrably shows that the effect of the combined idealism, enthusiasm and opportunism has resulted in a program which is biased heavily towards the residential sector. Even this figure itself understates the bias since well in excess of 90% of the resources allocated to the low-rise housing sector are spent on existing housing alone.

From an overall planning context, a second deficiency exists in the overall program structure, in that, our programs are heavily biased towards providing direct consumer subsidies, and they are weak in providing other forms of assistance that are required to ensure that conservation measures are properly planned and implemented.

RELATIVE CURRENT EXPENDITURES LEVELS  
ON  
ENERGY CONSERVATION IN BUILDINGS

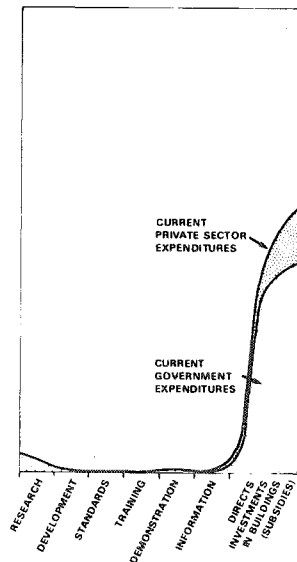


Figure 6 has been prepared to illustrate this weakness. The bottom axis of this figure is intended to illustrate a continuum of types of support that may be required to assist in the planning and implementation of conservation work in the building sector. The first two activities at the left end of the continuum focus on the development and proving of new technologies. The next two activities to the right are intended to represent the activities required to commercialize the technologies and prepare the industry to be able to deliver them in the market. The next two to the right are activities designed to create consumer awareness of the technologies and of their cost-effectiveness and to stimulate consumer demand for cost-effective

actions. At the extreme right, consumer subsidies represent the most costly approach the government can take to stimulating consumer demand. From the lower curve in Figure 6, it is clear that there has not been previously a fully integrated or balanced approach in the use of government funds.

Funds have been provided to support research, but rarely have the results of research been transferred to the market-place, whether to create the supply of new products and services or to create informed consumer demand.

While some demonstration activities have been undertaken, these have not generally been well focused. Our most expensive demonstration programs have funded unsolicited projects submitted by the private sector. Frequently, these projects were innovative and exiting, but rarely were they truly cost-effective or widely applicable in the marketplace.

Consumer subsidies to encourage conservation in the residential sector have been massive. The federal government has committed a total of approximately \$4 billion to encourage conservation and the replacement of oil heating systems. The Canadian Home Insulation Program (CHIP) has recently been evaluated, and the conclusion was reached that the program was a good investment from the perspective of the federal government and the Canadian taxpayer. However, the evaluation indicated several areas where the program could have been improved. These relate primarily to the fact that the consumers were not well enough informed and, consequently, that they overlooked many initiatives which could have been extremely cost-effective. Subsidies funds and consumers' own money was frequently used to do work that offered a relatively low return on investment. The evaluation also indicated that the industry lacked the knowledge and skills necessary to do the work in the most cost-effective manner. The Canada Oil Substitution Program (COSP) has not been fully evaluated, though one would expect from the structure of the program and from the available information that problems similar to those in the CHIP program are being experienced.

At the risk of overstating the case, the above argument would lead to the conclusion that many end use sectors have not been addressed by the Canadian government's energy conservation effort and that, even for existing housing where expenditures have been very large, the emphasis was on providing subsidies to create a demand for goods and services without providing the necessary support to stimulate the development of the conservation products and of the skills that are necessary in the industry to deliver the required goods and services.

From my comments so far, one might conclude that Canada's experience in the energy conservation area has been unsuccessful. My earlier comments that we have had some successful programs might be taken as necessary comments from any public servant if he wants to protect his job. If this impression has been created I want to dispell it, and to emphasize that we have had some considerable successes in those areas which we have addressed. There are, however, many more areas which need to be addressed if we are to see a more effective use of government and private sector resources. The need for such changes is well recognized at senior levels within the Department of Energy, Mines and Resources. The Department's Strategic Plan proposes some significant shifts in the direction of our current and possible new program activities so that there will a better coverage of all end use sectors, and so that in each sector there will be a coordinated effort incorporating an appropriate balance between the development of the supply of conservation products and services and the generation of demand for those services. The Strategic Plan indicates the desirability of providing subsidies only where a special need exists. It is expected that in normal circumstances, by developing a knowledgeable public to demand conservation products and services, and a skilled industry supply them, the marketplace will operate without the need for massive and universally available government subsidies.

