# Program Delivery for Canadian Industry: A Systematic Approach to Improving Industrial Energy Efficiency

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## ABSTRACT

A nation-wide, comprehensive study to assess the needs of Canadian industry in pursuing energy efficiency was recently commissioned. The results of this groundbreaking research are currently being used to deliver a market-based program on energy efficiency, and to develop Canada's industry sector strategy on climate change.

Key research findings, and approaches for ongoing comparative benchmarking applications, and program evaluation and evolution will be addressed in this paper. The results of the research will be discussed in the context of several questions that are critical to effective program planning and strategic company positioning. These include:

- How can a program agency help shift the industry sector to higher energy efficiency performance?
- What are the principal barriers, drivers and needs to pursuing energy efficiency?
- How does a company institutionalize an energy efficiency culture so that it is a fundamental part of an organization's behavior, technology choices and manufacturing practices?
- How can a company accurately measure its own level of energy efficiency leadership using a set of national standards?; And how can these national standards be a useful adjunct to program design?

These questions will be addressed by reviewing two phases of empirical research that were conducted in 1999 and 2000, obtaining research from all of Canada's mining and manufacturing industries. Phase I focused on identifying the principal industry needs, drivers, and barriers to pursuing energy efficiency, and expectations of government programs, as voiced by industry. Phase II involved the statistical development of a set of energy efficiency performance scales that can be used for ongoing program evaluation and broad-based company benchmarking.

In profiling results by region, the position of the respondent (Chief Executive Officer, Chief Financial Officer, and Energy or Technical Manager) and by company size, a series of sophisticated cross-segmentation analyses were developed. These results will be used to show how a solid understanding of target markets is essential for streamlined communications plans, niche marketing strategies, and effective program design. A further analysis of population subsets revealed a comprehensive set of scales for measuring a company's level of energy efficiency leadership. These scales, and their specific applications will also be presented.

As Canada's first in depth industry sector research of its kind, these findings and their applications offer unique insights into the market-based approach for energy efficiency programs and climate change strategies.

## Background

The Office of Energy Efficiency (OEE)'s primary framework for engaging industry is through the Canadian Industry Program for Energy Conservation (CIPEC). A successful model for government-industry partnerships in Canada, CIPEC's network includes 38 trade associations that represent more than 3,000 companies and approximately 90 percent of secondary industrial energy demand in Canada.

After 25 years of voluntary action on energy efficiency, CIPEC boasts many achievements. Among them is a decrease in the mining and manufacturing sectors' energy-related carbon dioxide emissions from 1990 to 1999. While GDP grew by 31.5% during the same period, CIPEC's direct net GHGs emissions from energy use for 1999 were 1.9% below 1990 levels. This success is largely due to changes in fuel mixes (electricity and biomass and other renewables are considered to be GHG neutral); changes in structure and improvements in efficiency. CIPEC industries have also seen an average annual improvement in energy intensity of 2% from1990 and 1999.

The 23 sectors now participating in CIPEC set energy efficiency targets, report and track progress, and execute action plans for reaching their targets. The task forces provide a forum for identifying common sector needs in such areas as energy-management planning, technical information, financing, training and employee awareness. The OEE works in conjunction with the task forces to develop appropriate services to satisfy these needs.

*Industrial Energy Innovators* (IEI) is a voluntary, company-based initiative in which participants formalize their commitment to energy efficiency. Industrial Energy Innovators turn CIPEC sector targets into action. In return, companies learn of significant energy savings opportunities, receive valuable energy management tools, and are given special opportunities to showcase their success in energy efficiency and commitment to environmental stewardship.

## Purpose

In 1999, an Industry Sector Market Research Study was instituted to obtain objective, strategic information to help the Industrial Program of Natural Resources Canada (NRCan)'s Office of Energy Efficiency build a three-year business plan. Specific project goals included identifying the principal market needs, drivers, and barriers to pursuing energy efficiency, and the industry's expectations of government programs. Through a competitive bid process, NRCan commissioned SRP Management Consulting Associates (SRP) to conduct the research and analyses, and provide the Industrial Program with recommendations.

