

New Directions for C-2000

By Nils Larsson

We have carried news about the C-2000 Program for Advanced Commercial Buildings in past issues, and we provide an update in this issue. Just to keep things straight, it should be noted that the Editor of ABN is also the Program Manager of C-2000, so keep your eyes open for excessive optimism in the following item, even though we can vouch for its substantive content.

First, a very brief reminder: C-2000 is a small demonstration program for high-performance office buildings, developed and sponsored by the CANMET Energy Technology Centre (CETC) of Natural Resources Canada. The program was launched in late 1993 and currently two of the seven buildings designed have been constructed and are being monitored.

The primary objective of the C-2000 program was (and remains) to promote a greatly improved level of energy and environmental performance, but criteria were developed for a wide range of other parameters in order to increase the program's relevance to a wide range of users. The program has provided a modest level of financial and technical assistance to a small number of development teams who agree to conform to the program requirements.

Technical and procedural requirements for the program were completed in 1993 and published as a 200-page document entitled *C-2000 Program Requirements*. Requirements cover a broad range of performance criteria, including demonstration of projected annual energy consumption that is no more than 50% of that required by ASHRAE 90.1, an industry-wide performance benchmark for good energy performance. Other performance requirements were

established to assure minimal environmental impact, a high quality indoor environment, adaptability, long-lived building components and facilitation of future maintenance.

The overall strategy followed has been to support the extra costs of design and construction of projects that meet the performance criteria, to monitor their actual performance over a three year period and to inform the industry of the results. The process has laid emphasis on the application of explicit performance targets, a careful selection of qualified teams and the development of close working relationships with other experts in the field.

As of April 1997, seven projects have been designed under the program and two have been completed and occupied. One of these projects met the energy performance criterion for annual energy performance, and the other improved on it.

Most of the incremental funding provided through the program has been used to improve the energy performance from the baseline ASHRAE 90.1 level to C-2000 requirements. The incremental funding available to individual projects, including in-kind contributions, ranged from \$315,000 to \$850,000, depending on the size of the project (from a minimum area of 5,000 m² to a maximum of 15,000 m²). These incremental costs were shared by the developer, CANMET and participating utilities, and payments covered design as well as the capital costs of construction and commissioning. These incremental costs represent anywhere from \$57 to \$150 per m² of gross area, or approximately 4% to 14% of total construction cost, but the two projects that were actually built

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Although the C-2000 program was limited to office buildings, the program criteria were applied to a program for multi-residential buildings called Ideas Challenge, which was jointly operated by CETC and the Canada Mortgage and Housing Corporation, Canada's national housing agency.

Although a final assessment will have to await the results of two more years of monitoring, several interim conclusions have been reached.

The program's demanding performance targets have been met in three recent projects through the use of relatively conventional technologies with incremental capital costs that are modest. There is a consensus amongst participants that the largest single factor in this apparent success is not so much technologies but process: the strong inter-disciplinary teamwork that facilitates a high level of integration of technologies, the design guidelines, the formulation of performance strategies and the availability of expert support. The results to date thus suggest that many of the C-2000 performance standards and processes can be adopted by the industry even without capital subsidies.

Clearly, the extra effort and cost of design, technical systems and processes associated with designing for high performance make it more cost-effective for larger projects than smaller ones; and experience suggests that normal design fees have to be augmented by at least \$50,000 to \$75,000 if a full design process including energy simulations is to be completed.



Largely because of the success of the C-2000 projects in the B.C. region, two major utilities there launched a new Design Facilitation program. Design facilitation involves intervention in the design process by skilled facilitators. A facilitator takes on the responsibility of promoting teamwork in the process, demonstrating what is meant by a whole-building performance approach, and bringing new skills to the design team, such as energy simulation, daylighting or monitoring techniques. Three Ontario gas utilities are now indicating their support for this form of demand-side management.

Turning this potential into practice, however, will require that professionals change the way they work and abandon the sequential process currently used in favour of an iterative, holistic and integrated team process. This presents a major challenge, since traditional ways of working are deeply entrenched.

Above:

*The Bentall Crestwood
8 C-2000 building in
Richmond B.C.*

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C-2000 Design Facilitation

Consideration of the first phase results led to the conclusion that the financial and technical support provided by CETC to the design process was the most cost-effective part of the program. It was therefore concluded that the limited funds available to the program would be much better concentrated on this stage. The second phase of the program is therefore being launched as the *C-2000 Design Facilitation* or *C-2000 DF* program.

