# Natural Resources Canada's Commercial Building Incentive Program

*John Cockburn, Office of Energy Efficiency, Natural Resources Canada*
*André Bourbeau, Office of Energy Efficiency, Natural Resources Canada*
*Bruno Gobeil, Office of Energy Efficiency, Natural Resources Canada*

## ABSTRACT

On December 15, 1997 Natural Resources Canada (NRCan) announced the implementation of a new program to encourage energy efficient construction in the commercial/institutional sector. Called the Commercial Building Incentive Program(CBIP), starting April 1, 1998 it provides a financial incentive to owners of newly constructed buildings that have a simulated performance 25% more efficient than if the building were constructed to the requirements of the newly published Model National Energy Code for Buildings. It is a three year program with a maximum contribution per project of $80,000 as long as funds are available.

The paper will describe the rationale for the program, the alternative program options and elements considered, the consultation process and findings, and the final program design considerations and decisions. Of particular interest will be the focus of the program on the building design process and its use of energy performance simulation.

The paper will also describe the relationship of the program to the commercial building data development efforts of the department and how the monitoring system will be used to determine the program outcomes and impact. It will show how the department is to establish a baseline for determining broader impacts, such as their indirect effects of new buildings, and hence, on overall commercial building energy use. The paper will emphasize the innovative aspects of the Canadian commercial building data collection strategy by which NRCan intend to establish a survey comparable to that produced by the EIA's Commercial Building Energy Consumption Survey (CBECS) but working with budget constraints that are more severe than those applied to the U.S. study. The paper will also report the major findings from the pilot testing on different approaches to the final survey design.

## Introduction

Between 1990-1995 the energy intensity of the Canadian economy declined. It is estimated that energy costs in the economy were $3.5 billion dollars less than they would have been without the intensity improvements, given the economic growth during the period. A comprehensive federal energy efficiency program targeted at all sectors and employing a wide range of policy instruments has existed in Canada since the early 1990s. This was in addition to utility and provincial government energy efficiency initiatives also in place at that time.

The programs managed by Natural Resources Canada(NRCan) and targeted at the commercial/institutional sectors, such as the Energy Innovators Program, and the Federal Buildings Initiative for government operations focussed on the existing stock. The only federal programs targeted at new commercial construction were a modest technology development and demonstration effort for

advanced commercial buildings and support for the development of the Model National Energy Code for Buildings(MNECB).

On the analytical side an important need exists with respect to the department's information resources on end use data, overall performance of the stock and the ability to track either natural or induced improvements. With the implementation of the CBIP the opportunity and need arises from both a program and analytical perspective to improve the capability to measure outcomes and impacts on the entire commercial stock. This paper will describe the genesis of the program and NRCan's commercial database efforts.

## The Market

Commercial energy use in 1996 was 1000 petajoules (or 1.1 quadrillion BTU), accounting for 13% of secondary energy demand in Canada. Commercial energy use-related emissions accounted for 51.6 megatonnes of carbon dioxide, which represents slightly more than 12% of emissions from total Canadian secondary energy use-related emissions. Statistics Canada defines the commercial sector as the activity related to trade, finance, real estate services, public administration, education and commercial services (including tourism).