DESIRABLE FUNDING PROFILES  
FOR  
ENERGY CONSERVATION IN BUILDINGS

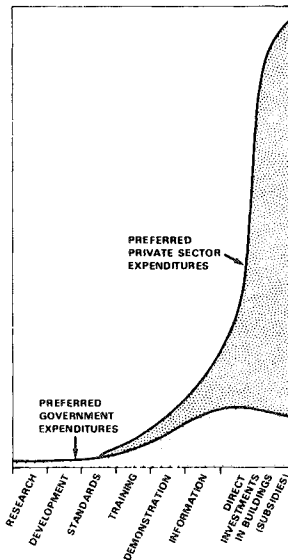


Figure 7 indicates the nature of the funding shift that would be entailed. I wish to make 2 points about this figure. The first is that it indicates a belief that with a more knowledgeable public and more confidence in the industry's ability to supply cost-effective services, private sector investment will be significantly higher than in a situation where government subsidies are made available to stimulate work without public knowledge and without a fully developed industry. This thesis has not been fully tested, but ample evidence exists in our evaluation of the CHIP program to suggest that the approach is viable.

The second point relates to the fact that programs are now seen within the Department in a totally different context. Previously, programs were seen as independent, and, in the sense of figure 7, vertical activities, which were to be managed in their own right. To the extent that there was any integration, it occurred by integrating vertical activities that applied across various end use sectors rather than horizontally across the continuum. Research was one of these vertical activities, managed essentially independently from activities to commercialize technologies or stimulate consumer demand. The largest of our demonstration programs also operated vertically. The Canadian Home Insulation Program (CHIP) and the Canada Oil Substitution Program (COSP), were vertical programs designed to provide subsidies for existing housing.

The new Strategic Plan has begun to ensure a different approach in that programs are now being described as horizontal activities which encompass all necessary activities from research through to public subsidies, as required, to achieve the energy saving objective for a particular end-use sector. As this approach takes hold, it will become progressively more difficult to claim that a program succeeded because it spent all its funds, or because it gave more grants than expected. Instead, it will be necessary to demonstrate that programs have had a real effect in saving energy and that the savings that were achieved approached the optimal for the available resources.

The new approach has been modeled on our past activities and programs for new housing, which are seen by my Department as comprising the most effective combined effort in the conservation area that our government has so far undertaken. Accordingly, I will spend some time describing our past and current efforts in this sector.

Though I do not wish to suggest that we have resolved all problems in the new housing area, I think it is safe to say that in this area we are definitely on the right track. Even more, I think one can safely say that if our current program succeeds, Canada's new housing units will be substantially more energy efficient and cost-effective in an energy sense than those than in any other country in the world. Third, I think one can also say that the prospects for success in our activities are reasonably high.

The optimism for success comes from the fact that the initiatives that are underway are strongly supported by both government and the building industry. Second, current activities focus both on creating the capability within the industry to supply goods and products - that is, the supply side is well addressed - and initiatives also focus on creating a sustained consumer demand in the absence of government subsidies for highly energy-efficient housing units - that is, the demands side is also addressed. I am sure that some of you will be aware of the R-2000 homes that are currently being built within Canada. In order to qualify as an R-2000 home, a building must meet rather demanding designs standards and must pass tests after construction to ensure that the house will perform in accordance with the design. Typically, an R-2000 home will have a space heating bill that is 75% less than a similar house which meets building codes that are currently in effect in Canada. Experience has shown that this reduction can be achieved at a relatively low incremental construction cost.

