

Canadian Industry Program for Energy Conservation: Improving Industrial Energy Efficiency in Canada

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ABSTRACT

Established in 1975 during the energy crisis, the Canadian Industry Program for Energy Conservation (CIPEC) is a unique, industry-government collaborative initiative that has evolved to meet the energy efficiency and climate change challenges faced by Canadian industry, with unrivalled success. In light of today's concerns about global climate change and greenhouse gas emissions, Canadian industry can point to CIPEC as having always been at the forefront of energy conservation.

In the fall of 2001, Natural Resources Canada commissioned a comprehensive study to determine the impact of the CIPEC program on changes in industrial energy consumption, using a 5-year time frame. Statistical analysis of the survey results reveals that CIPEC does influence the energy-related decisions of Canadian industry -- over the past 5 years, the increase in energy consumption among non-CIPEC participants was more than double that of CIPEC participants.

This paper describes the unique CIPEC model, outlines the program elements and discusses the impact CIPEC has had on industrial energy use in Canada.

Background

In April 1997, the Office of the Auditor General of Canada released a report assessing the quality of the performance information for the 16 market transformation programs delivered by the Office of Energy Efficiency (OEE), within the Canadian federal department of Natural Resources Canada (NRCan). These programs are aimed at influencing energy use in a specific end-use sector of the economy (i.e. residential, transportation, commercial, institutional and industrial).

The main conclusion of this 1997 report was that “*NRCan's current performance information, on both expectations and achievements, is not sufficient to determine the overall success of its energy efficiency initiatives.*” (Office of the Auditor General of Canada, 1997) In response to the findings of this report, and its renewed mandate to improve its program performance information, the OEE has been working on a means of better determining the impact of its programs on energy use in the targeted sectors.

In early 2002, the OEE conducted a comprehensive study of CIPEC program to distinguish quantitatively between the market effects¹ that are likely to occur naturally in the Canadian industrial sector (i.e., in the absence of any program efforts), and those likely to occur solely as a result of CIPEC program efforts. The key results of this research are presented herein.

¹ Changes in the structure of a market, or in the behaviour of relevant market actors, that leads to the increased adoption of energy efficiency technologies and actions.

What Is the CIPEC Program?

Established in 1975, CIPEC is a successful sector-based, industry-government collaborative initiative, managed by the OEE's Industrial Programs Division. CIPEC is a unique partnership between industry and government that promotes energy efficiency within Canadian industry as a means of reducing energy use per unit of production, thereby improving the economic performance of Canadian industries, and helping Canada meet its climate change objectives through reduced greenhouse gas (GHG) emissions.

Initially developed for the mining and manufacturing sectors of Canadian industry, CIPEC expanded its reach in 2001 to also include the energy producing and construction sectors. With the addition of 3 new sectors (Construction, Electrical Generation, and Upstream Oil and Gas), CIPEC's membership has grown to 25 sector Task Forces, covering 98 percent of secondary industrial energy demand in Canada and includes partnerships with 45 trade associations that represent more than 5,000 companies.

How Does CIPEC Work?

At the heart of the program lie the CIPEC sector Task Forces, each of which is made up of representatives from associations and companies engaged in similar industrial activities. The Task Forces act as focal points for identifying energy efficiency potential and improvement opportunities, establishing sector efficiency targets, reviewing and addressing difficulties and challenges, and developing and implementing plans and agendas for target achievement.

The overall strategic direction and leadership for CIPEC is provided by its Executive Board, which is made up of senior executives from sector-representative companies. By lending their time, vision and influence, Executive Board members create an effective channel to communicate the importance of improving energy efficiency and reducing GHG emissions at the company level.

The CIPEC Task Force Council, made up of the Chairpersons of the program's 25 sector task forces, operationalises the strategic direction identified by the Executive Board and co-ordinates the overall activities of Task Forces. The Task Force Council also provides a common forum for sectors to share ideas and recommend ways to address common needs. The OEE's Industrial Programs Division, is staffed by 19 people, who provide support for all CIPEC activities.

