# PROPOSALS FOR ENERGY LABELS ON APPLIANCES



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Background

In December, 1975 the Government directed the Department of Consumer and Corporate Affairs to prepare proposals for minimum energy efficiency standards for furnaces and major household appliances, and to develop an energy consumption labelling scheme for appliances, as part of the first phase of the government's broad energy conservation program. The Consumer Bureau interpreted this as a mandate to study and make proposals on an appropriate mix of standards, labels and consumer education and information programs.

In order to outline the government's intentions, to invite the co-operation and participation of industry, and to initiate an information-gathering phase which it was hoped would serve as a sound foundation for recommendations, officers of the Bureau met with representatives of the following associations in February and March:

- Canadian Gas Association
- Heating, Refrigerating and Air Conditioning Institute of Canada
- Canadian Appliance Manufacturers Association
- Canadian Water Heater Manufacturers' Association
- Electronic Industries Association of Canada
- Canadian Electrical Association
- Canadian Standards Association

After communications with these associations, with other government departments and agencies, and with the Federal Energy Administration and Department of Commerce in the United States, it became evident that a great deal of time, money, engineering expertise and industry co-operation and involvement would be required if the Government were to attempt to conduct the kind of detailed cost/benefit analysis that would be required to support the setting of minimum energy efficiency standards for appliances at reasonably high levels. Furthermore, it would not suffice merely to "borrow" the efficiency

standards adopted by our U.S. counterparts.[1] The dollar value of unit energy savings in the United States will be greater for most appliances because of residential electricity rates that average roughly twice those of Canada, while the costs of improving appliance efficiency should be lower south of the border due to larger scale production which manifests itself in the form of lower consumer prices for appliances.

An effective energy labelling scheme, on the other hand, would allow the consumer/manufacturer interface in the marketplace to determine over time the extent to which appliance prices should be pushed up in order to effect savings in energy consumption. The Government has decided to give an energy labelling program a chance to bring about the desired ends, where feasible, rather than plunging headlong into what might turn out to be an unnecessary exercise in the writing and enforcement of cumbersome direct controls, and the economic distortions they entail. It is felt that energy labels should serve as an ever-present incentive for manufacturers to introduce energy-saving design innovations into their products, whereas energy consumption standards might almost encourage manufacturers to produce only to the level of the minimum requirement.

It is proposed, then, that federal regulations requiring energy labels on refrigerators, freezers, ranges, washers, dryers, dishwashers, room air conditioners and televisions be written and put into effect as quickly as possible. A mandatory scheme is recommended for the following reasons:

1. there is a strong incentive for manufacturers of the less efficient products not to participate in a program which will draw consumers' attention to the fact that their product costs, say, $20 more per year to operate than the products of several competitors;

2. manufacturers are concerned that, under a voluntary program, some of their competitors (particularly importers) would secure considerable cost advantages through choosing neither to improve nor to label their products;
3. without appropriate regulatory requirements to back them up, government authorities would be left with little other than misleading advertising legislation to protect against a variety of possible abuses of a voluntary arrangement;
4. under a voluntary program it would be much more difficult for the government to ensure that the program begins as quickly as desired.

Because decisions respecting the choice of furnace, water heater or central air conditioner to be installed in a home, whether in a new house or as a replacement purchase, are almost always made by a contractor, plumber, oil company, buyer for a department store, or some other person other than the consumer who will actually pay for the products and their costs of operation, it is doubtful whether energy labels on these products would play a useful role. Since furnaces and water heaters consume approximately 50% and 20% respectively of a household's energy requirements, however, serious consideration should be given to the possibility of improving their performance through minimum efficiency regulations. Some suggestions regarding how the standards-writing exercises might be organized will be made in a separate statement in the relatively near future. The purpose of this write-up is to set out on paper the first (incomplete) draft of proposals for energy labels, to serve as a basis for discussion amongst interested parties.

Objectives of the Labelling Program

Because the notion of an energy labelling scheme has its roots in an energy conservation proposal put forward to Cabinet by the Office of Energy Conservation, it must be said that the objective of the program is simply to

conserve energy in the use of household appliances. However, in thinking about what type of labelling concept would be most effective, this objective must be translated into secondary objectives relating to the behaviour and attitudes of consumers and manufacturers:

1. to make consumers aware of the expected energy operating costs of individual products on the market;
2. to encourage consumers to compare the energy costs of similar, competing products;
3. to give manufacturers an incentive to improve the design of their products to reduce unit energy consumption wherever economically feasible;
4. to serve as a psychological signal to Canadians of the growing recognition given to the need to use finite resources more efficiently.

There is no evidence to suggest consumers are aware that, for example, refrigerators' lifetime energy operating costs can be expected to be roughly as great as their initial purchase price on average.[2] Nor, would they appear to be aware of considerable differences that exist between competing models' energy requirements.[3] On the contrary, a study by Liefeld[4] on the information preferences of "disadvantaged" Canadian consumers concludes that "the most important decision criteria for appliance choice in order of decreasing importance are: (i) warranty/guarantee; (ii) price; (iii) quality of construction; (iv) brand/manufacturer; (v) durability." Far down the list of 20 criteria, with an average ordinal ranking of .43, is energy consumption. A survey of retail appliance salesmen in the United States showed overall size, type of defrost, purchase price and colour to be the top four consumer concerns in the purchase of refrigerators, while operating costs were ranked fourth for freezers.[5]

At first glance, it may seem odd to put so much faith in a labelling program that will provide information to people who have demonstrated no interest in it. There are several reasons why this is not considered to be a problem, however, First, it is assumed that consumers have not pressed for information of this nature because they have not realized the extent to which it can save them money in choosing between products. Consider, for example, two refrigerators with identical features and product life. One costs $380 and the other costs $350. Brand preferences aside, consumers would purchase the less expensive one. If the lifetime energy costs of that refrigerator were $500 (appropriately discounted and adjusted for increased energy costs and the general rate of inflation), while the corresponding costs for the more expensive model were $300, then the lifetime costs of owning and operating the two products would be $850 and $680 respectively (neglecting the costs of maintenance, repair and disposal). If an effective labelling scheme were to be introduced making this fact known, consumers would be wise to buy the model with the higher purchase price.

Second, labels have an important advantage over most other methods of transmitting consumer information in that they get it to consumers in a relatively concise manner when they are likely to be most receptive to it -- at point-of-sale.

Third, the Government is planning to "back up" the appliance labels with a nationwide information program to publicize the existence of the program and to make known the importance of lifetime costing in purchasing appliances.

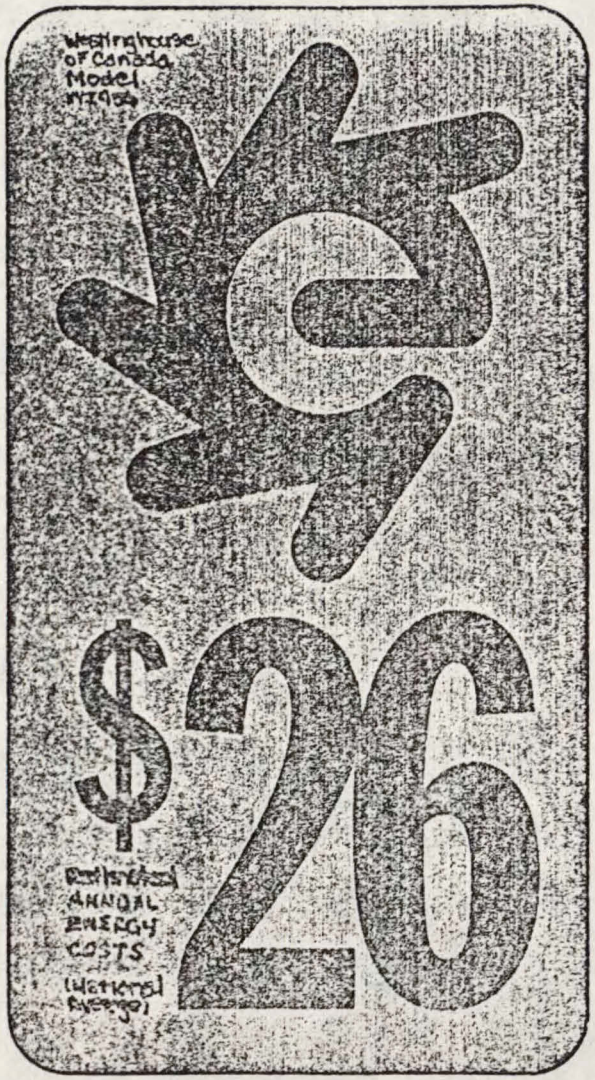
And finally, if energy prices continue to rise faster than the general rate of inflation over the next few years as expected, consumers are likely to be more concerned about how much energy their appliances use.

Label Philosophy, Design and Content

It is recommended that the regulations requiring the labelling of appliances should outline in detail the design specifications of the labels, including label size, colours, contents, wording, layout, size and type of print, and so on. They should also specify exactly where and how the label should be attached to the product when displayed for sale, so as to be sure to attract the attention of potential buyers. For a refrigerator, this would probably mean putting a sticker beside, or hanging a tag on, the door handle of the upper (freezer) door. For clothes washers, dryers, ranges and dishwashers, probably the upper right corner of the front panel or front door would be appropriate. Because of differences in the external design of televisions and air conditioners, alternative locations might have to be specified for labels on these products.

It is important that the labels bear a distinct and prominent program symbol, recognized and trusted by consumers as the mark of a government-backed program whose aim it is to provide them with important information. The symbol would be highlighted in all of the government's promotional backup for the program. In Appendix H is shown the derivation of a program symbol recommended to the department by Alan Fujiwara, a design consultant. The symbol is intended to suggest a combination of the "é" from the word "énergie" with a paddle wheel-like impression of energy, spinning or motion. The symbol is prominent on each of the label alternatives for washing machines shown on the next two pages.

Generally, the labels reflect a concern for the trade-offs between two desirable label characteristics - simplicity and the provision of "full information".[6] The first label is to the extreme in simplicity, offering only a national average estimated energy cost for the labelled appliance, for the purpose of easy comparison against similar, competing models.


Westinghouse
of Canada
Model
XYZ-966
$26
Estimated
ANNUAL
ENERGY
COSTS
(National
Average)


Westinghouse of Canada
Model XYZ-966
$26
Estimated
ANNUAL
ENERGY
COSTS
(National
Average)
$13
$38
The above arrow shows how this model compares
to other full size automatic
washing machines

Westinghouse of Canada
Model XYZ-985

# $260

Estimated Energy Costs for Ten Years (National Average)

For an estimate of the costs in your house, look on the table below.

| Province | Water Heater Type | Loads per week | | |
|---|---|---|---|---|
| | | 4 | 8 | 12 |
| Nfld. | Electric | 210 | 410 | 620 |
| P.E.I. | Electric | 410 | 810 | 1220 |
| N.S. | Electric | 290 | 490 | 730 |
| N.B. | Electric | 200 | 400 | 590 |
| Quebec | Electric | 160 | 320 | 490 |
| | Gas | 90 | 190 | 280 |
| Ontario | Electric | 150 | 310 | 460 |
| | Gas | 70 | 140 | 220 |
| Manitoba | Electric | 140 | 290 | 430 |
| | Gas | 70 | 140 | 220 |
| Sask. | Electric | 180 | 360 | 540 |
| | Gas | 50 | 100 | 150 |
| Alberta | Electric | 180 | 360 | 540 |
| | Gas | 40 | 80 | 130 |
| B.C. | Electric | 200 | 400 | 590 |
| | Gas | 60 | 130 | 190 |
| N.W.T. | Electric | 210 | 420 | 610 |
| | Gas | 50 | 100 | 130 |

Note: Costs with an oil water heater are approximately half-way between gas and electricity.

Because there is evidence that most appliance purchasers put a relatively small amount of effort into pre-purchase information-seeking,[7] and because it is believed that a majority of consumers visit only one or two stores before buying,[8] the second label includes a graphic illustration of how the labelled model's energy consumption compares to the consumption of competing models. Appendix B lists possible groupings of product types and sizes that would be meaningful for consumer comparisons.[9]

As well as highlighting a national average energy cost for quick comparison of washing machines' energy efficiencies, the third label endeavours to provide full information about how costs are influenced by energy prices,[10] water heater type[11] and number of loads washed per week.[12] It is clear that a purchaser in Prince Edward Island planning to wash 12 loads per week should weigh energy costs considerably more heavily in his decision-making than an Alberta consumer who does 4 loads each week with a gas-fired source of hot water.

The following determinants of energy consumption would be useful on the labels of the other appliances:

refrigerators - province
ranges - province
clothes dryers - province, loads per week
dishwashers - province, water heater type, loads per week
freezers - province
televisions - province, hours per week
air conditioners - province

The third label is also different from the first two in that the estimate of national average energy costs is for 10 years' operation rather than one.[13] This feature is seen as desirable because the effective intent of the labels is to encourage consumers to think in terms of lifetime costs

of owning appliances, rather than buying with only purchase price in mind. However, the government would want to ensure, perhaps by pre-market testing, that the statement of 10-year costs would not be interpreted as a suggestion that the product would last for 10 years.

