EFFICIENCY IMPROVEMENT TIMELINES FOR RESIDENTIAL VENTILATION EQUIPMENT

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Efficiency Improvement Timelines for Residential Ventilation Equipment

Final Report

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BLP File: 2856
October, 1995

ACKNOWLEDGMENTS

Buchan, Lawton, Parent Ltd wishes to thank Mr. Jim White, of CMHC, for his insight and knowledge of the workings of residential motor fan sets and for his tireless effort and involvement as the project's co-ordinator.

Buchan, Lawton, Parent Ltd is also indebted to the industry representatives who attended the meeting to develop the efficiency improvement timelines for residential ventilation equipment. These representatives considered the briefing documents prior to the meeting and provided input on behalf of their firms and their industries.

DISCLAIMER

This study was conducted for Canada Mortgage and Housing Corporation under Part IX of the National Housing Act. The analysis, interpretations, and recommendations are those of the consultant and do not necessarily reflect the views of Canada Mortgage and Housing Corporation or those divisions of the Corporation that assisted in the study and its publication.

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ABSTRACT AND KEY WORDS

The motor fan set efficiency of residential ventilation equipment is typically very low. With vast improvements in energy conservation in other sectors of the residential market — such as building envelope insulation, air sealing and window technology, and more efficient heating and cooling equipment — ventilation equipment energy consumption could no longer be ignored. The trend toward the continuous use of ventilation equipment is leading to ever increasing energy saving potential.

CMHC sponsored this project in order to find out the extent to which industry wanted to develop its own timeline toward the use of more efficient fan/motor sets.

A briefing document was developed on the need for an efficiency improvement timeline for residential ventilation equipment in terms of:

- opportunities and impediments
- a common framework of definitions
- supporting motor and control information
- supporting fan information

Industry members were contacted and asked to attend a meeting to investigate the common will for the development of industry timelines. The following key points were agreed upon during the meeting:

- significant room exists for cost-effective improvements to the efficiency of fan motor sets
- maintaining a level playing field within industry is essential
- the best way of implementing new requirements is government legislation based upon the advice of industry
- voluntary standards are not enforceable and reward those who do not play by the rules
- due to variations in operating conditions, residential ventilation equipment was grouped into the following three categories for the development of efficiency improvement timelines

    - exhaust fan equipment
    - heat recovery ventilators
    - circulation fan equipment

The timelines developed by industry for each product group are presented in this report. They will make it possible to compare motor fan set efficiencies, maintain a fair and level playing field for manufacturers, and reduce electrical usage over time.

Key Words:
ventilation, ventilation industry, residential ventilation equipment, motor/fan sets, furnace fans, circulation fans, heat recovery ventilators (HRVs), exhaust fans, range hoods

EXECUTIVE SUMMARY

There is a major shift taking place in the role of ventilation in housing. Houses need continuous, controllable, unobtrusive and energy-efficient ventilation if they are to provide safe and healthy indoor environments.

In the past, residential ventilation devices were generally intended for intermittent use. The duty cycle for various devices ranged from a few minutes per day for a bathroom fan to a number of hours per day for a forced-air furnace. Coupled with relatively low electricity pricing, residential ventilation devices were not generally recognized as significant energy consumers by the industry or the end users. Hence, little demand existed for higher efficiency devices, and the incentive was not there for the industry to improve the efficiency of these devices. Low capital cost and ease of installation have clearly been the only significant market drivers.

New requirements at the Building Code level and an increasing consumer awareness of indoor air quality issues are changing the operating conditions for residential ventilation devices and, hence, their design criteria.

Ventilation devices are often expected to operate on a continuous basis. Heat recovery ventilators are commonly being installed in new houses. By their nature, these devices are expected to be energy efficient. Forced-air furnaces are often an integral part of the overall ventilation strategy in a house and are frequently expected to operate full time. It is not uncommon, in a reasonably energy-efficient house, for the annual cost of electricity consumed by the furnace blower motor to exceed the cost of the natural gas consumed by the furnace. Likewise, bathroom fans are now being run continuously for general ventilation purposes as opposed to being run only when the bathroom is in use. Central exhaust fans are becoming more popular. With full-time operation of ventilation devices, energy efficiency has become a significant issue.

In recognition of the impact successful introduction of energy-efficient ventilation devices will have on national electrical energy consumption patterns, Canada Mortgage and Housing Corporation (CMHC) and the Ontario Ministry of the Environment and Energy sponsored this initiative to facilitate the integration of more efficient equipment into industry product lines.

Canadian residential ventilation industry members involved in the manufacture and distribution of exhaust equipment, HRVs and furnace fans were provided with a briefing document. This outlined the industry's historic

background, the potential benefits of improvements, and assessed energy consumption with typical, leading edge and better than average products on the market in relation to operating condition.

Industry members attending the meeting responded positively to the concept of efficiency improvement timelines for residential ventilation equipment. It was agreed that industry must lead the timeline process so that a fair playing field could be maintained at all times. There is also a need to develop test standards by which efficiency measures can be evaluated. Time frames between announcing new standards and bringing them into effect must be sufficient to allow industry members the time to develop new products where required.

Industry saw no value in a voluntary industry standard. Due to lack of knowledge on the part of the consumer, manufacturers who made no attempt to meet the standard would be expected to maintain a large portion of the market based upon initial price. It was unanimously agreed that government should legislate new standards based upon the advisement of industry through the continued use of the timeline process.

Given the variation in operating conditions of ventilation equipment, industry decided that it would be best to group equipment by function, and develop timelines for each product type separately. Industry members separated into groups to develop timelines for exhaust equipment, heat recovery ventilators, and circulation equipment.

The timelines developed by industry and presented in this document will make it possible to:

- fairly compare the motor/fan set efficiency of residential ventilation devices,
- provide a fair and level playing field throughout the process for manufacturers,
- reduce the average electricity usage of ventilation devices within each category over time, and
- provide the framework for further reasonable upgrades to mandatory requirements and their enforcement.

RÉSUMÉ

Le rôle de la ventilation dans l'habitation amorce un virage très accentué. En effet, pour être en mesure de procurer un milieu intérieur sûr et sain, les habitations doivent pouvoir compter sur une ventilation continue, réglable, discrète et éconergétique.

Dans le passé, les dispositifs de ventilation résidentiels étaient généralement destinés à un usage ponctuel. Le cycle d'utilisation des divers dispositifs variait de quelques minutes par jour, pour un ventilateur de salle de bains, à quelques heures par jour pour un générateur de chaleur à air pulsé. À une époque où le prix de l'électricité était abordable, les dispositifs de ventilation résidentiels n'étaient généralement pas considérés comme très énergivores par l'industrie ou les consommateurs. La demande n'était donc pas très forte pour des appareils plus éconergétiques, et l'industrie n'avait aucunement avantage à améliorer l'efficacité énergétique de ses produits. Un coût en capital peu élevé et une installation facile étaient vraiment les seuls critères importants à respecter dans la mise en marché de ces produits.

Or, les nouvelles exigences du Code du bâtiment et une sensibilisation accrue des consommateurs à la qualité de l'air intérieur sont venues modifier les conditions de fonctionnement des dispositifs de ventilation résidentiels et, par le fait même, leurs critères de conception.

Désormais, on attend souvent des ventilateurs qu'ils soient continuellement en marche. Les ventilateurs-récupérateurs de chaleur sont courants dans les maisons neuves. Leur nature même fait que ces appareils doivent être éconergétiques. Les générateurs de chaleur à air pulsé font souvent partie intégrante de la stratégie globale de ventilation d'une habitation, et on attend souvent d'eux qu'ils fonctionnent en continu. Il n'est pas rare, dans une maison raisonnablement éconergétique, que le coût annuel de l'électricité consommée par le moteur du ventilateur du générateur de chaleur excède le coût du gaz naturel consommé par ce même générateur. De même, des ventilateurs de salle de bains fonctionnent maintenant continuellement pour assurer la ventilation générale au lieu de n'être actionnés qu'à l'utilisation de la salle de bains. Et les ventilateurs d'extraction centraux sont de plus en plus populaires. Par conséquent, comme les dispositifs de ventilation fonctionnent en continu, l'efficacité énergétique est devenue une importante source de préoccupation.

Conscients des répercussions qu'aura l'adoption de dispositifs de ventilation éconergétiques sur la consommation d'électricité à l'échelle nationale, la Société canadienne d'hypothèques et de logement et le ministère de l'Environnement et de l'Énergie de l'Ontario ont parrainé cette initiative dans le but de faciliter l'intégration d'appareils plus efficaces dans les gammes de produits des fabricants.

