Conference Report

The Potential for Energy Efficiency in Canada

A more detailed Proceedings of this event, entitled A Workshop on the Potential for Energy Efficiency in Canada, *can be obtained by contacting the Policy Development Division/Division de l'analyse et du développement de politiques, Natural Resources Canada/Ressources naturelles Canada, 580 rue Booth Street, #1590, Ottawa, Ontario K1A 0E4*
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Earlier this year (May 4-5), the Efficiency and Alternative Energy Branch (EAEB) of Natural Resources Canada (NRCAN) sponsored a workshop on the Potential for Energy Efficiency in Canada. The objective was to exchange information and foster discussion of issues surrounding the study of energy efficiency potential and the barriers to its realization.

In his opening remarks, William D. Jarvis, Director General of EAEB, asked participants to get at some fairly pure analytical questions, such as the measurement of energy efficiency potential, the definition of economically attractive potential, and the relationship between potential improvements and attainable energy savings. He saw these questions as central to the development of energy efficiency policies and programs, but indicated that in recent years policy development has become tangled in technical analysis.

Jarvis invited participants to take part in clarifying the technical issues that determine the potential for energy efficiency because current differences of opinion over the true scope for efficiency improvements are significant. Some analysts say that reductions in the order of 50% are attainable at minimal cost,

while others project smaller savings at greater expense. In Jarvis' opinion, definitional differences, gaps in information, and differences in analytical framework underlie these very different views.

Methodological and Conceptual Issues

The first session of the workshop focused on methodological and conceptual issues surrounding the estimation of energy efficiency potential. In opening the session, Richard Howarth, Staff Scientist at the Lawrence Berkeley Laboratory in California, suggested that analysts of energy demand and efficiency usually fall into one of two categories. The first group consists of technologists who have learned some economics and rudimentary cost-benefit analysis, and have become proficient in preparing life-cycle cost estimates for different energy efficiency improvements. In general, they use bottom-up energy efficiency models which place the cost-effective potential at about 40% of current consumption, based on using technologies that are in the market. While this bottom-up approach makes it possible to take the potential of different technologies into account, some of the work is not very sophisticated and the meaning of the results has been difficult to interpret.

In the second group are users of top-down models which involve projections of future energy use based on assumptions of relatively slow penetration of new energy efficiency measures. These assumptions are themselves based on economic theories concerning the pace of technological change. The result is a supply, demand and price model in which technology is expected to improve over time and rational consumers are expected to adopt new cost-effective technologies as they become available.

Faced with disagreements between top-down and bottom-up theorists, Howarth said the appropriate response is not to make a choice, but to understand how the two perspectives can fit together. "They both contain some truth," he said, "and they're both over-simplifications." As energy costs only represent a small percentage of total costs, consumers are unlikely to be perfectly informed about the prices of different options, which would make it virtually impossible that they would adopt new cost-effective technologies as they become available.

Robert McRae, Head of the Department of Economics at the University of Calgary, presented a statistical overview of energy efficiency in Canada and other countries. He favours defining energy efficiency as the economically efficient use of energy per unit of output. But he pointed out that even such a simple description carries a number of complications, such as what is meant by energy, how it is aggregated, what units are used, and how output is defined for different sectors or the entire economy. He noted that these questions are often more difficult to answer at the aggregate level than with a bottom-up approach, where specific processes and types of capital equipment give energy efficiency a "much more natural connotation."

McRae summarized his position on different approaches to energy modelling by suggesting a middle ground. "... they both have their uses, one as a check on the other," he said. "I think the bottom-up approach is extremely useful and important, especially in these days, when there is such a wide range of technological change going on." On the other hand, a top-down approach can provide a useful statistical basis for decision-making.

Mitchell Rothman, Chief Economist at Ontario Hydro, said his organization sees no need to choose between top-down and bottom-up models: "As practitioners and practical people, we do both." He cited electricity sales as one of many areas in which the utility relies on a combination of forecasts and end-use data.

On the energy potential side, Ontario Hydro bases its estimates of demand-side savings on estimates of the technical, economic and attainable potential. Technical potential reflects assumptions about the best available technology; so that "you can get very different results in terms of the quantities of potential efficiency that are around." The first

task is to decide on the starting point, recognizing that continuous improvements in technology will lead to new efficiency opportunities over time. The technical potential, based on currently-available technologies, is used to develop a "frozen efficiency" forecast. If developed today, a frozen efficiency scenario would presume broad adoption of today's appliance technology by 2000.

In the wider context of overall resource planning, Ontario Hydro also attempts to trace the impact that changing technology and consumer behaviour will have in years ahead. The technologies which consumers are likely to adopt will depend on costs, so simple predictions of the best available technology are of little use. "We would rather know how you go from the likely basis to technologies that have been screened against avoided cost," to ensure that the alternatives in Hydro's scenarios "are in fact economic."