While CIPEC operates at the sector level, direct company involvement occurs through the Industrial Energy Innovators (IEI) component. Since 1995, almost 400 Canadian industrial processing companies have registered as IEIs, making a commitment to energy efficiency and supporting for Canada's goal of reducing GHG emissions. By participating in CIPEC and its program elements, IEIs learn of significant energy savings opportunities, receive valuable energy management products and services, and are given special opportunities to showcase their success in energy efficiency and support for Canada's goal of reducing GHG emissions.

CIPEC's Mission:

- Promote effective voluntary action which reduces industrial energy use per unit of production;
- Enhance industrial economic performance and competitiveness; and
- Help Canada meet its climate change objective (reduce GHG emissions to 6% below 1990 levels between 2008 and 2012).

What Are the Program Elements of CIPEC?

CIPEC offers a variety of resources and services to help Canadian companies become more energy efficient, cut costs, boost profitability, and become responsible corporate environmental citizens. In addition to holding regular Task Force meetings, CIPEC program elements include:

- Employee Awareness Kit and support for employee awareness activities
- Technical Information
- Energy Opportunity Guidebooks (many downloadable from the internet)
- Sector Benchmarking Studies and a web-site to access these studies and related information
- A series of 3 “Dollars to \$ense” energy management workshops offered throughout the year across Canada
- Success Stories & Case studies
- Innovative Financing Kit (including case studies)
- Bi-weekly electronic *Heads Up CIPEC* newsletter
- Energy Efficiency Audit funding

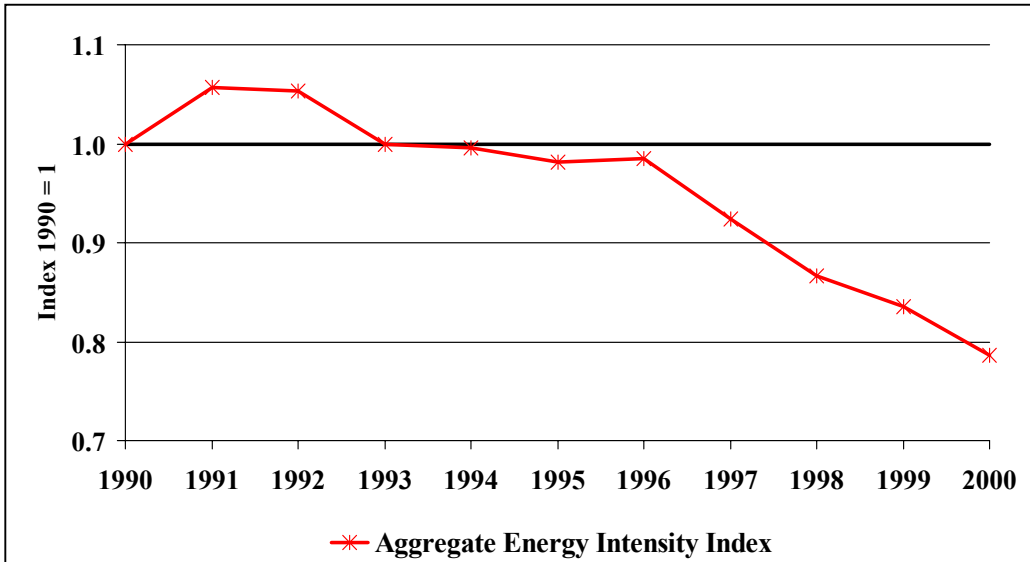
In addition to the elements listed above, two other NRCan programs work closely with CIPEC to promote industrial energy efficiency: the Industrial Buildings Incentive Program (IBIP) and the Renewable Energy Deployment Incentive (REDI) for Industry.

What Are the Aggregate Energy Use Trends of CIPEC Industries?

CIPEC has measured and reported on the energy intensity improvements of the industry sectors under its umbrella since the first CIPEC Annual Report was published in 1978.

Between 1990 and 2000, CIPEC industries posted an average energy intensity improvement of 2.4 percent per year (see Figure 1). Given that energy use by CIPEC industries grew by 13 percent between 1990 and 2000 and their gross domestic product grew by 44 percent, results show that CIPEC industries are becoming more energy efficient (Natural Resources Canada 2002).