Les membres du secteur canadien de la ventilation résidentielle qui fabriquent et distribuent des appareils d'extraction d'air, des ventilateurs-récupérateurs de chaleur et des ventilateurs de générateur de chaleur ont reçu un document d'information. Ce document relatait les antécédents historiques de l'industrie, exposait les avantages potentiels inhérents aux améliorations et présentait une évaluation de la consommation énergétique de produits courants, innovants et meilleurs que la moyenne vendus dans le commerce par rapport à l'utilisation qui en est faite.

Des représentants de l'industrie ont été réunis et ont réagi favorablement au concept d'un programme d'amélioration de l'efficacité des dispositifs de ventilation résidentiels. On s'est entendu pour que ce soit l'industrie qui prenne en main le processus d'amélioration de manière à ce qu'il soit juste en tout temps. On a également établi qu'il importait d'élaborer des normes d'essai pouvant servir à évaluer les mesures d'efficacité. La période entre l'annonce de nouvelles normes et leur mise en vigueur doit être suffisamment longue pour permettre aux membres de l'industrie de mettre au point, au besoin, de nouveaux produits respectant ces normes.

L'industrie ne voit aucune utilité à se doter d'une norme volontaire. Étant donné l'ignorance des consommateurs sur cette question, les fabricants qui ne s'efforceraient pas de respecter la norme seraient tenus de maintenir une large part de leur marché uniquement grâce au prix initial. Tous les intervenants s'entendent sur le fait que le gouvernement devrait adopter de nouvelles normes en se fondant sur les recommandations de l'industrie dans le cadre d'une utilisation suivie du programme d'amélioration.

Compte tenu de l'emploi varié qui est fait des dispositifs de ventilation, l'industrie a décidé qu'il serait préférable de regrouper les dispositifs selon leur fonction et d'élaborer des programmes d'amélioration distincts pour chaque produit. Les membres de l'industrie se sont divisés en sous-groupes afin de mettre sur pied des programmes pour les dispositifs d'extraction, les ventilateurs-récupérateurs de chaleur et les appareils de circulation.

Les programmes élaborés par l'industrie et présentés dans ce document permettront :

- une comparaison juste de l'efficacité des groupes moto-ventilateurs des installations de ventilation résidentielles;
- la mise en place d'un processus juste et équitable pour les fabricants;
- la réduction, avec le temps, de la consommation d'électricité moyenne des appareils de ventilation de chaque catégorie;
- l'élaboration d'un cadre favorisant d'autres améliorations raisonnables, par rapport aux exigences obligatoires, et leur mise en application.

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1.0 INTRODUCTION

As the energy efficiency of residential buildings has steadily improved, the emphasis for continued improvement has shifted.

- The earliest work on improving energy efficiency concentrated on improvements to the building envelope. This work involved increasing the levels of insulation, improving the design of windows, and addressing air leakage through the building envelope. This work lead to large reductions in the energy requirements for space conditioning these types of buildings.

- The second major target of energy efficiency work was the efficiency of heating and cooling equipment/systems. Dramatic improvements were made to the combustion efficiency of devices for both space and water heating.

- Significant work was undertaken to improve the efficiency of both lighting systems and household appliances.

- As these increases in energy efficiency were being undertaken, increasing emphasis was being placed on the importance of health issues in residential buildings.

To date, one major sector of residential energy usage has not received significant attention—the efficiency of equipment designed for moving air. This area has become even more important with the requirement for continuous ventilation by mechanical means to address major health concerns in housing.

This report summarizes work undertaken in the development of an industry consensus for the improvement of the energy of residential ventilation equipment. Specifically, it deals with the fan/motor sets incorporated into these devices.

Based on an initiative of the Canada Mortgage and Housing Corporation and supported by the Ontario Ministry of the Environment and Energy, a process was developed to define an industry-supported timeline for these efficiency improvements and to lay out, in detail, the steps required.

For the purpose of this work, three basic categories of residential ventilation equipment were defined; namely,

1. exhaust fans,
2. heat recovery ventilators, and
3. circulation fans.

The first group primarily includes bathroom exhaust devices, outside venting kitchen range hoods, and whole-house exhaust devices. The second group includes ventilation devices incorporating an element of heat recovery. The third group principally includes heating and cooling appliances used to circulate air within a dwelling unit.

The timeline outlined in this report is the culmination of a broad industry consensus process.

Initially, contact was made with a very large sample of players in the residential ventilation industry. This collection of players is listed in Appendix A.

A series of contacts were made with individual players and groups from this list. Subsequently, a meeting was held with a group of industry players to finalize a timeline suitable for broad industry support. Nineteen industry representatives attended this meeting and Appendix B includes a list of these persons. The industry meeting was attended by company representatives of firms involved in the production and sale of exhaust fans, heat recovery ventilators, furnaces, and motors.

This document outlines the efficiency targets required for each of the main categories of residential ventilation equipment listed above. It investigates the optimal processes required, the sequencing of actions necessary, and the timeframe for completing each action to optimize the process for improving the fan/motor set efficiency of residential ventilation devices.

This report addresses the need for government assistance and mandatory testing, indicates which standards need to be updated or developed, and identifies who should implement and enforce those standards.

The need for improved efficiency in residential ventilation equipment is acknowledged by industry and government. With increases in the scope and number of energy conservation requirements in building codes, it is becoming

increasingly apparent that standards for residential ventilation equipment will be implemented in various building codes.

The need to address standards is clear, given the apparent inefficiency of residential ventilation equipment, the trend toward continuously operating equipment, the substantial energy consumption of this equipment, and the corresponding costs. The value of a timeline for improving the energy efficiency of these devices is discussed in a document* produced as background for the development of the industry consensus timeline.

* The background document referenced above is the *"Briefing Document for the Development of Efficiency Improvement Timelines for Residential Ventilation Equipment"* (later referred to as the *"Briefing Document"*). This document investigates the value of an industry driven consensus, as well as the current range of efficiencies and operating costs for presently available and emerging residential ventilation devices.

2.0 GENERAL CONSENSUS

There is a strong consensus among industry members as to the merits of a timeline for improving the energy efficiency of fan/motor sets in residential ventilation equipment. There is also general agreement as to the actions required by the stakeholders and the appropriate sequencing of these actions.

Industry members recognize that the majority of residential ventilation products on the market today are far less efficient than would be acceptable under a reasonable cost-benefit analysis.

The current inefficiency of many products has an historical basis. Ventilation equipment was originally designed to distribute heat through dwellings or remove odours from bathrooms and kitchens. Given the short duty cycles faced by the equipment when used for those purposes and the low cost of electricity, the overwhelmingly important design criteria was a low first cost. Efficiency was not a serious design consideration.

The trend toward operating equipment continuously for ventilation purposes and the rising cost of electricity are the factors dictating change in the approach to the design of residential ventilation equipment.

Industry players acknowledge that the incentive to upgrade the efficiency of this equipment is presently marginal due to the current availability of low-cost, low-efficiency equipment. Selling upgraded equipment is extremely challenging when the issue of efficiency of this type of equipment is so poorly understood. Where the sale of higher efficiency equipment has been successful, it has usually been for reasons other than efficiency (i.e., improved ventilation performance or noise considerations).

It is general agreed that steps must be taken to improve the efficiency of residential ventilation devices over a reasonable timeframe. Industry must have strong representation in the development of any standards, with government taking a supporting role.

The development of a timeline to improve the efficiency of each type of ventilation device is seen as the first step in this process.

Across the board, it is considered essential that each step in the timeline process be viewed from the need to maintain a level playing field within industry at all times.

2.1 The Form of The Efficiency Requirements

While motor efficiency and fan efficiency are significant factors in determining the efficiency of a motor/fan set, establishing a standard for either or both will not ensure efficient motor/fan sets because the two can be mismatched or configured to create a poor profile. The standards required for this initiative must deal with motor/fan set efficiency as an entity. If any upgrades are required, it will be more cost effective for the manufacturer to determine the group of upgrades required for each specific ventilation device than for governments to prescribe requirements for generic component parts.

It is agreed, however, that parallel initiatives aimed at improvements in the efficiency of fractional horsepower motors would be beneficial.

2.2 Information for Industry

The dissemination of information must come first. Various reports, including the *Briefing Document* for this project, outline existing efficiencies of fan/motor sets used in residential ventilation devices and how these efficiencies can be improved with existing technology.

Independent testing agencies or industry associations do not publish information to permit the direct comparison of the efficiencies of motor/fan sets used in residential ventilation devices. However, the provision of such information would allow manufacturers to know the relative efficiency of their products much more precisely. This is a necessary first step towards improving motor/fan set efficiency.

2.3 Informing the Public

Governments have a vested interest in improving the fan/motor set efficiencies of residential ventilation devices. Industry will take the initiative to develop standards and products to meet these standards. Government must do its part by spearheading a marketing campaign aimed at informing the public of the benefits of improved efficiencies.