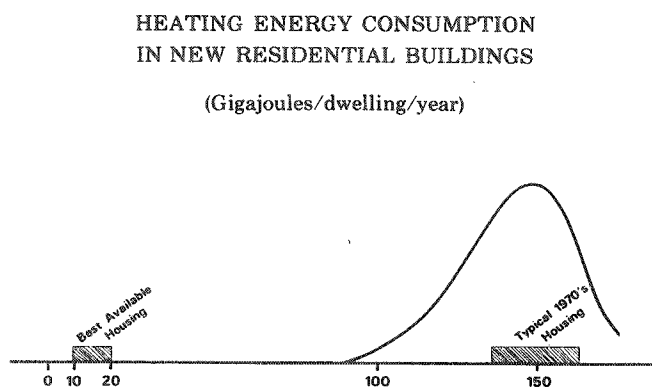


Figure 8 indicates the substantial reduction in space heating consumption that is entailed, and it provides an indication of the overall national impact that could be achieved if all new housing conformed to the R-2000 standard. The curve in this figure represents the number of new housing units at various levels of annual energy consumption.

Given the magnitude of the savings, when the proposal for the program was initially made there was great skepticism that such a large reduction could cost-effectively be achieved in any housing units and further there was almost universally skepticism that such techniques, if they could be developed, could be commercially transferred throughout the building industry. We presented an argument that not only could such techniques be developed, but also that they actually were already being employed on a limited scale by small builders in certain part of the country. The argument was reinforced by the results of a limited number of demonstration projects that had been planned and completed under federal/provincial agreements in the province of Saskatchewan.

COST-EFFECTIVENESS OF HOUSING DESIGNS





	SELLING PRICE (\$)	ANNUAL HEATING COST (\$)		
		INTEREST ON INCREMENTAL COST (16%)	PURCHASED ENERGY	TOTAL
A. CONVENTIONAL 	80,000	—	800	800
B. SUPER-ENERGY-EFFICIENT 	83,000	450	100	550
C. ACTIVE SOLAR 	100,000	3,000	300	3,300
D. PASSIVE SOLAR 	92,000	1,800	400	2,200

Figure 9 contains the essence of an argument that was presented from 1978 through the development phase of the initial Super Energy Efficient (SEE) home program in 1981.

It was argued that the preoccupation of the mid- and late-seventies with active solar heating for housing had been misguided, and that the results of activities in these areas had created some serious

misconceptions about energy-efficient housing. First, active solar housing had serious technical and financial problems that were not likely to be overcome. The collector systems were expensive and subject to technical failure, and likely could not be expected to have a long life. To reduce the need for backup systems, which were capable of supplying all of the required heating energy, large thermal storage systems were required. These added to the cost and complexity of the house and reduced available interior space. Further, the need for direct access to the sun placed severe restrictions on the number of building lots that could be used for active solar housing. By the late 70's, all early innovators in active solar housing had reached essentially the same conclusion, but in many cases, programs designed to encourage such housing continued and political interest and research continued in these areas.

By this time, however, innovators had generally rejected active solar space heating in favour of the passive solar approach. Unfortunately, this approach too, it was argued, had serious difficulties. It too required carefully selected lots, it required a significant increase in the use of glass in housing and, in order to reduce completely unacceptable temperature swings between day and night, or between sunny days and cloudy days, thermal mass had to be increased in the housing units. The novel construction techniques required were expensive and unfamiliar to builders and, in many cases, the houses looked substantially different from those that speculative builders felt they could easily sell in the marketplace. It was further argued that the emphasis on active and passive solar systems had created a love affair with gimmicks and fancy technologies at the expense of basic good construction practices. In effect, what was being sold as passive solar housing had much glass and thermal mass but poor attention to insulation, airtightness and construction quality.

In order to stimulate improved construction practices and attention to all important areas, and to minimize cost, the SEE home program was structured to take advantage of the builders' knowledge and skills in keeping construction costs low. The R-2000 standard was developed as an energy performance standard, which mandated that a building could not consume more than a specified amount of energy. Builders were completely free to design and construct the building in any manner they chose, so long as it could be demonstrated to meet the energy budget. This was done deliberately so as to encourage builders to be innovative in developing and using the best and most effective construction techniques. With 3 years of experience under the program, we can now say that this strategy was effective. Builders have proven that construction costs can be maintained at low levels, and that the energy budget levels can be achieved. They have also demonstrated that there is no need to significantly change the appearance of the houses. Thus, the marketability of units is not affected.