A number of people have been critical of the fact that energy consumption is shown on the draft labels in terms of dollars. They point out that this factor results in the display of a national average cost figure which is not close to the actual costs of operation in most parts of the country; on the third label, we are only able to get around this problem at the expense of increased label complexity which may confuse some consumers or discourage them from trying to understand the label. In addition, residential energy prices are increasing throughout the country, making it difficult to keep the dollar costs up-to-date. And these prices are rising at different times and different rates across the country. If we were to put kilowatt-hours per year or some kind of energy efficiency rating on the labels instead of dollars, however, the figure would be the same for all parts of the country, and rising energy prices would be of no concern.

In spite of these drawbacks, dollar estimates are believed to be some mix of "desirable feature" and "necessary evil". There is no evidence that consumers are motivated to save energy itself, particularly if they have to pay higher prices for their appliances in order to do so; it is assumed to be <u>money</u> that consumers are interested in saving when they add insulation to their house, buy a smaller car or choose an energy-efficient appliance.[14] Thus, if consumers are to be expected to respond to energy labelling initiatives, they first must have energy consumption in some dollar form for weighing against purchase prices. If annual kilowatt-hour consumption were to be provided, for example, consumers would have to:

1. have a feeling for what a kilowatt is, rather than being "scared off" or confused by an unfamiliar technical term;
2. know what price they pay for electricity;
3. know to multiply annual consumption by price per kilowatt-hour;

4. transform the annual cost into some form of lifetime cost;
5. take the time to make the calculation for each appliance under consideration (as opposed to quickly glancing at the labels for a national average figure which, admittedly, is somewhat less useful to them).

The U.S. Department of Commerce is mid-way through a major research project (to be completed in March, 1977) aimed at determining exactly what types of information consumers need, want and understand on energy labels for appliances. Early indications from some "focus sessions" are that, while most people are motivated by, and respond to dollars, many don't really understand BTU's, kilowatt-hours, therms or cubic feet of gas, or energy efficiency ratios. Many don't know how much they pay for energy. As regards the question of dollar figures and national averages, some consumers feel that the relative figure (national average) is all that they need to make a wise choice, while others respond that they would lend no credibility to a national average figure.

A Department of Commerce official suggested that the U.S. labels will probably highlight a national average dollar figure and show on a small table at the bottom of the label the dollar costs at different costs per kilowatt-hour (i.e., 2¢, 4¢, 6¢, 8¢ and 10¢). While this gets around the problem of regional updates that is characteristic of the third label put forward in this paper, it relies on consumers to know their own marginal cost of energy.

Clearly there is some uncertainty as to how consumers would actually take in and process different types of information that might be provided on energy labels. As the Department of Commerce study continues, it is likely to yield answers to some of our questions. However, Consumer and Corporate Affairs should probably conduct pre-market tests directed at learning more about some of the following considerations:

- understanding of terminology
- dollar energy costs vs. non-dollar forms
- annual vs. 10-year costs
- simplicity vs. full information

Information Program

The Office of Energy Conservation has budgeted $750,000 for fiscal year 1977-1978 for the preparation of pamphlets, posters, newspaper and television advertisements and other promotional material in support of the energy labels. In addition, CCA's Information and Public Relations Branch will have a valuable contribution to make in encouraging its consumer affairs contacts in the media to tell their readers and listeners about the importance of the new labels. Since two departments will be involved in the promotion of the program, their activities will have to be extremely carefully co-ordinated.

The details of the information program obviously need not be worked out until the government has committed itself to a particular label and is ready to begin. At this stage, however, it is apparent that two elements of the promotional backup will be crucial to the labels' success. First, consumers must be taught to recognize the labels and to accept them as a trustworthy source of useful information. Second, they must be given some awareness of the importance or significance of lifetime costing.

Test Procedures and Testing

If appliances are to be required to bear labels that show estimated energy costs, then it will be important that all manufacturers determine these costs under the same conditions.[15] Test procedures for measuring the energy consumption of each of the products to be labelled have been or are being developed in the United States and, for some products, in Canada. A list of the existing standards is given in Appendix C. It is recommended that these standards serve as the basis for the labelling regulations, although portions of them may need to be modified to suit Canadian conditions or situations, or to bring them closer in line with the government's aims. It is expected that the Department will require the full-time service of

at least one engineer for no less than a year to review the existing standards for all of these products, to deal with the technical concerns of the industry and to make recommendations respecting the content of the regulations.

The government could require that the energy consumptions shown on labels be certified by government laboratories or some independent third party such as the Canadian Standards Association. Instead, however, it is recommended that the regulations merely state that products must be labelled according to their energy consumption, and outline the test procedure that will be used by the government to measure energy consumption for enforcement purposes; this leaves the responsibility for label accuracy up to the manufacturer. While this second alternative may entail more enforcement activity by the government, it has the important advantage of making it possible for the program to come into effect more quickly. For example, it has been estimated that, if the Canadian Standards Association were to purchase the facilities needed for testing refrigerators and refrigerator/freezers, it would take a year to test all existing models. Individual manufacturers, on the other hand, would be able to conduct the tests as an on-going part of their research, development and production. Another drawback of a certification-based label would be the possibility that the prototype submitted for certification would be more carefully assembled and tuned than a typical model off the production line, so that the consequent energy consumption rating would be unrepresentative in the manufacturer's favour; under the proposed approach, however, manufacturers would be liable for any appliance whose energy consumption was found not to be as good as claimed by the label (within a specified tolerance).

Administration and Monitoring of the Program

Obviously, at the beginning of the appliance labelling program there will be a considerable amount of activity involved in informing manufacturers as to what is required of them by the regulations. However, the amount of on-going administrative support needed would be related in part to the amount of information displayed on the labels. For the simplest of the three labels put forward in this paper, the government need only provide manufacturers periodically with a national average cost of electricity (and gas in some cases). This cost would be applied by the manufacturer to his products' energy consumptions to arrive at the national average energy cost.

The administration behind the second label would be more extensive. Because individual manufacturers cannot be expected to know the energy consumptions of all competitors' models, the government would have to make this information available. It would seem logical to require manufacturers to send in to the government, perhaps once a year, a list of all their models and their energy consumptions. An administrative person would transform this information into the appropriate comparative graphs for the next year's labels, and send the information out to manufacturers. These yearly updates would reflect increases in residential energy rates, as well.

For the third label, the program's administrative staff would determine from available information on utility rate structures, provincial averages of the costs of electricity and the costs of heating water by gas, electricity and oil. This information would be given to manufacturers and importers who would compile the table on the right hand side of the label by multiplying these costs by their products' consumption of electricity and hot water.

There are several ways that the government will be able to monitor the effects of the labelling program on the energy efficiency of appliances during the first few years of the labels' existence. First, it is expected that the engineer responsible for the technical aspects of the writing of the labelling regulations and test procedures will be in close enough contact with technical people in the industry to be aware of the extent to which research and technical innovations to products are initiated in response to consumers' new awareness of energy costs. Second, if the comparison feature of the second draft label is included in the labels which eventually are required on appliances, the administrative staff would have an on-going record of the energy costs of operation for all individual models; if this feature is not a part of the label, the same information could be secured through in-store examinations of labels by the department's field staff, or by voluntary submission of the information by manufacturers. This information on models' energy consumptions is incomplete in the sense that it gives no indication of the effect of the program on trends in the sales of efficient and inefficient appliances. If manufacturers could not be required by the regulations to send in this information to the government a relatively extensive survey of retailers and appliance purchasers might be useful.

Enforcement

The enforcement of an appliance energy labelling program will be inherently different from the enforcement of existing labelling legislation under the department's jurisdiction. While it is relatively simple to test an 89-cent bag of cookies or a 99-cent tube of tooth paste for their net contents under the Consumer Packaging and Labelling Act, testing an appliance for its energy consumption is a much more complex and costly exercise. Unless the government could demonstrate that it has "reasonable grounds" to believe that any provision of the energy labelling regulations had been contravened, it would have no authority to inspect a manufacturer's plant or books, or to seize an appliance; and it might be hard to establish such reasonable grounds without first testing at least one of the manufacturer's products. Thus the government probably would have to purchase most of the

appliances that it wished to test. The costs of transporting heavy appliances to and from the testing laboratory of the government or its testing agent would be considerable. Costs of the actual testing of the energy consumption of refrigerators and air conditioners have been estimated at $600 and $550 respectively.[16] On top of that, money would have to be spent on restoring some of the products, damaged by testing, to their original state.

It is recommended that the government sample some products from the market each year and have them tested for energy consumption by the National Research Council, the Canadian Standards Association or some other agency or association which is likely to have other uses for the types of facilities required for testing in accordance with the procedures set out in the regulations.[17] It is felt that the Department of Consumer and Corporate Affairs itself would not be able to justify a capital expenditure of about $150,000 on the facilities needed to test only a few refrigerators per year, for example.

The relatively high cost of testing appliances' energy consumptions gives rise to another significant difference in the program's enforcement. Under the Consumer Packaging and Labelling Regulations, an inspector wishing to establish whether a shipment or a "lot" of products meets the requirements of the Regulations must examine a representative sample of products from the lot (e.g., a sample of 10 from a lot between 101 and 300).[18] Because of the expense, this would not be practical for energy labelling regulations for appliances. On the basis of a sample of one, a conviction could be applied only to the single appliance actually tested; the government would not be in a position to order that the labels of all other appliances in the lot bearing false labels be replaced.

It is recommended that, in the first two or three years of the program, the government should set aside about $100,000 annually for the testing of a relatively small sample of appliances. Depending upon the extent to which labelling violations are detected by these tests early in the life of the program, these enforcement expenditures could be increased or decreased in later years.

Some Important Legal Issues

On the basis of two legal opinions received late in 1975, the department was initially under the impression that appliance energy labelling regulations could be issued under the Consumer Packaging and Labelling Act which, although not written with the labelling of appliances in mind, contains a clause 18(1)(h) permitting the extension or application of any provisions of the Act to any product that is not a prepackaged product, whether or not the product's label contains a declaration of net quantity. About five months ago, however, a detailed consideration of how regulations might actually be formulated revealed a number of weaknesses in the use of the Act (relevant sections are reproduced in Appendix D of this paper) for energy labelling purposes. Appendix E is a copy of a memorandum from the department's Legal Branch touching on the following problems.

1. Section 4 of the Act, which normally prohibits the sale, importation or advertising of products not bearing a label containing a declaration of "net quantity" as prescribed under the Act, could not be applied in the case of appliance energy labels containing no declaration of net quantity, in spite of section 18(1)(h). At first this was interpreted by the Privy Council legal office as meaning that regulations under the existing Act could not force sellers to label their appliances. Subsequently, however, the PCO has agreed that a case may be made that sections 18(1)(h) and 10(b)(iii) can be read together, so as to permit a regulation which requires energy consumption information to be provided where there is already any label (defined as "any label, mark, sign, device, imprint, stamp, brand, ticket or tag") on the product. All appliances are thought to bear such a label.

2. The authorization in section 10(b)(iii) to require disclosure of information respecting the "performance... of the product" is not broad enough to require information about how the labelled product's energy consumption compares against competing models' energy use (as in the second label put forward in this paper).

3. On the surface, section 10(b)(iii) would not appear to authorize the requirement of an additional, impermanent label of the sort proposed in this paper; instead, it states that an existing "label" (likely to be of a permanent nature, possibly displayed where it is not readily seem by shoppers) is to be altered to include the required information. However, the Director of the Privy Council legal office has pointed out that Consumer Packaging and Labelling Regulations governing labelling respecting the "capacity of receptacles" (under section 18(1)(h) and 10(b)(iii) of the Act) have, in practice, permitted the use of a secondary display label in lieu of alterations to existing labels.[19]

4. Because section 4 of the Act could not be applied in the case of appliance labels, it would not be an offence under section 20(1) to sell, import or advertise an appliance that doesn't bear an energy label. If energy consumption information were required under sections 10(b)(iii) and 18(1)(h), however, the person who creates the label (probably the manufacturer), and ignores or fails to meet such requirements, would be subject to prosecution under section 20(2). Considerable problems in enforcement might arise. If foreign manufacturers failed to comply with the regulations, could the government do anything about it? And what action could the government take if importers or retailers were to choose to remove labels put on appliances by manufacturers?

Apart from the question of whether the Consumer Packaging and Labelling Act gives the government the authority to issue energy labelling regulations for appliances, there is the separate question of whether regulations of the sort proposed are constitutional. An exploration of this question was requested of the Department of Justice, with not only the possibility of regulations under the Consumer Packaging and Labelling Act in mind, but also with a view to finding alternative means of establishing the labelling scheme should the existing Consumer Packaging and Labelling Act prove to be an inappropriate vehicle.

At the time of writing, the Office of Energy Conservation and the Consumer Bureau are awaiting the decision of senior officials in the Department of Justice on a 22-page legal opinion on the constitutionality of federal regulations respecting energy labels or minimum energy efficiency standards, for both automobiles and appliances. The legal adviser who wrote the legal opinion feels that grouping appliances together with cars may strengthen the case for appliance labels and standards.

Because the contents of the legal opinion will remain unknown outside the Department of Justice until a decision has been reached by senior Justice officials, it is not possible to speak with any degree of certainty about what the eventual legal foundation of the labelling program is likely to be. There are several possibilities.