2.4 Standards and Requirements

Industry must be assured of the following points in order to support revising product standards to include motor/fan set efficiency.

1. *Harmonization of Standards* —The cost of testing for compliance to standards is considerable for manufacturers. It is agreed there is a need to harmonize existing standards rather than create new ones. Existing standards should be modified, where applicable, to incorporate fan/motor set efficiencies.

2. *Mandatory Standards Conformance Testing by Independent Agencies* — There is little value in upgrading standards to include motor/fan set efficiency if independent testing is voluntary. Manufacturers who do not currently test their products will be unlikely to test them in the future to a new standard unless this testing is made mandatory.

   Independent testing provides the essential ability to compare products. It will make it possible for manufacturers of particularly efficient products to more effectively market these devices. It will also allow purchasers to reasonably consider ventilation product motor/fan set efficiency when making their purchasing decisions.

   The provision of accurate information for marketing, choosing labelling, and setting minimum requirements for products is an essential step in ensuring market uptake of more efficient ventilation devices. The EnerGuide Program, run by Natural Resources Canada, is well positioned to provide support to marketing and standards implementation ventures.

3. *Reasonable Mandatory Minimum Efficiencies* —Voluntary requirements for minimum motor/fan set efficiencies are considered to be totally ineffective by industry. It is strongly felt that manufacturers of products not meeting the minimum efficiency will ignore the voluntary requirements and continue to produce inefficient devices. Low-cost, low-efficiency devices will continue to have a large market share.

   For minimum efficiency ratings to be of value, governments must introduce them as mandatory requirements for products installed in residential applications.

   All minimum efficiency levels referenced in standards must be reasonable. This involves an understanding of the current state of the ventilation

industry's available technology and the timeframes necessary to comply with new requirements.

4. *Implementation* —If products are to be independently tested in accordance with a standard or to comply with a particular minimum requirement as of a certain date, then it is essential that implementation occur on the date specified.

   Manufacturers must be assured that compliance will be required as of a particular date so they can have products tested and can develop new or modified products to meet new requirements.

   Delaying an implementation date would penalize manufacturers who were working to achieve the efficiency upgrading process. Manufacturers who did not expend the effort to ensure their products met the new requirements would gain an unfair advantage over those incurring considerable expense to meet the standard, if the implementation date was delayed.

5. *Enforcement* —To support mandatory standards testing and requirements, manufacturers must know that these standards and requirements will be enforced. Efforts must be made to ensure products not complying with minimum efficiency levels or not appropriately tested will not be permitted for installation in residential buildings.

   Building and electrical inspectors must be trained to ensure the installed ventilation devices meet the appropriate standards.

2.5 State of Technology

To achieve large gains in fan/motor set efficiency, the bulk of the gains must be realized by using more efficient motors. Many motor manufacturers currently stock motors in each size range that surpass today's industry standards when it comes to efficiency. These manufacturers stress that the technology to make large improvements in motor/fan set efficiencies based on improved motors is already available.

The industry is well aware of how to improve fans and how to couple fans with motors to make them more efficient.

2.6 Grouping for Standards

Ventilation devices serve a diverse range of purposes. They vary in duty cycle, air flow requirements, and design static pressures. All-inclusive standards do not exist for these devices. Current standards are, typically, for various categories of ventilation equipment.

Different efficiency requirements are appropriate for different types of ventilation devices based on their duty cycle and current technology.

In developing standards, it must also be recognized that certain devices in different categories, such as exhaust fans and heat recovery ventilators, are competing with each other. Efforts must be made to define performance to encourage heat recovery and other desirable design approaches.

2.7 Participants

To optimize the timeline process, the involvement of many participants is required. The specific requirements of participants are listed in the timeline sections. A brief overview of the participants and what is required of them is identified below. This list should not be presumed to include all participants or all beneficial functions for these players.

Residential Ventilation Equipment Manufacturers

- participate in the development process of the standards, predominantly through representation by their industry associations
- advise governments on minimum efficiency standards, predominantly through representation by their industry associations
- develop products with more efficient motor/fan sets

Component Manufacturers

- participate in the development process of the standards, predominantly through representation by their industry associations

- advise governments on minimum efficiency standards, predominantly through representation by their industry associations
- develop more efficient component products, particularly motors

Industry Associations (AMCA, HVI, HRAI, etc.)

- monitor, advise and coordinate the implementation and future development of efficiency improvement timelines for residential ventilation equipment
- participate in the development of standards
- advise government on minimum standards and timeframes for introduction of these standards
- create effective labelling programs
- distribute comparative test results for products tested to standards
- initiate proactive initiatives, such as HVI's newly formed subcommittee for defining efficiency of motor/fan sets

Standards Associations (CSA, ASHRAE, AMCA, etc.)

- revise existing standards to improve or include recording of motor/fan set power consumptions and efficiencies
- harmonize standards between associations
- develop omnibus standards to level the playing field between technologies

Government (Federal [EnerGuide], Provincial, Municipal)

- monitor and coordinate the implementation and future development of efficiency improvement timelines for residential ventilation equipment
- provide a favourable framework for improving motor/fan set efficiencies
- make independent testing in accordance with standards mandatory
- on advice from industry, provide reasonable minimum efficiency requirements

- provide public relations assistance and reasonable enforcement mechanisms to ensure installations comply with mandatory minimum requirements (such as through EnerGuide)
- provide funding for joint research, development and information transfer efforts in conjunction with industry associations and groups
- ensure co-operation between governments and authorities to effectively introduce new measures
- liaise with American and other jurisdictions
- fund revision of standards

Electric Utilities

- enforce standards effectively
- fund revisions to standards leading to reductions in peak power consumption

Promotional Organizations (Power Smart, etc.)

- promote more efficient than average, independently tested products through advertising and additional labelling

Canada Mortgage and Housing Corporation

- monitor and provide advice on implementation and future development of efficiency improvement timelines for residential ventilation equipment
- develop fan test rig for testing ventilation products and components for use by manufacturers and for development of standards
- support further research development and information transfer initiatives
- liaise with American and other foreign counterparts

2.8 Timelines Time Period

There is consensus that:

1. The timelines for immediate action are clear;
2. actions for a five-year period can be reasonably planned at this time; and
3. too many uncertainties exist to forecast actions beyond five years.

In each case, new requirements should be established at or near the end of the five-year period, and these requirements should remain in effect for an absolute minimum of three years following their establishment.

3.0 EXHAUST FAN EFFICIENCY IMPROVEMENT TIMELINE

Exhaust fans are the most common and most diverse group of residential ventilators. They include devices such as range hoods, kitchen exhaust fans, bathroom fans, multi-point exhaust fans, and air changers without heat recovery. Historically, most of these devices were developed as point exhaust devices with a relatively light duty cycle. Operation for a few minutes per day was not uncommon.

Product standards and evaluation criteria reflect this historical development and usage. Existing product standards are geared to testing characteristics such as air handling and noise generation. Information regarding energy consumption is rarely published, although it is apparently collected by test agencies. As a starting point, significant work is needed to place the industry in a position where it clearly understands the performance of the existing equipment and the extent to which improvements can be made.

The following discussion highlights some of the key elements to be addressed in a timeline to improve the efficiency of fan/motor sets in residential exhaust fans. Figure 3.1 provides a visual overview of what is needed.

Figure 3.1:
Exhaust Fan Motor/Fan Set Efficiency Timeline Overview

Action	Timeframe Required	Commencement	Completion
3.1 Product Directory Revisions *HVI (Home Ventilating Institute)*	9 months	November 1995	August 1996
3.2 Mandatory Independent Testing *Government +*	12 months	November 1995	November 1996
3.3 Product Labelling *Industry Associations*	12 months	November 1995	November 1996
3.4 Public Relations, Education and Enforcement *Government*	N/A	November 1995	ongoing
3.5 Fan Test Rig Development *CMHC*	2 months	N/A	December 1995
3.6 CAN/CSA C260 Revisions *Canadian Standards Association*	12 months	January 1996	December 1996
3.7 Minimum Mandatory Motor/Fan Set Efficiency Requirements *Government*	N/A	March 1997	N/A
3.8 Test Result Publication and Labelling *Industry, Associations and Agencies*	N/A	March 1997	N/A
3.9 Public Relations, Information Transfer, Enforcement *Government*	N/A	March 1997	ongoing
3.10 Motor Trade Show for Ventilation Industry *HVI, HRAI, CMHC*	N/A	May 1997	—
3.11 Product Marketing Assistance *Promotional Organizations*	N/A	May 1997	ongoing
3.12 Revised Efficiency Requirements *Industry, Industry Associations, Government, CSA*	3 years	December 1997	November 2000

3.1 Product Directory Revisions

	Timeframe Required:	9 months
HVI (Home Ventilating Institute)	Commencement:	November 1995
	Completion:	August 1996

The *Certified Home Ventilating Product Directory* prepared by the Home Ventilation Institute (HVI) is commonly used to select exhaust fan equipment. Currently, the Directory only provides air flow and sound ratings for these devices. At the static pressure used, the test agency measures power consumption, but does not publish this data.