Figure 1. CIPEC Aggregate Energy Intensity Index 1990-2000
Base Year 1990 (1.00)



Source: Natural Resources Canada. 2002

The average annual achievement of 2.4 percent per year exceeds the 1 percent per year energy intensity improvement target set by the CIPEC Executive Board by almost two and half times. Total energy saved by CIPEC industries during 2000 is equivalent to 95 percent of Canada's residential heating demand in 2000, which equates to approximately \$1.8 billion in fuel costs. Also, the energy-related GHG emissions of CIPEC industries were up 1.7 percent in 2000. Without the strong energy intensity improvements made by CIPEC industries, CIPEC energy related GHG emissions would have been 27 percent higher (Natural Resources Canada 2002).

The data used to generate these results are collected by Statistics Canada, and interpreted by the Canadian Energy End-Use Data and Analysis Centre (CIEEDAC) at Simon Fraser University in Burnaby, British Columbia. From the Statistics Canada data, CIEEDAC produces energy intensity indicators for each sector, based on energy consumption, production and GDP. The OEE and CIPEC continue to work closely with Statistics Canada and CIEEDAC to ensure measurement accuracy and acceptability of the data.

While the aggregate results indicate that effective energy management is having a positive effect on Canada's industrial energy intensity and GHG emissions, they do not tell us how much of that change is attributable to CIPEC program elements versus general market structure and behaviour of market actors.

Scope & Methodology

Discrete Choice Theory (DCT)-based methods were used to quantifiably estimate the improvements in industrial energy efficiency that occur solely as a result of the CIPEC program. DCT methodology was used because conventional impact analysis methods could

not readily assess the impact of CIPEC, due to the voluntary nature of the program. (POLLARA 2002)

Through a competitive bid process, NRCan commissioned POLLARA Inc. to conduct the research and analyses, in order to determine how CIPEC program elements (*independent variables*) impact indices of energy consumption change (*dependent variables*) over a 5 year period. Since such changes could be due to extraneous factors (such as weather, changes in production and size of business), the analysis eliminated the effects of such factors, to isolate the impact of the CIPEC program on energy consumption.

POLLARA designed the telephone survey questionnaire in consultation with senior CIPEC program officers and completed 1,223 telephone surveys to a randomly selected sample of companies who do, and do not, participate in the CIPEC program. Participation was defined as taking advantage of any of the CIPEC program elements, from receiving a *Heads Up CIPEC* newsletter, to attending one of the Dollars to \$ense energy management workshops. Non-participants represent the Control Group (i.e. those that have not actively participated in program components) and Participants represent the Treatment Group (i.e. those that have participated). Accordingly, a sufficient number of participants (450) and non-participants (773) were surveyed to produce meaningful (i.e. reliable) results.

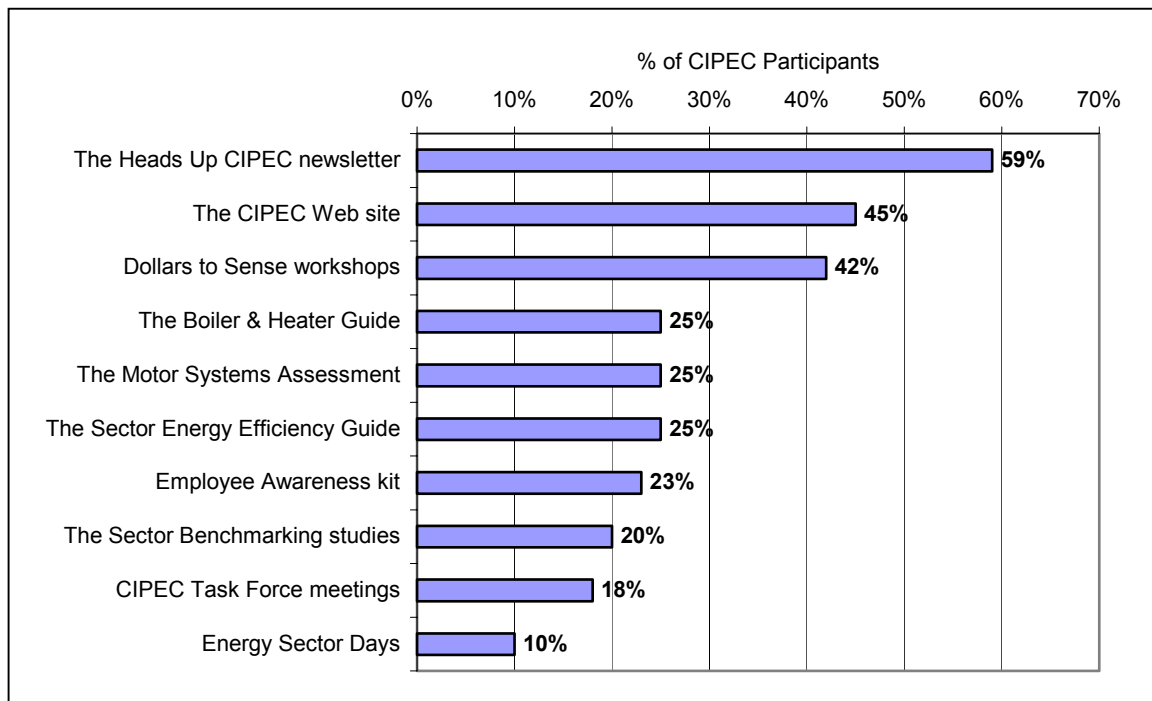
For a more in-depth understanding of the DCT methodology used to measure the impact attribution of CIPEC, readers are referred to the paper "*Estimating the Impacts of Voluntary Programs: Results from a recent study in the Canadian Industry Program for Energy Conservation (CIPEC)*" being presented in Panel 6 of this conference Data, Analysis and Modeling.