The issuing of regulations under the existing Consumer Packaging and Labelling Act has one great advantage over the other alternatives -- it can be done relatively quickly, without asking Parliament to pass new legislation or to amend existing legislation. For that reason, it should be pursued until the associated drawbacks are perceived to be insurmountable. The Director of the Privy Council legal office has recommended that a rough draft of proposed regulations under the Act be prepared as quickly as possible and sent to his office for an assessment of their validity by the Criminal Law Section. The potential enforcement difficulties outlined in item 4 above would seem to be the greatest threat at this time to the eventual choice of this regulatory mechanism. There may be constitutional complications as well, since it is hard, if not impossible, to justify the provision of energy consumption information on labels on the basis of either weights and measures or criminal law, the two federal jurisdictions on which the Consumer Packaging and Labelling Act is founded.

Depending on the decision reached by Justice officials on the constitutional legal opinion currently before them, another alternative may be to write a new act, founded on some thus-far untried federal authority over energy

conservation, giving the government the power to pass regulations aimed at reducing, through efficiency standards and energy labels, the consumption of energy by all cars and appliances sold in Canada.

It may be, on the other hand, that Justice determines that no case for such an inherent federal authority can be extracted from constitutional jurisprudence. The "next best" alternative then might be to fall back on established federal authority over interprovincial and international trade, being content to require the labelling only of appliances that are imported or shipped from one province to another. It is estimated that this would apply to roughly 75 percent of the appliances purchased in Canada.[20] Assuming that at least 90 percent of domestically produced appliances are manufactured in Quebec or Ontario, it is apparent that similar requirements by these two provinces to cover intra-provincial sales would cover most of the 25 percent of Canadian sales not covered by the federal regulations.

Costs and Benefits

Towards the beginning of this paper, it was explained that the labelling route to reduced energy consumption by appliances had been selected in part because of the great difficulty in determining at what level efficiency standards should be set. The basic problem, even in the United States where a lot of money is being spent in researching the question, is that very little is known about the effects of improvements in energy efficiency on consumer prices of appliances. This lack of information on cost structures in the appliance industry will also prevent us from carrying out a full cost/benefit analysis before the implementation of the proposed labelling program. As implied earlier, however, this is not seen as a drawback of any great consequence because, in effect, manufacturers and consumers will do the analysis themselves over the next few years as consumers begin to take into consideration their new-found knowledge on energy operation costs, provided on the labels. If a manufacturer pushes energy conservation innovations in a washing machine to the point where the Consumers' Association of Canada

rates his machine as giving a poor-quality wash, or to the point where his product is priced above competing models to an unreasonable degree, his sales will suffer and he will make some changes in his product. If, on the other hand, a particular manufacturer ignores the new concern about energy costs while his competitors make improvements to their products, he could again expect a drop in sales.

The above is not intended to suggest that we have no feeling at all for what appliance industry cost structures are like. Consider the upper half of Figure A on the next page, for example, showing in theoretical terms the costs and benefits to consumers of energy efficiency improvements that could be made to a particular, "before-labels" appliance. The horizontal axis represents possible decreases in the product's lifetime energy consumption, relative to its consumption prior to the introduction of energy labelling. Vertically, the Increased Cost curve illustrates the increases in retail purchase price associated with each possible level of lifetime energy savings. The curve is "concave-from-above" because it is assumed that manufacturers seeking to improve a product's efficiency would make the least expensive innovations first. The Lifetime Energy Savings curve shows the corresponding savings in energy <u>costs</u> over the life of the product, appropriately adjusted to reflect energy price increases, the general rate of inflation, and discounting to present value.

Let the "lifetime cost" of owning and operating an appliance be defined as "purchase price plus discounted costs of energy over the life of the product". And let the before-labels lifetime cost of the product under consideration in Figure A be PQ as shown in the lower half of the Figure. Then the lifetime cost associated with each possible decrease in the product's energy consumption would be as indicated by the Lifetime Cost curve. Up to point R on the horizontal axis, lifetime energy savings are increasing at a greater rate than increases to purchase price. Beyond

FIGURE A

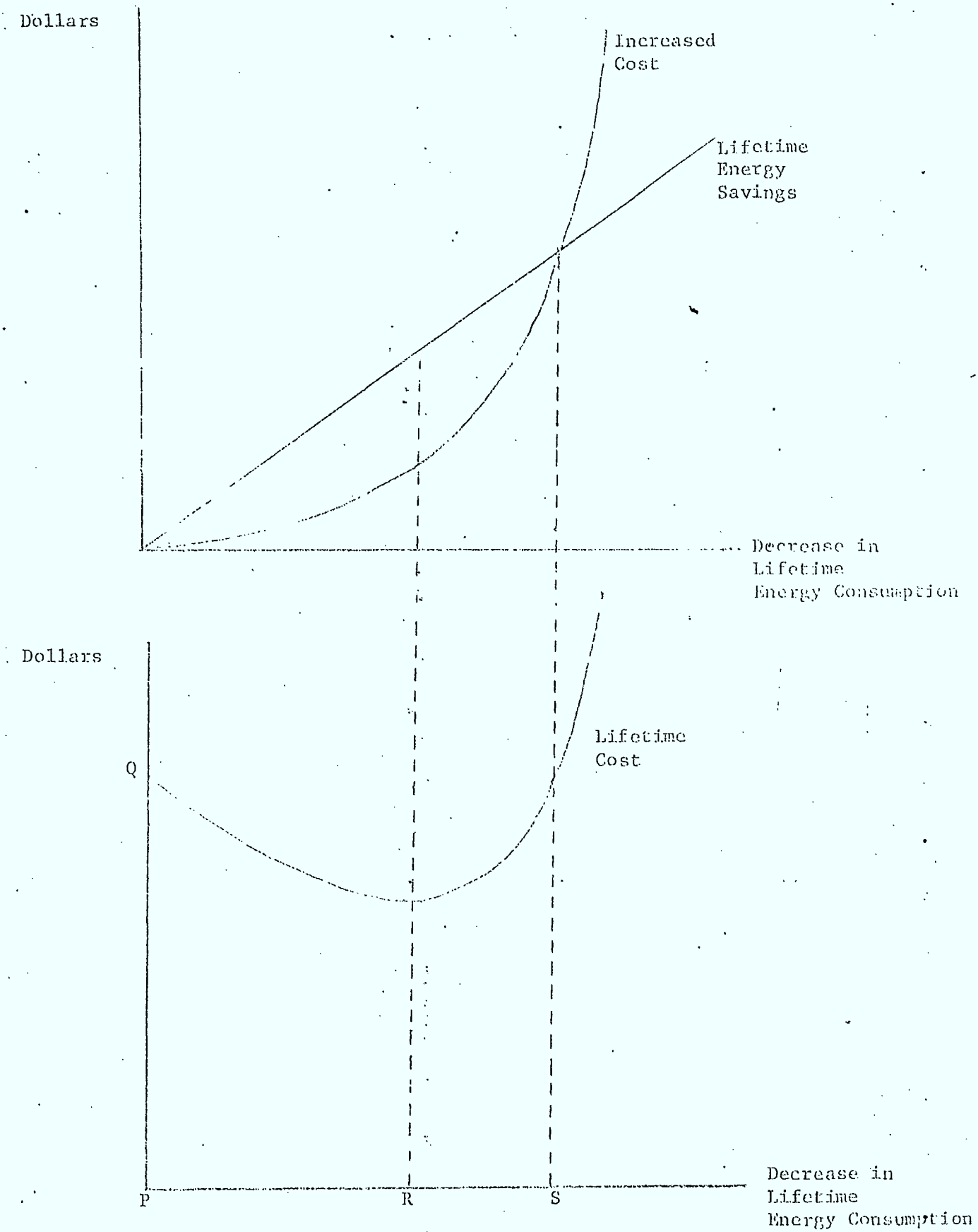

Dollars
Increased Cost
Lifetime Energy Savings
Decrease in Lifetime Energy Consumption
Dollars
Lifetime Cost
Q
P
R
S
Decrease in Lifetime Energy Consumption

FIGURE B

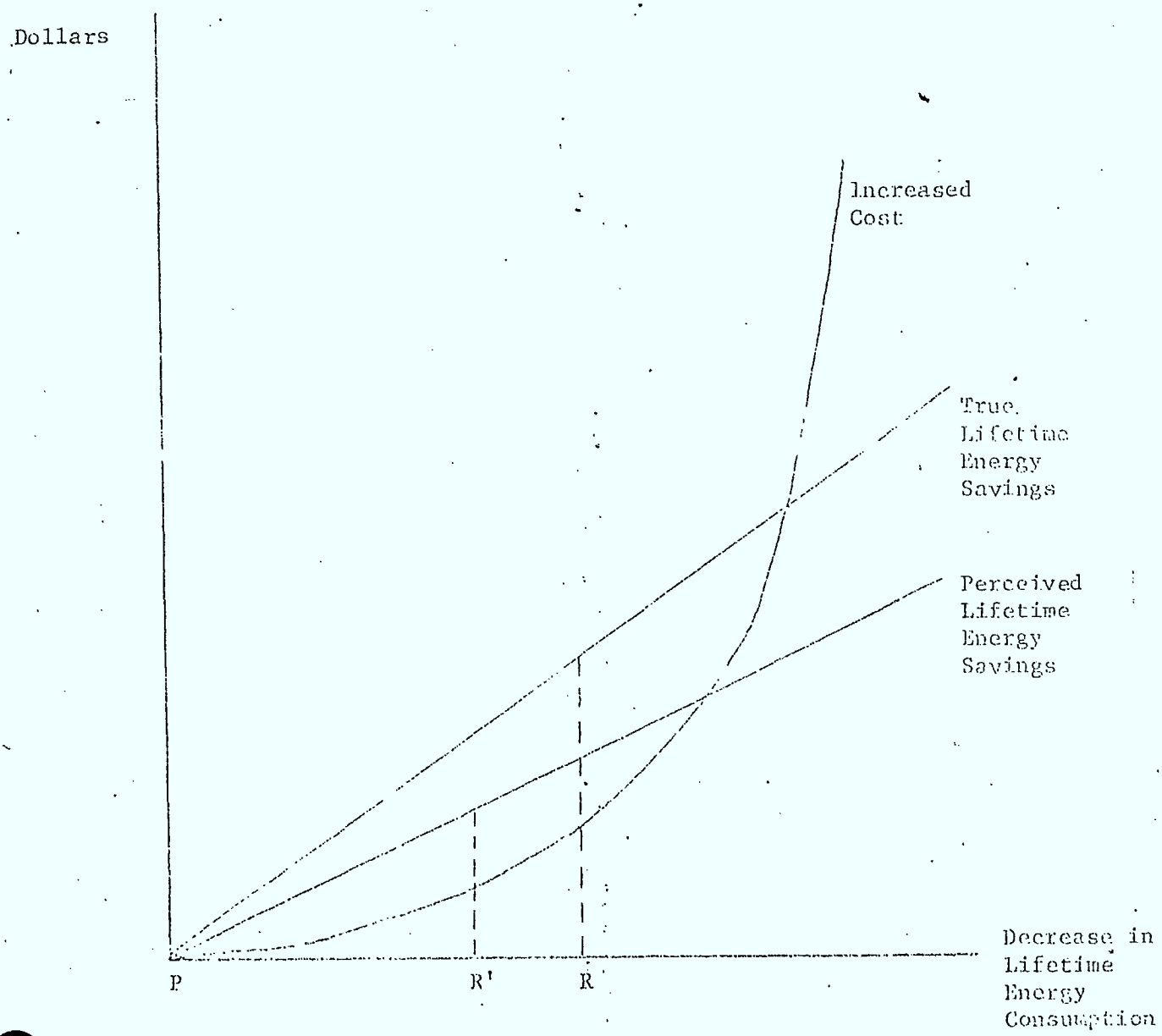
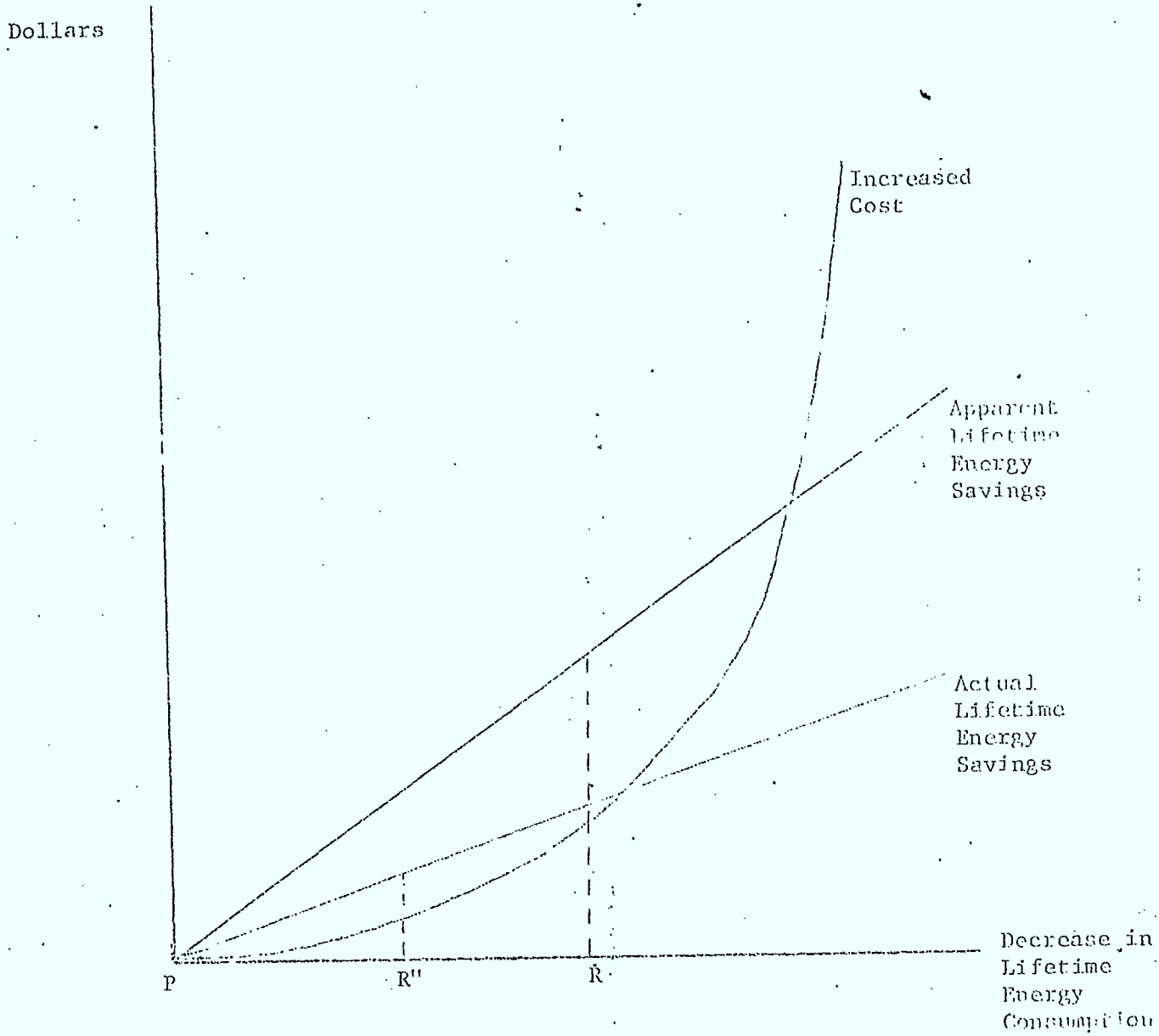