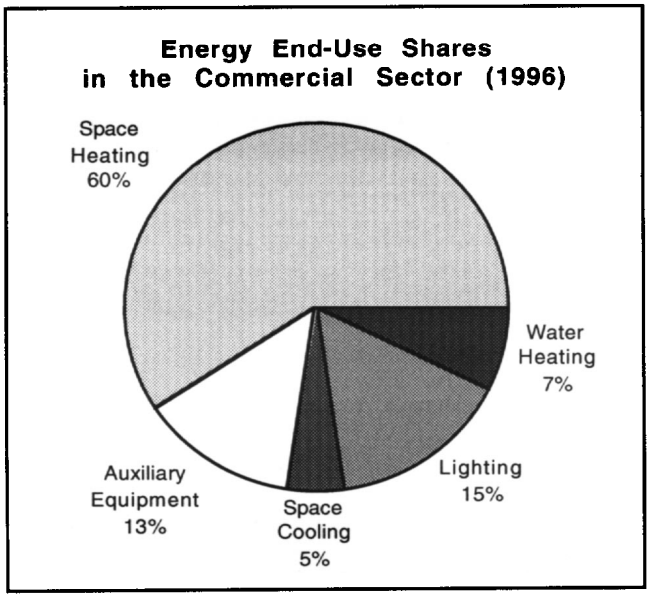



**Figure 1**

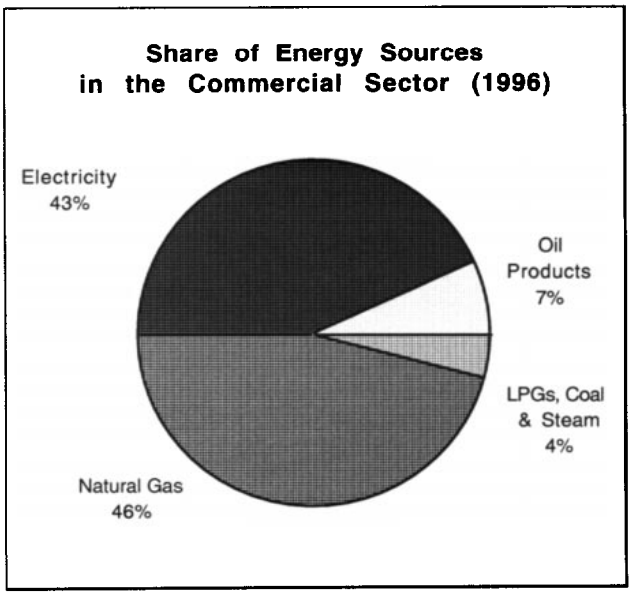



**Figure 2**

Sources: Natural Resources Canada

In 1996, about 3000 construction permits were issued, mostly in the non governmental sector, for projects valued at $250,000 or more[1]. The total value of these permits amounted to approximately $3 billion[2]. The levels of construction in the general retail trade and services, hospitality, and

1 Statistics Canada, Catalogue 64-001.

2 Statistics Canada, Catalogue 64-001.

restaurants have increased over the last few years while the commercial office construction levels have declined to a very low base. It has been estimated that the energy intensity of new office and retail buildings constructed under the current practice is 50% lower than that of he average existing stock of such buildings[3].

## Program Space

Current design practice in the commercial sector varies from region to region across Canada and between segments. Figure 3 indicates a 34% difference between the highest and lowest energy intensity for new small offices (i.e. between Montreal and Vancouver, respectively). It also shows the varying relationship to the levels resulting from the application of the MNECB. Moreover, there are some segments of the commercial sector, such as high rise office and retail buildings, in which the current practice is reported to be 10% more efficient that MNECB. In the high rise office segment this would be energy use of about 25kWh/m$^2$(2.32 kWh per ft$^2$) per year[4].