Four central questions on energy efficiency progress, drivers, barriers and needs were established to set the primary framework for further investigation. From this research, NRCan's Office of Energy Efficiency (OEE) gleaned information on the behavioural, cultural, organizational, financial and technological aspects of energy efficiency improvements. These findings also led to a second phase of research conducted in 2000, Energy Champion: Performance Profiling. Through the Energy Champion: Performance Profiling work, SRP Management Consulting Associates helped the OEE's Industry Program define a series of scales against which to measure a company's energy efficiency performance. The 1999 market research and Energy Champion: Performance Profiling of 2000 are currently being applied to

OEE service refinement and new program design for industry. In particular, the results of this research are reflected in the industry measures identified in Canada's Climate Change Action Plan 2000 on Climate Change.

## Scope

A detailed study of the mining and manufacturing sectors has furnished a great deal of data relevant to each of the project goals. SRP conducted interviews with approximately 800 companies across Canada, a truly representative sample of the industry population.

The results of the study are rich in both nature and depth. The research addressed the fundamental questions of market needs by evaluating the broader concepts of organizational energy efficiency commitment, corporate priorities and barriers to energy efficiency, in addition to specific technological achievements and informational needs.

The research spanned all industrial mining and manufacturing sectors throughout Canada, profiling results by region, by the position of the respondent (Chief Executive Officer, Chief Financial Officer and Energy or Technical Manager), and by company size.

Information obtained through extensive segmentation analyses reveals new opportunities for the Industry Program business plan. The Office of Energy Efficiency is currently using the results to evaluate its existing industrial energy efficiency programs, and to continue to align its services with market needs. Many of the key findings can also help industrial companies compare their own performance with industry at large. In particular, Phase II of the research helps define an organization's progress toward energy efficiency relative to that of industry at large.

## Methodology

NRCan's Office of Energy Efficiency purchased access to a database of 11,500 firms within Canadian mining and manufacturing industries to permit SRP Management Consulting Associates to construct a comprehensive sampling framework. SRP organized the data by region, company size, Standard Industrial Classification (SIC) code, and constructed a stratified matrix which conformed to the national profile of Canadian industry. The purchased data was supplemented using an existing database of NRCan's registered Industrial Energy Innovators for the purposes of developing comparative data for internal review.

The sampling frame involved manipulation of the purchased database to organize the information by region, company size and Standard Industrial Classification (SIC). This provided a sampling framework of 11,476 firms with over 20 employees, covering 24 different SIC codes, and all regions of the country. The final sample size included 790 respondents creating a sampling framework that accurately represents Canada's industry population. The results are statistically valid at a 95% confidence level ± 3.5%.

A questionnaire was developed by SRP in close consultation with the OEE's Industry staff. The questionnaire was pre-tested and modified for quality control prior to carrying out the field work. Telephone consultations were conducted by SRP, and results were coded, keyed and analyzed using SPSS software.

Analyses explored regional segmentation, company size segmentation, and position in a corporation. In addition, Phase I of the Market Research identified that champions of energy efficiency make up approximately 22% of the Industry population. This permitted SRP to conduct a gap analysis between leading energy efficiency "Champions" and companies less involved in energy efficiency.

These results suggested that it might be possible to profile a company's position along a curve of energy efficiency. This second phase of research is described under the heading, *Energy Champion: Performance Profiling.*

## Limitations

The results of this research are time-sensitive since the study focused on evaluating market trends in industry action on energy efficiency, barriers, drivers and needs. Industry responses on these matters will reflect current energy cost structures, economic growth, policy frameworks and regulations. As these and other factors evolve, so too will the barriers, needs and drivers that influence energy efficiency decision making within industry. The extent to which the data loose validity with time could only be verified by repeating similar research at a later date. No repeat research has yet been commissioned.

## Key Results

SRP's early analyses found that industry at large could be divided into two segment populations based on a company's energy efficiency accomplishments in the last five years. Of the total industry population, approximately 22 percent have achieved significant or extraordinary progress in energy efficiency, while the remaining 78 percent have achieved little. The 22 percent of leading energy-efficient companies are henceforth referred to as "Champions" while the remainder are referred to as "Other Companies".