What Were the Characteristics and Energy Consumption Behaviour of the Firms Surveyed?

Overall it was found that CIPEC program participants use energy management tools such as literature, workshops, plans and audits more often than by non-participants. While 42% of CIPEC participants make use of such tools "frequently", this is true of only 14% of non-participants. Only 6% of participants indicated that they do not use energy management tools at all, compared to 23% of non-participants (POLLARA 2002).

- *Heads Up CIPEC* is the most-used element of the CIPEC program (Figure 2). It was revealed that 60 percent of readers tend to read the newsletter at least once per month, 27 percent read it "several times per year" and the remaining 12 percent either indicated they read it annually (9%) or that they did not know (3%).
- The Dollars to \$ense workshops engender positive steps toward energy efficiency among CIPEC program participants. On average, 3 employees per firm, among participating firms, have attended a workshop. The activities most often implemented by a majority of participants following a workshop are: facility energy demand profiles (63%), meter point records (60%), identification of an energy management team (59%) and energy use inventories (53%). Motor loading evaluations (47%), leak detection for air compression systems (47%) and electrical and thermal equipment inventories (45%) are reportedly undertaken by a near majority workshop of participants.

Figure 2. CIPEC Participants – Incidence of Participation in CIPEC Program Elements



Source: Pollara Inc. 2002

- CIPEC program participants (50%) were far more likely than non-participants (14%) to have undergone an energy audit by consultants in the last 5 years. The low incidence of energy audits among CIPEC non-participants can be partially explained by lack of use (and perhaps lack of awareness) of third party funding.

Before assessing changes in energy consumption for the entire firm/facility surveyed, a series of questions was asked to determine changes for specific energy systems. Not only did such questions serve to provide system-specific information, but they were also used as a means of preconditioning respondents to consider all components of their facility prior to responding to questions concerning their facilities in total (POLLARA 2002).

- Running production machinery and building HVAC are by far the most prominent uses of energy. Not surprisingly, electricity and natural gas are the most commonly and heavily used sources of fuel. Electricity represents over half of energy bills for 43 percent of firms. In all, 93 percent of firms use electricity. Natural gas constitutes over half of energy consumption for 16 percent of firms and in all 66 percent of firms use natural gas. While almost a third of firms use propane (35%) and diesel (30%) these fuel sources generally constitute less than 25 percent of the energy bills among firms that use them.
- A clear majority of respondents indicated that they have lighting systems (96%), building HVAC systems (92%) and production machinery (83%). Slim majorities

have compressed air systems (56%), motor drive systems (55%) and water systems (52%). Fewer have boiler plant systems (35%), process furnace systems (33%), refrigeration systems (27%), and process drying systems (26%).

