ibpsaNEWS

Volume 8 Number 1
July 1996

Contents

The International Building Performance Simulation Association (IBPSA) exists to advance and promote the science of building performance simulation in order to improve the design, construction, operations and maintenance of new and existing buildings worldwide.

Volume 8 Number 1
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President's message

While IBPSA's impact at the international level is well recognised - largely through its Building Simulation conference series (Vancouver '89, Nice '91, Adelaide '93, Wisconsin '95 and Prague '97) - it is true that our organisation has been ineffective in evolving products and services which are appropriate to the everyday needs of practitioners. There are two related reasons for this failure. Firstly, the global distribution of IBPSA members gives rise to a requirement to cover disparate work practices, professional expectations and regulatory frameworks. Secondly, IBPSA's international focus has meant that the coordination of activities at the local level has been highly problematic, if not impossible.

This situation is set to change with the introduction of a new organisational structure which places the emphasis on regional activities aimed at helping practitioners to better understand, appreciate and apply simulation in a design context. The underlying premise is simple: that regionally based organisations can best identify and serve local needs, while a network of such organisations will bring about best practice improvements through inter-region know-how exchange. Already the process of network building has started, with IBPSA Affiliates established for Australasia, Canada, Czech Republic, Greece, the UK and the US. It is expected that several new Affiliates will be added to this list over the coming months.

The intention is that Affiliates should be financially and administratively autonomous. In practice this means that they will raise and deploy their funds locally. IBPSA, for its part, will direct its resources to regional interchange through newsletter production, the maintenance of electronic communication facilities and the continuation of the Building Simulation conference series. In this way IBPSA will act to empower and complement its Affiliates in their work to inform and support their members in the context of local design issues and concerns.

Continued over

In future, the IBPSA Board of Directors will comprise regionally nominated representatives (i.e. individuals elected locally by Affiliate members), a President, Vice President, Treasurer and Secretary, all elected by the aggregate membership at large. The following guidelines have been formulated to assist with the establishment of a new Affiliate:

- The proposers of the Affiliate should prepare a brief case for consideration by the IBPSA Board of Directors. This should define the geographic territory to be covered and endorse the IBPSA Mission Statement, indicating where the goals of the Affiliate might differ. Affiliation will depend only on the organisation having a purpose consistent with that of IBPSA. The Affiliate and IBPSA would then enter into a specific agreement, with IBPSA perhaps providing a limited amount of matching funding to assist with initial start-up costs.
- Affiliates may adopt the name “IBPSA <Region>” or they may use any other appropriate name. Their letterhead and other publicity material should indicate that they are an “Affiliate of IBPSA”.
- IBPSA will provide Affiliates with a list of operational guidelines, contact information for persons available to assist the local organiser and camera ready originals of the IBPSA logo. Affiliates will normally provide membership data to IBPSA for use in mailing IBPSA materials.
- The organisational structure and finances of an Affiliate will be independent from IBPSA. This means that Affiliates will retain all member dues and other funds raised through their activities. (An individual or organisation may pay dues directly to IBPSA if there is no Affiliate operating in their area or by choice.) Affiliate members will automatically become full members of IBPSA.
- The expectation is that the biannual Building Simulation conference will be hosted by an Affiliate, with the risk and surplus shared by all Affiliates (in proportion to the amount of sponsorship raised) and IBPSA.

If you would like to become, or help form, an IBPSA Affiliate then please write to the IBPSA Secretary, Larry Degelman. As the energy and environment theme evolves and, in response, the uptake of simulation accelerates, the need for an effective support infrastructure will become even more palpable. IBPSA has come a long way towards addressing this need, let’s not stop now.

See you at Building Simulation ’97 in Prague.

Joe Clarke, President, IBPSA

BLAST, DOE-2 to Merge

C. O. Pedersen, University of Illinois, and F. C. Winkelmann, Lawrence Berkeley National Laboratory.

For the past several decades, the US government has maintained and supported two building energy simulation programs, DOE-2 and BLAST. DOE-2 has been supported by the Department of Energy (DOE), and has its origins in the Post Office program written in the late 1960's for the US Post Office. BLAST has been supported by the Department of Defense (DOD), and has its origins in the NBSLD program developed at the US National Bureau of Standards in the early 1970's. For the loads calculation DOE-2 uses a room weighting factor approach and BLAST uses a heat balance approach.

The need for two separate government supported programs has been questioned for many years, and discussions of the possible merger of the two programs began in April 1994 with a DOD sponsored conference in Illinois. No concrete plans came out of the conference, but eventually, under the initiative of Program Manager Dru Crawley at DOE, a merger project has begun. This project, called BestOf! for lack of a more creative name, is intended to combine the best parts of DOE-2 and BLAST, and begin the restructuring process necessary to make the merged program more amenable to accepting modifications and additions.

The overall structure envisioned for the program can be seen with the aid of the diagram in figure 1 below.

The idea is to combine the heat balance engine of the IBLAST program (a version of the BLAST program which has integrated building, system and plant simulation) with a generalized HVAC engine which includes the systems from BLAST and DOE-2 and well as links to MODSIM (from HVACSIM+) and SPARK. The heat balance engine will also be restructured to accommodate the daylighting program and WINDOW-4 based fenestration program from DOE-2 as well as new ground heat transfer and zone air flow models. Both the DOE-2 building description language and the BLAST input file will be usable by the combined program. Depending on the progress made by the Industry Alliance for Interoperability, a common object-oriented data store may eventually become the main interface to the program. One of the main goals is to develop an organized, modular program structure so that additional features and other programs can be added easily. In this regard, all current code will undergo significant reengineering, and will be converted to standard Fortran90.

The merged program is viewed as an interim step along the path to the next generation energy analysis programs. Another article in this newsletter presents the

