Research & Development Highlights

93-205 Technical Series

Efficient and Effective Air Handling Devices

Introduction

There are many devices in houses that move air, and all of them use more energy than necessary for their intended task. With the advent of continuous mechanical ventilation, including both air exchange and distribution of air to or from all rooms, fan usage is becoming more important. From initial studies at CMHC, it appeared that many motor-fan sets for air exchange are only 1% to 3% efficient, and the motor-blower sets in forced-air furnaces were only 5% to 15% efficient. The cost of wasted energy, over the year, ranged from 50 dollars in the first instance to several hundred dollars in the second. This project investigated the efficiency of the components used to meet air movement needs in houses, and how those efficiencies inter-related in systems.

Research Program

Individual devices, including controllers, motors, fans and cabinets, were studied in the context of the more common air handling operations in a house. Use was compared with flow power requirements, and projections were made as to what minimum, typical, near-term maximum and future potential efficiencies were, and could be. Reduction of flow power requirements, through optimization of the ducting components for instance, was left for a future study, when better component performance information will be available. For comparison, some larger-building devices and systems were also investigated.

Findings

Current residential air handling devices and systems are one tenth as efficient than they could be, and major improvements should be cost-effective even with present costs for electricity. Their commercial counterparts are presently that efficient (but could also benefit from further upgrades, because of the scale of the waste involved).

Although some furnace motor-fan sets are about 20% efficient, poor installation practices make them only 7% efficient as air handling devices. Individual exhaust devices are typically less than 2% efficient. The spread between poor and best can be in the order of ten to one, even without major new developments in technology or production.

Many components make such low efficiencies possible, even probable, as each device feeds the inefficiency of others closer to the load. A 40% efficient fan, operating at half its maximum efficiency because of mismatching, when fed by a 30% efficient motor through a 50% efficient speed controller, is only 3% efficient in delivering the required flow power. While no one efficiency is very low, the end result is abysmal.

A 65% efficient fan, de-rated to only 75% by oversizing and driven by a 90% efficient motor through a 90% efficient speed controller, is still 40% efficient and consumes 13 times less power to do the same task as the above example. If the fan were more efficient and better matched to the load, with slight improvement to the motor and controller, efficiencies above 60% would be possible, for a further reduction in input power of about 30 percentl The potential for energy efficiency improvements in small air handling devices is clearly vast.

Implications for the Housing Industry

Since most such improvements are cost-effective now for continuously operating fans, and even for some frequently used intermittent devices, the industry has not produced equipment that is “self-evidently optimal” as several industry persons have stated. The industry must get involved in developing test standards, improved information on real ventilation needs and better access to information on optimal designs.

ft must also develop plans for getting efficient devices into the marketplace, at competitive prices, before unilateral legislation makes that a requirement without adequate industry input.

A phased approach to increasing required efficiency may have many benefits to all involved, especially if this opens the marketplace in the USA to devices developed here in Canada, for leading-edge technologies. Little time can be wasted, however, or external suppliers will have the whole marketplace. Soon after devices are available to the new house market, a major demand can be expected in existing houses, as the benefits of mechanical ventilation, at low electrical operating cost, become evident.

Project Manager: Jim White
Research Report: Efficient and Effective Air Handling Devices (1993)
Research Consultant: Allen Associates

A full report on this research project is available from the Canadian Housing Information Centre at the address below.

For a somewhat different, but usefully compatible, look at the problem, readers may wish to consult the CMHC report entitled "Barriers to the Use of Energy Efficient Residential Ventilation Devices".

Housing Research at CMHC

Under Part IX of the National Housing Act, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

This factsheet is one of a series intended to inform you of the nature and scope of CMHC's technical research program.

*The **Research and Development Highlights** factsheet is one of a wide variety of housing-related publications produced by CMHC.*

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