Comparative study results for the two distinct population sets, "Champions" and "Other Companies" follow the general summary of findings.

## General Summary of Findings

SRP reported that the most compelling market driver and motivator was *Considerations of cost efficiency and marketplace competitiveness* or, put another way, *Save money, Increase profits.* With only a five percent lower magnitude of importance, *General organizational commitment to environmental responsibility* was the second most important market driver.

From a government support perspective, the needs of the Canadian industrial market, in order of respondent preference, are:

1. Information on regulations;
2. Information on demonstrated energy efficiency technologies, applied technical information and case studies;
3. Financial incentives and information on access to financing; and
4. Benchmarking & industry information exchanges, and industry-wide comparison information.

## Comparative Data: Champions in Energy Efficiency and Industry at Large

This section reveals how various industry groups answered a series of research questions related to the key drivers, motivators and needs, as well as progress, barriers to progress and energy efficiency measures that they plan to undertake in the next five years. Significant trends identified through the cross-segmentation analyses are presented here. In addition, key results of the gap analysis comparing the leading quartile of energy efficient performers and industry at large are described

*1. What are the key market drivers, motivators, and needs?*

Drivers and Needs. For all segments, "Considerations of cost efficiency and marketplace competitiveness" was considered the most important driver and "Concern about government-mandated energy consumption related emissions targets" the least important.

The West showed the largest gap by region between these two drivers while smaller firms showed the largest gap by size, and CEOs the largest gap by position. By comparing regional responses, our research found that companies in the West are least motivated by supports and rewards.

When comparing Champions and Other Companies, a shift occurs. Both Champions and Other Companies rated "Considerations of cost efficiency and marketplace competitiveness" as the most important driver. However, Champions rated "Government informational, financial, and organizational supports and rewards" as the least important, while Other Companies rated "Concern about government-mandated energy consumption related emissions targets" as the least important. This suggests that Champions are less motivated by "Supports and rewards" and more motivated by "Cost efficiency and competitiveness". This type of market segment information offers the OEE's Industry Program detailed insights for specialized program design.

Market Needs - Federal Government Information, Products and Services. When comparing Champions and Other Companies, Champions identified "Applied technical information", "Case studies", and "Benchmarking & industry information exchanges" as their - three strongest preferences. Other Companies identified "Applied technical information", "Case studies", and "Financial incentives" as their three strongest preferences. The three least attractive preferences in both groups were for "Public recognition", "Technical training", and "conferences and seminars".

Market Needs - Natural Resources Canada Support. When specifically addressing NRCan's support services, comparing Champions and Other Companies, both identified "Information on demonstrated energy efficiency technologies", "Information on regulations", and "Information on access to financing" as their three strongest preferences. The two least attractive preferences in both groups were for "Staff training", and "Employment assistance".

SRP's cross-segmentation analyses also enable the OEE's Industry Program to construct regionally sensitive program delivery methods and approaches. For example, on a regional basis, respondents from the West identified applied technical information, staff orientation / awareness information and financial incentives as their three strongest preferences for government supports. Respondents from Ontario identified R&D information, technical training, benchmarking and industry information exchange as their three strongest preferences. Therefore,

regional needs may be specifically addressed when allocating fiscal or staff resources to a particular region.

By comparing results on company size, our research found that a greater need for benchmarking and industry exchange distinguishes mid-sized companies and larger companies from smaller companies. Case studies were found to be more popular with smaller companies whereas applied technical information and financial incentives were needed by all groups.

It is equally important to note the least attractive preferences across all regions when designing a program or allocating resources: public recognition, technical training and conferences and seminars were the least preferred methods of government support. While this does not necessarily mean that these supports should be dropped altogether, it does suggest that a program agency must carefully identify niche markets for these types of services.

It is important to note that support needs are time sensitive, and reflect other influencing variables. Provincial regulations, energy costs, even trends in employment and human resource availability will impact the priority that industry places on a particular service at a given time. Through program evaluation, and a more comprehensive assessment of industry's energy profiling, the OEE's Industry Program is able to adjust program delivery and design to accommodate the evolving needs of industry. A standardized method for addressing these evolving needs and assessing program influence on shifts in energy efficiency performance is further discussed in the context of phase II of the research.