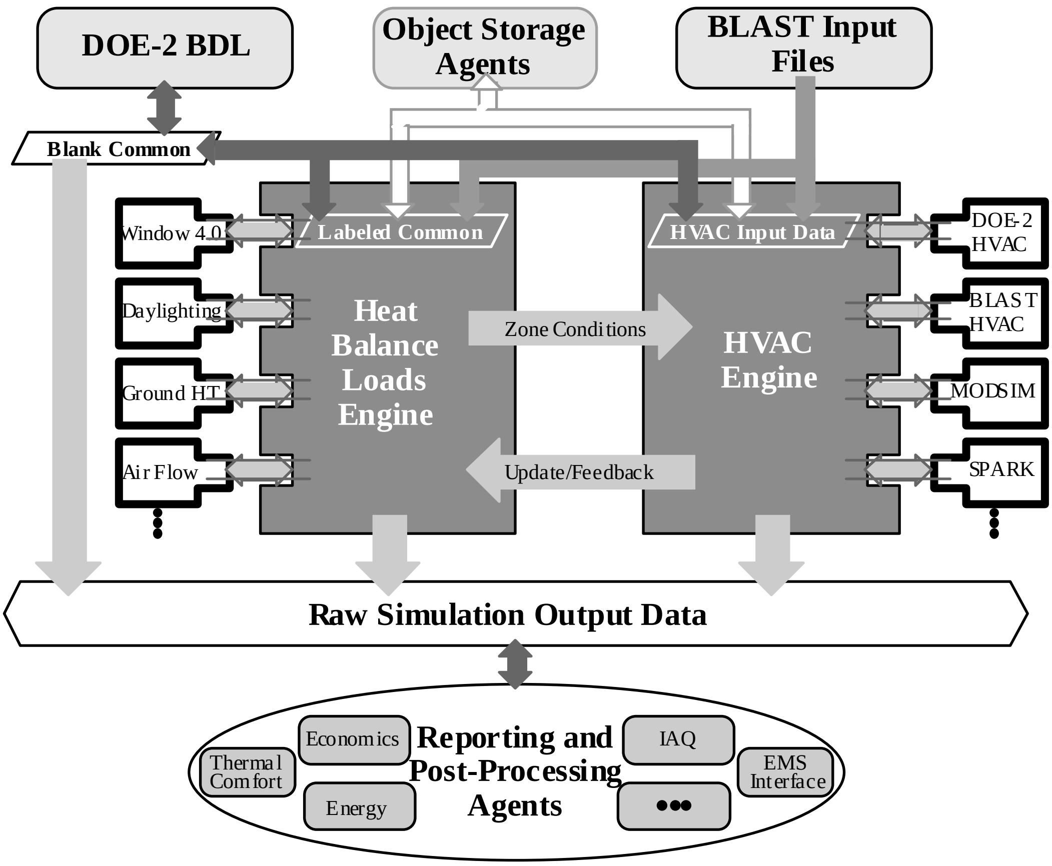

Figure 1 The overall structure of the merged program

results of a workshop held in August 1995 to examine the methods and procedures which should be used in the next generation program. A second conference aimed at getting users' viewpoints will be held in Washington DC in June 1996.

Two separate teams are working on the merged program. Initial work is being done by a team from USACERL and the University of Illinois, and they will be joined by a team from LBNL this summer. The merged program is scheduled to be delivered in the spring of 1998.

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Workshops on Next-Generation Building Energy Simulation Tools

Drury B. Crawley[1], Linda K. Lawrie[2], Frederick C. Winkelmann[3], Curtis Pedersen[4], Richard Liesen[4], and Dan Fisher[4]

INTRODUCTION

In early1995, the US Departments of Energy (DOE) and Defense DOD began planning development of a new building energy simulation tool that builds on their experience developing existing programs—DOE-2 (Winkelmann et al. 1993) developed by Lawrence Berkeley National Laboratory and BLAST (BLAST Support Office 1992) developed by Construction Engineering Research Laboratories (CERL) and University of Illinois (UI). This project is anticipated to take approximately 24-30 months to complete. In 1997, planning will begin for next-generation building simulation tools that go substantially beyond the capabilities of simulation programs available today.

In August 1995, DOE and Defense DOD cosponsored a workshop on next generation building energy simulation tools to provide planning input for next-generation tools. The focus of the 1995 workshop was intentionally limited to energy simulation developers and expert users. The workshop followed the Building Simulation '95 conference organized by IBPSA. A second workshop that focuses on users is planned for June 1996. This article summarizes the results from the August 1995 workshop.

STRUCTURE OF THE EXPERTS WORKSHOP

The goal of the experts workshop was to generate and prioritize applications, capabilities, and methods and structures for next-generation simulation environments. The scope was simulation of building lifecycle processes that influence energy performance and environment sustainability. Participants were told that this workshop was not: a forum to discuss pros and cons of any existing tool, to decide who might perform any development work for any potential U.S. next-generation simulation tools, nor a place to discuss platforms or user interfaces.

The workshop was organized into three breakout sessions: Applications, Capabilities, and Methods and Structures. The participants were divided into five groups facilitated by one of the authors. The facilitators used a five-step process for each of the breakout sessions: brainwriting, grouping and eliminating duplicate ideas, brainstorming, prioritizing and pareto voting, and summarizing. Each is described briefly below.

At the beginning of each breakout session the workshop leaders described the general subject of the session (applications, capabilities, or methods and structures). Then, each group began brainwriting—each workshop participant writes down ideas on 3 x 5 cards (one idea per card), then passes each card to their right. Over the next 10-15 minutes, the group reviews each idea as they are passed and continue to generate new ideas. Brainwriting encourages idea-generating through individual creativity and brainpower. Then the groups organized the cards/ideas into general groups while eliminating duplicate ideas. To make sure no important ideas were missed, the groups then spent 10-15 minutes brainstorming—group generation of new ideas. After brainstorming, each group counted their cards/ideas and each participant then selected their top 20% of the ideas (pareto voting) (multiplied number of cards by 0.2 to get the number of votes allowed each participant). Votes (using dots) were applied to the cards only after all participants in the group had selected their top 20%. The groups then rank-ordered the cards from highest priority (most votes) to lower priorities (fewest votes). It should be noted that all the ideas are considered important. Voting only provides a relative ordering of the ideas within each group. Last, the facilitator prepared a summary, presented below, that was presented to the entire workshop at the end of each breakout session.

SUMMARY OF APPLICATIONS BREAKOUT SESSION

Group 1

The group recommended a range of applications going far beyond simply calculating energy use. This indicates that any future program or suite of programs should be able to do quantitative simulation of many issues related to energy use such as lighting, indoor air quality, and exterior environmental impact. Another key result was that future programs should not just

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be aimed at designers, but are also needed in such areas as research, education, and standards development. Also, it was concluded that the program should be useful not only for the initial design of a building, but should also be applicable throughout the building life cycle, including construction, commissioning, operation, and retrofit.

Group 2

Group 2 had a large percentage of professors, and the suggestions for applications reflected that fact. The top choice for application of the new program was for student education. The other top choices were to provide equipment sizing capability and system operation optimization. Generally the group took a broad systems view for applications by including such topics as parameter estimation, indoor air quality determination, and fault diagnosis as high priority choices.

Group 3

During initial discussions for the breakout, Group 3 decided not to limit its ideas to the domain of current energy simulation programs, but to open itself up to further-reaching applications. After the prescribed idea formation (56 individual items generated), the group attempted to group the ideas. Eight categories (design, operations, database, life cycle costing, controls, codes and standards, education and training, and other) encompassed the ideas generated. Potential applications for a new tool are widespread throughout the building/construction area.

Group 4

There was strong consensus in prioritizing the applications of next generation tools. Although the group was composed almost entirely of researchers, the focus was clearly on applications that would benefit practising mechanical engineers and architects. Research applications received low marks, while building industry applications such as thermal comfort, productivity, controls, optimization, and code compliance were considered top priorities. Thus the group perceived the primary beneficiaries of the next-generation tool to be the building design, operations, maintenance and construction communities.

Group 5

This group swayed from wanting everything in the world fundamentally modeled to having simple inputs for users and not having them worry about fundamental models. At first the group thought about the user and discussed options that a user would like to see in a simulation tool. The group believed that the interface was the key link between having the accessibility of sophisticated algorithms and user manageability of the large amount of building information. The group also concluded that having objects that could be easily interfaced with each other to form custom models was crucial. In other words if some group in the world updated a system model or a component of the zone model you could replace that object with the updated object quickly. Key technical concepts supporting this idea are: interoperability, object-oriented or -based, and sharing of common data or databases. This is a natural extension of concurrent engineering or collaborative technologies.

SUMMARY OF CAPABILITIES BREAKOUT SESSION

Group 1

Here, the group discussed areas where additional research and/or better models were needed rather than simply repeating the capabilities of current programs (which, of course, the group assumed would be carried over into future programs). Additional work is needed in two broad areas: (1) fundamental physics and (2) processes that traditionally received little emphasis but are now important. In the first category the members of the group were surprised by the number of basic heat transfer mechanisms that are still poorly understood, are not well modeled, or have not been incorporated in the mainstream whole-building programs, but which are important in any future program. These mechanisms include foundation heat transfer, moisture absorption/desorption, phase change materials, outside air film conductance, and inside air flow. The second category—processes that previously were not emphasized but are now of concern—includes issues related to indoor air quality, such as indoor pollutant production and transport, and pollutant mitigation processes, such as ventilation control.