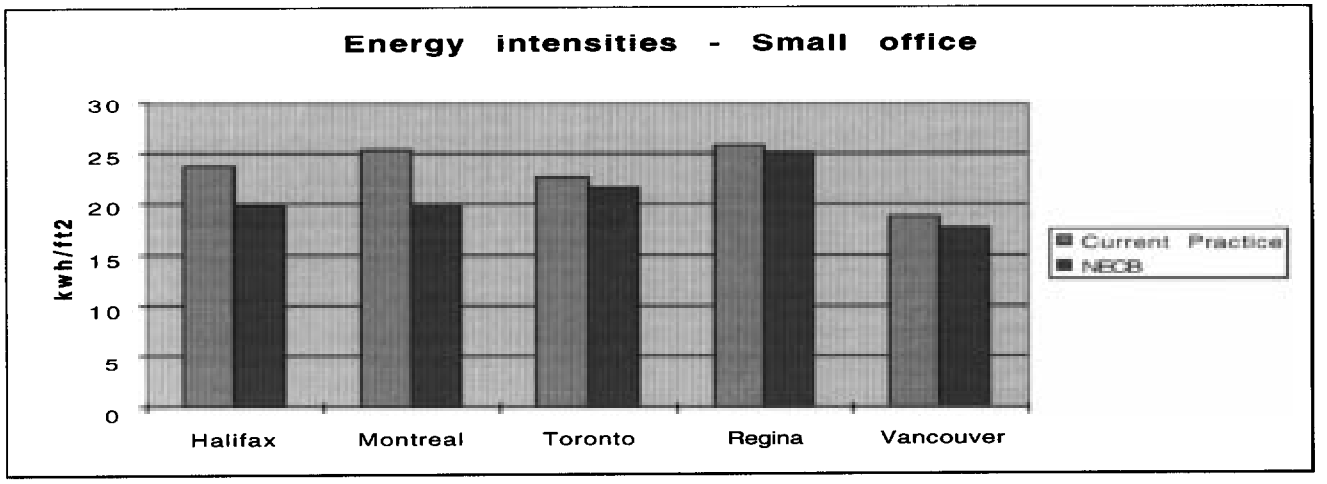



**Figure 3**

The experience of utility demand side management programs and departmental R and D and advanced construction efforts in this area suggests that significant potential improvements exist at cost effective levels. A fundamental lesson from these programs has been the importance of communication between owners and design disciplines: architectural, mechanical and electrical, at the earliest stage possible in the design process. In some instances significant savings have been effected with no appreciable increase in capital costs due to downsizing opportunities in the HVAC plant and

3 This number has been obtained by comparing 1996 stock energy intensities published in NRCan's publication entitled: *Energy Efficiency Trends in Canada 1990-1996* (May 1998) with the energy intensities of new buildings included in the following report prepared for NRCan: *New Commercial Construction Baseline Specifications for CBIP*, Marbek Resources Consultants (December 1997).

4 New Commercial Construction Baseline Specifications for CBIP, Marbek Resource Consultants, December 1997 for NRCan

distribution systems.[5]

At the other end of the technology adoption spectrum NRCan and others have devoted significant effort and resources to the development of the MNECB. Six years of research and consensus code development through the National Research Council of Canada culminated in its publication in September of 1997. The MNECB provides thermal requirements that are life cycle cost justified on a regional basis in both a prescriptive, trade-off and performance version. It is intended to provide a floor for Canadian construction practice in the commercial sector.

Given the availability of significant efficiency potential, the existence of basic program infrastructure in the sector with the Code and R and D efforts and the government's commitment in the 1997 federal budget to explore new measures in this sector, NRCan turned its attention to determining the nature of appropriate initiative for new commercial buildings.

## Program Development

Previous consultations (in 1996) had indicated interest in the use of an economic instrument for a program focussed at the design stage. It was determined because of the likely level of funding, the existence of well defined influencers in the design community, and the potentially large impact that the design phase would be an attractive pressure point. While incentives can distort price levels it was thought that the direct involvement of the building owner in controlling design costs would help to minimize perverse effects. As well, energy efficiency at the design stage was felt to increase the chances of effecting permanent change in building practice as compared to the often transitory impact of product based incentives.

The 1996 Federal budget raised the question as to whether or not investments in energy efficiency and renewable energy were disadvantaged in the Canadian economy. The Finance Minister asked his department and NRCan to lead a round of consultations to identify impediments to investment in energy efficiency and renewable energy and to examine tax and other options for overcoming these impediments. Discussion papers were generated, submissions received from 22 intervenors and meetings were held involving numerous participants.

A great deal of attention was given to adjusting the capital cost allowance rate (CCA) for energy efficiency and renewable energy assets and the use of tax credits to encourage such investments. The CCA rate is the rate at which an asset can be depreciated for income tax purposes. The premise was that the current CCA rate at 4% was longer than the lifetime of many of the assets and therefore discouraged investment in energy efficient equipment. Suggested non-tax measures included expansion of the information, regulation and voluntary programs currently delivered by NRCan. The view was also expressed that the new approach should be systemic rather than focussed on individual products, services or technologies. In the 1997 federal budget the Finance Minister allocated $60 million over three years to address these concerns and asked NRCan to develop measures to that end for implementation in the 1998-99 fiscal year. In support of these activities in the commercial sector a survey of baseline construction practice in nine locations for five building types was conducted[6].