Dollars
Increased Cost
True Lifetime Energy Savings
Perceived Lifetime Energy Savings
P
R'
R
Decrease in Lifetime Energy Consumption

FIGURE C


Dollars
Increased Cost
Apparent Lifetime Energy Savings
Actual Lifetime Energy Savings
P
R''
R
Decrease in Lifetime Energy Consumption

that point, the reverse is true. Thus, a "perfect" labelling program would lead to reduction PR in the lifetime energy consumption of the appliance, since the costs to consumers of any further improvements in the product's efficiency would exceed the value of the energy savings.

It is useful to be aware of differences between this theoretical point of equilibrium and the level of efficiency improvement that may be brought about under minimum energy efficiency standards which the Federal Energy Administration in the United States has the power to impose under the Energy Policy and Conservation Act passed in 1975. The FEA may prescribe minimum standards for an appliance if it can illustrate that the savings in operating costs throughout the estimated average life of the product will outweigh any consequent increases in purchasing costs or maintenance expenses.[21] In other words, implicit in the U.S. legislation is a willingness to push energy savings beyond the economist's traditional point of optimal allocation of resources at R, where marginal costs and benefits are equated, to as far as point S, where the total costs and benefits of the changes in product design are equal.

Before leaving this discussion of theoretical relationships, two complications should be introduced. The upper half of Figure A is reproduced in Figure B. Assume that the True Lifetime Energy Savings curve represents some notion of the "true" current-dollar present value of the energy savings in operating the appliance over its lifetime (using the interest rate paid on premium savings accounts as the rate of discount). Then in a world of "perfect knowledge" and "rational" consumers, the product's efficiency can be expected to be improved by the amount PR, as explained above. However, if consumers are shown an annual cost figure on a label, they are likely to perceive the lifetime energy savings to be different than the "true" value, for several reasons. They may not have a good impression of the expected life of the product, or of what changes can be expected in the real price of energy. They probably would have no

conscious awareness of the concept of discounting to present value, although in their weighing of purchase price against energy costs they could be expected to value current savings considerably more highly than future savings. The perceived energy savings would likely be lower than the "true" savings, as shown in Figure B. The associated improvement in product efficiency would be PR', the distance between R and R' being larger the greater the extent to which the value of the savings is undervalued. It is because of this danger of undervaluing savings that an estimate of lifetime savings, referred to as ten-year savings on the third labelling alternative in this paper, is believed to be very useful to consumers. In addition, such an estimate may have a greater impact on consumers than an annual figure, merely because it is considerably bigger. It is conceded, however, that even the ten-year figure may be ignored or weighed lightly in a purchaser's decision-making.

The second "complication" is crucial to any evaluation of the benefits from a labelling program (or from minimum efficiency standards). From discussions with the Division of Building Research at the National Research Council of Canada, it has been determined that energy wasted in the operation of inefficient appliances is given off into the household as heat, directly reducing heating costs over about 55 per cent of the year (national average) when homes are being heated.[22] Again the upper half of Figure A is reproduced, this time as Figure C. Consider refrigerators, ranges, freezers or televisions. Assume that the Apparent Lifetime Energy Savings curve represents the value of energy savings from the operation of the appliance itself. The Actual Lifetime Energy Savings Curve located 45 per cent of the distance to the Apparent curve, would indicate the savings in appliance operation costs net of increased heating costs.[23] One would argue, then, that the optimal improvement in energy efficiency would be PR", significantly less than the improvement PR implied by consideration only of the gross savings. A corollary to such an argument would be that products should be labelled according to their net energy uses rather than their gross energy requirements. This, in turn, could

be expected to reduce the impact of the labels on consumers because, for all the products to be labelled except clothes dryers and room air conditioners, the net figure would be significantly less than the gross figure.

For air conditioners, operated only in the warm summer months, gross and net energy consumptions are equal. For clothes dryers, the energy actually used up as a consequence of its operation is greater than its metered intake of electricity or gas. This is because the air that a dryer blows outside is drawn in from the air in the home and replaced in the home by air that is drawn in from outdoors. During the winter months, this air is cold and must be heated from the outdoor temperature to room temperature by a furnace. For dryers, then, the optimal improvement in efficiency would be greater than PR.

Dishwashers and clothes washers are a little different again. Most of the energy in the hot water they use is dumped down the drain and lost to the household. However, some of the hot water energy escapes from water pipes or from the appliance itself before the water is drained, and contributes to the heating of the house.

Appendices A-1 to A-8 contain relatively detailed estimates, for each of the eight appliances in question, of the potential for gross and net energy savings over the first 10 years of an energy labelling program. In making the calculations, the following average before-label annual unit consumptions of energy by each type of appliance were assumed to decrease by one-tenth of the amount indicated, over each of the ten years:[24]

| | before-label annual unit consumption | ten-year improvement in efficiency |
|---|---|---|
| refrigerators | 1500 kwh. | 40% |
| freezers | 1600 kwh. | 30% |
| electric ranges | 1200 kwh. | 10% |
| clothes washers | 1700 kwh. | 20% |
| electric dryers | 900 kwh. | 10% |
| dishwashers | 1500 kwh. | 20% |
| air conditioners | 400 kwh. | 20% |
| colour televisions | 350 kwh. | 20% |

Gross and net energy savings and net dollar savings for all eight of the labelled appliances together are shown in the table on the next page. Gross Savings, expressed in kwh although part of the savings would be in oil and gas used to heat water for clothes washers and dishwashers, are the savings in the operation of the appliances themselves. These same savings, net of increases in household heating necessitated by the improvements in appliance efficiency, are also shown, this time in units of electricity, gas and oil. It is important to note that there are net losses of oil and gas and that, while the 1985 net savings in electricity are estimated at one per cent of national demand, the losses in gas and oil in that year could both be expected to be about one-tenth of one per cent of national demand. The kwh equivalent of the net savings of all three energy forms would be approximately 58 per cent of the gross savings; that is, on the average, 42 per cent of the savings of energy in the operation of appliances would need to be replaced in the household through increased space heating. The total dollar value of the net savings of electricity, gas and oil are also given in the table, in 1976 dollars at 1976 prices.

Even if the energy efficiencies of all the appliances were to improve no further after 1987, gross energy savings, net energy savings (or losses, in the case of gas and oil) and dollar savings would continue to increase for about 15 years, until all household appliances were of 1987 efficiency. Even beyond that, the savings would continue to increase somewhat in response to population growth.

It is important to note that the figures shown in the table are exactly what the title says -- estimates of the potential for energy savings under an energy labelling program. It would be misleading to refer to these figures as the benefits from a labelling scheme, for there is no way of knowing the extent to which appliances' energy efficiencies would be improved in the absence of energy labels. Historically, many product innovations in Canadian-made appliances

## ESTIMATES OF THE POTENTIAL FOR ENERGY SAVINGS UNDER AN ENERGY LABELLING PROGRAM

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| Gross Savings (millions kwh.)[1] | 115 | 355 | 734 | 1270 | 1972 | 2854 | 3932 | 5215 | 6722 | 8466 |
| Savings Net of Heating Effects[2] | | | | | | | | | | |
| - Electricity (millions kwh.) | 100 | 305 | 626 | 1070 | 1677 | 2426 | 3340 | 4526 | 5700 | 7176 |
| - as % of national demand[3] | | | .18 | | | | | 1.04 | | |
| - Gas (millions cubic feet) | -57 | -164 | -329 | -565 | -869 | -1245 | -1696 | -2231 | -2845 | -3560 |
| - as % of national demand[3] | | | -.02 | | | | | -.10 | | |
| - Oil (millions gallons) | 0 | -2 | -3 | -8 | -11 | -16 | -23 | -31 | -38 | -49 |
| - as % of national demand[3] | | | -.01 | | | | | -.10 | | |
| Dollar Savings (millions dollars)[4] | 1.9 | 4.9 | 10.7 | 17.0 | 27.3 | 39.5 | 53.9 | 73.2 | 92.6 | 115.5 |

Footnotes

1. Savings in energy consumed by labelled appliances, obtained by summing lines E from Appendices A-1 to A-8.

2. Savings of electricity, gas and oil, net of the effects on household heating. The figures are obtained by summing line E from Appendix A-5 and sections M from the other tables in Appendix A.

3. The figures used for national demand in 1980 and 1985 were from the high-price, low growth scenario given on pages 55, 56 and 58 of An Energy Strategy for Canada: Policies for Self-Reliance, Department of Energy, Mines and Resources, Ottawa, 1976.

4. These are the total dollar values (in 1976 dollars and at 1976 prices) of the savings in electricity, gas and oil (whose prices are assumed to be 2 cents per kwh., $1.50 per mcf and 45 cents per gallon respectively).

have been spillovers from U.S. research and development. One could argue, then, that pressures placed on the American industry by the appliance requirements under the Energy Policy and Conservation Act will serve, indirectly, to decrease considerably the energy consumptions of appliances in Canada.

The assumed 10-year improvements in appliance efficiencies used in calculating the estimates of potential energy savings are considered to be conservative. Generally, the improvement percentages were obtained by adjusting the Federal Energy Administration targets for reduced consumption under the U.S. minimum standards program, to reflect information obtained from a variety of other sources. The following are the targets for reductions in the average energy consumption (measured between 1972 and 1980) of each appliance type.[25]

| | |
|---|---|
| Refrigerators | 43-50% |
| Freezers | 33-40% |
| Dishwashers | 22-40% |
| Gas clothes dryers | 14-20% |
| Electric clothes dryers | 6-14% |
| Room air conditioners | 28-40% |
| Colour televisions | 50-80% |
| Electric ranges | 8-20% |
| Gas ranges | 43-50% |
| Clothes washers | 11-50% |

Each of these efficiency targets was discussed in FEA "Technical Background Information" papers. Tables from those papers, showing various design options and their corresponding efficiency improvements (not additive), are reproduced in Appendix F of this paper.[26]

What follows is a brief summary of some of the other evidence that was taken into consideration with respect to possible improvement percentages for the individual appliances.

A. Refrigerators and refrigerator/freezers

1. Page 7 of Appendix 1 of a CAMA submission dated June 15, 1976 states that the approximate range of energy efficiencies (measured in cubic feet per kwh per day) for top-freezer, two-door, frost-free refrigerators sold in Canada is 3.2 to 4.5.
2. The AHAM 1976 Directory of Certified Refrigerators and Freezers shows rather wide ranges in monthly energy costs for refrigerators, refrigerator/freezers and freezers. At 2¢ per kwh., monthly costs for automatic defrost refrigerator/freezers between 15.5 and 18.5 cubic feet in capacity range from $1.70 to $3.45, for example.
3. A Business Week article (July 26, 1976) stated that Philco Cold Guard refrigerators and freezers "are priced about 3% higher than comparable models from Philco's competitors but consume an average of 40% less energy." If the average refrigerator uses 1500 kwh per year, this implies a savings to consumers of $12 per year at current average Canadian electricity prices.

B. Electric ranges

1. In November 1976, Canadian General Electric announced that it was "introducing an energy-saving, self-cleaning oven which ... costs eight per cent less than the previous model."[27] The oven now consumes 27 per cent less energy, saving buyers about $1.80 per year in energy costs, at current prices. This was made possible by a new type of door gasket, improved insulation and a highly efficient hinge.
2. Hydro Quebec, Ontario Hydro and Calgary Power have estimated that during non-cleaning cycles, self-clean ovens use 25% to 40%, 30% to 50% and 15% to 30% less energy respectively than standard ranges, in large part because of higher levels of insulation.[28]
3. In Appendix 1 of the CAMA submission dated June 15, 1976, it is estimated that "the retail premium cost of insulating the oven only (not the door) of a standard range, in the same manner as a self-clean oven would be $7.00. The estimated energy saving is 18%." Assuming an annual energy use of 400 kwh by the oven

portion of standard electric ranges, the value of these savings would be $1.44 per year at current prices. However, the estimate of 18% savings seems low in view of item 2 above.