Group 2

The system orientation of the group carried through into the capabilities session. The top vote went to: coupled interzone air flow and thermal processes incorporating moisture/contaminant transport and infiltration. The academic orientation also came through in many of the high-vote suggestions which included: first principles system and plant models, and fundamental room air heat balance models. Receiving lower numbers of votes, but still popular, were such things as 1-, 2- and 3-dimensional conduction, and stratification. All the suggestions were oriented toward including more basic or fundamental process models.

Group 3

Our group assumed that the current capabilities inherent in several of the simulation codes would remain and focused on areas that need more definition, research or both. Categories of ideas included air flow, lighting and fenestration, moisture, model flexibility, heat transfer, building information structure, weather and uncertainties, and "other". Some categories represent improvements needed in current models; some are entirely new areas for building simulation.

Group 4

Although there was also a strong group consensus in prioritizing next-generation tools' capabilities, the focus of the group was in this case clearly driven by an interest in fundamental research rather than end use. The group considered the research community—not the user community—best positioned to make decisions related to the modeling of physical processes. It was agreed that issues related to the room air flow field (such as intrazone air flow and mixing) and issues related to solar radiation (glazing and shading systems, internal radiant exchange and daylighting) are areas where current models are deficient.

Group 5

During the second session the group made a distinct shift back to fundamental physics and total generality. They wanted all heat transfer in 3-D and transient with simultaneous heat and mass transfer. They also wanted fully flexible system and plant modeling, daylighting and ray tracing, and 3-D radiation modeling—"all physical processes should be modeled at the most detailed level possible." Then they made a slight concession in that yes, several simpler levels of models for quicker execution time and input simplicity should also be available. This is just the schizophrenia of researchers who may develop software or want simulation tools that are usable by practitioners.

SUMMARY OF METHODS AND STRUCTURES BREAKOUT SESSION

Group 1

It was unanimously agreed that a future program should have three basic elements:

- A common product model for the building. This model (building description) should be object-oriented, standardized so that different programs can read from it and write to it, and persist through the building life cycle to avoid reentering data for different applications.
- A modular calculation—modular means that the calculation comes in pieces that can be connected to simulate the problem at hand or are interoperable, i.e., can work together on the common building model.
- Databases of component product information—databases of generic or actual products that contain the input needed to simulate these products. Such databases are needed for envelope components (windows, walls, light fixtures, etc.), HVAC components (coils, heat exchangers, chillers, cooling towers, etc.) and whole HVAC systems.

In addition to these basic elements, a number of supporting features were listed. The most important were: integration with CAD, visualization of complex outputs, and case study databases.

Group 2

The group here issued a call for interoperability, and friendly interfaces coupled with modularity and open program structure. A category the group deemed important was that of product modeling and in this category they thought standardized data structures for product databases should be a goal. In the area of interfaces, the suggestions were quite typical and included graphical inputs and on-line help. One interesting suggestion was the concept of "meters" to assist with tailoring output. The suggestions for advanced techniques included such interesting topics as: modal reduction, inverse modeling capability and error propagation analysis.

Group 3

Four important categories emerged: modeling, solving, interface, and architecture. Fundamental to the discussion in the group was that the architecture of the software should be open to allow for most flexibility from all concerned. It should be built around an object-oriented environment to help smooth the model translation problems prevalent in current software. Inherent knowledge of building systems should be available for the user to have intelligent defaults when modeling a facility. The environment should be able to simulate in variable time steps to take advantage of the response time in the various building elements. Interfacing to the software is a key issue and "easy to use" is the keyword.

Group 4

Predictably, there was not a strong consensus on the methods and structures that should be utilized in the new tool. There was some agreement on methods at the most general level: extensible libraries and modularity of components. General agreement was also reached that every effort should be made to model processes in the most fundamental way possible (simultaneous systems and plants, adaptive time steps). There was not a clear consensus on specific techniques. There was not only great diversity, but also strong opinions on which solution technique should be used to solve various problems.

Group 5

Finally during the last session the concentration was on user interfaces with knowledge-based defaults and rules, algorithm and module communications, and verification. The participants wanted to put it all together: sophisticated models with graphical and knowledgeable shells for the users, all algorithms able to communicate with all others, a standard format completely verified. This culmination will allow everyone to be able to access these powerful integrated algorithms with ease of use or excruciating detail.

SUMMARY CONCEPTS FROM THE BREAKOUT SESSIONS

The following figures summarize the concepts and ideas generated in each of the three breakout sessions. In total, the five groups generated 225 ideas for the Applications breakout session, 242 ideas for the Capabilities breakout session, and 201 ideas for the Methods and Structures breakout session. Figure 1 shows the total votes by major category from the Applications breakout session, Figure 2 the total votes by major category from the Capabilities breakout session, and Figure 3 the total votes by major category from the Methods and Structures session.

CONCLUSIONS

A somewhat surprising outcome of the workshop (at least to the authors) was that not many new or unusual ideas were brought up—even with a group of international building energy simulation experts. The hundreds of ideas generated during the workshop showed instead that the field of building energy simulation still has many fundamental problems that need to be addressed. Even the experts were not willing to stretch the boundaries and capabilities of simulation (even in their own minds) until more of these basic issues are resolved. The authors hope that the workshop was a beginning for the building simulation field—to start them talking about the future, instead of focusing on where they are today.

NEXT STEPS

The authors have initiated a project to combine the best capabilities of the DOE-2 and BLAST building simulation programs. In 1997, the team will begin formulating a plan to develop the next generation of building energy simulation tools in the United States. The plan will propose development of new building energy tools that go substantially beyond the capabilities of currently available simulation tools with a broader scope in the building simulation arena. It is our intent to structure development of the next generation tools as an open process so that a number of contributors from around the United States and the world can and will participate.

The authors plan to hold a second workshop that focuses on user needs in June 1996. The topics will be similar: Applications, Capabilities, and Interfaces. If you would like to obtain a copy of the summary report including the complete list of ideas generated during both workshops, contact:

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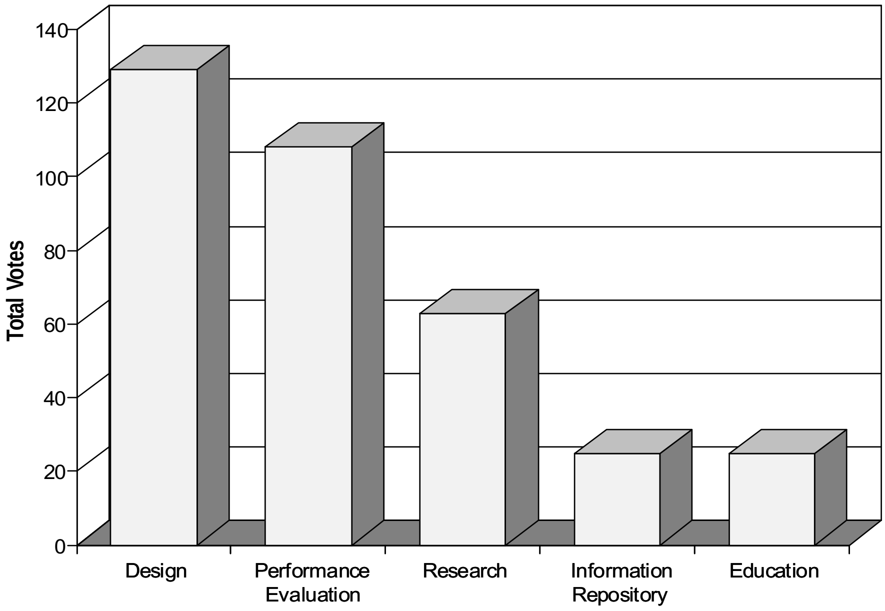
Figure 1 Applications of Next Generation Building Simulation Tools