---

5 Interim Report on the C2000 Program, Nils Larsson, March 1996 for NRCan

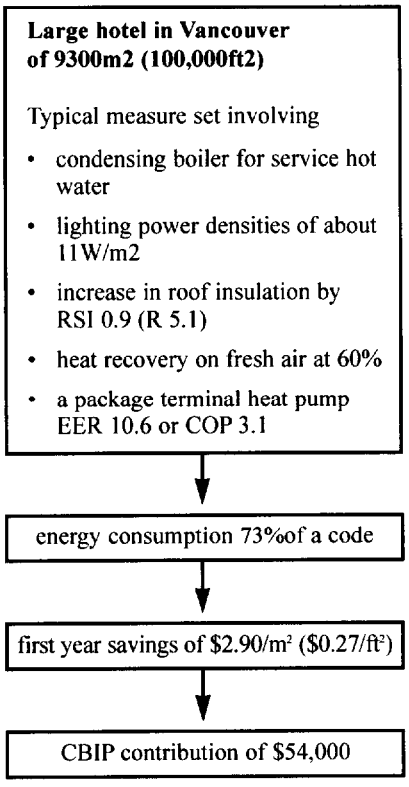
6 New Commercial Construction Baseline Specifications *op cit*

Existing literature on and interviews with those involved with new commercial building DSM programs were conducted. An econometric analysis of projected commercial sector activity was conducted that suggested renewed vigour in the market during the program mandate after several years of recession generated stagnation. Rebound in absolute terms was predicted to be modest given the low activity level in previous years and would take some time to develop. [7]

Subsequently, on the building performance side, thousands of hours of simulation were conducted to compare the effect of various hurdle rates. Program-compliant measures were developed for many building types, both to validate availability and attractiveness and also to develop prescriptive options for certain segments.

With respect to the fiscal incentive mechanism various options were discussed in the consultations, such as tax credits for the installation of efficient equipment and direct financial subsidy programs. Participants in the commercial building sector expressed a decided preference for a direct government program as the least complicated and most flexible approach. They felt this was paramount in a dynamic market such as the commercial sector. This view was also shared by Finance department officials.

A key issue that arose during program design was the amount of incentive that would attract the interest of the developers and designers and remain within the available funding for the program. As well there were questions as to the most appropriate qualifying rate that would both differentiate qualifying buildings (and regulate access to limited program funds) but not prove problematical to meet with existing technology and practice. Stakeholders clearly indicated that the initially proposed 35% better than MNECB and $30,000 incentive would not have the desired impact and the program was made easier to qualify for and richer. Stakeholders also expressed the view that the amount of incentive should be based on the savings.




## The Program

The objective of CBIP is to permanently change design practice in the commercial/institutional sector so that cost effective measures are specified in designs on a routine basis. Once the ease of applicability of these measures had been demonstrated then widespread adoption of the MNECB would be more likely. Eventually increases in the stringency of prescribed levels in subsequent iterations of the MNECB could be contemplated as market practice improved. CBIP, a $10 million per year program, slated to run 1998-2001, provides a federal contribution to the design costs of buildings that are constructed such that their annual energy use is 25% less than if that building were to be constructed to the requirements of the MNECB. CBIP contributes twice the value of the first years energy savings compared to the energy consumption

7 Tax Revenue Impact of a Commercial Building Energy Efficiency Tax Credit, DRI/McGraw-Hill, July 24, 1997 for NRCan

of the building if it were constructed to the requirements of the MNECB. The maximum contribution is $80,000. For situations in which replication is likely to be widespread recipients are limited to a maximum contribution of $1 million.