From the national perspective, it was also argued that there were additional benefits to going to super energy-efficient housing. In that, such housing would have a lower total cost to the nation. While the capital invested in the house would undoubtedly increase, there would be a reduced demand for energy supply investment to produce the energy used for heating such homes.

TOTAL NATIONAL CAPITAL INVESTMENT  
FOR RESIDENTIAL ELECTRIC SPACE HEATING  
( \$ per House)



	SELLING PRICE	INCREMENTAL CONSTRUCTION COST	INSTALLED HEATING PLANT (kW)	DIVERSIFIED DEMAND	UTILITY INVESTMENT	TOTAL
<b>A. CONVENTIONAL</b> 	80,000		25kW	6kW	12,000	12,000
<b>B. SUPER-ENERGY-EFFICIENT</b> 	83,000	3,000	4kW	1kW	2,000	5,000

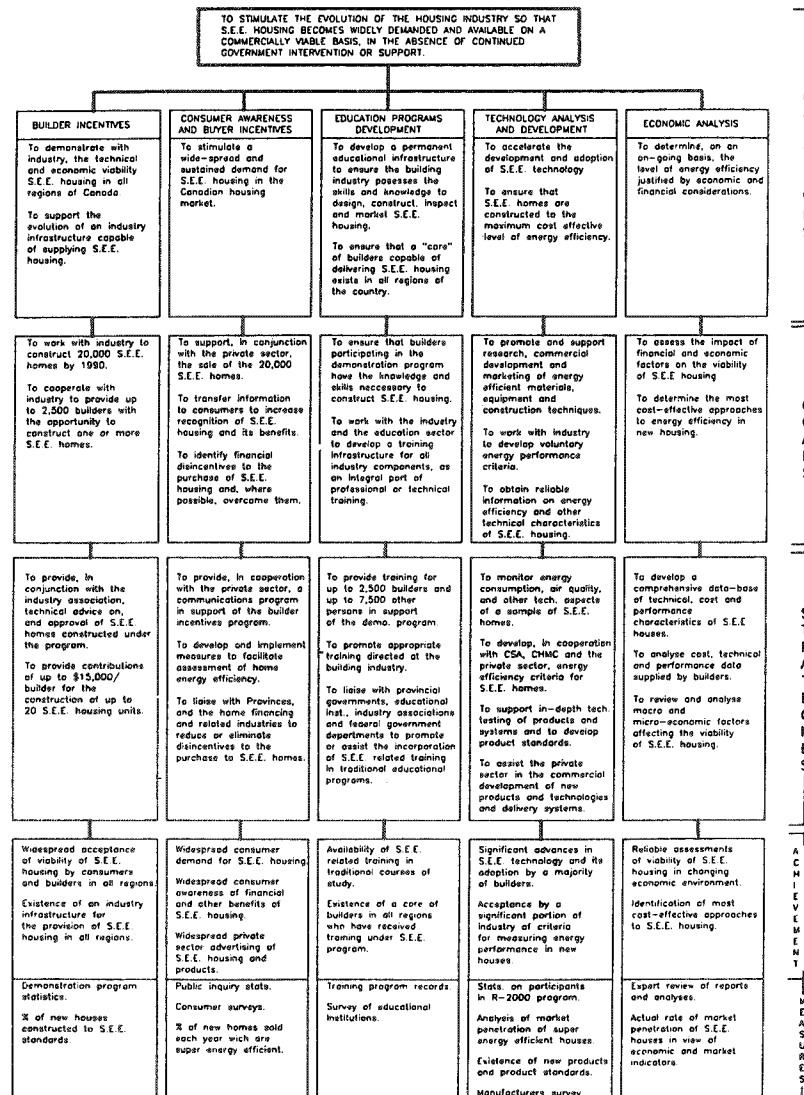
Figure 10 provides an indication of the expected reduction in investment in energy plant, as well as the net reduction in construction costs for R-2000 housing.