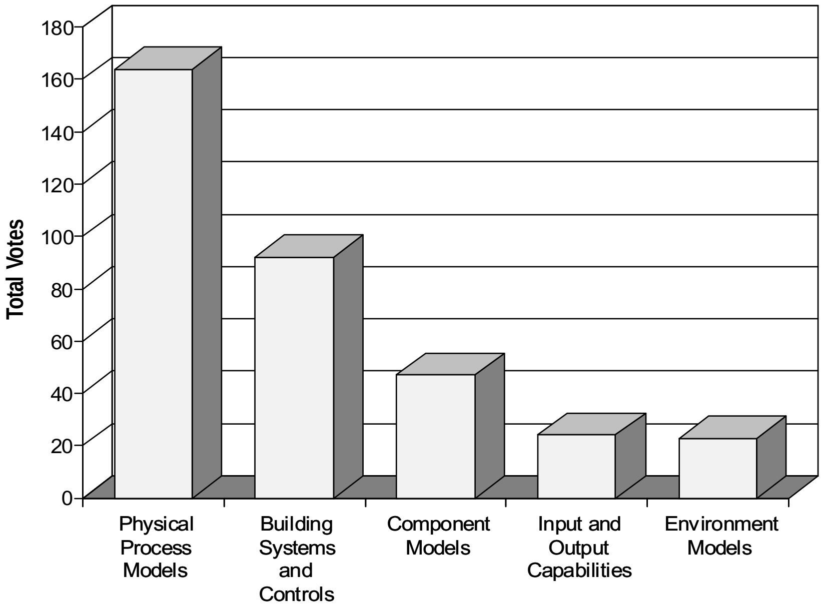
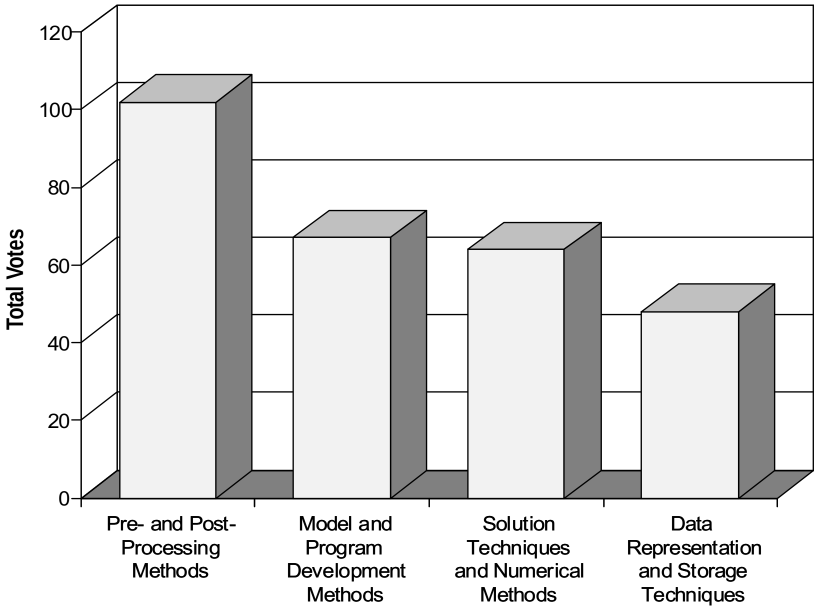


Figure 2 Required Capabilities of Next Generation Building Simulation Tools

Figure 3 Proposed Methods and Structures For Next Generation Building Simulation Tools



ACKNOWLEDGMENTS

The authors participated as leaders and facilitators for the workshops. The authors wish to thank the participants for their contributions to the workshop and the long range planning efforts that will evolve from them. The participants in the first workshop included:

Marlin Addison	*Energy Simulation Specialists, Inc.*
Doug Balcomb	*National Renewable Energy Laboratory*
Chip Barnaby	*WrightSoft*
Vladimir Bazjanac	*Lawrence Berkeley National Laboratory*
Ian Beausoleil	*Morrison Natural Resources Canada*
Bill Beckman	*Solar Energy Laboratory, University of Wisconsin*
Nathan Blair	*Solar Energy Laboratory, University of Wisconsin*
Jean-Pascal Bourdouxhe	*Laboratoire de Thermodynamique, Universite de Liege, Belgium*
Rob Briggs	*Pacific Northwest National Laboratory*
Axel Bring	*Royal Institute of Technology, Sweden*
Bill Carroll	*Lawrence Berkeley National Laboratory*
Joe Clarke	*Energy Systems Research Unit, University of Strathclyde, Scotland*
Sten de Wit	*Technology University Delft, The Netherlands*
Mike Donn	*School of Architecture, Victoria University, New Zealand*
Helmut Feustel	*Lawrence Berkeley National Laboratory*
Jon Hand	*Energy Systems Research Unit, University of Strathclyde, Scotland*
Philip Haves	*Loughborough University of Technology, England*
Doug Hittle	*Solar Energy Applications Laboratory, Colorado State University*
Michael Holtz	*Architectural Energy Corporation*
Bob Howe	*Carrier Corporation*
Ron Judkoff	*National Renewable Energy Laboratory*
John Mitchell	*Solar Energy Laboratory, University of Wisconsin*
John Murphy	*The Trane Company*
Konstantinos Papamichael	*Lawrence Berkeley National Laboratory*
Roger Pelletret	*Centre Scientifique et Technique du Batiment, France*
Per Sahlin	*Royal Institute of Technology, Sweden*
Peter Schwartz	*Pacific Gas and Electric Company*
John Seem	*Johnson Controls, Inc.*
Ed Sowell	*California State University, Fullerton*
Jeff Spitler	*Oklahoma State University*
Paul Strachan	*Energy Systems Research Unit, University of Strathclyde, Scotland*
George Walton	*National Institute of Standards and Technology;*
Mike Witte	*GARD Analytics*
Gerhard Zweifel	*Swiss Federal Laboratories for Materials Testing and Research, Switzerland*

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Winkelmann, F.C., B.E. Birdsall, W.F. Buhl, K.L. Ellington, A.E. Erdem, J.J. Hirsch, and S. Gates. 1993. *DOE-2 Supplement, Version 2.1E*, LBL-34947, November 1993. Springfield, Virginia: National Technical Information Service.

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IBPSA on the Web

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IBPSA now has a presence on the world wide web:

http://www.mae.okstate.edu/ibpsa/

The web pages currently general IBPSA information, a mission statement, a link to the Building Simulation '97 home page, tables of contents for past Building Simulation conferences, ordering information for past conference proceedings, and links to other building related pages.

The IBPSA web pages have had over 3100 accesses from over 25 different countries in the last eleven months. For the last three months, we have averaged about 400 accesses per month.

Including the table of contents of each of the past Building Simulation conference proceedings allows us to be found by people searching the web for topical information. For example, using the Dec Alta Vista search engine (http://altavista.digital.com) with the terms "buildings CFD", a reference to the Building Simulation '93 Table of Contents is found, which contains listings for:

Lam, J., R. Yuen, T. Lau. 1993. Improvements to User-friendliness of a Computational Fluid Dynamics (CFD) Code for Simulation of Air Movement in Buildings. Proceedings of Building Simulation '93 : 77-83.