4. In tests on about 10 standard electric ranges, Consumers' Union estimated differences of about 193 kwh per year, worth about $3.90 at currenet Canadian prices, in the energy usage of the most efficient and least efficient models; presumably the difference would be much larger if self-cleaning ovens were included. For 6 gas ranges, the annual spread was 1440 cubic feet, worth about $2.15 at $1.50 per mcf.[29]

C. Clothes Washers

1. Test results were given for standard-size automatic washing machines in the April 1976 edition of the Canadian Consumer. Of the 12 machines tested, the Simplicity model, costing 9% more than average, used slightly more than one-half as much hot water as the other machines, on average (almost all the energy used by washers is for water heating). It was rated highly in cleaning performance, with only one machine being rated higher. The least efficient hot water users were the Bayerest and the Westinghouse which were rated low in cleaning performance. Assuming 400 loads per year, the national average costs of hot water for the machines, taking into account the costs of heating water by both gas and electricity, range from a low of about $16 per year to a high of about $36.

D. Clothes Dryers

1. Consumers' Research Magazine, July 1975, reports that, for the 12 electric dryers tested, the most efficient model(when measured in pounds of water removed per kwh) required about 25 per cent less energy than the least efficient. If the average annual use of electricity per dryer is 900 kwh, then the differences in operating costs would be about $4.50 at 2¢ per kwh.

E. Televisions

1. For nine 19-inch colour television sets tested for the December 1975 issue of Consumers' Research Magazine, energy operating costs ranged from 22¢ to 33.2¢ for 100 hours of use, at 2¢ per kwh. Neither picture quality nor overall rating seemed to be related to the amount of energy consumed.

F. Air conditioners

1. In a brief dated May 18, 1976 submitted by the Heating, Refrigerating and Air Conditioning Institute of Canada, it was stated that room air conditioners have an approximate range of Energy Efficiency Ratios (measured in BTU's per watt-hr.) of 5.6 to 9.8.

2. In the 1976 AHAM Directory of Certified Room Air Conditioners, these ranges of EER's are reported for 115-volt window air conditioners of different cooling capacities:

| | |
|---|---|
| under 9,000 BTU/hr. | 5.4 to 10.5 |
| 9,000 to 12,000 BTU/hr. | 6.6 to 11.6 |
| 12,000 to 15,000 BTU/hr. | 8.7 to 10.2 |

Assuming an average of 400 hours' use per year, and an electricity cost of 2¢ per kwh, the annual operating costs for air conditioners with different EER's are as shown in the following table.

ENERGY EFFICIENCY RATIO

| BTU/hr. | 5 | 7 | 9 | 11 |
|---|---|---|---|---|
| 6,000 | $9.60 | $6.84 | $5.34 | $4.38 |
| 8,000 | $12.80 | $9.12 | $7.12 | $5.84 |
| 10,000 | | $11.40 | $8.90 | $7.30 |
| 12,000 | | $13.68 | $12.46 | $10.22 |

3. According to information given in the June 1976 issue of Consumers' Research Magazine, some air conditioners can be purchased for significantly less than competing products with similar cooling capacities and EER's. Gibson and Hotpoint models rated at 10,000 BTU/hr., each with EER's of 7.5, were priced at $240 and $360 respectively, for example (U.S. prices).

4. The HRAI brief mentioned above also made these comments on energy efficiency improvements:

> "A theoretical model was developed for a 5000 BTU room air conditioner. To increase the E.E.R. from 6.0 to 8.0, based upon Canadian operating conditions of 400 hrs/annum, using power at a cost of 1.8¢ per KWH, the payback to the consumer would be 19.3 years without changing values.
> It is also a fact that increasing the E.E.R. also significantly increases the size and weight of the unit. This necessitates using more resources and also more energy to produce. Another model was developed and it was found that the weight increased by 17 lbs. Industry has concurred that it requires 20 KWH to convert raw material to derive 1 lb. of material. This then gives 340 KWH to reduce the energy being consumed by the final product. It is then apparent that we consume more producing than is saved."

Appendix G shows how the payback period of 19.3 years was calculated by Westinghouse. For several reasons, this argument by HRAI, that the 24% reduction in energy consumption associated with raising the EER from 6 to 8 is not economically feasible, is not seen as conflicting with the assertion in this paper that an energy labelling scheme could play an important role in bringing about economically justified improvements in the energy efficiency of room air conditioners, of at least 20% over the next 10 years. First, the HRAI example considers the possibility of <u>immediate</u> changes to product design, as opposed to longer term changes that could be co-ordinated in an optimal fashion with on-going purchases of capital equipment. New technology and product innovations are likely to come about in the United States, where the basic design work for air conditioners apparently is done, in response to further rises in the real costs of electricity and to pressure by the U.S. government.

Furthermore, it is believed that,if manufacturers were to make major changes in the design of their air conditioners over the long term, improved efficiency would not necessarily mean heavier products as suggested by HRAI. In the Consumers' Research Magazine article mentioned in item 3 above, the weights of 8,000 BTU/hr. models with EER's of 9.2 or 9.3 range from 115 pounds to 142 pounds. Apparently

then, if some manufacturers were to make major long-run design changes to their products rather than merely "scaling up" the efficiencies of existing models by adding weight to evaporators, condensers, compressors and other components, efficiency gains could be made without adding weight to the products. It is worth noting, too, that other sources of information estimate the energy input per pound of product to be less than 20 kwh.[30]

Concluding Remarks

The following recommendations are made with respect to the development of energy labels:

1. a steering committee, with representatives from the Consumer Standards Directorate, the Consumer Interest Study Group and the Office of Energy Conservation should be formed immediately to co-ordinate the program; the Legal Branch, Information and Public Relations and the Consumer Services Branch can be involved when necessary;
2. the department should proceed immediately to put together a rough draft of regulations to be issued under the Consumer Packaging and Labelling Act, to be sent to the Privy Council legal office for assessment; if this regulatory route proves not to be feasible, the government will be able to fall back on some other option, as suggested by the forthcoming legal opinion from the Department of Justice;
3. subject to the findings of a quick pre-market test of some label alternatives for consumer comprehension, the labels should show dollar estimates of 10-year or 15-year energy operating costs;
4. products should be labelled according to their gross consumption of energy, rather than their consumption net of increases to household heating, for two reasons:
   a) the principal aim of the program is to save as much energy as possible in the operation of appliances;
   b) the over-statement of "true" savings is likely to be more than offset by consumers' tendancy to weigh savings in initial purchase cost more heavily than savings in future energy operating costs;

5. some variation of the "full information" label (showing how energy costs are affected by provincial residential energy costs and by product usage) probably should be required by the regulations at first; while pre-market tests can determine whether consumers will understand the labels, only after the labels are actually on products will we be able to determine the extent to which shoppers read, and are affected by, the supplementary information given in the table to the right. If they don't use it, it can be removed in later years; in the meantime, the basic national average costs still would be plainly visible.

FOOTNOTES

1. The Energy Policy and Conservation Act of December, 1975 gives the Federal Energy Administration the power to set targets for improvements in the average energy consumption of major household appliances, and to prescribe mandatory minimum energy efficiency standards in the event that these targets are not approached at a reasonable rate. The FEA budgeted more than $3,000,000 in 1976 for research and development into energy labels and minimum standards.

2. The "average" refrigerator/freezer, for example, is assumed to be about 15 cubic feet in capacity, to cost less than $400 and to consume about 1500 kwh./year. At 1976 electricity prices of 2¢/kwh., energy costs are $30 per annum, or $450 (without discounting) over the assumed 15-year life of the product.

3. According to a CAMA submission dated June 15, 1976, some refrigerator/freezers use approximately 50% more energy per cubic foot of capacity than the most efficient models.

4. Product Information Preference of Disadvantaged Consumers by John Liefeld, Department of Consumer Studies, University of Guelph, for the Consumer Research Council, 1975.

5. Research Project to Develop Energy Information Labels for Home Appliances, prepared by Human Sciences Research Inc., McLean, Virginia for the National Bureau of Standards, U.S. Department of Commerce, September 1974.

6. At this stage, the labels are shown as unilingual English because general label content is the principal concern. When labels actually appear on the market, however, they will be fully bilingual, probably either as a one-side sticker or as a tag with English on one side and French on the other.

7. In "Prepurchase Information Seeking for New Cars and Major Household Appliances" by Newman and Staelin, Journal of Marketing Research, August 1972, the number of stores visited by the 653 people sampled, and the out-of-store information-seeking scores obtained by those people (out of a possible 20), were distributed as follows:

| Number of Stores | | Information-Seeking Score | |
|---|---|---|---|
| 1 | 49% | 0 to 2 | 22% |
| 2 or 3 | 26% | 3 to 5 | 27% |
| 4 or 5 | 16% | 6 to 8 | 24% |
| 6 or more | 7% | 9 to 11 | 14% |
| | | 12 to 14 | 9% |
| | | 15 to 20 | 4% |

8. "A Taxonomy of Prepurchase Information Gathering Patterns" by Claxton, Fry and Portis, Journal of Consumer Research, December 1974, shows that 8% of the sample of 293 made an average of 8 store visits before buying, while 27% made 4 visits and the remaining 65% averaged about 1.2 visits. Also see footnote 6 above.

9. The U.S. Energy Policy and Conservation Act requires that major appliances shall be labelled as to their estimated annual energy consumption, and that the labels shall include a comparison against the energy consumption of competing products. For refrigerators, refrigerator/freezers, freezers, dishwashers, clothes dryers and room air conditioners, the comparison groupings shown in Appendix B of this paper are quite similar to those proposed by the FTC for use in the United States (page 43250, Federal Register, September 30, 1976). The other groupings were dreamt up by the writer.

10. From thus-far unpublished information received from Statistics Canada on local electricity bills for January 1976, and from the Canadian Gas Association 1975 Statistical Summary figures for December 1975, the following provincial average costs of residential energy were assumed:

| | electricity (¢ per kwh.) | gas ($ per mcf.) |
|---|---|---|
| Newfoundland | 2.3 | - |
| Prince Edward Island | 4.5 | - |
| Nova Scotia | 2.7 | - |
| New Brunswick | 2.2 | - |
| Quebec | 1.8 | 2.21 |
| Ontario | 1.7 | 1.74 |
| Manitoba | 1.6 | 1.68 |
| Saskatchewan | 2.0 | 1.19 |
| Alberta | 2.0 | .95 |
| British Columbia | 2.2 | 1.49 |

11. By converting figures given in the March 1974 edition of Consumers' Research Magazine to imperial gallons, the following costs of heating water by electricity and gas were calculated:

| | electricity (¢ per gallon) | gas (¢ per gallon) |
|---|---|---|
| Newfoundland | .69 | |
| Prince Edward Island | 1.35 | |
| Nova Scotia | .81 | |
| New Brunswick | .66 | |
| Quebec | .54 | .31 |
| Ontario | .51 | .24 |
| Manitoba | .48 | .24 |
| Saskatchewan | .60 | .17 |
| Alberta | .60 | .14 |
| British Columbia | .66 | .21 |

12. Only the costs of hot water are included in the figures given on the labels; that is, the relatively small costs of electricity are excluded. The figures are for a washing machine using 15 gallons of hot water per load.

13. For this mock-up, the 10-year cost was obtained by multiplying the annual cost shown on the other two labels by 10. In practice, however, the yearly costs could be discounted to present value or adjusted for anticipated increases in energy prices.

14. An Examination of Measures Designed to Encourage Energy Conservation from the Perspective of Motivation Theory, prepared for the Office of Energy Conservation in October, 1975 by Avrim Lazar and Associates, Ottawa, defines "extrinsic motivation" as motivation employing rewards and punishments, or incentives and disincentives. "Intrinsic motivation" changes behaviour by altering the basic values of individuals. Energy labels are largely an extrinsic motivation suggesting, in effect, that energy conservation is a tool to be used in saving money, thus increasing one's potential for consuming.

15. Think, for example, how differences between products would be distorted if some manufacturers were to test refrigerator/freezers in a room at 20°C, with the freezer at -9°C and the refrigerator at 6°C, while other manufacturers tested their products in a room at 30°C with the two compartments set at -15°C and 1°C respectively.

16. In a letter to the writer dated April 9, 1976 from the Assistant Director, Special Projects, Standards Division, Canadian Standards Association.

17. Officials at both the NRC and the CSA have indicated an interest in becoming involved in the testing of energy consumptions. Before taking the discussions any further, more information will be needed on the exact nature of the tests, the number of tests to be performed per year, and so on.

18. Sample sizes are set out in SOR/75-130, Canada Gazette Part II, March 7, 1975.

19. Section 38 of the Consumer Packaging and Labelling Regulations, SOR/74-142, Canada Gazette Part II, March 1, 1974.

20. From data in the CAMA Industry Forecast 1976, and from discussions with people in the industry, it was assumed that about 20 per cent of appliances sold in Canada are imports. Ontario and Quebec were each assumed to provide 45 per cent of the domestic production.

