Industrial Energy Performance Indicator Reports

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ABSTRACT

The mandate for this work originated in December, 1996, when a joint meeting of federal and provincial Ministers of Energy and Environment, in addressing their responsibility to provide leadership on the Greenhouse Gases/Climate Change agenda, endorsed the following statement (#13 of 45 initiatives launched at that time):

> *"Industrial establishments will be provided with a confidential benchmarking report on their energy efficiency progress, including how they compare to national and international averages for their sector. Information will also be provided on energy management best practices in their industries."*

The goal of the initiative is to use information provided on the state of energy practice to prompt, motivate, and induce companies to implement further energy efficiency measures. And one premise underlying it is that useful guidance on the state of energy practice in a company can be obtained from existing data sources, primarily the Industrial Consumption of Energy (ICE) survey and the Annual Survey of Manufacturers (ASM), both products of Statistics Canada. In addition there are existing surveys which include energy consumption that are undertaken by associations such as the Canadian Portland Cement Association, the Canadian Chemical Producers Association, the Canadian Pulp and Paper Association, etc.

Since the commitment was made, Natural Resources Canada staff have undertaken a large amount of investigative and developmental work which will be presented. Existing data from three sectors, pulp, cement and fluid milk, has been analyzed and will be delivered with draft context and energy efficiency guidance notes to the management of about 100 establishments. The author will also be able to report on how this information was received by these managers, and on the recommendations that will have been collected from industry on the more specific nature and frequency of industrial energy performance reporting desired.

Introduction

Background

The term benchmarking is business school terminology for a formal process of surveying the competition and adopting the best practice, in terms of customer satisfaction, that is identified. Many benchmarking authorities claim that it is not possible to "energy benchmark", because the option that provides the greatest customer satisfaction may be more energy intensive.

If you accept that energy is a production input that can be benchmarked, rarely has that been done. The Benchmark Exchange (TBE; 1000's of companies in 41 countries, over half of the

Fortune 100 companies) lists 190 benchmarked topics, and energy is not among them.

A way of thinking about benchmarking which I have adopted was presented in a paper from Michigan (ITI, 1996). In benchmarking, the business and process issues covered must be measurable and thus they are called "metrics", and the paper defines two types of metrics, "performance" and "practice". **Performance metrics** are unambiguous measures of "increasing" or "decreasing" performance. Thus, greater value-added per employee, lower scrap rates, etc. are performance metrics and one knows whether increasing or decreasing values are better. Benchmarked metrics usually directly correlate with performance.

Practice metrics are ambiguous, while higher values may be better in some situations, they may not be so in others. Thus "energy costs per $100,000 in sales" is not always indicative of better or worse performance. That is, these practice metrics are naturally interpreted in light of other firms in the industry, specific manufacturing processes, or a particular business context. Each company can interpret its own benchmark measures based on its own special circumstances. Thus a low ranking for a practice metric may not concern management because of special circumstances known to them alone. Energy is, with rare exception, a practice metric.

Courtesy of earlier work done at the Canada's Office of Energy Efficiency (Saint-Pierre and Métivier, 1996), it was known going into this pilot project that the Canadian Standard Industrial Classification (CSIC) framework by which industries are grouped and compared has two significant characteristics which limit the exactness of comparative data from establishments within their respective codings.[1]

The first convention limiting the comparativity of data is that every industrial establishment is ascribed one CSIC code number which is that relating to the product of highest value produced at the establishment. This means that within one category, although the products are comparable, the degree of processing that occurs at the establishments may not be the same, and, further, that other products of lesser value may be produced there. Examples of this include pulp and paper operations which produce several types of pulp (TMP, kraft, etc) at one site, and establishments in the sugar and steel industries which may produce rather than purchase lime as an input to their processes.

The second convention is that the CSIC system was developed as a tool for trade monitoring and thus the classifications are those that are adequate for that purpose. This often mixes products which may have significant differences in their production energy requirements. An example of this would be CSIC 1011 - Meat and Meat Products Industry (Except Poultry) which combines the processing of beef, pork and lamb although each has inherently different processing and thus energy requirements.