Stankovic, S., A. Setrakian. 1993. Thermal and CFD Modelling vs Wind Tunnel in Natural Ventilation Studies. Proceedings of Building Simulation '93 : 457-462.

Other references to Building Simulation '89, '91, and '95 are found with the same search.

The IBPSA web pages are still very modest in scope – suggestions and contributions are welcome! For further information, contact Jeff Spitler.

Design of *PowerDOE*™, a Windows™-Based Visually Oriented Analysis Tool

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PowerDOE™ is a new PC-based building energy performance simulation tool projected for release late summer or early fall 1996. It will combine the full capabilities of DOE-2.2 with an easy-to-use, flexible Windows™ graphical user interface (GUI). The DOE-2.2/PowerDOE project is a collaboration between the U.S. Department of Energy and the Electric Power Research Institute (EPRI), carried out by Lawrence Berkeley National Laboratory (LBNL) and James J. Hirsch and Associates. This paper primarily describes the PowerDOE user interface and some of the more significant differences between DOE-2.1E and DOE-2.2. The DOE-2.2 simulation engine structure and new capabilities are also discussed.

INTRODUCTION

PowerDOE™, a new, PC-based building energy performance simulation tool, combines the full capabilities of DOE-2.2 with an easy-to-use, flexible Windows™ graphical user interface (GUI). PowerDOE development was initiated in 1992 as a collaboration between the U.S. Department of Energy and the Electric Power Research Institute (EPRI), carried out by Lawrence Berkeley National Laboratory (LBNL) and James J. Hirsch and Associates. The project's principal objective is to combine the features of DOE-2 and micro-AXCESS to create a state-of-the-art program that will become a widely used and accepted tool for building simulation, energy analysis, and design. As the project has proceeded, significant revisions and enhancements to the DOE-2 simulation engine has produced a new "standard" version of DOE-2, DOE-2.2. PowerDOE is targeted to serve an expanded range of users including building performance analysts, HVAC designers, architects, and electric and gas utility personnel and contractors. Additional support for the project comes from Bonneville Power Administration, Duke Power, Pacific Gas and Electric, Southern California Edison, and Southern Company Services.

This paper describes the PowerDOE user interface and the methods used to unify the building description and building analysis process. The DOE-2.2 simulation engine structure, including differences between DOE-2.2 and DOE-2.1E are described. The way in which the program allows the simulation engine and user interface to interact are also discussed.

PowerDOE STRUCTURE AND SIMULATION ENGINE

PowerDOE has a modular structure that allows sections of the program to be externally accessed or to be connected with other analysis tools. For example, the Review Results module, can be used as a stand-alone application for post-processing DOE-2.2 results. The PowerDOE structure enables third-party developers to use these modules and the DOE-2.2/PowerDOE simulation engine in their applications. PowerDOE will also be linked to the Building Design Advisor (BDA), a multimedia, integrated building design support tool under separate development by LBNL.

The simulation engine performs an hourly time-step simulation based upon techniques used in the DOE-2 and micro-AXCESS programs, as well as other existing accepted and time-tested techniques. Due to reduced file access and improved memory management, the simulation speed is expected to be approximately 25% faster than existing DOE-2 program implementations. Simulations can also be performed in the background while the user performs other tasks on the computer.

The program requires a 486-based or Pentium™-based PC, VGA graphics card, color VGA monitor, and 16 megabytes of memory. A Super-VGA monitor with at least 800x600 resolution and at least 256 colors are suggested for best display of the application's graphics. In order to take advantage of higher resolutions, PowerDOE automatically re-scales data and diagram windows to maximize diagram size, while keeping data values and labels at a consistent size. Microsoft Windows™ version 3.1 is the minimum operating environment. Windows for Workgroups™, Windows95™, or WindowsNT™ are all supported.

DOE-2.2 ENHANCEMENTS OVER DOE-2.1E

DOE-2.2 contains significant changes from version 2.1E. Perhaps the most significant change is the combination of the old System and Plant DOE-2 programs into a new, combined HVAC simulation program. One reason for this change is to improve the connectivity between the loads incurred by the secondary HVAC systems (air handler coils, reheat coils, etc.), and the primary HVAC equipment (boilers, chillers, etc.) Thus, DOE-2.2 and PowerDOE use the concept of "circulation loops". Other Version 2.2 enhancements include the following:

Polygons — all opaque heat transfer surfaces can now be described as arbitrary

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[5] *D. J. Borstein & Associates, Los Altos, California, USA*
[6] *Electric Power Research Institute, Palo Alto, California, USA*

polygons. Polygons for use with windows will be added in a subsequent release.

Windows — windows can now be "built up" in a layer-by-layer manner, combining multiple glass layers, gaps and/or blinds.

Lighting systems — lighting systems can now be described on a luminaire-by-luminaire basis or the user can describe a target illuminance and DOE-2 will calculate the required number of luminaires.

Central plant equipment — each chiller, boiler, pump, etc., is now modeled separately, thus each piece of equipment can now have unique characteristics.

Libraries — DOE-2.2 now uses a more general library feature that permits a user to store and retrieve building components such as windows, walls, lighting fixtures, spaces and schedules. PowerDOE's library functionality currently exceeds DOE2.2's in that PowerDOE can also store and retrieve air handlers and central plant equipment.

Expressions — Expressions are general multi-line equation-like entries used to calculate or select input values. Expressions can be simple or complex and can reference one of more other building parameters.

PowerDOE USER INTERFACE

The PowerDOE user interface implements a number of unique approaches to facilitate developing an accurate building description. PowerDOE organizes architectural and HVAC elements in a hierarchy that is intuitive and familiar to designers and analysts. Building areas are grouped into floor plans, with each floor plan being composed of conditioned and unconditioned zones, plus any plenums. HVAC equipment is grouped by air and water flow paths that supply the heating, cooling, and ventilation requirements of the building areas. Electricity and fuel supply are grouped into meters that can reflect the actual building circuits and sub-metering, as well as provide end-use consumption and demand estimates.

Most of PowerDOE's input screens are organized to visually illustrate the selected building component while simultaneously displaying only the most important data pertaining to the selected building component. More detailed inputs and component descriptions are accessible if desired. PowerDOE also provides a global summary worksheet in a spreadsheet-like format containing summary data for all building elements. Users can efficiently review or directly edit any building data from this central "database". Additionally, most inputs in PowerDOE can either be user-input values, PowerDOE defaults, user defaults, library data, or expressions. A data-type label placed immediately next to each input field, status bar label (bottom of screen) and font color all inform the user of the type of data being displayed.