21. Section 325 of the Act. Other costs and benefits of the labels, such as any change in the utility or performance of the product, or any negative effects on competition, are also to be taken into consideration.

22. From a computer simulation of a typical house, the Division of Building Research determined that, with the indicated insulation levels, energy wasted by appliances would contribute to household heating for the following portions of the year:

| | R20 walls R30 ceilings | R12 walls R20 ceilings |
|---|---|---|
| Vancouver | 25% | |
| Lethbridge | 37% | |
| Saskatoon | 47% | |
| Winnipeg | 48% | |
| Toronto | 35% | |
| Ottawa | 40% | 47% |
| Montreal | 37% | |
| Fredricton | 38% | |
| Halifax | 38% | |
| Saint Johns | 48% | |

The national average would be about 37 per cent for R20 in the walls and R30 in the ceilings. The Ottawa figure is increased by 18 per cent if levels of R12 and R20 are assumed; applying this same percentage to the national average for the higher insulation levels yields an estimate of 44 per cent for the national average with levels R12 and R20. But even these levels of insulation are higher than found in the average Canadian household. Assuming that houses with no insulation at all would require heating throughout about 65 per cent of the year (national average), the figure for a typical household in Canada was assumed to be 55 per cent.

The assumptions made and the equations used in the NRC computer simulation are outlined in Building Research Note 117, Net Annual Heat Loss Factor Method for Estimating Heat Requirements of Buildings, November 1976, by G. P. Mitalas.

23. For the purpose of simplicity, this assumes an equivalence amongst the heating values per dollar received from oil, gas and electricity.

24. The before-label consumptions were based on information from a number of sources, including the CAMA and HRAI briefs, the Office of Energy Conservation's 100 Ways to Save Energy and Money in the Home, the AHAM refrigerator directory, and a paper by Ontario Hydro's Power Market Analysis Department, dated January 1976, entitled "Selected Analyses of Electricity Use in Ontario". Information to support the assumed 10-year efficiency improvements is given further on in the "Costs and Benefits" section of this paper.

25. Page 19881, Federal Register, May 14, 1976.

26. The titles of the technical papers, put out in March 1976 by the Appliance Efficiency Program, Conservation and Environment, Federal Energy Administration, Washington D.C. 20461, are:

Technical Background Information for Appliance Efficiency Targets for Clothes Dryers;
Technical Background Information for Appliance Efficiency Targets for Clothes Washers;
Technical Background Information for Appliance Efficiency Targets for Monochrome and Colour Televisions;
Technical Background Information for Appliance Efficiency Targets for Room Air Conditioners;
Technical Background Information for Appliance Efficiency Targets for Freezers;
Technical Background Information for Appliance Efficiency Targets for Kitchen Ranges and Ovens;
Technical Background Information for Appliance Efficiency Targets for Dishwashers;
Technical Background Information for Appliance Efficiency Targets for Refrigerator-Freezers.

27. From an article in the Ottawa Citizen, exact date unknown.

28. This information was contained in a letter dated March 31, 1975 from a CAMA member (name not legible) to the Office of Energy Conservation.

29. Page 528, Consumer Reports, July 1974

30. Mr. F. Metcalfe, Vice President (Engineering) of White Westinghouse, Edison, in an address on energy efficiency ratios to the Technical Licensee Conference (a world-wide technical group), used a figure of 10 kwh per pound.

ESTIMATES OF THE POTENTIAL FOR ENERGY SAVINGS UNDER AN ENERGY LABELLING PROGRAM

REFRIGERATORS *

| | | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Savings Factor | .00 | .04 | .08 | .12 | .16 | .20 | .24 | .28 | .32 | .36 | .40 |
| B | Unit Savings (kwh.) | 0 | 60 | 120 | 180 | 240 | 300 | 360 | 420 | 480 | 540 | 600 |
| C | Sales (thousands) | 669 | 710 | 744 | 784 | 835 | 860 | 895 | 935 | 975 | 1015 | 1055 |
| D | Apparent Annual Savings for the Year's Production (millions kwh.) | 0 | 43 | 89 | 141 | 200 | 258 | 322 | 393 | 468 | 548 | 633 |
| E | Apparent Savings for Products Improved to Date (millions kwh.) | 0 | 43 | 132 | 273 | 473 | 731 | 1053 | 1446 | 1914 | 2462 | 3095 |
| G | Loss of Heat to the Home (millions kwh.) | 0 | 24 | 73 | 150 | 260 | 402 | 579 | 795 | 1053 | 1354 | 1702 |
| H | Increased Heating - Oil (millions gallons) | 0 | 0 | 1 | 2 | 4 | 6 | 9 | 13 | 17 | 22 | 27 |
| | - Gas (millions cubic feet) | 0 | 47 | 141 | 291 | 504 | 779 | 1122 | 1541 | 2041 | 2624 | 3298 |
| | - Electricity (millions kwh.) | 0 | 3 | 8 | 16 | 29 | 44 | 64 | 87 | 116 | 149 | 187 |
| M | Actual Savings | | | | | | | | | | | |
| | - Electricity (millions kwh.) | 0 | 40 | 124 | 257 | 444 | 687 | 989 | 1359 | 1793 | 2313 | 2908 |
| | - Gas (millions cubic feet) | 0 | -47 | -141 | -291 | -504 | -779 | -1122 | -1541 | -2041 | -2624 | -3298 |
| | - Oil (millions gallons) | 0 | 0 | -1 | -2 | -4 | -6 | -9 | -13 | -17 | -22 | -27 |
| | Total Actual Savings (millions kwh.) | 0 | 19 | 59 | 123 | 213 | 329 | 474 | 651 | 861 | 1108 | 1393 |

... on page A-9

ESTIMATES OF THE POTENTIAL FOR ENERGY SAVINGS UNDER AN ENERGY LABELLING PROGRAM

ELECTRIC RANGES*

| | | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Savings Factor | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 | .10 |
| B | Unit Savings (kwh) | 0 | 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 |
| C | Sales (thousands) | 563 | 598 | 639 | 678 | 715 | 750 | 785 | 820 | 855 | 890 | 925 |
| D | Apparent Annual Savings for the Year's Production (millions kwh.) | 0 | 7 | 15 | 24 | 34 | 45 | 57 | 69 | 82 | 96 | 111 |
| E | Apparent Savings for Products Improved to Date (millions kwh.) | 0 | 7 | 22 | 46 | 80 | 125 | 182 | 251 | 333 | 429 | 540 |
| G | Loss of Heat to the Home (millions kwh.) | 0 | 4 | 12 | 25 | 44 | 69 | 100 | 138 | 183 | 236 | 297 |
| H | Increased Heating - Oil (millions gallons) | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 2 | 3 | 4 | 5 |
| | - Gas (millions cubic feet) | 0 | 8 | 23 | 48 | 85 | 134 | 194 | 267 | 355 | 457 | 576 |
| | - Electricity (millions kwh.) | 0 | 0 | 1 | 3 | 5 | 8 | 11 | 15 | 20 | 26 | 33 |
| M | Actual Savings | | | | | | | | | | | |
| | - Electricity (millions kwh.) | 0 | 7 | 21 | 43 | 65 | 117 | 171 | 236 | 313 | 403 | 507 |
| | - Gas (millions cubic feet) | 0 | -8 | -23 | -48 | -85 | -134 | -194 | -267 | -355 | -456 | -576 |
| | - Oil (millions gallons) | 0 | 0 | 0 | 0 | -1 | -1 | -2 | -2 | -3 | -4 | -5 |
| N | Total Actual Savings (millions kwh.) | 0 | -3 | 10 | 21 | 36 | 56 | 82 | 113 | 150 | 193 | 243 |

on page A-9

ESTIMATES OF THE POTENTIAL FOR ENERGY SAVINGS UNDER AND ENERGY LABELLING PROGRAM

FREEZERS*

| | | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Savings Factor | .00 | .03 | .06 | .09 | .12 | .15 | .18 | .21 | .24 | .27 | .30 |
| B | Unit Savings (kwh.) | 0 | 48 | 96 | 144 | 192 | 240 | 288 | 336 | 384 | 432 | 480 |
| C | Sales (thousands) | 457 | 474 | 493 | 511 | 528 | 548 | 568 | 588 | 608 | 628 | 648 |
| D | Apparent Annual Savings for Year's Production (millions kwh.) | 0 | 23 | 47 | 74 | 101 | 132 | 164 | 198 | 233 | 271 | 311 |
| E | Apparent Savings for Products Improved to Date (millions kwh.) | 0 | 23 | 70 | 144 | 245 | 377 | 541 | 739 | 972 | 1243 | 1554 |
| G | Loss of Heat to House (millions kwh.) | 0 | 13 | 38 | 79 | 135 | 207 | 298 | 406 | 534 | 684 | 855 |
| H | Increased Heating - Oil (millions gallons) | 0 | 0 | 1 | 1 | 2 | 3 | 5 | 6 | 9 | 11 | 14 |
| | - Gas (millions cubic feet) | 0 | 25 | 74 | 153 | 262 | 401 | 578 | 787 | 1035 | 1326 | 1657 |
| | - Electricity (millions kwh.) | 0 | 1 | 4 | 9 | 15 | 23 | 33 | 45 | 59 | 75 | 94 |
| M | Actual Savings | | | | | | | | | | | |
| | - Electricity (millions kwh.) | 0 | 22 | 66 | 135 | 230 | 354 | 508 | 694 | 913 | 1168 | 1460 |
| | - Gas (millions cubic feet) | 0 | -25 | -74 | -153 | -262 | -401 | -578 | -787 | -1035 | -1326 | -1657 |
| | - Oil (millions gallons) | 0 | 0 | -1 | -1 | -2 | -3 | -5 | -6 | -9 | -11 | -14 |
| | Total Actual Savings (millions kwh.) | 0 | 10 | 32 | 65 | 110 | 170 | 243 | 333 | 437 | 559 | 699 |

Continued on page A-9

ESTIMATE OF THE POTENTIAL FOR ENERGY SAVING UNDER AN ENERGY LABELLING PROGRAM

COLOUR TELEVISION*

| | | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Savings Factor | .00 | .04 | .08 | .12 | .16 | .20 | .24 | .28 | .32 | .36 | .40 |
| B | Unit Savings (kwh.) | 0 | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 |
| C | Sales (thousands) | 900 | 945 | 992 | 1042 | 1094 | 1149 | 1206 | 1266 | 1330 | 1396 | 1466 |
| D | Apparent Annual Savings for the Year's Production (millions kwh.) | 0 | 7 | 14 | 22 | 31 | 40 | 51 | 62 | 74 | 88 | 103 |
| E | Apparent Savings for Products Improved to Date (millions kwh.) | 0 | 7 | 21 | 43 | 74 | 114 | 165 | 227 | 301 | 389 | 492 |
| G | Loss of Heat to Home (millions kwh.) | 0 | 4 | 12 | 24 | 41 | 63 | 91 | 125 | 166 | 214 | 271 |
| H | Increased Heating - Oil (millions gallons) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 3 | 3 | 4 |
| | - Gas (millions cubic feet) | 0 | 8 | 23 | 47 | 79 | 122 | 176 | 242 | 322 | 415 | 525 |
| | - Electricity (millions kwh.) | 0 | 0 | 1 | 3 | 5 | 7 | 10 | 14 | 18 | 24 | 30 |
| M | Actual Savings | | | | | | | | | | | |
| | - Electricity (millions kwh.) | 0 | 7 | 20 | 40 | 69 | 107 | 155 | 213 | 283 | 365 | 462 |
| | - Gas (millions cubic feet) | 0 | -8 | -23 | -47 | -79 | -122 | -176 | -242 | -322 | -415 | -525 |
| | - Oil (millions gallons) | 0 | 0 | 0 | 0 | -1 | -1 | -1 | -2 | -3 | -3 | -4 |
| | Total Actual Savings (millions kwh.) | 0 | 3 | 9 | 19 | 33 | 51 | 74 | 102 | 135 | 175 | 221 |

Continued on page A-9

ESTIMATE OF THE POTENTIAL FOR ENERGY SAVING UNDER AN ENERGY LABELLING PROGRAM

ROOM AIR CONDITIONERS*

| | | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Savings Factor | .00 | .02 | .04 | .06 | .08 | .10 | .12 | .14 | .16 | .18 | .20 |
| B | Unit Savings (kwh.) | 0 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 |
| C | Sales (thousands) | 190 | 205 | 220 | 220 | 230 | 240 | 250 | 260 | 270 | 280 | 290 |
| D | Annual Savings for the Year's Production (millions kwh.) | 0 | 2 | 4 | 5 | 7 | 10 | 12 | 15 | 17 | 20 | 23 |
| E | Total Savings (millions kwh.) | 0 | 2 | 6 | 11 | 18 | 28 | 40 | 55 | 72 | 92 | 115 |