These factors make this project one of exploration and guidance rather than a process of segregation and judgement. Also, given the survey fatigue of industry, NRCan has attempted, as a first step, to manipulate existing knowledge of industry in a way that can be of use to Canadian industry, and secondly, coincident with this initiative, to determine the degree of support for a more interactive, and doubtless more useful, energy "benchmarking" initiative.

A great deal can be learned from IBM's PROBE (Promoting Business Excellence) initiative which is being offered to Canadian businesses through a partnership effort with Industry Canada and the Alliance of Manufacturers and Exporters. It offers companies the opportunity to be benchmarked

[1] The Canadian Standard Industrial Classification system is currently being phased out as the North American Industrial Classification System (NAICS) is adopted.

against about 20 of the most comparable of 700 companies in an IBM databank. Major considerations identified by IBM in conducting this type of project were:

Companies have to be at an advanced state of management ability to benefit from benchmarking. The bottom 20-40% of companies in terms of management practices not only would not be interested in benchmarking, their management would feel threatened by an unsolicited assessment of their performance and they would make that known.

The "benchmarker" needs to know a great deal about the client company in order to make valid comparisons. Anything less than an on-site assessment and discussions with the implementers of the practices that are being assessed puts the efforts' credibility at risk.

Scope

In September, 1997, we solicited bids from consultants to assist us with a pilot project. Six proposals were received, and the successful bidder was a team consisting of Marbek Resource Consultants Ltd., Willis Engineering , and the Tellus Institute.

The purpose of the contract included to: 1) investigate and report on a methodology to prepare Industrial Energy Performance Indicator reports, which utilize the resources of Statistics Canada, Natural Resources Canada, CIEEDAC, and the CIPEC Task Forces and, 2) develop and deliver draft Industrial Energy Performance Indicator Reports for three Standard Industrial Classification (CSIC) code industrial groupings.[2] The candidate groups represented: a homogeneous energy intensive industry, e.g. steel, cement; a heterogenous energy intensive industry, e.g. pulp & paper, mining; and, a CIPEC Tier II (less energy intensive) industry, e.g. textiles or the dairy sector.

The main steps of the project were viewed as being:

to develop the methodology (tactical steps) necessary to implement the initiative as understood by the participating parties;

to undertake an assessment of what had been done internationally that would aid in the development of this initiative. Best practice studies have been done for a variety of industrial sectors by such agencies as NRCan's Energy Technology Branch (the Industry Targeted Program) the World Energy Council, United Nations, various laboratories of the United States Department of Energy, the United Kingdom's Energy Technology Support Unit (ETSU) at Harwell, and agencies of the governments of France, Switzerland, Germany, Australia and New Zealand.

to meet with the three target Task Forces and related associations to obtain advice on matters of detail to facilitate the implementation of the initiative; and,

to prepare a draft correspondence array for each of the three sectors.

Methodology

Selection of Pilot Sectors

As noted above, the objective of the study was to develop and test a methodology that is broadly applicable across most industry sectors. To test the approach, Canada's industrial facilities

[2] CIEEDAC, the Canadian Industrial Energy End-Use Data Analysis Centre, was created in 1993 at Simon Fraser University in British Columbia and CIPEC, the Canadian Industry Program for Energy Conservation, is a joint industry- government initiative dating back to 1975.

were organized into three groupings having the following characteristics:

- Group 1 - - Homogeneous product, energy intensive
- Group 2 - - Heterogeneous products, energy intensive
- Group 3 - - CIPEC Tier 2 (less energy intensive).

Following discussions between NRCan and the consultant, the following pilot sectors were selected:

- Group 1 - - Cement
- Group 2 - - Pulp
- Group 3 - - One of Dairy Products or Auto Parts

It was recognized that Group 3 types of industry provided a much wider scope and variability in conditions than experienced in the Group 1 and 2 industries. Consequently, it was agreed that the initial situation assessment activities would include both Group 3 candidates and that a recommendation as to which one to proceed with for the purposes of the initial study would be made at the conclusion of the background work. It should also be noted that selection of the Group 3 pilot industry sectors also required an assessment of whether the 3-digit or 4-digit SIC level was more appropriate. After review of the extent of product diversity at the 3-digit level, it was decided to proceed at the 4-digit SIC level. That is, the range of product diversity, and consequently plant and energy use diversity, found at the 3-digit level was felt to be too great to generate meaningful benchmark data suitable for plant-specific comparisons.