PowerDOE is organized into four main modules: Locate Site, Describe Building, Run Calculations and Review Results. The Locate Site module allows you to specify the building location and other information about the site. The Describe

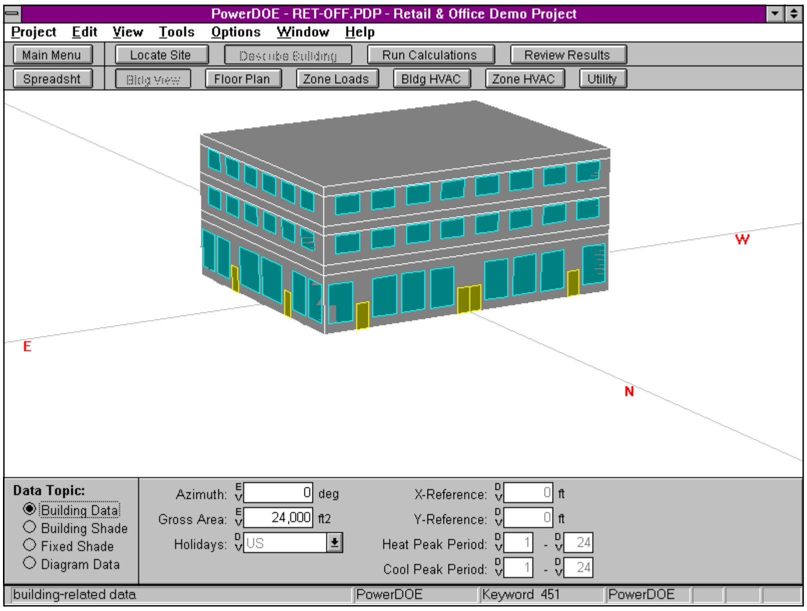

Figure 1 Building View provides graphical feedback on the overall building envelope description.

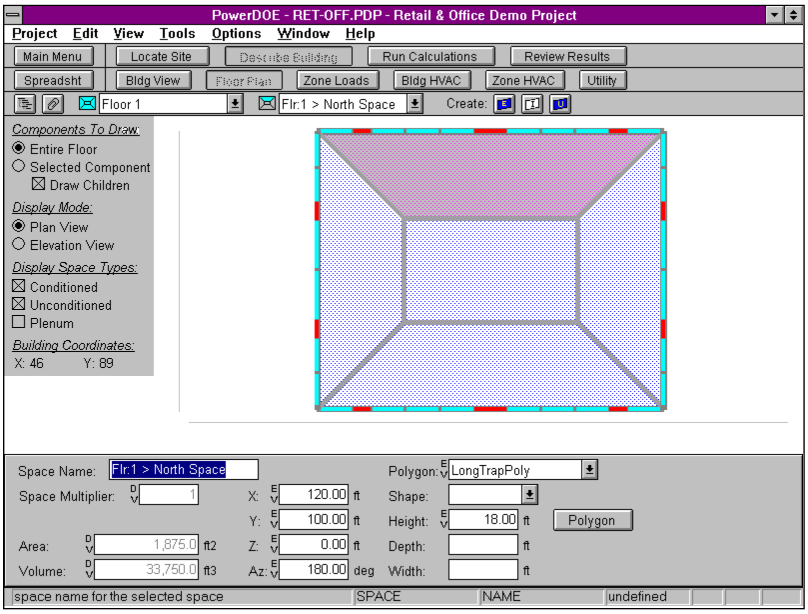

Figure 2 PowerDOE Floor Plan screen with space data displayed at bottom of screen.

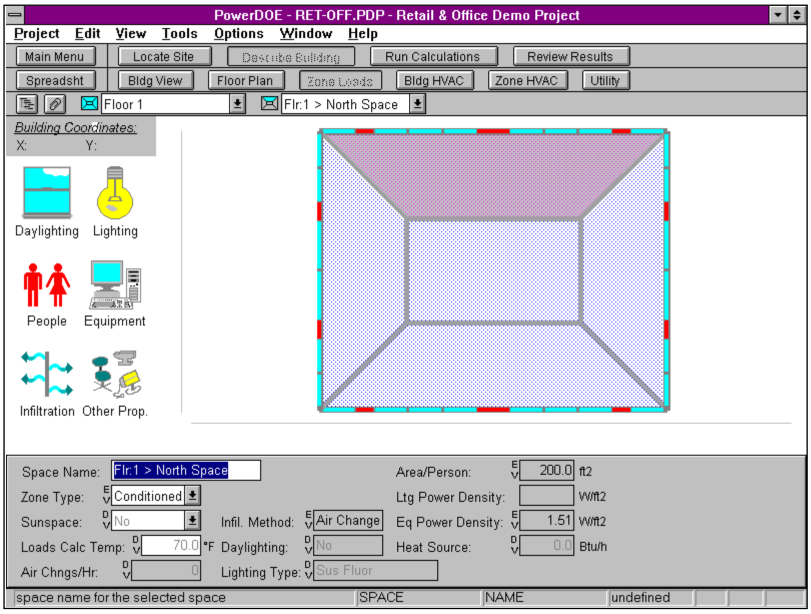

Figure 3 Building Zone Loads Screen

Building module is where the user enters information describing the building and its equipment. Run Calculations is used to setup parametric simulation runs and to specify simulation periods. Review Results provides graphical and tabular summary of simulation results. Due to space constraints, only the two most important modules, Describe Building and Review Results, are described here.

DESCRIBING BUILDINGS

The Describe Building module consists of seven main components: Summary Spreadsheet, Building View, Floor Plan, Zone Loads, Building HVAC, Zone HVAC, and Utility Services.

PowerDOE incorporates several graphical features that provide visual feedback and reduce the time required to prepare an accurate building description. The Building View screen (Figure 1) which displays a three-dimensional view of all defined buildings and external shading surfaces, allows the user to quickly catch gross building and external shading geometry errors. The user may shift the position of the viewer and the focal point of the view, and can also choose to view the building in a wire-frame or solid-fill mode utilizing hidden line removal. The user may also select the building element to be edited simply by clicking on it. To aid in solar analysis, in a subsequent release, this three-dimensional view will also show shadows cast by external shading surfaces for a given sun position or sequence of sun positions.

The Floor Plan screens (Figure 2) display either floor plan or elevation views of building elements, as well as the associated data for a particular space, wall, window, or door. Simply by clicking the mouse on a different element, the user can bring up and edit the data for that element. Basic data on the space, wall, window, or door are displayed on screen, with buttons providing access to dialog boxes for specifying additional details.

The Zone Loads module (Figure 3) is where the user may view and/or edit a variety of data by zone, including equipment energy use and characteristics that affect heating and cooling loads. The Zone Loads module provides access to lower level dialog boxes for describing lighting, daylighting, infiltration, furniture, people, and equipment.

The Building HVAC Equipment module (Figure 4) is where the user defines building-level HVAC components such as thermal circulation loops (e.g., chilled water, hot water, condenser water, or domestic hot water loops, primary and secondary as appropriate), including pumps, pipe losses, and controls associated with building's thermal loops; also primary equipment such as chillers, cooling towers, and boilers. Separate diagrams are used for each loop. On each loop diagram, "suppliers" (e.g., in Figure 4, chillers) are shown across the top of each loop, while "demanders" (e.g., in Figure 4, CHW coils) are shown across the bottom of each loop. Suppliers, demanders, and loop characteristics are illustrated as icons. Clicking or double clicking on the icons presents summary of detailed data, respectively, for each item. Only "installed" equipment for each thermal loop is illustrated.