*2. What steps toward energy efficiency have industrial companies implemented in the past five years, and to what effect?*

An organizational gap analysis was used to differentiate between the leading companies and those companies that were new to the energy efficiency scene. Several factors distinguished these two classes of companies and led to the second phase of research – preparing a set of statistically validated national standards on energy efficiency measurement. Distinguishing factors included : a corporate plan on energy management was present within 54% of champions versus only 18% of companies; strong executive commitment for energy efficiency was identified among 85% of Champions versus only 53% of other companies. Other elements that were stronger with champions included programmes for rewarding employee participation in energy efficiency within the company, and the presence of energy efficiency targets. These and other variables were assessed for their statistical validity and greater level of detail in phase II – Energy Champion: Performance Profiling.

Measures. Both Champions and Other Companies identified "Lighting", "HVAC", and "Building envelope" as their three most common energy efficiency improvement measures, and "High efficiency boilers", "Heat pumps", and "Renewable energy" as their three least common measures.

Organizational activities. Both Champions and Other Companies identified " A strong executive commitment for energy efficiency", "A system for monitoring and tracking energy use", and "A system for reporting energy use" as their three most common activities. The two least common activities were "An individual champion or department of energy efficiency" and "A program for rewarding employee participation in energy efficiency within the company". The other activities identified as least common were "Participation in industry-wide associations and initiatives that address energy issues", by Champions and "A corporate plan regarding energy management" by the Other Companies.

Progress. Champions clearly felt they had made the highest level of overall progress (a 35 percent higher rating). Of those respondents reporting *at least modest progress*, Champions again reported the highest percentage of energy cost savings over the last five years (a 21 percent higher rating). There was less than a 2 percent variation between Champions and Other Companies in their response to using *targeted energy efficiency initiatives.*

Between 25 and 30 percent of the companies rated themselves above average in terms of energy efficiency when asked to compare themselves to other companies in their sector and to compare their sector with others at the international level. Fewer than 10 percent rated themselves below average on these issues. Of note, however, is the fact that over a third of the respondents had no opinion about their sector's international ranking, while only eight percent had no opinion on their company's comparative performance within their sector. Comparing Champions and Other Companies revealed some interesting differences on these two issues. In both cases, Champions were much more likely to rate their firm's energy efficiency commitment as "above average" (45 percent versus 19 percent) and to perceive their industrial sector as being above average internationally (45 percent versus 29 percent).

3. ***What are the principal barriers to enhanced energy efficiency that companies face?***

Both Champions and Other Companies identified "Insufficient return on investment" and "Lack of government or utility incentives to proceed" as their two most significant barriers to enhanced energy efficiency. The two least significant barriers were "Lack of appropriate or proven technology" and "Insufficient commitment by higher management". These barriers were consistent for the two population sets for both the last five years and the next five years and for most segmentation analyses.

Regional differentiation identified an additional barrier for Quebec respondents: Insufficient human resources devoted to and responsible for energy efficiency.

4. ***What future steps for improving energy efficiency do companies plan to undertake?***

Both Champions and Other Companies identified "Lighting", "HVAC", and "Change in production processes as their three most likely future energy efficiency improvement measures, and "High efficiency boilers", "Heat pumps", and "Renewable energy" as their least likely measures.

Results revealed additional regional variation, such as demand management in the Maritimes and changes in production processes in Ontario and Quebec. Examining the measures planned by industry within particular regions offers useful insights for awareness campaigns, information dissemination, and partnership development, particularly with regional governments and associations.

## Conclusion of Phase I Research

The two strongest drivers for all sizes of companies are:

- cost efficiency; and
- an organizational commitment to the environment.

The strongest barriers for all sizes of companies are financial in nature:

- insufficient return on investment;

- lack of investment capital; and
- lack of government financial incentives.

In spite of this, the industrial sector expects to achieve significant energy efficiency gains over the next five years.