*Footnotes on page A-9

## DISHWASHERS*

| | | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Savings Factor | .00 | .02 | .04 | .06 | .08 | .10 | .12 | .14 | .16 | .18 | .20 |
| B | Unit Savings (kwh.) | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 |
| C | Sales (thousands) | 315 | 350 | 395 | 435 | 480 | 520 | 560 | 600 | 635 | 670 | 705 |
| D | Apparent Annual Savings for the Year's Production (millions kwh.) | 0 | 11 | 24 | 39 | 58 | 78 | 101 | 126 | 152 | 181 | 212 |
| E | Apparent Savings for Products Improved to Date (millions kwh.) | 0 | 11 | 35 | 74 | 132 | 210 | 311 | 437 | 589 | 770 | 982 |
| F | Savings of Electric Input (millions kwh.) | 0 | 5 | 16 | 33 | 59 | 94 | 140 | 197 | 265 | 346 | 442 |
| G | Loss of Heat to Home (millions kwh.) | 0 | 3 | 9 | 18 | 32 | 52 | 77 | 108 | 146 | 190 | 243 |
| H | Increased Heating - Oil (millions gallons) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 3 | 4 |
| | - Gas (millions cubic feet) | 0 | 6 | 17 | 35 | 62 | 101 | 149 | 209 | 283 | 368 | 471 |
| | - Electricity (millions kwh.) | 0 | 0 | 1 | 2 | 4 | 6 | 8 | 12 | 16 | 21 | 27 |
| I | Savings of Hot Water Input (millions kwh.) | 0 | 6 | 19 | 41 | 73 | 116 | 171 | 240 | 324 | 424 | 540 |
| J | Savings of Fuels - Electricity (millions kwh.) | 0 | 3 | 10 | 21 | 37 | 59 | 87 | 122 | 165 | 216 | 275 |
| | - Gas (millions cubic feet) | 0 | 14 | 34 | 73 | 130 | 207 | 305 | 428 | 578 | 757 | 964 |
| | - Oil (millions gallons) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 |
| K | Loss of Heat to Home (millions kwh.) | 0 | 1 | 3 | 7 | 12 | 19 | 28 | 40 | 53 | 70 | 89 |
| L | Increased Heating - Oil (millions gallons) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| | - Gas (millions cubic feet) | 0 | 2 | 6 | 14 | 23 | 37 | 54 | 78 | 103 | 136 | 172 |
| | - Electricity (millions kwh.) | 0 | 0 | 0 | 1 | 1 | 2 | 3 | 4 | 6 | 8 | 10 |
| | Actual Savings | | | | | | | | | | | |
| | - Electricity (millions kwh.) | 0 | 8 | 25 | 51 | 91 | 145 | 216 | 303 | 403 | 533 | 680 |
| | - Gas (millions cubic feet) | 0 | 5 | 11 | 24 | 45 | 69 | 102 | 141 | 192 | 253 | 321 |
| | - Oil (millions gallons) | 0 | 0 | 0 | 0 | -1 | -1 | -1 | -2 | -2 | -2 | -3 |
| M | Actual Savings (millions kwh.) | 0 | 7 | 23 | 49 | 88 | 139 | 206 | 289 | 388 | 510 | 650 |

... numbers on page A-10

## AUTOMATIC CLOTHES WASHERS*

| | | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Savings Factor | .00 | .02 | .04 | .06 | .08 | .10 | .12 | .14 | .16 | .18 | .20 |
| B | Unit Savings (kwh.) | 0 | 34 | 68 | 102 | 136 | 170 | 204 | 238 | 272 | 306 | 340 |
| C | Sales (thousands) | 490 | 520 | 560 | 590 | 625 | 660 | 695 | 730 | 765 | 800 | 835 |
| D | Apparent Annual Savings for the Year's Production (millions kwh.) | 0 | 18 | 38 | 60 | 85 | 112 | 142 | 174 | 208 | 245 | 284 |
| E | Apparent Savings for Products Improved to Date (millions kwh.) | 0 | 18 | 56 | 116 | 201 | 313 | 455 | 629 | 837 | 1082 | 1366 |
| F | Savings of Electric Input (millions kwh.) | 0 | 1 | 3 | 6 | 10 | 16 | 23 | 31 | 42 | 54 | 68 |
| G | Loss of Heat to Home (millions kwh.) | 0 | 1 | 2 | 3 | 6 | 9 | 13 | 17 | 23 | 30 | 37 |
| H | Increased Heating - Oil (millions gallons) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | - Gas (millions cubic feet) | 0 | 2 | 4 | 6 | 12 | 17 | 25 | 33 | 45 | 58 | 72 |
| | - Electricity (millions kwh.) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 3 | 3 | 4 |
| I | Savings of Hot Water Input (millions kwh.) | 0 | 17 | 53 | 110 | 191 | 297 | 432 | 598 | 795 | 1028 | 1298 |
| J | Savings of Fuels - Electricity (millions kwh.) | 0 | 9 | 27 | 56 | 97 | 151 | 220 | 305 | 405 | 524 | 662 |
| | - Gas (millions cubic feet) | 0 | 30 | 94 | 196 | 341 | 530 | 771 | 1067 | 1419 | 1835 | 2317 |
| | - Oil (millions gallons) | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 2 | 3 | 4 | 5 |
| K | Loss of Heat to Home (millions kwh.) | 0 | 2 | 7 | 15 | 26 | 41 | 60 | 83 | 110 | 142 | 179 |
| L | Increased Heating - Oil (millions gallons) | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 3 |
| | - Gas (millions cubic feet) | 0 | 4 | 14 | 29 | 50 | 79 | 116 | 161 | 213 | 275 | 347 |
| | - Electricity (millions kwh.) | 0 | 0 | 1 | 2 | 3 | 5 | 7 | 9 | 12 | 16 | 20 |
| | Actual Savings | | | | | | | | | | | |
| | - Electricity (millions kwh.) | 0 | 10 | 29 | 60 | 103 | 161 | 235 | 325 | 432 | 559 | 706 |
| | - Gas (millions cubic feet) | 0 | 26 | 76 | 161 | 279 | 434 | 630 | 873 | 1161 | 1502 | 1898 |
| | - Oil (millions gallons) | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 2 | 1 |
| | Total Actual Savings (millions kwh.) | 0 | 15 | 47 | 98 | 169 | 263 | 382 | 529 | 704 | 910 | 1150 |

*Footnotes on page A-10

## ELECTRIC DRYERS*

| | | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Savings Factor | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 | .10 |
| B | Unit Savings (kwh.) | 0 | 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 |
| (D) | Sales (thousands) | 435 | 470 | 495 | 530 | 560 | 590 | 620 | 650 | 680 | 710 | 740 |
| | Apparent Annual Savings for the Year's Production (millions kwh.) | 0 | 4 | 9 | 14 | 20 | 27 | 33 | 41 | 49 | 58 | 67 |
| E | Apparent Savings for Products Improved to Date (millions kwh.) | 0 | 4 | 13 | 27 | 47 | 74 | 107 | 148 | 197 | 255 | 322 |
| G | Loss of Heat to Home (millions kwh.) | 0 | 0 | 1 | 1 | 3 | 4 | 6 | 8 | 11 | 14 | 18 |
| H | Increased Heating - Oil (millions gallons) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | - Gas (millions cubic feet) | 0 | 0 | 2 | 2 | 6 | 8 | 12 | 16 | 21 | 27 | 35 |
| | - Electricity (millions kwh.) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 |
| I | Savings of Warm Air Intake (millions kwh.) | 0 | 2 | 6 | 14 | 24 | 37 | 54 | 74 | 98 | 128 | 161 |
| J | Decreased Heating - Oil (millions gallons) | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 3 |
| | - Gas (millions cubic feet) | 0 | 4 | 12 | 27 | 47 | 72 | 105 | 143 | 190 | 248 | 312 |
| | - Electricity (millions kwh.) | 0 | 0 | 1 | 2 | 3 | 4 | 6 | 8 | 11 | 14 | 18 |
| | Actual Savings | | | | | | | | | | | |
| | - Electricity (millions kwh.) | 0 | 4 | 14 | 29 | 50 | 78 | 112 | 155 | 207 | 267 | 333 |
| | - Gas (millions cubic feet) | 0 | 4 | 10 | 25 | 41 | 64 | 93 | 127 | 169 | 221 | 277 |
| | - Oil (millions gallons) | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 3 |
| | Total Actual Savings (millions kwh.) | 0 | 6 | 13 | 40 | 68 | 107 | 155 | 214 | 284 | 369 | 465 |

Continued on page A-11

Footnotes for Calculations of Savings for Refrigerators, Ranges, Freezers, Televisions and Air Conditioners

A. Assumed improvements in efficiency at constant rates over 10 years:

| | |
|---|---|
| - refrigerators | 40% |
| - electric ranges | 10% |
| - freezers | 30% |
| - colour televisions | 40% |
| - air conditioners | 20% |

B. Savings factor multiplied by the following assumed before-label average unit annual energy consumptions:

| | |
|---|---|
| - refrigerators | 1500 kwh. |
| - electric ranges | 1200 kwh. |
| - freezers | 1600 kwh. |
| - colour televisions | 175 kwh. |
| - air conditioners | 400 kwh. |

C. Straight-line extrapolation from CANA Industry Forecasts 1976, except for televisions for which the assumed 1977 figure of 900,000 was increased by 5% per year.

D. B multipled by C

E. The sum of D over all previous years and current year

G. Assuming that the wasted energy goes as useful heat into the home during 55% of the year, based on discussions with the Division of Building Research, National Research Council.

H. Assuming that 51%, 38% and 11% of Canada's home heating uses oil, gas and electricity respectively, based on Stat. Can. #64-202, Household Facilities and Equipment, April 1975.

M. E minus H

N. E minus G

Footnotes for Dishwasher and Clothes Washer Calculations

A Assumed improvements in efficiency of 20% (D) and 30% (CW) at constant rates over 10 years

B Savings factor multiplied by before-label assumed average unit annual consumptions of 1500 kwh. (D) and 1700 kwh. (CW)

C Straight-line extrapolation from CAMA Industry Forecasts 1976

D B multiplied by C

E The sum of D over all previous years and current year

F Using U.S. Dept. of Commerce estimate that 45% (D) and 5% (CW) of savings would be in electric input

G Assuming that the wasted energy goes as useful heat into the home during 55% of the year, based on discussions with the Division of Building Research, National Research Council

H Assuming that 51%, 38% and 11% of Canada's home heating uses oil, gas and electricity respectively, based on Stat. Can. #64-202, Household Facilities and Equipment, April 1975

I Using U.S. Dept. of Commerce estimate that 55% (D) and 95% (CW) of savings would be in hot water input

J Assuming that 51%, 35% and 14% of Canada's household hot water is heated by electricity, gas and oil respectively, based on Stat. Can. #64-202, Household Facilites and Equipment, April 1975

K Assuming that 30% (D) and 25% (CW) of hot water energy escapes to the house, based on Efficiency of Electric Water Heaters by S. Masteris of Ontario Hydro, March 1976, and assuming that 55% of that energy contributes to heating the home in winter months

L Same as H above

M (F + J) - (H + L)

N E - ( G + K)

Footnotes for Electric Dryer Calculations

A. Assumed improvement in efficiency of 10% at a constant rate over 10 years

B. Savings factor multiplied by before-label assumed average unit annual consumption of 900 kwh.

C. Straight-line extrapolation from CAMA Industry Forecasts 1976

D. B multiplied by C

E. The sum of D over all previous years and current year

G. Assuming that the wasted energy goes as useful heat into the home during 55% of the year, based on discussions with the Division of Building Research, National Research Council.

H. Assuming that 51%, 38% and 11% of Canada's home heating uses oil, gas and electricity respectively, based on Stat. Canada #64-202, Household Facilities and Equipment, April 1975.

I. E multipled by .50, on the assumption that the heat value of warm air drawn into the dryer from the home is equal to 50% of the dryer's consumption of electricity, based on a submission by Howard Davis of Delmarco Management Ltd. of Burnaby, British Columbia

J. Same as H above

M. (E + J) - H

N. (E + I) - G

# POSSIBLE COMPARISON GROUPINGS

Down the left-hand side of the page are listed types of product which should be grouped together for purposes of useful consumer comparison. For products available in different sizes or capacities, further breakdown would be needed; possible size groupings are listed at the right of the page.

| Product Type | Size or Capacity | Size Groupings |
|---|---|---|
| Refrigerators (one door) | 7.5 to 8.4 cu.ft. | 6.5 to 9.5 cu.ft. |
| Manual Refrigerator/Freezers | 8.5 to 7.4 | 7.5 to 10.5 |
| Automatic Refrigerator/Freezers | 9.5 to 10.4 | 8.5 to 11.5 |
| Manual Freezers | : | : |
| Automatic Freezers | : | : |
| | 24.5 to 25.4 | 23.5 to 26.5 |
| Standard Electric Ranges | | |
| Self-Clean Electric Ranges | | |
| Gas Ranges | | |
| Automatic Clothes Washers | | full-size |
| | | compact |
| Electric Clothes Dryers | | full-size |
| Gas Clothes Dryers | | compact |
| Dishwashers | | |
| Room Air Conditioners | 4,800 to 5,299 BTU/hr | 4,500 to 5,600BTU |
| (115 volt) | 5,300 to 5,799 | 5,000 to 6,100 |
| | 5,800 to 6,299 | 5,500 to 6,600 |
| | : | : |
| | : | : |
| | 15,800 to 16,299 | 15,000 to 16,600 |
| B/W Television | 5 inches | 4 to 6 inches |
| Colour Television | 6 | 5 to 7 |
| | 7 | 6 to 8 |
| | : | : |
| | : | : |
| | 27 | 26 to 28 |

# EXISTING STANDARDS FOR MEASURING ENERGY CONSUMPTION AND/OR PERFORMANCE

Refrigerators, Refrigerator/Freezers and Freezers

CSA Standard C300
"Capacity Measurement and Test Methods for Household Refrigerators"