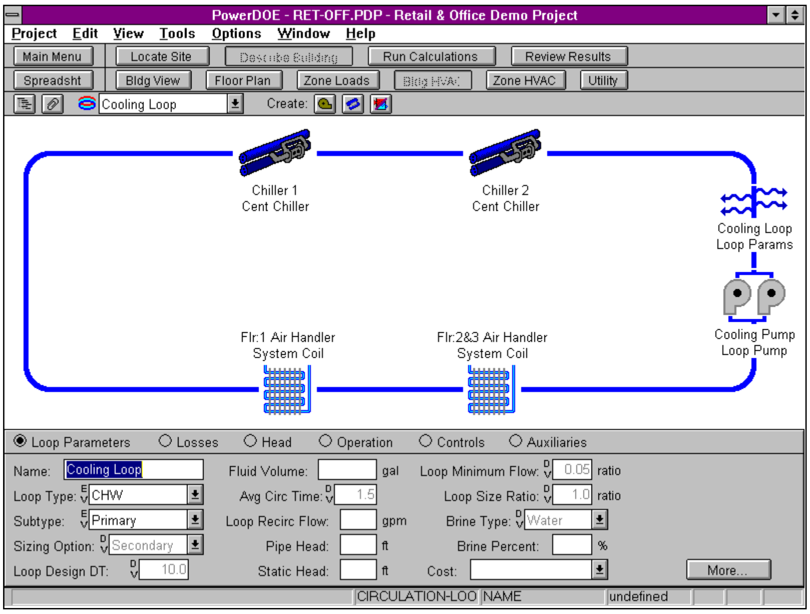

Figure 4 Building HVAC Equipment Screen

The Zone HVAC module (Figure 5) allows the user to specify air-side, unitary and zonal HVAC equipment. The diagram presents a conceptual illustration of each system. Features of each system are illustrated as icons. Clicking or double clicking on the icons presents summary of detailed data, respectively, for each feature. Only "installed" features of each system are illustrated as colored icons. The lower right area illustrates characteristics of the zones served by the illustrated system.

The Utility Services module (Figure 6) is where the user may view and/or edit utility rate descriptions and the assignment of electric or fuel meters to utility rates.

The Schedules screens are accessible from all other input modules via the right mouse "quick menu". Schedules allow all building and HVAC schedule profiles to be entered either graphically, numerically, or with expressions (Figure 7). For easily comparing various schedules, PowerDOE can display up to four different weekly schedules side-by-side, as shown in Figure 8.

The PowerDOE interface incorporates a utility called ScreenKey, which allows a "system administrator" to customize or re-configure the program screens. New screens can be added or existing screens altered, including the hiding, protecting, and moving of parameters. In this way, the application can be recast for specific users or to create new products. For example, a utility could create a customized version for field representatives that examined a limited number of building characteristics. The ScreenKey feature can be used to prevent non-technical users from altering building parameters that should only be edited by a more experienced user, and will also prevent them from becoming overwhelmed by the large magnitude of data. ScreenKey also simplifies translation of the input screens into other languages, so that PowerDOE can be quickly adapted for use in other countries.

PowerDOE includes a comprehensive online help system. Context-sensitive help is available for every data entry field, as well as for every program screen. When the user points to a data field and clicks the right mouse button, PowerDOE displays a drop down "Quick Menu" beside that field. The user can then select Field Help for the particular field, or Topic Help for information on the current screen. Help is also available from the main menu bar or by pressing the F1 key, and includes standard

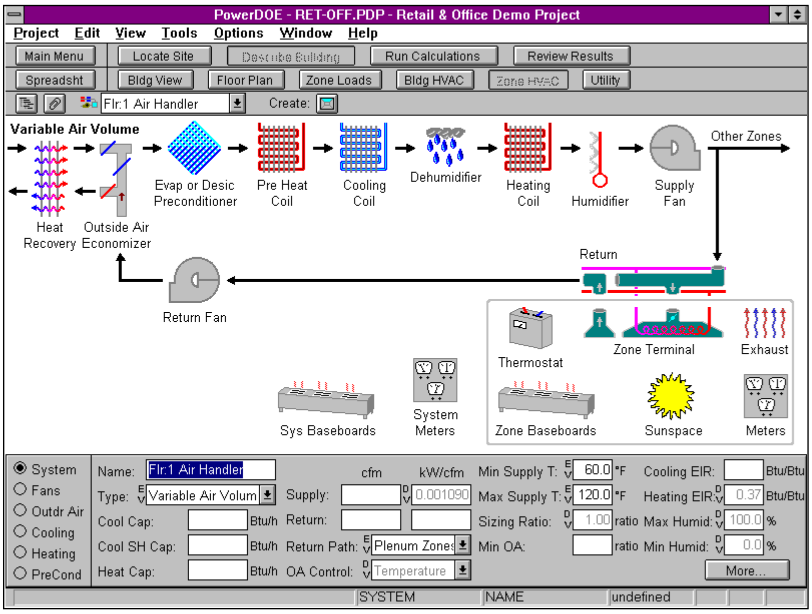

Figure 5 Zone HVAC System Screen - VAVS

Windows Help components such as Contents and a Search Keywords dialog box. In addition, the online help system contains extensive hypertext links that provide quick access to related topics and additional detail.

PowerDOE's Quick Menu is also used for attaching comments and/or descriptions to any named item, for accessing the schedule module, and for entering an expression to describe a building parameter.

For entering expressions, a dialog box presents up to four expressions including the program default expression, the current library expression, the user-entered default expression, and the standard user-entered expression.

REVIEW RESULTS

Results are reviewed in a separate application called DOE2REV that enables prepa-

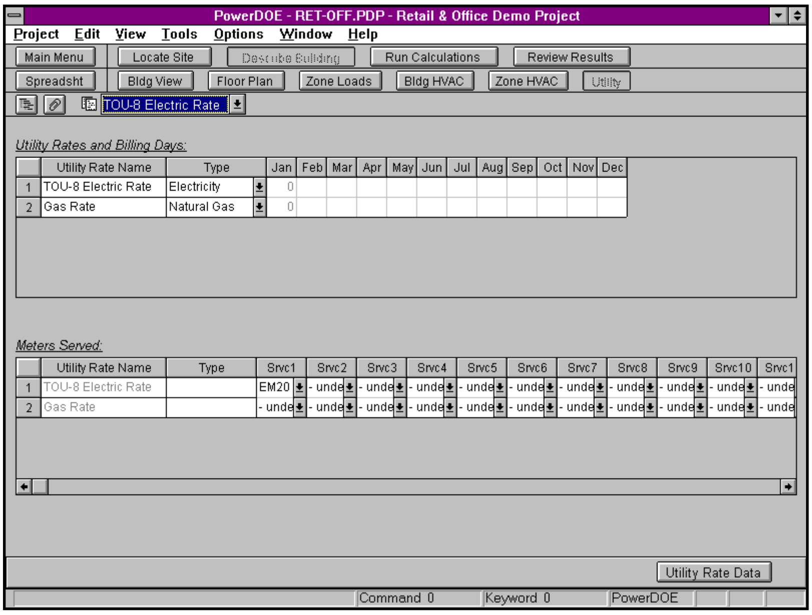

Figure 6 Utility Services Screen

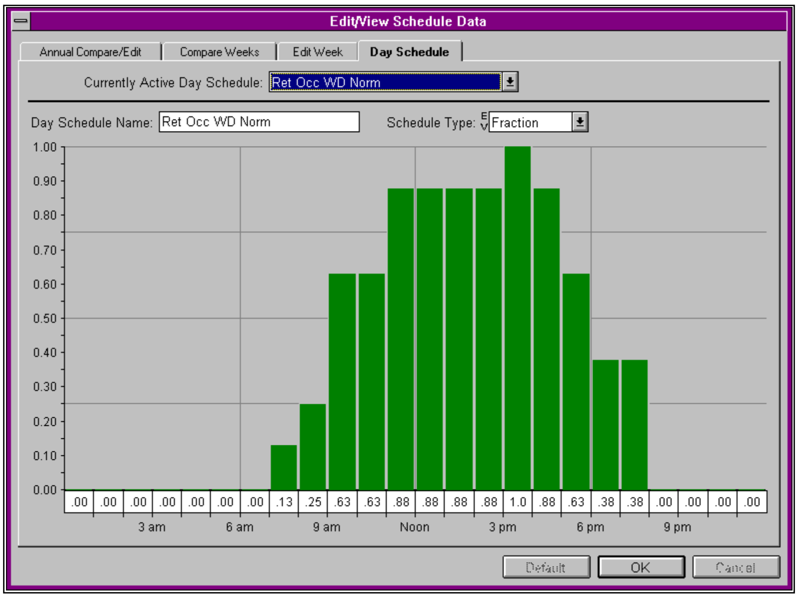

Figure 7 Day Schedule Screen

ration and display of customized reports. When running PowerDOE, DOE2REV is seamlessly integrated, with full navigation functionality between the two applications as if they were one. One can, however, execute DOE2REV as a separate application for post-processing DOE-2 results. The review results module serves three primary functions:

