Research & Development Highlights

93-204 Technical Series

Energy and Power Needs and Availability in Housing

Introduction

Many housing operations require energy (the energy requirement or “need”), and there are several sources of both low-grade and higher-grade power and energy available to most houses (energy availability). Because preliminary studies showed that ventilation is very inefficiently delivered in present systems, a more general study of the energy needs and availability of typical housing processes was initiated. This is ground-breaking work, even after several decades of energy conservation research, partly because the original focus of most projects was on conserving energy, no matter what the real need, and partly because adequate building science is scarce in many areas.

Research Program

After listing the many operations in housing that either use energy, or process it and make it available (at a lower energy or quality), a typical set of operations was studied in detail, by a team of experts in housing research. From those detailed studies, certain general approaches were developed, then applied to other processes. Because there is an inadequate science goveming many energy flows, it was necessary to define surrogate efficiencies for some processes, where true energy needs could not be readily defined. In those cases, the energy of power output of a human performing the same task was estimated, from existing studies. For energy or power supplied to housing from external systems (electricity, gas, oil, water, etc.) the efficiencies of those processes was taken into account.

Findings

Most of the processes in housing require small amounts of power or energy, but are so inefficiently performed that they consume much larger amounts. Power and energy available to the house, from processes such as wind, sunshine, etc., is often greater than what is needed to perform the task, but less than the present input requirement, because of the huge inefficiencies of the devices and systems now in use.

The efficiencies of most housing processes are less than 10% and often less than 1%. Stated another way, the energy wasted is usually more almost 10 times the real need, and often more than 100 times that need. The reasons vary, but they include low conversion efficiencies, mismatches of the device or process to the task and poor matching of energy quality (using electricity to deliver low-temperature heat).

Some available devices are much more efficient than others, so that the range in the input powers of existing devices performing the same task is often great. Since few consumers are even aware of the concept of absolute efficiency, however, or of the advantages and reductions in operating cost possible from using more efficient devices, they are not as popular as they should be. Interestingly enough, few manufacturers or energy officials are aware of these concepts, either, so there is little push towards more efficient devices or methods at present.

Implications for the housing industry

Most housing processes waste much more power and energy than they need to perform the tasks involved, for a huge increase in input energy over what is really required. This is significantly increasing operating costs, and producing a negative impact on the planet. In many cases there are more efficient devices available, and they are likely cost-effective now. There is a real requirement, however, for better understanding of all such process energy or power needs, and of how to specify a device or system which does the job but uses far less energy and costs much less to operate.

Aithough higher efficiency devices are cost-effective now, there are few mechanisms available to identify the benefits of their use, so that suppliers, builders and consumers require new information on how to design build and choose the best available product or system.

With a swing to more efficient delivery of housing processes, energy independent housing will be closer to reality, cooling needs will again drop, and it will be possible to deliver a higher quality indoor environment with a reduced impact on the external environment. We will not have to freeze in the dark to be energy efficient and soft on the planet. Significant improvements in the thermodynamic efficiency of many household devices and systems is both possible and highly desirable. Most are cost-effective nowl These improvements are possible through an array of processes, such as reduction of energy conversion losses; better matching of devices to loads; increased heat recovery; general use of energy sources of lower quality or energy, for loads with low energy needs; and higher utilization of ambient energy. Much more research is required in this area, because this project was just a first look at a field that holds enormous potential. A considerable improvement could be made in many areas, however, using what is presently available to best advantage.

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Research Consultant: Marbek Resource Consultants Ltd. (with Allen Associates, Sheltair Scientific Ltd., and Professor John Timusk, University of Toronto)

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

Housing Research at CMHC

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