For buildings of less than 4650 $m^2$ a prescriptive path is offered by which owners can install a set of energy efficiency measures that have been predetermined to meet the hurdle rate. The contribution is then calculated based on the building's specific location and energy prices. This path was developed in recognition that the saving and thus contributions available to smaller buildings may not be large enough in actual dollar terms to offset the additional costs of demonstrating compliance through energy performance modelling.

In the food service segment the question arose as to whether or not process loads were to be included in the reference and design cases. The approach adopted was to leave that to the potential applicant. Modelling of process loads was considered to be less advanced that other loads and consequently an engineering justification was to be provided for savings in projects that included process loads. This approach will likely be used for other building types such as arenas.

Buildings larger than 4650$m^2$ must submit performance calculations which demonstrate that they meet the hurdle rate. The department is committed to deploying software that will provide a standardized user-friendly graphical interface and an energy performance engine equivalent to DOE 2.1 E. This software will be a derivative of software that is being developed by a national consortium to support the compliance function and performance path the MNECB. The consortium is comprised of NRCan, provincial energy ministries, and gas and electric utilities.

## Program Adaptive and Behavioural Impact

It is critical for the program to have a lasting impact For this reason significant emphasis has been placed on the deployment of training programs and workshops to familiarize the design community with the use of modelling techniques, efficient energy management techniques and practices and the program requirements. This effort will be focussed in the first year of program operation when take up rates are expected to be lower than in following years and funds are available. It remains to be seen whether or not a widely available energy design facilitation discipline will develop or the necessary skills and behaviours adopted by current professions. Efforts are underway to develop a tracking mechanism, likely a combination of surveys and focus groups to determine the impact on the propensity of designers to present energy efficient options to building developers.

Frequently, during the consultations the point was made that the incentive would do little to affect the behaviour of developers who did not occupy the premises and pay the energy bills. For this reason the program intends to implement a commercial building labelling scheme. Earlier research has indicated widespread interest by tenants if such a scheme were to exist, especially if it incorporated broader environmental parameters. It is expected that a recognition program may help leading edge developers to market the superior performance of their buildings to prospective tenants and, given adequate promotion, help to move the market. The criteria for participation in the labelling component may well include adherence to a standardized commissioning protocol and commitment to building operator training so that the important impact of those practices is recognized. In the same vein an awards program, managed by the Office of Energy Efficiency, is contemplated to recognize and promote the program.

Finally, a mark of program success will be the eventual adoption of the MNECB in major markets across Canada. This will also signal the start of a re-evaluation of the prescriptive requirements of the MNECB from the perspective of both the general stringency and compliance rules.

## Program Performance and Monitoring

Commercial energy use data are observed data published by Statistics Canada under the commercial and other institutional and public administration categories. However, there is no commercial energy use data available by building type and by end-use. This data is estimated using NRCan's commercial energy end-use model. As the department designed CBIP, a data collection strategy was also established to address this important lack of data. The goal of the strategy was two fold:

- improve NRCan's analytical capabilities to baseline the performance of the Canadian building stock and monitor its evolution; and,
- monitor the impacts of the new commercial building program on energy efficiency improvement and its indirect impact on the overall commercial building market.

In addition, the department will gather with a large scale survey reliable baseline data for new commercial buildings and the overall commercial building sector. The survey will allow NRCan to determine broader impacts of the program such as the indirect effects on new building practices and, hence, on overall commercial building energy use. Figure 4 describes the relationship of the program efforts to influence energy efficiency to the commercial building data development efforts and how the monitoring system will be used to determine the program outcomes and impact.