The next edition of the HVI Directory could be updated to include power consumption at specific static pressures and air flow rates based on the compiled testing. For comparing relative performance, the preferred format for this information would be a power-to-flow-rate ratio (i.e., W/L/s [W/cfm]). HVI currently uses three different static pressures for testing, based on fan type. The static pressure used or the category of the fan should also be clearly referenced to each fan model.

3.2 Mandatory Independent Testing

	Timeframe Required:	12 months
Government +	Commencement:	November 1995
	Completion:	November 1996

To permit purchasers to compare fan equipment when making purchasing decisions and to enable regulators to set and enforce reasonable standards, comparable test information must be available for all fans sold in the residential market.

The present Ontario Building Code and the proposed revisions to the National Building Code both reference CSA Standard CAN/CSA-C260: *Rating the Performance of Residential Mechanical Ventilating Equipment* for determining air flow rate capacities and sound ratings for required exhaust fans. This standard is becoming the key reference for exhaust fans of all types. Any testing and labelling requirements pertaining to energy consumption of such equipment should be addressed within the context of this standard.

To promote universal testing to this standard, governments should mandate independent testing of equipment to CAN/CSA-C260 for all exhaust fans sold into the Canadian residential market. This will facilitate the selection of equipment based on comparable information in the areas already covered by the standard.

By requiring independent testing before updating CAN/CSA-C260, manufacturers are provided further assurance that, when efficiency requirements are introduced in the standard, they will be enforced. Innovative manufacturers who improved their products to meet proposed efficiency standards should not be placed at a competitive disadvantage as a result of governments failing to enact or enforce proposed changes.

It should be possible to table the requirement for mandatory testing within two months. The effective date for the mandatory requirement should be one year later to allow manufacturers time to have their products independently tested to CAN/CSA-C260 in cases where they have not already done so. Some time would be required to deplete old stock and existing inventories, but implementation of the standard could be accomplished well within the one year period.

3.3 Product Labelling

	Timeframe Required:	12 months
Industry Associations	Commencement:	November 1995
	Completion:	November 1996

In order for the standard to be effective, products conforming to the standard must be clearly labelled. An industry organization, such as HVI or CSA, or a government agency, such as EnerGuide, could perform such a role. It must be readily apparent to anyone inspecting a device that it has or has not been tested in accordance with the standard.

Initially, the appropriate labeling will reflect only the current testing requirement of CAN/CSA-C260. Labeling will be revised to include efficiency information as this requirement is added to the standard. Subsequent labeling can be revised in parallel with the revision of the standard.

3.4 Public Relations, Education and Enforcement		
Government	Timeframe Required:	N/A
	Commencement:	November 1995
	Completion:	ongoing

Appropriate government agencies should provide designers, builders and installers with information bulletins on the requirement to test all fans for use in residential buildings to the CAN/CSA-C260 standard. The bulletins could provide information on aspects such as:

- rationale behind the requirement (i.e. why it has been referenced),
- where to get information on all products meeting the requirement,
- how to check a product for compliance, and
- the penalties associated with non-compliance.

Action is also needed to communicate to industry that the standard will be enforced and how it will be achieved by government. Key routes for the dissemination of the information bulletin include:

- industry associations distributing to designers, builders and subcontractors and related publications, such as those provided by the Canadian Home Builders' Association and HRAI;
- municipalities distributing to building inspectors; and
- electrical utilities distributing to all electrical inspectors.

It should clearly stated that inspectors will soon be ensuring exhaust fans are appropriately tested and labelled.

Planned updates to government publications pertaining to ventilation should be timed to include the updated requirements of the CSA Standard CAN/CSA-C260. Links to the industry (i.e. industry associations) can be used to keep costs to a minimum.

Further information transfer efforts should be tied to revisions to CAN/CSA-C260.

3.5 Fan Test Rig Development

	Timeframe Required:	2 months
Canada Mortgage and Housing Corp.	Commencement:	N/A
	Completion:	January 1996

CMHC's current contract for the development of a fan test rig can be a significant aid in shortening the timeline for developing more efficient motor/fan sets. The development of the test rig is based on a review of existing facilities and it should include operational and reporting software. The final report on the project is expected to include the specifications for constructing the rig to permit manufacturers to fabricate their own for in-house product development.

This initiative may encourage manufacturers to test the performance and efficiency of fans, motors and combined motor/fan sets earlier in the process. Many manufacturers who, otherwise, might not have had the resources to undertake product testing should find it feasible with the test rig.

The development of the test rig and test procedures for combined motor/fan set testing can, thereby, provide a mechanism to improve industry readiness to adapt to more efficient product standards.

The developers of the fan test rig are currently testing the prototype rig on motor/fan sets.

3.6 CAN/CSA-C260 Revisions

	Timeframe Required:	12 months
Canadian Standards Association	Commencement:	January 1996
	Completion:	December 1996

The standards committee responsible for CAN/CSA-C260 should be convened to update the standard to include motor/fan set efficiency during the development of CMHC's fan test rig. The committee should be encouraged to review the testing process and refine it in an appropriate manner. CMHC and its partners should then be in a position to have the test procedures aimed at the efficiency rating incorporated into the standard.

The CSA committee should seek to coordinate its activities with the activities of bodies such as ASHRAE and AMCA in order to harmonize the test

standards used throughout North America. The committee should also draw from the expertise of HVI's newly-formed subcommittee defining the efficiency of motor/fan sets.

At this preliminary measure, the published output from the updated section of the standard could be in the form of a power-to-air-flow ratio at given static pressure(s). Similar to an energy-input-to-energy-output ratio, this will make it possible to compare the performance of various fans; but it will do so without tarnishing the more efficient motor/fan sets. Concern was expressed that even the very efficient fans would look bad given current technology, and this would undoubtedly create an industry backlash.

Another alternative suggests the targets could be set to permit acceptance of a fan based upon meeting a minimum power-to-air-flow ratio at any one of three static pressures, such as those shown in Table 3.1. This rating system would allow direct comparisons of motor/fan set efficiencies for fans at a given static pressure despite varying flow rates.

The requirement imposed must be flexible with static pressure because fans are designed for such a variety applications.

The values in the following table have been put forward for discussion and are not necessarily the values which should be acted upon.

Table 3.1 Proposed Exhaust Fan Mandatory Maximum Power to Air Flow Ratios

Static Pressure		*Power to Air Flow Ratio*		*Efficiency*
(Pa)	(in. w. g.)	(W/L/s)	(W/cfm)	(%)
25	0.10	1.7	0.8	1.5
62	0.25	1.7	0.8	3.7
100	0.40	1.7	0.8	5.9

The initial two columns would be reported in publications. Minimum flow rates should also be required of fans designed to meet the requirement at either of the two higher static pressures. A value of 25 litres per second (50 cubic feet per minute) would be reasonable in either case.

The power-to-air-flow ratio can be considered as a constant multiplied by the static pressure and divided by the efficiency. The three maximum power-to-

air-flow ratios given are equal because the variations in static pressure were largely off-set by the variation in the reasonable efficiency values. There may be far less similarity between maximum power-to-air-flow ratios for each static pressure actually mandated at this time or in future revisions.

Whichever system is chosen, all fans currently on the market should be independently tested to a revised standard within six months of the finalization of the standard.

3.7 Minimum Mandatory Motor/ Fan Set Efficiency Requirements		
Government	Timeframe Required:	N/A
	Implementation:	March 1997
	Completion:	N/A

Once the revised standard is in place and the present state of the industry is better understood as a result of uniform testing, governments will be in a position to legislate improvements to the energy efficiency of motor/fan sets. In provincial jurisdictions with an energy efficiency act, the improvements can be set out in changes to the act. Federally, the National Energy Code may be used as a mechanism to set out minimum efficiencies.

It must be recognized that the task in the near term is to develop consensus on uniform testing. The initial benchmarks should be suitably lenient—manufacturers will require time for product development to meet the improved efficiency requirements.

A timetable should be set out for improvements to the requirements to permit industry to maintain the ability to deliver appropriate products to the market. The industry suggests that, in the short term, it would be reasonable to impose a minimum motor/fan set efficiency requirement making the bottom 20 per cent of the existing market obsolete. Government may, through consultation, develop consensus around more aggressive targets once test procedures, test results, and other factors are better known. A grace period of approximately six months will be needed to implement even the least aggressive targets.