- Non-participants have had higher average increases in energy consumption over the last five years compared to CIPEC participants for all ten systems examined. In fact, CIPEC program participant energy consumption on average has declined for water systems (-0.6%) and boiler plant systems (-1.0%). The energy consumption among all firms for other systems has increased, although the increase is significantly lower among CIPEC program participants.
- While there is no significant difference between participants (48%) and non-participants (55%) in the percentage that have had increased total facility energy consumption, participants (25%) were significantly more likely to report decreased consumption than non-participants (8%). Moreover, while 80% of non-participants report total energy consumption as being the same (35%) or higher (55%) than 5 years ago, this is true of only 64 percent of participants.

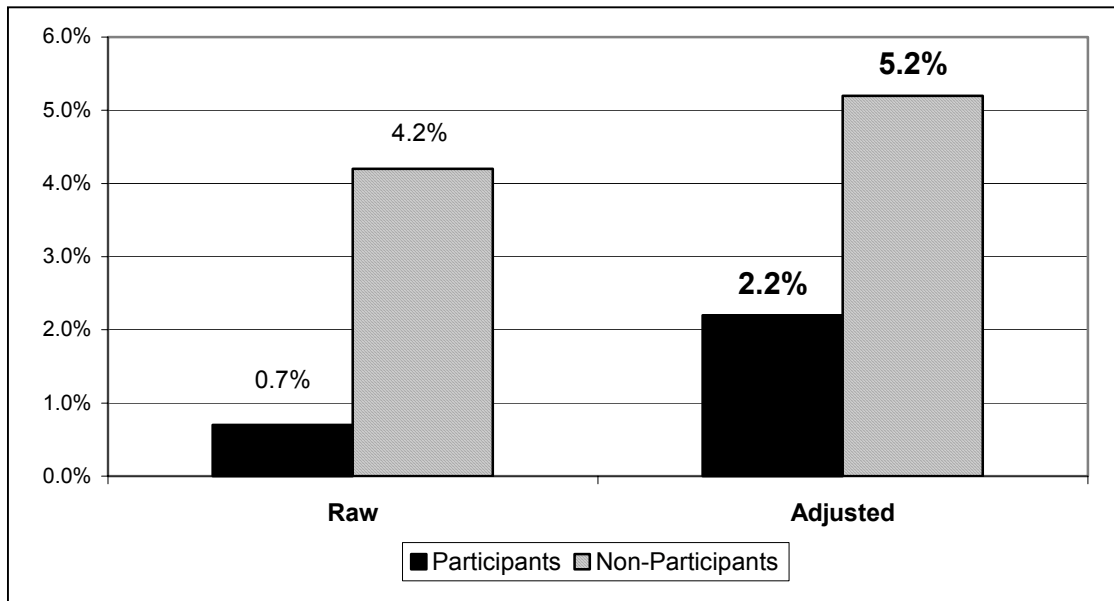
Conclusion: What Is the Impact of the CIPEC Program on Changes in Industrial Energy Consumption?

POLLARA's analyses revealed that the CIPEC program has reduced industrial energy consumption over the last 5 years. Figure 3 shows that before extraneous variables were removed (raw) CIPEC program participants have had an average increase in energy consumption of less than 1 percent (0.7 percent) over the last 5 years, whereas non-participants show an increase of 4.24 percent. After the effects of extraneous factors are removed (e.g. weather, changes in business size and production), the *adjusted* mean 5-year change in energy consumption among CIPEC program participants is an increase of only 2.2 percent, which is 2.4 times lower than the adjusted mean increase of 5.2 percent among non-participants (POLLARA 2002).

This study confirms what has to date been mainly anecdotal evidence -- that participation in CIPEC improves reduces a company's energy intensity thereby helping them cut costs and increase their profitability. Its ability to instigate positive change was affirmed when India chose the CIPEC model as the basis for the Indian Industrial Program for Energy Conservation (IIPEC).

While the nature of CIPEC has evolved to meet the changing needs of the Canadian industrial sector, its mission remains the same: to promote, encourage and foster energy efficiency improvements and GHG-emissions reductions in partnership with Canadian industry. CIPEC has long been regarded as the role model for successful business-government partnerships in Canada. CIPEC's success is built on the proven belief that improvements in energy efficiency go hand-in-hand with a sound strategic business plan, and that by working together, industry is helping to create a stronger economy and a cleaner environment through energy efficiency.

**Figure 3. Mean 5-year Increase in Energy Consumption
Participant vs. Non-Participant**



Source: Pollara Inc. 2002

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