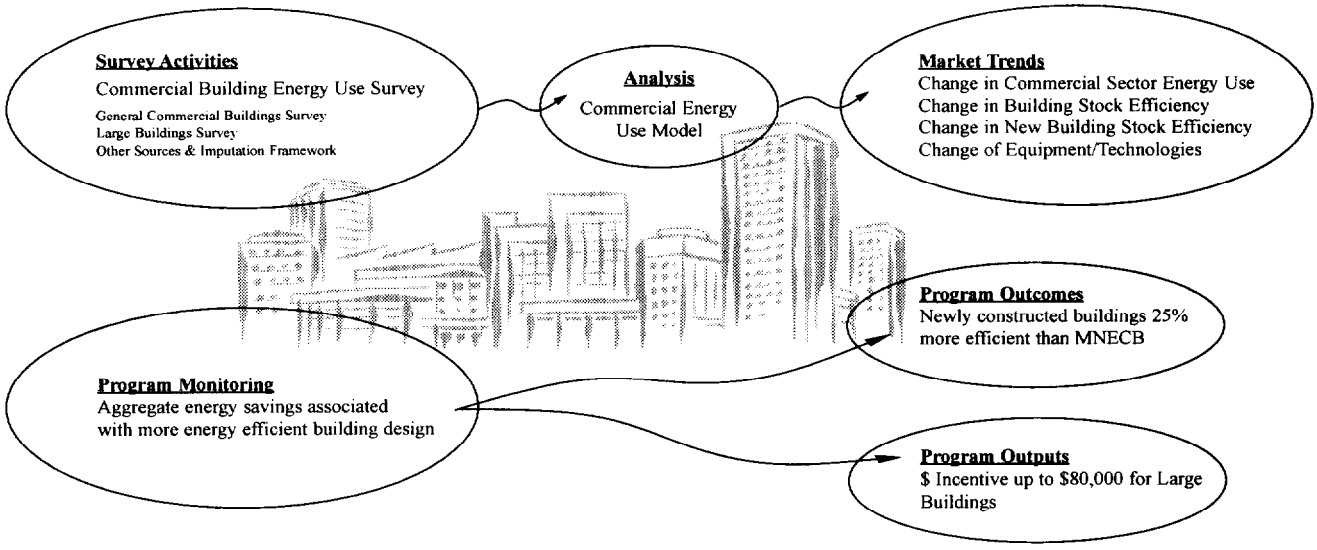



**Figure 4:** Relationship of the Program Efforts to influence energy Use and NRCan Data Collection Strategy

## NRCan's Commercial Sector Data Collection Strategy

In 1995 NRCan launched the Canadian Commercial Energy End-Use Data and Analysis Centre

(CCEEDAC), at McMaster University, expressly to analyze existing commercial sector data. These analyses confirmed the deficiencies in the data and helped to prioritize data requirements. The ultimate requirements of NRCan's data collection strategy (in order of priority) are to:

(i) Provide accurate overall segment energy intensities (i.e., total energy use per square foot of floor space per year for each energy source within each market segment) by energy source (i.e., gas, electricity, oil and other fuels) at the national level.

(ii) Provide accurate energy end-use intensities by segment by energy source at the national level (e.g., energy consumed for space heating and cooling, water heating, lighting, ventilation, office equipment, other).

In the United States, the energy Information Administration (EIA) of the Department of Energy, has developed and conducted the Commercial Buildings Energy Consumption Survey (CBECS) which examines the physical characteristics, energy using equipment and energy consumption of a sample of some 6,000 buildings. However, no equivalent resources exists in Canada to describe the commercial sector.

In mid-1996, NRCan funded a study to undertake a feasibility of implementing a data collection strategy for the commercial sector. The study proposed a conceptual design that responds to these objectives and has the potential to be implemented nationally, while recognizing the more severe department's budget constraints that those applied to the US study[8]. After the announcement of CBIP the department added a new requirement to the strategy so as to provide a reliable baseline for the new program. The study recommended that two closely related surveys be undertaken. The first survey will develop a statistically valid, stratified, random sample of the stock of commercial buildings in Canada and gather information on energy intensity data (by fuel source) at the building type level and the second one will gather energy intensity at the end-use level for large buildings.

The latter survey will obtain data from Building Service Companies (BSCOs) and building Energy Services Companies ( ESCOs). For some buildings in the stock survey, BSCOs are expected to provide equipment inventories, and possibly floorspace and other information in sufficient detail to allow an energy modelling program to determine energy end-use intensities. The model will also require annual energy utility data. ESCOs are expected to provide energy end-use intensities for some segments. They may also provide data similar to the BSCOs on specific buildings, and may even have energy end-use intensities for those sample buildings.