3.8 Test Result Publication and Labelling	Timeframe Required:	N/A
Industry, Industry Associations, Independent Testing Agencies	Commencement:	March 1997
	Completion:	ongoing

A publication containing the test results of all products tested to the revised standard should be made available by the time the new standard takes effect. It would be most beneficial if the information could be incorporated into HVI's *Certified Home Ventilation Products Directory*. Products meeting the maximum power-to-air-flow ratio requirements could be differentiated from those that do not.

Where revisions to the HVI labelling practices for fan equipment correspond with changes to the CSA Standard, both changes should come into effect simultaneously. The labels for products meeting the maximum power-to-air-flow ratio requirements must highlight compliance to updated standards to simplify inspection procedures for Canadian distribution and installation. The labelling should include power-to-air-flow ratio ratings at CAN/CSA-C260 specified static pressures.

3.9 Public Relations, Information Transfer, Enforcement:	Timeframe Required:	N/A
Government	Commencement:	March 1997
	Completion:	ongoing

A public relations effort will be required to ensure all stakeholders are aware of the updated regulations and the resulting positive benefits. This should include:

- A national advertising campaign underlining the importance of a CSA or HVI label to consumers.
- Provision of copies of the certified product directories to retailers, builders, renovators, and mechanical contractors involved in residential construction to allow easy identification of products conforming with the minimum standards.

For this reason, it will be desirable to maintain a database of persons who received the previous versions of the *Certified Products Directory* to ensure they receive the updated information.

3.10 Motor Trade Show for Ventilation Industry		
HVI, HRAI, CMHC	Timeframe Required:	N/A
	Event:	May 1997

Many manufacturers of ventilation equipment do not have sufficient requirements for motors to be in a position to demand more efficient products from motor manufacturers. Additionally, small manufacturers do not have the time resources necessary to investigate efficient motor purchase options. However, the ventilation industry as a whole, is a large purchaser of motors.

It has been suggested that a Trade Show highlighting all types of residential ventilation products would be beneficial to all industry players. Such an event would promote better understanding of fan and motor technology. The organizational skills of HVI, HRAI and AMCA could be used to arrange the event with invitations to all ventilation equipment manufacturers and all motor manufacturers to attend.

Motor manufacturers would welcome the opportunity to show the value of their motors to the whole ventilation industry. The trade show could also provide a venue for CMHC to promote and publicize the availability of the fan test rig and to test the motors and fans manufacturers bring to the trade show. Creative angles, such as efficiency competitions, could be used to increase interest.

3.11 Product Marketing Assistance		
Promotional Organizations	Timeframe Required:	N/A
	Commencement:	May 1997
	Completion:	ongoing

Once the test results are published for the revised CAN/CSA-C260 standard, organizations promoting the efficient use of electricity, such as PowerSmart, are expected to promote and provide additional labelling for products with particularly efficient motor/fan sets.

3.12 Revised Efficiency Requirements	Timeframe Required:	3 years
Industry, Industry Associations, Government, CSA	Revisions Publicized:	December 1997
	Implementation:	November 2000

The near-term minimum efficiency requirements will typically be based on the limits imposed by the technology currently available on the market.

Clearly this set of minimum requirements can be upgraded once manufacturers have time to re-engineer products and retool for new production. In some cases, products are already available that are many times more efficient than a standard that would likely include most motor/fan sets currently on the market. As time goes on, the technology will evolve to push the bounds still further.

Typically, engineering a new product with the complexity of an exhaust fan could take two years, and retooling could take six months.

Therefore it is conceivable that, five years from now, it would be reasonable to have new minimum standards for motor/fan set efficiencies that require two to four times the minimum efficiency of the proposed initial requirements.

Manufacturers require sufficient lead time to achieve these results. Publication of aggressive efficiency targets two to five years in advance of their imposition is essential to assuring a smooth transition to more efficient technology. Considerable background work is needed to establish a consensus on appropriate targets.

Failure to set targets well in advance will create a considerable backlash in the industry.

4.0 HEAT RECOVERY VENTILATOR EFFICIENCY IMPROVEMENT TIMELINE

Heat recovery ventilators (HRVs) are the relative newcomers to the group of residential ventilators. Developed over the last 15 years, these devices have been targeted initially at super energy-efficient homes—homes where the capacity to ventilate continuously is key. Most of these devices were developed as whole house ventilators capable of operating on a continuous duty cycle. Product standards and evaluation criteria reflect this usage.

Existing product standards rate heat recovery effectiveness in addition to the ratings of air handling capability and noise generation found in other product standards. Manufacturers have expended considerable effort selecting more energy-efficient motor and fan technologies, perfecting low-energy consumption defrost cycles, and testing their products throughout a range of conditions. Manufacturers of HRVs suggest they are already "down the road" on manufacturing energy-efficient products, and this will have an impact on the extent to which improvements can be made.

The following discussion highlights some of the key elements to be addressed in a timeline to improve the efficiency of fan/motor sets in heat recovery ventilators. Figure 4.1 provides a visual overview of the required actions.

Figure 4.1:
HRV Motor Fan Set Efficiency Timeline Overview

Action	Timeframe Required	Commencement	Completion
4.1 Mandatory Testing Requirement *Government +*	12 months	November 1995	November 1996
4.2 Product Labelling *Industry Association*	12 months	November 1995	November 1996
4.3 Public Relations, Education and Enforcement *Government*	ongoing	May 1996	ongoing
4.4 ASHRAE Standard Development & CSA Standard Revisions *CSA, Federal Government*	ongoing	ongoing	ongoing
4.5 Standardized Product Information Sheets *Industry, Associations and Agencies*	3 months	November 1996	February 1997
4.6 Initial Mandatory Requirements *Government*	N/A	April 1997	ongoing
4.7 Certification Labelling *Industry Associations*	6 months	November 1996	April 1997
4.8 Product Marketing Assistance *Promotional Organizations*	N/A	July 1997	ongoing
4.9 Fan Test Rig Development *CMHC*	2 months	N/A	December 1995
4.10 Future Mandatory Requirements *Government, Industry , Associations*	30 months	January 1997	July 2000

4.1 Mandatory Testing Requirement

Government

Timeframe Required:	12 months
Commencement:	November 1995
Completion:	November 1996

A substantial proportion of currently manufactured heat recovery ventilators are already tested by an independent testing agency for conformance with CAN/CSA-C439, *Standard Methods of Test for Rating the Performance of Heat Recovery Ventilators.* The Ontario Building Code and National Energy Efficiency Act reference this standard by requiring a minimum sensible heat recovery efficiency for HRVs installed in residential applications.
There appears to be general consensus among HRV manufacturers who currently market products in Canada, that testing and minimum efficiency levels must be mandatory for regulations to be effective. As long as unverified HRVs are available, there is far less incentive for manufacturers to pay an independent agency to test their product to the standard.

Requiring all residential HRVs sold in Canada to be independently tested according to CAN/CSA-C439 is the necessary first step toward a coordinated approach by industry to improving motor/fan set efficiency. It would be a clear indication of government intentions to take the issue seriously and to enforce minimum requirements based upon future revisions to the standard.

It should be possible to introduce mandatory testing within six months, with an effective date for implementation six months thereafter. This will provide manufacturers with the time to test their products to the CAN/CSA-C439 Standard where they have not already done so.

4.2 Product Labelling

Industry Association

Timeframe Required:	12 months
Commencement:	November 1995
Completion:	November 1996

Industry associations, such as HVI, must ensure products meeting the standard are effective labelled. It must be readily apparent to anyone inspecting the HRV that it has or has not been tested in accordance with the standard.

In this way, enforcement agencies can key their acceptance of the product to the industry labelling program.

4.3 Public Relations, Inspection, and Enforcement		
Government	Timeframe Required:	ongoing
	Commencement:	May 1996
	Completion:	ongoing

Appropriate government agencies must provide information bulletin(s) for designers, builders and installers to inform them of the requirement for all HRVs to be independently tested to CAN/CSA-C439. Similar to the bulletin(s) pertaining to exhaust fans, the bulletin(s) on HRVs must explain why the requirement has been imposed, where to get information on all products meeting the requirement, how to check a product for compliance, and the potential issues related to non-compliance.

Action is also needed to show the industry how the standard will be enforced. Training and update programs created for key enforcement agents must be updated to include the requirements for use of HRVs tested to CAN/CSA-C439. Suggested target groups include:

- electrical inspectors via utilities,
- building inspectors via provincial and municipal governments,
- private sector building inspectors,
- designers, builders and mechanical subcontractors, and
- retailers and wholesalers.

Any information provided to these groups should clearly outline the parties responsible for ensuring compliance and the ways to identify acceptable equipment. Government publications pertaining to ventilation should be updated to clearly indicate acceptable equipment and unacceptable equipment.