The final question is the pace at which the technology will be adopted. "We have to understand what attainable potential is, and when we say 'attainable,' that's a function of what the utility or the demand planner does." That is, attainability depends in large part on the incentive programs the utility is willing to run, and more broadly on the behaviour that the organization adopts. By contrast, Hydro's only opportunity to influence technical or economic potential is at the research and development stage.

Rothman concluded that with four definitions of the potential for energy efficiency, it's inevitable that different researchers will come up with conflicting numbers. He noted that this only demonstrates the need for clear dialogue, so that each participant in the debate understands the measures that other people are using.

Measuring Energy Efficiency Potential

Following a discussion period on methodological issues, concurrent sessions on measuring the energy efficiency potential in each end use sector (transportation, commercial, residential, and industrial) were held. Several recommendations were formulated by participants in these discussions, including the following:

- There is a clear need to improve the exchange of information and data. This process might be assisted by the creation of a joint association of demand-side professionals, the establishment of a central information clearing house and a repeat workshop every two years.
- There is a need to standardize terminology and definitions for use in the analyses of efficiency potential, program impacts, and the impacts of natural market forces on efficiency trends.
- There is a need to pool resources, share data and evaluate the impacts of policy measures.

The reader interested in more information about these sessions, including sector-specific recommendations, is invited to consult the full proceedings, *A Workshop On The Potential For Energy Efficiency In Canada*, which is available from NRCAN.

Barriers to Energy Efficiency Potential

The second day of the workshop featured the presentation of widely different views on barriers to energy efficiency potential. The two presenters on this subject were Ronald J. Sutherland, of Argonne National Laboratory and Michael Margolick, Executive Director of the BC Energy Council. The presentations were followed by a discussion in which a group of panelists addressed different barrier issues, often taking up points raised in the initial presentations.

Ronald Sutherland noted that, from talking with energy conservation advocates, he has concluded that differences in opinion on the issue of barriers turns on a fundamental question of policy objectives: while economists focus primarily on the efficient allocation of all resources, conservation advocates see energy efficiency as a valid objective in its own right. The concept of market barriers is not particularly useful in a discussion of efficient allocation, he said, but they are extreme-

ly important in any consideration of energy conservation as a social priority.

In general, Sutherland said, the market barriers postulated by conservation advocates do not relate specifically to energy, but seem to have more to do with broader investment behaviour. But those market barriers do not show up in the modern literature on investment, so it seems unlikely that investment resources are being used inefficiently. Sutherland evaluated a number of the market barriers claimed to exist by conservation advocates and dismissed them as nonexistent or irrelevant. For instance, in regard to some conservation advocates viewing low energy prices as a barrier to energy efficiency investments, he commented: "It occurs to me that if the price of energy falls and people buy more of it, that's not exactly a market barrier, ... In fact, it describes exactly how markets are working efficiently."

Sutherland stressed the importance of the distinction between energy efficiency and economic efficiency. He also argued that some commentary on the barriers issue suggests that perceptions of barriers to conservation "are generally contrived to justify a social policy."

In conclusion, Sutherland suggested that:

- Energy efficiency and market barriers are not appropriate considerations for future energy policies;
- Future policy should be designed to bring the consumer price of energy closer to its true marginal cost, recognizing that accurate price signals are "a critical first step" that precedes any other government intervention; and
- If economic efficiency is a policy priority, it is crucial to get regulated utilities and regulatory bodies out of the energy conservation business.

Michael Margolick disagreed with Sutherland's contention that conservation policy is not designed to increase energy efficiency. Margolick stressed that Canadian energy efficiency specialists understand the distinction between energy efficiency and economic efficiency. He contended that when a conservation program or policy is advocated, it is almost always advocated on the basis that it will increase economic efficiency."

Margolick suggested that there are reasons why rational consumers might operate in a market in which decisions which are optimal for them might not be optimal overall. In these instances interventions can improve economic efficiency. It is clear that the cost of acquiring perfect information on an energy efficient investment decision can be greater than the benefit that would accrue to the consumer who makes the decision. A free market advocate presumes an environment in which all the choices made are economically efficient in the absence of intervention, and concludes (by definition) that energy efficiency is not economically efficient because it is not a choice made by rational consumers.

The presentations by Margolick and Sutherland helped to highlight divergent views on the existence of barriers and broadened the perspectives of many who work on questions of energy efficiency potential.

The energy efficiency potential workshop realized much of what it aimed to achieve. It brought together people from across the country who work in the energy efficiency field. The sessions on end-use sectors stimulated the discussion of problems that are currently slowing the advance of work in the area. Discussion touched upon most of the difficult areas, including data development and analytical frameworks, and led to a list of recommendations to improve the exchange of information and data, and to standardize terminology and definitions. Finally, workshop participants were able to see how widely disparate are views on the existence and importance of barriers to the realization of energy efficiency potential. While no consensus was reached on the barriers issues, the discussions following formal presentations served to flush out most of the issues between the polar arguments on the barriers landscape.

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