It is clear from the results of this research that the industrial market is not homogeneous in terms of energy efficiency. Industry sector views and responses to the opportunities and benefits of energy efficiency, progress made to date and current and future needs, all vary by market segment. Furthermore, based on comparative Champions *and Other Companies* data, the adoption of an energy efficiency culture - the *institutionalization* of energy efficiency - involves attitudinal change throughout all levels of an organization.

Phase II, Energy Champion: Performance Profiling involved the creation of a series of scales to further define what it means to institutionalise energy efficiency in an organization. The research results and applications follow.

## Phase II, Energy Champion: Performance Profiling

Initial findings from the needs analysis suggested that it would be possible to develop a series of reliable scales against which to measure a company's energy efficiency performance. This section first identifies the characteristics of a company that institutionalises an energy efficiency culture into its organization, and then describes national standards of leadership against which a company can measure its own performance.

In summary, Champions:

- Place a greater emphasis on both marketplace competitiveness and environmental responsibility
- Are more likely to be aware of, have participated in, and be influenced by NRCan programs
- Are interested in a different package of information, products, and services (particularly public recognition activities, conferences & seminars, benchmarking, and industry information exchanges)
- Participate in a fuller range of organizational activities that enhance energy efficiency
- Rightly perceive themselves as corporate and industry leaders
- Employ a fuller range of energy efficiency measures
- Face a different package of barriers to energy efficiency improvements
- Are more likely to report having benefited from federal government support, and
- Highly rate the usefulness of each type of government support

Using the data compiled in Phase I, three sets of scales for evaluating a company's energy efficiency performance were established. By assessing a company's performance based on energy efficiency progress, organizational commitment, and measures implemented, it is possible to identify who the energy efficiency champions are. The next section describes the methodology followed in establishing scales against which to measure an organization's performance.

## Methodology for Establishing Performance Profiling

Using the original data sets, multiple analyses were conducted to streamline indicators of energy efficiency performance according to three broad categories: organizational progress, the organizational framework, activities or measures. The validity of the scales was tested by examining the correlation between qualitative and quantitative assessments of a company's energy efficiency performance.

Each level of performance reflects quartiles of the industry population from low (level 1) to high (level 4) energy efficiency performance. Each variable listed in the scales was assessed for its accuracy in predicting the level of an organization's performance.

The OEE now has at its disposal a survey formula to complete this assessment. The formula or questionnaire allows a company to be scored against the characteristics that tend to define an organization's level of energy efficiency progress.

Tables 1 to 3 that follow show what characteristics an organization tends to exhibit within each quartile of energy efficiency performance. These tables illustrate predicted organizational activities, measures adopted and government support needs for each company, based on its own performance.

Organizational activities: these 10 organizational frameworks assess the dimension of sustained commitment to improvements and changes in a corporate culture.

| Organizational Activities | Champion Levels | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Strong executive commitment for energy efficiency | | | | |
| A system for monitoring and tracking energy use | | | | |
| A system for reporting energy use | | | | |
| Participation in ISO quality assurance programs | | | | |
| A training system for enhancing staff awareness and practice of EE | | | | |
| Specified energy efficiency improvement targets | | | | |
| Purchasing criteria that recognize energy efficiency in suppliers | | | | |
| A corporate plan regarding energy management | | | | |
| An individual "champion" or department of energy efficiency | | | | |
| Participation in industry-wide associations and initiatives that address EE | | | | |

**Table 1. Organizational Activities Using Energy Champion: Performance Profiling**

**Measures adopted.** These 11 facility-based measures and process related actions assess a company's performance at project implementation to increase its energy efficiency.

| Measures Adopted | Champion Levels | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Lighting | | | | |
| HVAC | | | | |
| Change in production process | | | | |
| Compressed air or steam trap maintenance | | | | |
| Building envelope | | | | |
| Heat recovery | | | | |
| Demand management | | | | |
| Motor drive systems | | | | |
| High efficiency boilers | | | | |
| Fuel conversions | | | | |
| Renewable energy | | | | |

**Table 2. Measures Adopted using Energy Champion: Performance Profiling**

**Government supports.** This demonstrates how each level of energy efficiency performance corresponds to the use a company makes of government support services and the value of those services as perceived by industry. It is important to note that Champion level companies make the most use of all of the government supports listed here.