There may be merit in merging the promotion of updates to standards for HRVs into the promotion of updates to the CAN/CSA-C260 standard. Given the limited funding available for such promotional activities, industry associations and standards committees should be encouraged to coordinate their activities in this area.

Information transfer to the general public would be desirable, however, the cost of a broad-based effort may limit the extent of such activity. Manufacturers and industry associations should be encouraged to create an awareness of tested and approved products through their product advertising.

4.4 ASHRAE Standard Development & CSA Standard Revisions		
CSA, Federal Government	Timeframe Required:	ongoing
	Commencement:	ongoing
	Completion:	ongoing

ASHRAE is currently formulating a new standard for HRVs. Given Canada's leadership position in standards for these products, every effort should be made by the CSA and government agencies to encourage harmonization of the ASHRAE standard with the existing CSA standard. In this way, manufacturers would be required to test in accordance with a single standard to gain access to markets across North America.

Among the issues to be addressed in the revisions to the HRV standard CAN/CSA-C439, are modifications to reporting the power consumption and motor/fan set efficiencies. Part of the harmonization effort could be directed to sorting out issues and moving the HRV industry further down the road to greater efficiency in the medium term.

Currently, the reference to CAN/CSA-C439 in the Ontario Building Code requires a minimum of 55 per cent sensible heat recovery efficiency at a temperature of -25°C, (-13°F) and an air flow of not less than 30 L/s (64 cfm). Power consumption is currently not adequately reported.

The effect of fan power consumption on sensible heat recovery efficiency is minimal. Waste power supplied to the supply air stream fan is largely factored out of the equation for calculating sensible heat recovery efficiency. Waste power supplied to the exhaust air stream is treated as potentially recoverable heat. The power rates given in a table on the CAN/CSA-C439 test summary report sheet relate only to flow rates. The use of low static pressures during testing makes it possible to utilize low motor speeds for flow rates that would require high motor speed settings in typical applications. This reduces the power levels recorded.

To adequately portray power consumption, it should be graphed on the charts of air flow versus static pressure. The following procedure could be used to provide this information for the consumer:

- ensure:
  - gross supply air flow rate is greater than or equal to gross exhaust air flow rate
  - exhaust side static pressure across HRV is greater than or equal to supply side static pressure across HRV
- measure power consumption
- plot these power consumption values against gross supply air flow rate

This addition to the chart would provide a level playing field for defining the power consumption of the motor/fan set on high speed. However, it may be necessary to also identify power consumption of HRVs on medium and low speed.

It would be useful to be able to compare HRVs quickly on the basis of power consumption. Therefore, an additional table should be provided detailing the power-to-air-flow ratio for HRVs at varying static pressures. The table would require ratings at minimum static pressures obtained on the various HRV speed settings.

Table 4.1:
Proposed HRV Power Consumption Rating Table

Minimum Static Pressure[1]		*Flow Rate[2]*		*Power to Air Flow Ratio*	
(Pa)	*(in. w. g.)*	(L/s)	*(cfm)*	(W/L/s)	*(W/cfm)*
174	*0.7*	61 - 94	*130 - 200*	___	___
100	*0.4*	33 - 57	*70 - 120*	___	___
50	*0.2*	17 - 28	*35 - 60*	___	___

1/ The static pressures across HRV to be the lower of the supply air stream value and the exhaust air stream value.

2/ The flow rate for calculating the energy consumption is to be the lower of the supply and the exhaust rates. Both supply and exhaust flow rates are to be measured within the given range when testing is performed to calculate the power rating.

Considerable consensus appears to be developing around the concept of a "cost of fresh air" rating. The cost of fresh air would include both power consumed by motor/fan sets and costs associated with the loss of heated air in

the exhaust air stream. This concept would encourage heat recovery and level the playing field between HRVs and exhaust only or non-heat recovering ventilation equipment.

It was suggested that the industry, through HVI, investigate and possibly develop a procedure for determining the cost of fresh air rating. It may be possible to include testing, calculations, and presentation of such a value in the harmonized set of CSA and ASHRAE standards. It has been suggested that such a concept should be introduced into both the CAN/CSA-C439 and C260 standards.

4.5 Standardized Product Information Sheets		
Industry, Industry Associations, Independent Testing Agencies	Timeframe Required:	3 months
	Commencement:	November 1996
	Completion:	February 1997

A coordinated effort will be required to update the presentation of data to be consistent with the new ASHRAE standard and revisions to CAN/CSA-C439. However, certain changes could be carried out whether or not a revised standard is soon forthcoming. The power consumption in relation to air flow information previously discussed could be added to the next draft of HRV rating sheets if general agreement can be obtained on the presentation methods.

An effort is needed to encourage HVI to update its presentation of data when it updates its listings for the 1996 *HVI Tested / Certified Catalogue*.

4.6 Initial Mandatory Requirements		
Government	Timeframe Required:	N/A
	Commencement:	April 1997
	Completion:	ongoing

It is generally agreed that government should set maximum power consumption limits for HRVs tied to air flow and static pressures. This will help address the need to eliminate the most inefficient models from the market, as well as setting the baseline for future efficiency upgrades and/or revisions.

Minimum standards would be based on the results of testing carried out in accordance with the revised CAN/CSA-C439. Maximum allowable power consumption limits should be set in consultation with industry, however, a reasonable consensus exists to initially accept Canadian HRVs that have been tested and approved to the current CAN/CSA-C439. This attempts to recognize the considerable effort already expended by manufacturers on product development and the endeavor to recover these costs in the near term.

The motor and fan components used in the production of the vast majority of HRVs are of very similar technology. Minimal benefit, therefore, would be gained by excluding certain products from the market at this time.

With the minimums set according to existing technology, the mandated minimum requirement could come into effect within six months of being tabled.

4.7 Certification Labelling

	Timeframe Required:	6 months
Industry Associations	Commencement:	November 1996
	Completion:	April 1997

An appropriate labelling program for all HRVs tested in accordance with CAN/CSA-C439 could be provided by the independent testing agency or the umbrella organization publishing the test results. Products meeting the mandatory requirement for power-to-flow ratio must be labelled differently from non-conforming products. It must be clear, without reading the fine print on the label, that products are acceptable for use in Canada.

Since the HVI developed the *Certified Home Ventilating Products Directory* and the current labelling schemes, they would appear to be the practical group to continue fulfilling the labelling function.

Label information could include:

- a statement regarding independent testing in compliance with CAN/CSA-C439;
- the flow rates and corresponding sensible recovery efficiencies at 0°C and -25°C;

- the three power-to-air-flow ratios and corresponding static pressures;
- the defrost type.

4.8 Product Marketing Assistance		
Promotional Organizations	Timeframe Required:	N/A
	Commencement:	July 1997
	Completion:	ongoing

Once the test results are published for the revised CAN/CSA-C439 standard, organizations promoting the efficient use of electricity, such as PowerSmart, are expected to promote and provide additional labelling for HRVs with particularly efficient motor/fan sets.

The criteria for accepting energy efficient products could include prescriptive limits for sensible heat recovery and power consumption, as well as specified requirements as to the type of defrost mechanism. Product selection criteria should be determined in conjunction with industry, industry associations, utilities and governments.

Alternatively, if all encompassing criteria, such as the annual cost of fresh air has been determined by HVI and the standards associations; it may be possible to reference their literature directly to determine qualified products.

4.9 Fan Test Rig Development		
	Timeframe Required:	2 months
CMHC	Commencement:	N/A
	Completion:	December 1995

Concern was expressed that CMHC's current contract for the development of a fan test rig will duplicate some of the industry testing presently being carried out at ORTECH. Strong recommendations were made to CMHC to enhance the facility at ORTECH rather than cause industry to undergo additional testing in a new, separate facility, particularly with respect to testing HRVs.

4.10 Future Mandatory Requirements	Timeframe Required:	30 months +
Government, Industry and Industry Associations	Commencement:	January 1997
	Completion:	July 2000

Once the initial mandatory limits on power-to-air-flow ratio are in place, government should consult industry as to a reasonable improvement in performance to be achieved by the year 2000. HVI's Ventilation Performance Energy Ratings Subcommittee would be very capable of working jointly with government on this issue.

The standard timeframe for the development of a new HRV product is typically two and half years—two years for engineering and prototype testing, and six months for retooling. Therefore, industry would have enough time to revise the designs for existing products and introduce new ones before the new requirement would take effect at the beginning of the year 2000.

Existing technology should make it possible for the revised mandatory maximum power-to-air-flow ratios to be greatly reduced from those first mandated. (See the *Briefing Document* for details.)

4.11 Further Comments

The HRV industry anticipates that, by the year 2000, all continuously operating ventilation equipment should have heat recovery.

Further, various manufacturers of HRVs predict that, within ten years,

- very efficient motors will be widely available;
- controls will be far more sophisticated further allowing ventilation to occur on the basis of demand via automation; and
- heating, ventilating and air conditioning systems will be integrated.