So far, we can say that the program has been a great success. While doubts still exists in some quarters, the federal government, and the Canadian Home Builders Association (CHBA) have fully endorsed the objectives of the program, and the need for continued effort. The original SEE home program had a budget of \$6 million over a period of 3 years. Based on the experience of that program, our Cabinet has recently approved a \$50 million extension to this program with the objective of involving 25% of all builders in Canada, and of stimulating the construction of a sufficient number of R-2000 homes so that they become widely demanded and available on a commercial basis in the absence of continuing government subsidies.

One can argue that the program has had the degree of success that it has because it is a horizontal program, encompassing all necessary work from research through to consumer motivation, as required, to achieve its objectives. The program's managers have had great flexibility in using the available funds to meet the required needs thus, we have been in a position to negotiate effectively the required changes with the industry and to implement them without lengthy bureaucratic delays. If the program did not operate in this horizontal fashion, it would be necessary to encourage other departments and agencies to conduct complimentary work and to resolve issues before final decisions could be made on the program's implementation. Any of you who have worked in bureaucracy would appreciate the difficulty of such coordination primarily, because of differing objectives of various agencies and occasionally because of effects on other bureaucratic empires.

Figure 11 is an outline of the program's framework.

## PROGRAM FRAMEWORK SUPER ENERGY EFFICIENT (S.E.E.) HOME PROGRAM



OBJECTIVES  
GOALS  
STRATEGIES  
INDICATORS

Note that funds are available for builders incentives, which provide hands-on experience for builder and sub-trades, and demonstrate the houses to the housebuying public. \$20 million is allocated to this activity.

\$7 million is allocated to consumer awareness activities. This will be supplemented by advertising and promotion funds from builders, the housebuilders' association, and from individual manufacturers. An example of cooperative advertising has already been undertaken by one major manufacturer who last year implemented a pilot advertisement program to promote R-2000 housing. The manufacturer spent a total of \$500,000 on this pilot campaign and he intends to continue it. Other manufacturers will also be encourage to supplement the available government funding.

\$6 million is allocated to education and training activities for builders, sub-trades, building inspectors and real estate personnel. \$5 million is allocated to refining and proving the technology through research, development and the preparation of standards and guidelines for material, equipment, etc.. \$500,000 is dedicated to economic analysis and to the removal of financial and institutional barriers which may reduce the marketability of R-2000 housing. The remaining \$12 million is allocated for management, administration, program development and for salaries of staff both in the house building association and in the federal government.

One might note that direct consumer subsidies are not provided under this program. It is expected that by increasing consumer knowledge, and by providing the strengths and abilities in the industry, market forces will cause a continuing demand in the absence of direct consumer subsidies.

The essential elements of this program that are seen as leading to his success are: the close cooperation with industry in the design and implementation of the program; the reliance on industry to develop the most cost-effective techniques for implementing the conservation measures; the integration of all necessary activities under the program's framework; and the ability of the program's manager to restructure program elements to respond to emerging needs under the program without lengthy bureaucratic delays. In short, the program is seen as comprehensive, responsive, flexible, and integrated with the on-going private sector delivery mechanism.

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As noted above, it is intended that all energy conservation programs should be restructured to reflect this integrated approach and such an approach is detailed in the Department's Strategic Plan. Except for the SEE home program, however, the program changes have not yet been fully approved. The question of whether the changes will be approved, or the extent to which they will be implemented is yet an open one. Restraint is a major principle governing the federal government's activities. This affects both dollars and staff. To effect the necessary changes would cause some significant disruptions within bureaucratic empires, and some resistance may be expected in some quarters to the re-allocation of the resources that are currently available. The effectiveness of bureaucrats in protecting their own empires and resisting changes should never be underestimated. From the political perspective as well, some problems can be envisaged, current subsidy programs have developed large constituencies, both within consumer groups and in certain segments of the industry. Wholesale restructuring of such programs could create pressures on the political system and the anticipation of negative reactions could make it more expedient politically to leave things as they are.

At the present time, what can be stated, is that the Strategic Plan has been prepared. In effect, the map has been drawn. What remains to be done is to carefully analyze and, select the road to be followed and to allocate the resources to ensure that we arrive at our destination.