Following selection of the pilot sectors, the remainder of the project was organized into two further phases: A Situation Assessment; and, Methodology Development and Testing.

Situation Assessment

The Situation Assessment focussed on three streams of investigation. These were:

Canadian and International Review. There are a range of potentially complementary initiatives underway in Canada, the US and Europe that involve some form of energy indicators. Consequently, a review of these initiatives was carried out in order to seek possible "lessons learned" for application to this study. This review included both a literature search and discussions with personnel involved in these initiatives.

An Industry Needs Assessment. It was recognized from the study's outset that the benchmark indicators must provide information to industrial firms that is not only accurate and informative but also is presented in a concise format that will effectively promote industrial energy efficiency investments. Consequently, the situation assessment included personal interviews with a sample of the companies and their industry associations. The objectives were to establish industry's willingness to participate in an energy performance benchmarking process, to define the pre-requisite "benchmark indicator data characteristics" that would promote industry's active

participation and, to identify existing industry data sources suitable for the project.

Review of Statistics Canada ICE and ASM data. As noted in the introduction, it was recognized from the project's outset that Statistics Canada's (STC) existing ICE and ASM surveys, as well as existing industry association data, represented important potential data sources. Simply stated, ICE data could provide the numerator (energy) data and ASM could provide the denominator (output) data. Both of these data sets have been used extensively in the past by CIEEDAC for the production of sector specific energy intensity indicators for Canadian industry. However, these previous efforts have not included the generation of comparative, establishment-specific energy performance data nor has the format been defined for benchmarking purposes. Therefore, an assessment of the compatibility of these data sources and procedures with the demands of this project's objectives represented the second key stream of investigation.

Methodology Development and Testing

The Methodology Development and Testing also consisted of three principal areas of work.

Development of Draft Methodology. For each pilot sector, a proposed approach to data collection, report format and audience testing was developed and discussed with the targeted sector representatives.

Production of Prototype Reports. Sample Industrial Energy Performance Indicator Reports (IEPIR) were produced for each pilot sector.

Target Audience Testing: To further test the applicability of the Energy Performance Indicator Reports, the project team distributed the draft reports to a wide sample of personnel within each of the pilot industry associations as well as individual plants. In each case, copies of the draft IEPIR reports were provided to the industry personnel and brief, structured interview were held. The interviews sought industry specialists' views on three areas: the usefulness of the reports; suggestions for improving the content or format of the reports; and, the level of effort that each would be willing to contribute to data collection required to produce the reports.

Results

Review of relevant international benchmarking and indicator work

While there has been a significant amount of benchmarking and indicator work undertaken, not all of it is relevant to this initiative. In examining the experience to date, particular emphasis was given to initiatives that had the following five characteristics: deal with energy indicators in the industrial sector; deal with indicators at the level of individual companies or facilities (micro-level) as opposed to sector-wide (macro-level) work such as the "Energy Intensity" and "Energy Efficiency Trends" work of the policy groups in NRCan and CIPEC reports; deal with indicators of energy efficiency performance as opposed to practice (i.e. results as opposed to engineering processes, equipment or procedures); involve actual benchmarking or indicator exercises as opposed to studies such as DSM potential studies; is accessible (i.e. the information is not confidential or restricted).

A total of ten initiatives were reviewed. Based on the above criteria, four were selected for more detailed study. The remaining initiatives also grapple with related data quality, format etc. issues but are less relevant overall.

The initiatives that are most directly relevant to this study include plant-level performance

measurement combined with a broader facility/sector performance comparison. They are: Performance Benchmarking Service - Industrial Technology Institute; Energy Efficiency Best Practice Programme - Energy Technology Support Unit (ETSU); Industrial Technology and Energy Management - University City Science Center; and, Environmental Profile Data Sheet - CPPA and TerraChoice.

Of these four programs, the ETSU project in Britain is the closest to the concept identified for this project. Feedback provided by ETSU personnel indicated that the program has been well received by industry. Materials and sample reports from the ETSU were acquired by the consultants and those sample reports provided a good model for the draft sector reports produced by this project.