Integrated designs, sophisticated controls, and more efficient motors all benefit the objectives of the energy-efficiency timelines for ventilation. The development of standards and legislation should anticipate and facilitate the evolution of equipment designs in some of these directions.

5.0 CIRCULATION FAN TIMELINE

Fans identified under this category are not commonly considered residential ventilation devices. Circulation fans are usually part of the forced-air heating furnace installed in the residence.

Because these fans are a component within a furnace, purchasing decisions for these types of devices are more complex than those for other types of ventilation equipment.

A consumer's furnace purchasing decision involves evaluating the device as a heating appliance, not as a ventilation device. For fuel-fired furnaces, the efficiency rating is very visible and often a prime consideration in the purchasing decision. The currently reported efficiency rating, however, only deals with the fuel utilization aspect of the furnace. Fan/motor set efficiency is not considered, in spite of the fact that, over the life of the furnace, the cost of the energy to operate the fan motor may approach or even exceed the cost of the fuel used by the furnace.

The expected life of the typical furnace used today is longer than the expected life of the circulation fan motor. Consequently, at some time in the life of the furnace, a decision will be required about the purchase of a new motor.

In the case of new furnaces, the furnace manufacturer will be the driving force from the consumer side in any improvement in the efficiency of fan/motor sets. The furnace manufacturer currently makes the decision on the type of fan/motor set installed in their product and, only in rare cases, offers any type of options.

Historically, furnaces were controlled to run the circulation fan during the heating cycle and associated cool down period. This would normally equate to an average duty cycle during the heating season of less than 25 percent and an average annual duty cycle of less than 10 percent. With these types of duty cycles, energy performance was not a serious consideration.

With the increased use of air conditioning systems, the duty cycle of the fan in the forced-air furnace increased. At the same time, an increase in the power requirements of the circulation system was required to meet cooling load air flow requirements.

In recent years, it has become more common to see circulation fans running a very much higher duty cycle because of electronic or electrostatic air cleaning

systems installed in series with the furnace. Under these conditions, the circulation fan would normally operate at a reduced speed.

In many instances, the requirement for full-time mechanical ventilation and distribution of ventilation air throughout the house has further altered the duty cycle of furnace circulation fans. The most common type of mechanical ventilation system now installed in low-rise residential construction uses the furnace circulation system for the continuous distribution of fresh air—with the fresh air introduced to a point in the return air side of the ductwork. If the furnace circulation system is not operating, virtually no fresh air is distributed to the house.

Circulation fans installed in furnaces are the largest of the fan/motor sets used in a residential ventilation system. Because the devices are sized for the cooling requirement, they are significantly larger than would be required for simple distribution of ventilation air. This oversizing factor makes improvement in the efficiency of these devices even more important.

In the case of a fan/motor set, it is the industry consensus that most of the efficiency improvement should center on the motor rather than the fan. The technology exists for dramatic improvement in the efficiency of the sizes of these motors; and, in many cases, the suitable motors are currently manufactured.

Any possible improvement in the efficiency of the fan portion of the fan/motor set would be small and would come at a very high development and production cost. The effectiveness of any improvements would be adversely affected by current air flow designs of furnaces and the associated ducting. Fundamental changes to furnace design are not anticipated by the industry in the foreseeable future.

The following discussion highlights some of the key elements to be addressed in a timeline to improve the efficiency of fan/motor sets used for the circulation of air in houses. Figure 5.1 provides a visual overview of the overall timeline.

Figure 5.1:
Circulation Fan Motor/Fan Set Efficiency Timeline Overview

Action	Timeframe Required	Commencement	Completion
5.1 Development of Standard Test Methods for Motors *CSA*	6 months	March 1996	August 1996
5.2 Mandatory Independent Testing *Government +*	12 months	September 1996	September 1997
5.3 Product Labelling *Industry Associations*	12 months	July 1997	ongoing
5.4 Public Relations, Inspection and Enforcement *Government*	ongoing	March 1996	ongoing
5.5 Minimum Mandatory Motor/Fan Set Efficiency Requirements *Government*	N/A	September 1997	N/A

5.1 Development of Standard Test Methods for Motors

CSA

Time frame Required: 6 months
Commencement: March 1996
Completion: August 1996

Standardized testing and reporting methods are required to ensure a level playing field for all motor and fan manufacturers before any attempt can be made at promoting the use of higher efficiency devices. The testing and rating requirements must realistically simulate the load and duty cycles to which these motors will be subjected during normal operation. Part load efficiencies are of particular concern since, for ventilation purposes, the motor fan sets will normally operate at a small fraction of their full load capacity.

5.2 Mandatory Independent Testing to the New Standard		
Government (EnerGuide) +	Timeframe Required:	12 months
	Commencement:	September 1996
	Completion:	September 1997

The current methods used to report the efficiency of fan/motor sets can be very misleading for both the manufacturers of furnaces and consumers. For purchasers to compare fan/motor efficiencies when making purchasing decisions and to permit regulators to set and enforce reasonable standards, comparable test information must be available for all motors sold in the residential market. This requires the testing of all motors intended for installation in furnaces.

5.3 Product Labelling		
	Timeframe Required:	12 months
Industry Associations	Commencement:	July 1997
	Completion:	ongoing

The results of testing must be available in an easy to interpret form. In the case of furnaces, the efficiency fan/motor set should be included in the furnace efficiency labelling. This could take one of two forms. Either a single overall efficiency rating for the furnace, incorporating both the current AFUE rating and the fan/motor set efficiency rating or individual numbers for the two separate factors.

The concept of a single number is attractive because of its simplicity in reporting; however, it has the drawback of obscuring the differences in fan motor efficiency between furnaces using different fuels. In addition, the efficiency reporting system for fuel use is well established, and modifying this system is likely to take longer than it would to establish a separate motor/fan set efficiency labelling system.

For the motor replacement sector, the motor labelling is important. In this case all replacement motors will require labelling.

5.4 Public Relations, Inspection and Enforcement	Time frame Required:	ongoing
Government	Commencement:	March 1996
	Completion:	ongoing

The savings associated with improvements in the efficiency of fan/motor sets in residential furnaces is substantial in terms of home operating costs. The key to a major uptake of new, more efficient devices is to convey the appropriate information to consumers in an easily understood manner. This information will be most credible if seen to be coming from an independent source. Government can clearly play the major role in this respect.

It is the consensus of industry members that, as long as the playing field is level, the inclusion of high-efficiency motors in furnaces will be relatively easy from an industry perspective. It is important, however, to accompany any requirement for high-efficiency motors with strict enforcement and ensure all equipment on the market, whether originating in Canada or elsewhere, meets the required standards.

5.5 Minimum Mandatory Motor Fan Set Efficiency Requirements	Time frame Required:	N/A
Government	Commencement:	September 1997
	Completion:	N/A

Once the revised standard is in place and the present state of the industry is better understood as a result of uniform testing, governments will be in a position to legislate improvements to the energy efficiency of motor/fan sets. In provincial jurisdictions with an energy efficiency act, the improvements can be set out in changes to the Act. Federally, the National Energy Code may be used as a mechanism to set out minimum efficiencies.

The following table shows the proposed efficiency for motor/fan sets to be mandated within five years.

Table 5.1

Proposed Circulation Fan Mandatory Maximum Power to Air Flow Ratios

Static Pressure		*Power to Air Flow Ratio*		*Efficiency*
(Pa)	(in. w. g.)	(W/L/s)	(W/cfm)	(%)
75	0.3	0.05	0.11	30
175	0.7	0.11	0.23	35
300	1.2	0.12	0.26	40

A timetable should be set out for improvements to the requirements to enable industry to maintain the ability to deliver appropriate products to the market. The industry suggests that, in the short term, it would be reasonable to impose minimum motor/fan set efficiency requirements as laid out in the above table Government may, through consultation, develop consensus around more aggressive targets once test procedures, test results and other factors are better known.

6.0 CONCLUSIONS

There was general agreement among the industry members who participated in this consensus process that significant room exists for cost-effective improvements to the efficiency of fan/motor sets in residential ventilation systems.

It was agreed that the most important aspect of moving in the direction of improved efficiency is maintaining a level playing field. Without this level playing field, progressive industry members are unfairly disadvantaged by those less progressive ones. Any mandatory changes must be based on consensus standards, testing and appropriate labelling.

For all timelines presented in this report, industry has provided a process for government to regulate industry effectively. It is industry's belief that voluntary requirements have little if any impact on industry and only through effective mandatory requirements can the process of moving towards the widespread use of more efficient motor/fan sets begin. It must be emphasized that industry believes the process for determining efficiency standards and the timing of their implementation must be industry and not government driven.