The project will also implement a detailed review, testing for accuracy, and collection of alternative databases from other sources such as governments, utilities, association and regional or local BSCOs which may provide complementary information. To make full-use of such data, the study plans for a conceptual design and development of a repository database which integrates data from both surveys and from alternative data sources. Data gaps will be identified and where appropriate, modelling techniques used to impute missing values and to develop energy intensity and energy end-use intensity estimates.

The two proposed surveys will be pilot tested to finalize the full scale survey approach and methodology by the end of summer of 1998. This study will provide the sample, field-ready

---

8 The results of this work is reported in a document prepared by ARC Applied Research Consultants and Engineering Interface Limited in June 1997 entitled: ***A Detailed Strategy for Commercial Sector Data Collection in Canada***.

instruments and a detailed schedule and cost estimate for the first national stock survey, the 1998 Commercial Building Energy Use Survey (CBEUS). Plans are to conduct the survey in November 1998.

Although the project presents a number of complex challenges (such as the development of an efficient sample frame), this new survey has the potential to yield a cost-effective study that will set a new standard for the accuracy and the validity of data in the commercial sector. Initially largely inspired by the US survey, the current data collection strategy proposes an alternative approach for the design and the implementation of a complex survey that have few precedents. It will require close coordination of a wide range of technical skills and scientific specialities, integrating the results into a single product. Close coordination will be critical to ensure optimum data collection in each component and integration between each component, ensuring that modelling concerns are addressed at all points in time.

Two years after this first stock survey in 1998, NRCan plans to complement CBEUS by conducting two trend surveys on new buildings and the retrofit of existing buildings. These surveys will allow the assessment, before completion of the CBIP program, of major energy efficiency trends. Monitoring is expected to continue beyond the termination of the financial incentive as the program's influence on building practice is expected to continue beyond its existence.

## Conclusions

At time of writing experience with the program is so limited that estimates of program effectiveness are premature. Considerable flexibility is built into the program and the possibility exists for re-evaluation of hurdle rates, incentive levels and eligible building types. The program is committed to expressly consider the inclusion of multiple unit residential buildings in its second year. They were initially excluded due to uncertainties on appropriate hurdle rate and the fact that it is a highly active building segment which might exert revenue strains on the program.

Early experience suggests that hurdle rates that vary across the country may be desirable. Although this prospect raises some marketing and communication questions for a national program, current practice appears to vary regionally. Thus, in some regions complying with the incentive hurdle rate is easier than in others. This effect is somewhat mitigated by using the regionally sensitive MNECB as the baseline.

An intractable problem appears to be the time lags that occur in moving a project from conception to construction. This is especially true in high rise commercial construction with complex financing regimes, extensive permit and infrastructure requirements and alternative calls on capital resources. Coupled with split incentives this segment is clearly the most problematic.

## References


ARC Applied Research Consultants for Natural Resources Canada, *A Detailed Strategy for Commercial Sector Data Collection In Canada*, June 1997

Canadian Commercial Energy Use Data and Analysis Centre (CCEEDAC) - University of McMaster, *Commercial Sector Energy End-use Data in Canada: Recommendations for a National Data Collection Strategy*, October 1995

Canadian Commission on Building and Fire Codes, National Research Council of Canada, *Model National Energy Code for Buildings,* September, 1998

Caneta Research Inc., Memorandum to Natural Resources Canada, *Revised Current Practice - Small Office - Halifax, Montreal, Toronto, Regina and Vancouver*, March 19, 1998

DRI/McGraw-Hill, *Tax Revenue Impact of a Commercial Building Energy Efficency Tax Credit,* July , 1997.

Markek Resources Consultants for Natural Resources Canada, *New Commercial Construction Baseline Specifications for CBIP*, December 1997

Natural Resources Canada, *Energy Efficiency Trends in Canada 1990-1996*, Spring 1998.

Natural Resources Canada, *Interim Report on the C 2000 Program,* March, 1996

Statistics Canada, *Business and Trade Statistics*, Catalogue 64-001