The CPPA and TerraChoice Environmental Profile and Verification Program also offers another industry potential approach which is both financially self-supporting and is endorsed by the industry. This program's approach is particularly interesting from the micro, or facility, level in that a standardized data collection methodology has been developed by the industry. This methodology provides a detailed facility level output defined on the basis of specific products and could be readily applied to both energy and environmental performance benchmarking. However, approaches such as this are more applicable to the detailed and interactive procedures envisioned under the potential phase two of this pilot project.

The review of related initiatives also provided insight into choice of metrics as well as alternative means of presenting the industry benchmark. More specifically:

Metric: All recognize the desirability of physical units. However, they also emphasize flexibility and the need to express the metrics in terms that are familiar and meaningful to the industry in question.

Benchmarking Approach: As noted previously, the assumption for this project is that individual facilities will be able to compare their performance to an industry average and performance range for comparable facilities. However, several other options were also witnessed or recognized as warranting consideration. These include a comparison of: site performance against the "Best Practice" within its group of association members, where Best Practice is defined as the "Best" performer in a group or, alternately, the top quartile; site performance against the "Best Practice" within comparable facilities in Canada or throughout North America; and, site performance against a theoretical "engineering Best Practice"

Assessment of Industry Interest and Preferences

The industry assessment led to a number of important conclusions related to the design and implementation of the project. These include the following:

There is need to approach each sector in a "customized" manner. There are too many variations among the sectors (needs, interest, data availability, organizational structure and resources etc.) to rely on one "standardized" approach e.g., choice of metrics, data sources etc. Where available, the existing industry associations provide an essential point of entry and coordination.

Within any given industry there is a wide range of views and level of understanding as well as commitment to the energy performance benchmarking concept. This emphasizes not only the need for the involvement of the industry association but also the need to engage the support of a recognized "energy champion" within each. In many cases, this person is likely to be involved with their industry's CIPEC task force.

In general, interest in energy benchmarking is relatively high among the energy intensive Tier

1 industries. However, due in large part to the energy intensive nature of these industries and their involvement with programs such as CIPEC, these Tier 1 industries already have access to a variety of energy efficiency information, particularly at the macro level. For example, the cement and pulp industries both have existing initiatives (data collection, member reporting etc.,) that could be used as a basis for energy performance reports. The bigger challenge in these industries may be to develop the approach and reports in a format that they recognize as providing "value- added". Similarly, the perceived benchmarking needs and, hence interest, among these industries tends to be at the more detailed level (i.e., at the process level)

For facility level energy benchmarking applications in the pilot Tier 1 industries, a preference was indicated for use of their own industry association generated data. Moreover, given the objectives of this project, the data reporting conventions and practices employed by the association should be employed in the benchmarking application (e.g., use of lower or higher heating values for fuel inputs, use of primary or secondary energy values for electricity etc.). Depending on the presentation format, some brief explanation of the differences from STC data may be required.

The Tier II industries (dairy or auto parts) present a totally different set of challenges than the large Tier 1 industries. Energy costs are relatively small in percentage terms (e.g., about 1%, or less) and consequently interest in energy benchmarking commands less priority than in the Tier 1 industries. Nonetheless, energy costs in absolute terms, or as percentage of annual profits, can be significant. However, in general, these industries have not assigned the same level of priority to energy as in the Tier 1 industries and, consequently, the availability of data and related supportive resources is also much less. Moreover, the number of facilities included within each of the pilot Tier II industries is greater than in either of the pilot Tier 1 industries which presents further challenges to this project.

Re: Statistics Canada Data

Two Statistics Canada (STC) surveys are of particular relevance to this project: ICE (Industrial Consumption of Energy) and ASM (Annual Survey of Manufacturers). The facility coverage, level of data disaggregation and data availability (timing) provided by these surveys were compared both with the preferences noted in the industry assessment and with the lessons learned from the review of related initiatives. The conclusions reached differ for each of the pilot sectors.

Cement: This industry, through its association, the CPCA (Canadian Portland Cement Association), collects annual energy and production data for all 18 plants that is suitable for this project. These data differ somewhat from the data provided to, and reported by, Statistics Canada, due in large part to differences in reporting conventions as well as levels of disaggregation. (Both sets of data are reported in the most recent CIPEC annual reports). The CPCA and ICE energy consumption data are available within the same time frame; however, the CPCA production data are available approximately 6 to 12 months in advance of the ASM data. Given the promotional purpose of this initiative and the stated preferences of the industry, direct access and use of the CPCA data appears to offer the best data alternative.