Industry has provided these timelines for government based upon good will, faith in government to act upon the recommendations wisely, and a recognition of the need to address the current, apparent inefficiency of motor/fan sets used in residential ventilation devices. Government is expected to act on the advisement of industry to determine minimum efficiency requirements.

The timelines recommended in this document will make it possible to:

- fairly compare the motor/fan set efficiency of residential ventilation devices,
- provide a fair and level playing field throughout the process for manufacturers,
- reduce the average electricity usage of ventilation devices within each category over time, and
- provide the framework for further reasonable upgrades to mandatory requirements and their enforcement.

APPENDIX A

Contact List - Residential Ventilation Industry

Contact Name	*Company Name*	*Product Manufactured*
ARNOTT, Mr. Gordon	HRAI Heating, Refrigerating and Air Conditioning Institute	
RAMMIEN, Mr. Dale	HVI Home Ventilating Institute	
MCEACHERN, Mr. Gary	Airdex Corporation	Blowers
RUTHERFORD, Mr. Neil	Delhi Industries Inc.	Blowers
REYNOLDS, Mr. Steve	Dundas Foundry Company	Blowers
STRUJAC, Mr. Don	M.K. Plastics	Blowers
COOPER, Mr. Mel	M.K. Plastics	Blowers
ROBB, Mr. R. Arnold	Universal Fan & Blower Ltd.	Blowers
RYAN, Mr. John	ASL Tomkins Ltd	Blowers:Sales
SOLTANI, Mr. Shaw	ASL Tomkins Ltd	Blowers:Sales
MCCRIMMON, Mr. Roy	Airmart HVAC Inc.	Fans
DIETZ, Mr. Dennis	American Aldes Ventilation Corporation	Fans
WOLBRINK, Mr. Dave	Broan Manufacturing Company, Inc.	Fans
CARON, Mr. Claude Sam	CDC A Division of Motors & Ventilators Inc.	Fans
KOBAYAKAWA, Mr. Roy	Matsushita Home and Commercial (Panasonic)	Fans
SALERNO, Mr. Joe	Reversomatic Heating and Manufacturing Limited	Fans
MOROZ, Mr. Harry	Reversomatic Heating and Manufacturing Limited	Fans
TALTY, Mr. Tim	Talty Associates	Fans
FORTIN, Mr. Christian	Venmar Ventilation Inc.	Fans
ARNOLD, Mr.	Eucania Machining Ltd.	Fans/Blowers:Components
FAXON, Mr. Paul	Howard Industries Inc.	Fans/Motors
BOLES, Mr. Mike	Semco	Fans/Blowers
HILL, Mr. Kevin	Woods Air Movement Ltd	Fans/Blowers

Contact Name	*Company Name*	*Product Manufactured*
MACLEAN, Mr. Arnie	Aeroflo Inc. Ventilation Technology	Fans:Sales
BRYDON, Mr. Larry	Davie Environmental Equipment Ltd.	Fans/Blowers:Sales
WHELPLEY, Mr. Michael	Davie Environmental Equipment Ltd.	Fans/Blowers:Sales
MCPHAIL, Mr. Jim	EBM Papst	Fans:Sales
HUNT, Mr. Graham	EBM Papst	Fans:Sales
BLACKMORE, Mr. Grant	EEE Eden Energy Equipment	Fans/HRVs:Sales
BECKETT, Mr. Paul	Jenn Air	Fans:Sales
LES, Mr. Dan	Nutone Industries	Fans:Sales
MONK, Mr. Wayne	Thermal Technics Corporation	Fans:Sales
MONK, Mr. Tony	Thermal Technics Corporation	Fans:Sales
RUTHERFORD, Mr. Bob	Thermal Technics Corporation	Fans:Sales
DITTMAR, Mr. Peter	Carrier Canada	Furnaces
KOBY, Mr. V.	Hunter Enterprises Orillia Ltd.	Furnaces
VALE, Mr. Bill	Lennox Industries	Furnaces
PARTINGTON, Mr. Brian D.	Temspec Inc.	Furnaces:(Class Room Heaters)
OLMSTEAD, Mr. Richard	CES/Venmar	HRVs
CLARE, Mr. Edward C.	Clare Brothers Ltd.	HRVs/Furnaces
CRAWFORD, Mr. Lloyd	Del-Air Systems Ltd.	HRVs
DANISH, Mr. Tarek	Environment Air Ltd.	HRVs
SALDIN, Mr. Ron	Honeywell	HRVs
PASNICK, Mr. Henry	Honeywell	HRVs
FRANKLIN, Mr. John	Nutech Energy Systems Inc.	HRVs
GRINSBERG, Mr. Peter	Nutech Energy Systems Inc.	HRVs
HENDERSON, Mr. Craig	Nutech Energy Systems Inc.	HRVs

Contact Name	*Company Name*	*Product Manufactured*
KINZELMAN, Mr. Craig	Stirling Technology, Inc.	HRVs
MURDUFF, Mr. Roy	Trent Metals Limited	HRVs
COOKE, Mr. Gord	vanEE Air Solutions Inc.	HRVs:Sales
SMITH, Mr. Greg	Emerson Electric	Motors
MACNEIL, Mr. Joe	Fasco	Motors
DURIE, Mr. Allen	Fasco	Motors
BHARGAVA, Mr. Niraj	GE Canada	Motors
MCKELVIE, Mr. Dan	Leeson Canada Inc.	Motors
DAY, Mr. Joe	Magnetek	Motors
BISHOP, Mr. Graeme D.	Reliance Electric Limited	Motors
DELEON, Mr. Jack	Reliance Electric Limited	Motors

APPENDIX B

Industry Representatives at Timeline Meeting

Industry Representatives

Mr. Grant Blackmore President Eden Energy Equipment 71 Wyndhan Street, South Guelph, Ontario N1E 5R3 (519) 821-8478 (tel) (519) 821-8491 (fax)	Mr. Rainer Blomster President Kanalflakt Canada Limited 1712 Northgate Blvd. Sarasota, Florida 34234 USA (813) 359-3267 (tel) (813) 359-3828 (fax)	Mr. Allen Durie Applications Engineer Fasco Industries Sale Barn Road Cassville, Missouri 65625 USA (417) 847-8270 (tel) (417) 847-8207 (fax)
Mr. John Franklin President Nutech Energy Systems Inc. 511 McCormick Boulevard London, Ontario N5W 4C8 (519) 457-1904 (tel) (519) 457-1676 (fax)	Mr. Peter Grinsberg Nutech Energy Systems Inc. 511 McCormick Boulevard London, Ontario N5W 4C8 (519) 457-1904 (tel) (519) 457-1676 (fax)	Mr. Graham Hunt Technical Support EBM Industries Inc. 110 Scotia Court, Unit 33 Whitby, Ontario L1N 8Y7 (905) 432-2001 (tel) (905) 432-2068 (fax)
Mr. Michel Julien Project Manager R & D Venmar Ventilation Inc. 1715 Haggerty Drummondville, Québec J2C 5P7 (819) 475-2630 (tel) (819) 474-3066 (fax)	Mr. Wayne Monk Operations Manager Thermal Technics Corporation 6075 Kestrel Road Mississauga, Ontario L5T 1Y8 (905) 795-9500 (tel) (905) 795-9506 (fax)	Mr. Tony Monk President Thermal Technics Corporation 6075 Kestrel Road Mississauga, Ontario L5T 1Y8 (905) 795-9500 (tel) (905) 795-9506 (fax)
Mr. Terry O'Leary National Manager Field Service and Training Inter-City Products Corporation Canada 249 Courtland Avenue Vaughan, Ontario L4K 4T2 (905) 569-7946 (tel) (905) 738-6200 (fax)	Mr. Richard Olmstead Associate Interlink Research Inc. P.O. Box 22098 3510 8th Street, East Saskatoon, Saskatchewan S7H 5P1 (306) 373-0597 (tel) (306) 373-0597 (fax)	Mr. Henry Pasnick Market Manager Honeywell 740 Ellesmere Road Scarborough, Ontario M1P 2V9 (416) 293-8111 (tel) (416) 297-4268 (fax)
Mr. Neil Rutherford Engineering Manager Delhi Industries Inc. 523 James Street Delhi, Ontario, N4B 2Z3 (519) 582-2440 (tel) (519) 582-0581 (fax)	Mr. Joseph Salerno President Reversomatic Heating and Manufacturing Limited 790 Rowntree Dairy Road Woodbridge, Ontario L4L 5V3 (416) 851-6701 (tel) (416) 851-8376 (fax)	Mr. Michael Whelpley Sales Davie Environmental Equipment Ltd. 25 Kelfield Street Rexdale, Ontario M9W 5A1 (416) 244-5586 (tel) (416) 249-8239 (fax)