AHAM Standard HRF-2-ECFT
"Test Procedure to Determine the Freezer Temperature and Energy Consumption of Household Refrigerators, Combination Refrigerator-Freezers and Freezers"

American National Standard B38.1
"Methods of Testing for Household Refrigerators, Combination Refrigerator-Freezers and Household Freezers"

Ranges

CGA Standard 1.1
"Domestic Gas Ranges: Free-Standing Units"

American National Standard C71.1
(for household electric ranges)

American National Standard Z21.1
(for household gas cooking appliances)

Clothes Washers

AHAM Standard HLW-2EC
(metering of electricity and water used)

American National Standard Z224.1
(performance of clothes washers)

Clothes Dryers

CGA Standard 7.1
"Domestic Gas Clothes Dryers"

AHAM Standard HLD-1
"Performance Evaluation Procedure for Household Tumble Type Clothes Dryers"

.../2

Clothes Dryers (Cont'd)

AHAM Standard HLD-2EC
(metering of electricity or gas used)

American National Standards Z21.5.1 and Z21.5.2

Dishwashers

(currently under development by AHAM and the National Bureau of Standards)

Room Air Conditioners

(a standard is currently under development by a sub-committee of the CSA Steering Committee on the Performance of Electrical Products)

ASHRAE Standard 16-19
"Method of Testing for Rating Room Air Conditioners"

American National Standard Z234.1
"Room Air Conditioners"

Televisions

(a method of measuring energy consumption has been developed by the National Bureau of Standards)

## RELEVANT SECTIONS OF THE CONSUMER PACKAGING AND LABELLING ACT

4. (1) No dealer shall sell, import into Canada or advertise any prepackaged product unless that product has applied to it a label containing a declaration of net quantity of the product in the form and manner required by or prescribed under this Act and in terms of either

(a) numerical count, or

(b) a unit of measurement set out in Schedule I to the Weights and Measures Act and a Canadian unit of measurement set out in Schedule II to that Act,

as may be prescribed.

---

10. Each label containing a declaration of net quantity of the prepackaged product to which it is applied shall

(a) be applied to the prepackaged product in such form and manner as may be prescribed; and

(b) in such form and manner and in such circumstances as may be prescribed show

(i) the identity and principal place of business of the person by or for whom the prepackaged product was manufactured or produced for resale,
(ii) the identity of the prepackaged product in terms of its common or generic name or in terms of its function, and
(iii) such information respecting the nature, quality, age, size material content, composition, geographic origin, performance, use or method of manufacture or production of the prepackaged product as may be prescribed.

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18. (1) The Governor in Council may make regulations...

(h) subject to any other Act of the Parliament of Canada, extending or applying any provision of this Act to or in respect of any product or class of product specified in the regulations that is not a prepackaged product but is ordinarily sold to or purchased by a consumer

(i) otherwise than for resale or for use in the course of a business, trade or calling, or
(ii) with a label applied thereto, whether or not that label contains a declaration of net quantity.

D E P A R T M E N T  O F  J U S T I C E

M E M O R A N D U M

September 21, 1976

TO: Ted Snow
Consumer Research Branch

FROM: I. Hutton
Legal Adviser

RE: Appliance Energy Consumption Labels
Our File 2750-5

You have requested my opinion on the question whether it would be possible to implement a system of energy labelling for appliances by means of regulation passed under the Consumer Packaging and Labelling Act. The basic features of the proposed or desired labelling system, as I understand them, are: 1) that it is to be mandatory that specified electrical appliances shall have labels showing how much energy they consume under specified circumstances of use; 2) that the label should also contain certain comparative energy-use information - i.e. a statement of how much energy is consumed under identical circumstances of use by other, similar or identical appliances; 3) that the label should be of an independent nature, and be displayed in a location where the public is sure to see it when making the purchase; 4) that the sale or importing of an appliance without the label, as prescribed, should be an offence.

The following major difficulties emerge in trying to achieve these objects through new regulations under s.18(1) of the Consumer Packaging and Labelling Act:

1) It is not possible, by this method, to make it mandatory that appliances shall bear energy-consumption labels when sold. Although section 18(1)(b) permits the application of any provisions of the Act to unprepackaged products, section 4 of the Act, as it exists cannot be read - and was not intended to be read - as making labels of this nature mandatory. No other section in the Act renders labels mandatory.

There is, at present, some difference of opinion in the Department of Justice as to whether sections 18(1)(b) and 10(b)(iii) can be read together, so as to permit a regulation which provides that energy consumption information shall be provided, where there is any label in existence on the product (The broad definition of "label" in the Act supports an argument that most appliances are sold with existing labels). My view, as set out in an earlier memorandum, was that a reasonable argument could be made that, where any "label" was in existence, the regulation could prescribe that the label should disclose how much energy the appliance consumed. Mr. P. Johnson, Director of the Privy Council office, through whom any proposed regulations would have to pass, feels that only where there was an existing label showing net quantity, can such disclosure of information be required. He and I both feel that appliance labels do not normally disclose "net quantity". If your Department feels that, in spite of this obvious area of challenge in the courts, and of the other difficulties mentioned below, it wishes to proceed, this matter can be presented for a ruling to a senior official in the Department of Justice. Let me know if such a ruling is required.

I would point out that, if this difficulty of interpretation were raised in the course of a prosecution (e.g. where the appliance bore a label - not of net quantity - but did not disclose energy consumption as required under the proposed regulation), the accused may well get the benefit of the doubt. The court may well be inclined to say that, since the statute is not clear in authorizing the regulation, the regulation is ultra vires the Act, and the accused is not obliged to comply with the regulation.

... 3

2. It is questionable whether the authorization in s. 10(b)(iii) of the Act to require disclosure on certain label of "performance ... of the product" is broad enough to authorize regulations which require disclosure of relating to other products energy consumption information. Mr. Johnson feels strongly that such a regulation would be ultra vires the statute. Again in a prosecution context, the lack of clarity in the "authorizing" provisions of the statute, would probably be interpreted against the Crown.

3. The location and impermanent nature of the desired label create some problems. Assuming that most appliances carry a brand name or sign (such as "GE"), and assuming that my interpretation of the Act (set out above) is correct, and the existence of such label makes applicable the power to prescribe what energy consumption information shall be disclosed in the label - then it would be difficult in many instances to mark out an arrangement whereby the permanent brand or sign can be accompanied by an impermanent label bearing energy consumption information in an eye-catching, large format. The statute does not authorize the requirement of a separate label; thus, a separate, more suitable location of the energy label cannot be prescribed by regulation.

4. It is not possible, in my opinion, to make the sale or import of unlabelled appliances an offence through exercise of the regulatory power under s.18(1) h. Section 4(1) of the Act, which prohibits the sale of prepackaged products which do not have the prescribed labels, cannot be made to apply to declarations other than net quantity; appliances are not sold or described in terms of net quantity.

As I mentioned in an earlier memorandum, it may be possible to partially enforce the proposed energy-labelling regulations by reason of s.20(2); this section states, among other things, that every person who contravenes a regulation made under s.18(1)(b) is guilty of an offence. The proposed regulation would provide that where there are labels on appliances, they shall contain certain energy-consumption data; the person who creates the label

and ignores such requirement would appear to be subject to prosecution. However, the seller or importer of an appliance bearing a label which does not contain the required information is not caught - except if the label contains false or misleading representations (in which case s.7(1) can be made, by regulation, to apply).

You have indicated to me that the Department might decide to propose new legislation (i.e. amendments to the existing Consumer Packaging and Labelling Act or a new Act) to set up a compulsory energy labelling scheme along the lines set out above. I would suggest that it would be wise to obtain an opinion on the constitutional validity of such a proposal before committing too many resources. As you know, such an opinion can only be given under signature of the Deputy Minister of Minister of Justice, and requires some time.

It seems to me that the proposed regulation cannot be constitutionally justified as valid federal legislation in relation to criminal law or weights and measures. What will have to be explored is whether it can be justified constitutionally under the "trade and commerce" or "peace, order and good government" powers of the federal parliament.

I.C. Hutton

# FEA ESTIMATES OF ENERGY EFFICIENCY IMPROVEMENTS

## Refrigerators and Refrigerator-Freezers

| Design Options | Efficiency Improvements (%) |
|---|---|
| Improved Refrigerant | 4 |
| Improved Compressor Motor Efficiency | 12 |
| Improved Compressor Mechanical Efficiency | 16 |
| Motor Modifications | 14 |
| Minimize Superheat to Compressor | 14 |
| Improve Evaporator Heat Transfer | 8 |
| Improve Condenser Heat Transfer | 8 |
| Eliminate Condenser Fan Motor | 5 |
| Insulate Interchanger | 7 |
| Improved Insulation | 22-33 |
| Improve Door Seals and Cabinet Throat Design | 3-5 |
| Provide On-Off Switch for Anti-Sweat Heaters | 12 |
| Use a Post Condenser Coil for Anti-Sweat Heaters | 5 |
| Defrost on Demand | 4-18 |

## Kitchen Ranges and Ovens

| Design Options | Efficiency Improvements (%) |
|---|---|
| Eliminate standing pilot lights (Gas) | 25 |
| Forced convection ovens | 10 |
| Increased oven insulation | 10-15 |
| Basic design changes | 3-5 |
| - burner configuration | |
| - door seals | |
| - improved materials | |
| Microwave ovens and combination units | 10 |

# FEA ESTIMATES OF ENERGY EFFICIENCY IMPROVEMENTS

## Clothes Washers

| Design Options | Efficiency Improvements % |
|---|---|
| Reduce Water Temperatures (80°) | 30-50 |
| Reduce Water Usage (Fill Level) | 10-20 |
| Increase Motor Efficiency | 2-5 |
| Control Improvements (Cycle) | 10 |

## Clothes Dryers

| Design Options | Efficiency Improvements % |
|---|---|
| Eliminate Pilot (20%) | 20 (Non-electric) |
| Increase Insulation | 2 |
| Air Flow Design Changes | 3-5 |
| Preheat Input Air | 5-10 |
| Venting - Summer/Winter | 10-15 |
| Improve Control System | 10-15 |
| Seals - Drum, Door | 5-10 |
| Mechanical Design Changes | 3 |
| Reduce Air Temperature (P) | 5 |
| Motor Improvements | 2 |

## Dishwashers

| Design Options | Efficiency Improvements % |
|---|---|
| OPERATING CONTROLS | |
| Eliminate Hot Drying Cycles | 9 |
| Operate with Lower Water Inlet Temperature | 20-30 |
| Reduce Rinse Cycles | 8 |
| Reduce Electric Heater On-Time | 4-5 |
| DISHWASHER DESIGN | |
| Changes in Geometry and Control | 11 |

# FEA ESTIMATES OF ENERGY EFFICIENCY IMPROVEMENTS

## Freezers

| Design Options | Efficiency Improvements (%) |
|---|---|
| Improved Refigerant | 4 |
| Improve Compressor Motor Efficiency | 14 |
| Improve Compressor Mechanical Efficiency | 16 |
| Motor Modifications | 14 |
| Minimize Supheat to Compressor | 14 |
| Improve Evaporator Heat Transfer | 8 |
| Improve Condenser Heat Transfer | 8 |
| Eliminate Condenser Fan Motor | 5 |
| Insulate Interchanger | 7 |
| Improved Insulation | 27-33 |
| Improved Door Seals & Cabinet Throat Design | 3-5 |
| Provide On-Off Switch for Anti-Sweat Heaters | 12 |
| Use a Post Condenser Coil for Anti-Sweat Heaters | 5 |
| Defrost on Demand | 4-18 |

## Room Air Conditioners

| Design Options | Efficiency Improvements (%) |
|---|---|
| Switch Device to Cut Off Fan When the Compressor is Off | 5-10 |
| Electrical Motor Efficiency | |
| Compressor Motor | 5 |
| Fan Motor | 2 |
| Compressor Efficiency | 2-5 |
| Heat Exchange Efficiency | 5-8 |
| Cycle Efficiency | 10 |
| Air Flow | 3-5 |
| Coil Geometry, Tube Spacing, Fin Spacing & Fin Geometry | 3-8 |

## Television Sets

| Design Options | Efficiency Improvements (%) |
|---|---|
| Solid State Circuitry | 80-90 |
| Elimination of Instant-on Feature | 8-10 |

# EFFECT OF EER ON ROOM AIR CONDITIONERS

Case Example: 5,000 BTU Compact
Operating in Orangeville at 400 hrs. per year at an energy cost of .0185/KWH
(400 hrs. is high)

(a) With EER of 6.1

| | | |
|---|---|---|
| Annual cost to run | 320 x 400 x .0185 | = 6.07 |

(b) With EER of 8.0

| | | |
|---|---|---|
| Annual cost to run | 525 x 400 x .0185 | = 4.63 |
| ANNUAL SAVINGS | | 1.44 |

Cost to purchase

| | |
|---|---|
| 6.1 EER (list) 1975 | 219.95 |
| 8.0 EER (list) 1975 | 247.95 |
| Premium to purchase | +28.00 |

Years to break even 28.00 ÷ 1.44 = 19.3

NOTE: Interest cost on premium cost to purchase and any increase cost in energy have both been ignored as 400 hours per year (in Canada) as an average is high and anything over 10 years of life more than generous.

APPENDIX G