Pulp: This industry, through its association, the CPPA (Canadian Pulp and Paper Association), collects annual energy and production data for 40 of its 42 members that is suitable for this project. These same data are also currently provided to STC's ICE survey. However, to date, the ICE survey has not used the production data provided, as this is the focus of the ASM survey. In this case, extended use of the CPPA data currently provided to the ICE survey appears to offer the

best data alternative.

Dairy Products and Auto Parts: These industries include a greater number of facilities than in either of the above industries. At the 4-digit SIC level, STC coverage of these industries varies widely from survey level coverage to full census level in one case. ICE coverage is smallest for the Dairy Products (both 1041 and 1049) and largest for the selected sub sectors of the Auto Parts industry. The same general coverage patterns are also applicable to the ASM survey, although overall coverage is much greater than the ICE survey.

As noted above, neither industry group currently has any association level energy consumption or production data collection method in place. The conditions encountered by these industry groups are broadly similar to those for most Tier II industries. In either of these cases, reliance on STC data sets appears to offer the best data alternative.

Conclusions

Based on the pilot project experience to date, the following conclusions are presented:

There is need to approach each sector in a "customized" manner. There are too many variations among the sectors (needs, interest, data availability, organizational structure and resources etc.) to rely on one "standardized" approach e.g., choice of metrics, data sources etc. Where available, the existing industry associations provide an essential point of entry and coordination.

Preferred data sources and collection methods depend on the sector, its current priority vis-a-vis energy use, its existing data collection procedures, if any, the strength and focus of its industry association membership (i.e., does membership overlap with relatively homogeneous product manufacture grouping).

For cement and pulp industries, energy and production data collection procedures represent the best starting point.

For Tier 2, such as Dairy Products, the ASM data provided good coverage of the facilities. Energy and production data, in both physical units and dollars, were available for the facilities (It should be noted that four of the company surveys reported combined results for all of their facilities when they occurred within a single province. This distorts facility size and number data, but otherwise does not seriously effect the data results). The continued inclusion of physical units in the survey is under review by Statistics Canada on a case-by-case basis. It should be noted that to change this practice would negate the value of the survey data for benchmarking purposes.

As noted previously, the most significant challenge experienced in working with the Statistics Canada data for the purposes of facility benchmarking was the inclusion of significant differences in facility type, and hence, processes. For example, the fluid milk facilities included in the pilot phase assessment appear to include three broad categories of equipment usage: fluid milk transfer and storage; fluid milk pasteurization; and, powdered milk production. The relative presence of these types of equipment/processes within any given facility is highly influential on the facility's resulting energy performance indicator. (Note: further follow-up on this issue is currently under investigation with Statistics Canada).

Statistics Canada was well set up to deal with data requests such as those needed to produce the benchmarking reports. Statistic Canada's manufacturing unit is well set up to deal with commercial data requests such as this. In fact, given that it is main frame data must be manipulated,

the only reasonable approach is to work directly through this unit. Service was inexpensive, and relatively timely. Although it took more than 2 months to progress this request, the delay was largely due to summer vacation schedules. Under normal circumstances, it appears that a lapse time of about 3 to 4 weeks from the initial Statistics Canada meeting and submission of a detailed data request specification to production of energy performance indicators should be adequate

The review of related initiatives also provided insight into choice of metrics as well as alternative means of presenting the industry benchmark. More specifically:

Metric: All recognize the desirability of physical units. However, all also emphasize flexibility and the need to express the metrics in terms that are familiar and meaningful to the industry in question.

Benchmarking Approach: The preferred approach is to provide indicators that facilitate a comparison of facility performance to an industry mean and a "Best Practice", where Best Practice is defined as the top quartile.

As of the closing date for this paper (April 30, 1999), the three task force chairs associated with the pilot sectors are working with NRCan staff and the project consultants to fully explain the value and implications of this project to their special interest association executives and directors, and to bring these bodies to a position where they will commission a staffer or consultant to undertake the necessary work to prepare, for joint release by government and the organization, sectoral energy performance reports.

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