| Government Supports | Champion Levels | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Technical expertise | | | | |
| Information on access to financing | | | | |
| Information on demonstrated energy efficiency technologies | | | | |
| Information on regulations | | | | |
| Industry-wide comparison information | | | | |

**Table 3. Government Supports based on Energy Champion: Performance Profiling**

## Applications

The OEE's industry program is now well positioned to assess how well it addresses the barriers, drivers and needs for particular market segments within industry. In addition, these statistical findings can help the OEE assess broad-based industry performance, and evaluate shifts in the performance of a particular company or sector to higher energy efficiency performance. By comparing the shifts in industrial energy efficiency over time, it will be possible for the OEE's Industry Program to evaluate its own effectiveness in shifting the market toward greater energy efficiency.

**Specific applications of performance profiles:**

1. Benchmark any company's relative position on the dimension-specific scales
2. Track the progress of any specific company
3. Track the aggregate progress of the mining and manufacturing sectors
4. Target marketing and support resources to the specific needs and barriers of companies at specific levels of development

5. Provide a self-assessment tool for Industrial Energy Innovators

**Specific applications for Climate Change Strategies.** The Government of Canada's Industry Sector Strategy on Climate Change builds on the results of Phase I and II of the research. To address the barriers facing industry and to satisfy the services required from government, Natural Resources Canada is currently designing the following new services:

- A subsidized audit program: This will address the specific needs of SMEs by enhancing the awareness of specific energy efficiency opportunities, by providing information on demonstrated technologies, and by satisfying the demand for facility-specific information. Audits will also open the door to many non-audit related programs or spin-off projects in areas such as cogeneration, renewable fuels, fleet efficiency.
- Sector benchmarking: This will address the need for comparative data, and will further engage companies in a sector-wide approach to energy efficiency. Both technical and broad-based benchmarking reinforce the critical message of energy efficiency for enhanced competitiveness and productivity.
- Industrial Buildings Incentive Program: This program will offer funding for energy efficient design of new buildings and / or plant expansions. This measure will specifically address some of the financial hurdles which can otherwise prohibit energy efficiency measures from being implemented.
- Energuide for industry: A new labelling and standards program for industrial equipment, this measure will increase industry awareness, provide the data necessary for industry to make sound purchasing decisions, and enable the energy efficiency culture to permeate the organization.
- Expansion of CIPEC: By expanding CIPEC to all industry sectors, industry will gain a greater collective momentum toward energy efficiency, and acquire a heightened awareness of supplier-purchaser relationships, competitiveness and leadership.
- Awareness: A comprehensive climate change awareness program will help raise industry awareness of organizational and technical opportunities for energy efficiency and improved competitiveness. The program design will build on the niche market approaches identified in phase I of this research.

## Conclusion

The OEE's Industry program plays a central role in supporting individual companies as well as the sector level activities of the Canadian Industry Program for Energy Conservation (CIPEC). Assessing the barriers, drivers, and needs of industry is the cornerstone for effective program design for improving energy efficiency while enhancing productivity and competitiveness. This research has shown that industry needs are not equal across sectors, regions, or company size. A solid understanding of target markets is essential for streamlined communications plans, niche marketing strategies, and effective program design.

Clearly, a company must institutionalise an energy efficiency culture so that it is fundamental to the organization's behaviour, technology choices and manufacturing practices. A particular company's success in satisfying these three areas may now be evaluated using the OEE's Champion scales. However, these scales and other market research results are time sensitive. Therefore, effective program evaluation and evolution must be based on a comprehensive, periodic assessment of industry's needs. Evaluating industry's movement along the scale of energy efficiency offers a unique and useful approach to assessing program effectiveness.

Thanks to the statistical and program evaluation expertise offered by SRP Management Consulting Associates and the extensive participation of the Canadian manufacturing and mining sectors, the primary research objectives were met. Quality data acquisition, and the in-depth analyses included in this research bring new information to the Industry Program about specific market needs, population subsets, and significant trends. The Industry Program has already begun to apply the study findings to new and streamlined efforts aimed at enhancing industrial energy efficiency and marketplace competitiveness.

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