As in the first phase, participating design and development teams will be expected to conform to the C-2000 DF criteria on a best-efforts basis. An area of uncertainty exists, however, as to the feasibility of imposing the previous energy performance requirement under the new conditions of no capital support. In addition, the C-2000 DF energy requirements are now being re-structured so that they reference the National Energy Code for Buildings (NECB) instead of the previous ASHRAE 90.1 benchmark. The performance criteria for the first few projects funded under C-2000 DF will therefore be developed on a custom basis until a performance requirement is established that is shown to be both demanding and achievable.

Based on the experience in Phase 1, the new C-2000 DF process relies on the following elements to increase the likelihood of high performance:

- an insistence on close teamwork by all members of the design team from the beginning of the design process, so that the performance and cost implications of various design options are considered in a holistic way, and at an early stage,
- the involvement of one or more design facilitators in most design meetings, to act as a guide to performance options and a link to various contracted specialists,

- augmentation of normal design team expertise with an energy engineer, an environmental specialist and a cost consultant,
- the availability of a roster of specialized technical experts who can be called in at short notice to assist the design team in issues such as daylighting, thermal storage or other specialized technical areas,
- the use of a clear and comprehensive technical guideline document, such as that developed for the C-2000 program,
- the development of short written performance strategies by the design team, so that performance targets can be established within each performance area and the costs and benefits of each option examined, and
- during the construction phase, commissioning of all major systems including the building envelope to ensure that systems are properly installed and perform to designed levels.

Activities during 1997/98

Program funding is still very constrained, but the following projects are now planned for the period April 1997 to April 1998:

- continuing monitoring of the two existing C-2000 projects for a two-year period;
- application of C-2000 principles to an office retrofit, developed in partnership with Consumers Gas and PWGSC;
- design of a branch library in Saskatoon, in partnership with the City of Saskatoon and the Saskatoon Library Board;
- design of a condominium in Dundas, Ontario, in partnership with Union / Centra Gas, the

developer, the architects and (potentially) CMHC;

- design of a condominium in Victoria BC, in partnership with the developer and CMHC.

By November 1997, revised program criteria will be published that will include the following elements:

- use of the Canadian National Energy Code for Buildings (NECB) as an energy reference, and a level of required energy performance that is related to the NECB benchmark.
- explicit recognition of issues related to retrofit work, which is not covered in the existing manual.
- more detail and guidance on environmental impact issues, specifically drawing on recent international work and studies carried out as part of the GBC '98, BEPAC and Athena projects.
- updated supporting information.

The Larger Context

Several other initiatives are related to the new phase of C-2000 activities. One is the recent federal announcement of \$20 million per year over three years to promote energy efficiency in commercial buildings. Efforts are being made to coordinate the design of the new tax measures with C-2000 to ensure that the two initiatives complement each other.

Another CETC activity that relates to the C-2000 program is the development of software to allow users to verify the compliance of their designs to the requirements of the National Energy Code for Buildings (NECB). This work, which is being carried out in a cooperative effort with provincial agencies and utilities across Canada, will result by 1998 in an energy simulation tool that will greatly

simplify the task of designing for energy efficiency. The tool will be of special value to C-2000 designers since the program will now use the NECB as a benchmark.

Although work is currently going on (see previous section) to develop an updated set of C-2000 design guidelines during 1997, a longer-term project will result in a new generation of design guidelines integrated with performance assessment criteria. The first activity in this area of work is the *Green Building Challenge '98*, an effort to develop a second-generation method to define and assess building performance that involves twelve countries. This work will also produce the basis for a new performance guideline, which is expected to be applied to the C-2000 program by 1999.

Building performance labelling has the potential of greatly increasing the demand for high performance buildings, by making tenants and users more aware of performance issues. CETC is therefore promoting the concept of labelling, and it is expected that the GBC '98 assessment framework will be adopted for labelling, in a manner that is consistent with C-2000.

Finally, CETC will continue to serve a valuable function as a clearing house for information related to R&D in the commercial and multi-unit residential building sectors. This function is an informal one, but is nevertheless of great importance, given the large gap between theory and practice.

Nils Larsson

Further Information:

A number of C-2000 publications are now available, some free and others at modest cost. These include:

C-2000 Performance Requirements; N. Larsson, Editor; 200pp; updated April 1996; \$50;

Report on the Bentall Crestwood 8 project; (including appendices); Bunting Coady et al; 80 pp; \$20;

Green on the Grand - Final Report; Enermodal Engineering Ltd; 63 pp; 1996; \$20;

C-2000 Design of Prince George Native Friendship Centre; Bunting Coady Architects and Tesco Pacific Ltd; 60 pp; 1997; \$10;

Summary of C-2000 Building Simulations; 51 pp; Caneta Research Ltd; 1994; \$10

Interim Report on the C-2000 Program; 1996; 15 pp, free.

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