- Viewing and/or printing simulation inputs and results using pre-defined report templates (e.g., architectural, engineering, utility energy use, and utility costs reports)
- Modifying a report template or creating a new one, containing user-defined tables and graphs
- Displaying a full-page graph of simulation inputs and results for any period of time (day, week, or month)

Several screens are provided to allow defining tables or graphs of either inputs or results, and specifying how they will appear in report pages, enabling the user to define what data series to view and in what format. Cutting and pasting between the analysis tool and other Windows applications is fully enabled. A sample report page is shown in Figure 9. Any hourly data series can be filtered into a daily, weekly, monthly, seasonal, or annual series. Filtering options allow selecting values, peaks, sums, and peak sums, which can then be incorporated into reports.

CONCLUSION

The initial version of PowerDOE will be released in late summer or early fall 1996. Subsequent releases are planned that will incorporate additional features and interface with other analysis tools. Under consideration are:

- A link to CAD packages, which will allow importing building drawings into PowerDOE
- A link to the LBNL-developed Simulation Problem Analysis and Research Kernel (SPARK); users will be able to create models of advanced building technologies, processes, and controls with SPARK and insert them into PowerDOE for simulation
- Interactive calculations (i.e., performed interactively prior to the annual energy simulation); examples include interactive zone-by-zone peak load calculations used to size HVAC equipment, and interactive illuminance distributions calculations used to design building envelope daylighting features and locate daylighting controls.
- Integration of the loads and system/plant calculation, which will allow the effects of equipment undersizing and load shedding to be simulated
- To aid in solar analysis, the three-dimensional building view will also show shadows cast by external shading surfaces for a given sun position or sequence of sun positions.
- A module for showing compliance with building energy standards, with possible support from a consortium of Canadian utilities and/or government agencies
- A library of generic parameterized prototype buildings and building components — the user would select a prototype by building type (i.e.:

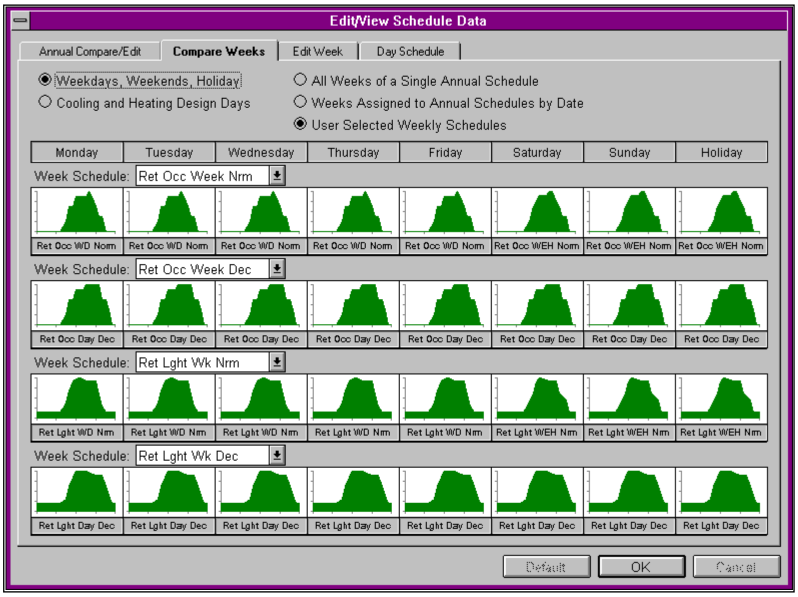

Figure 8 Compare Weekly Schedule Screen

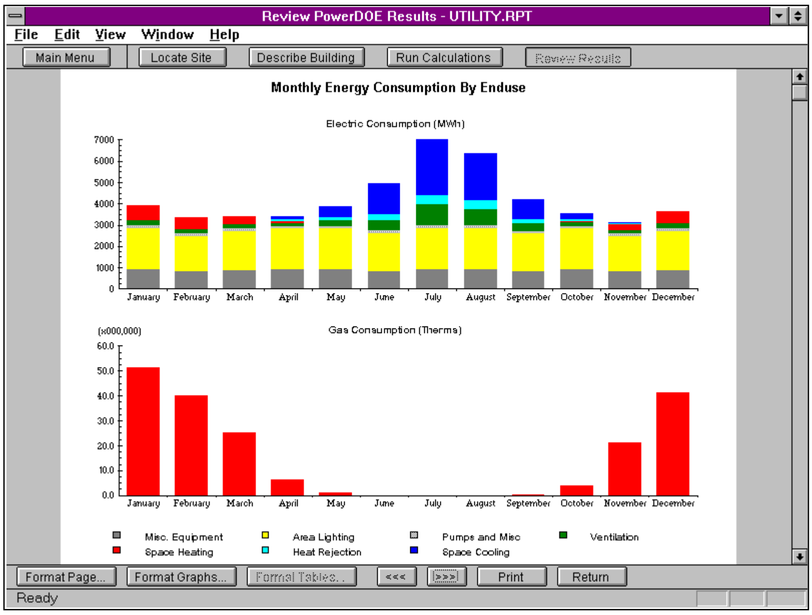

Figure 9 Review Results Sample Report Page

office, hospital, etc.), size (i.e.: large, medium, small), vintage (i.e.: pre 1970's, 1970's, 1980's, 1990's, etc.), and location.

- Building wizards for guiding the user step-by-step through the process of describing a building
- A module for simulating supermarket refrigeration systems, under development by EPRI
- A module for simulating food service installations, under development by EPRI
- A module for retrofit analysis

Inquiries regarding PowerDOE may be directed to djbasoc@well.com.

❖

If you are a member of IBPSA North America, please take a moment to complete the Services Directory survey enclosed with this IBPSA News and fax it back to Jeff Haberl, Texas A&M University

409-862-2457.

The results of the survey will be posted on the IBPSA Web page.

The calculation engines of the most widely spread building simulation tools were, almost without exception, developed during the seventies. The challenge then was to perform a multizone hourly simulation over a year within acceptable execution times. These programs are therefore highly optimized to perform well on a selected class of problems. If you want to do something slightly different, you are often out of luck. Changing the built-in models is generally beyond reach for anybody but the code developers. Today, person-time rather than machine-time is the limiting factor, and the flexibility of truly modular programs, such as TRNSYS, has proved to be invaluable. Consequently, significant research efforts are invested in model development for TRNSYS and for more recently developed modular simulation environments. Unfortunately, moving models between different environments or solvers, such as TRNSYS, HVACSIM+, ALLAN.Simulation, CLIM 2000, ESACAP, IDA, SPARK, EKS etc., is still a tedious and error prone handicraft.

NMF is a suggested standard for a component model source format, aiming at complete automation of model implementation in several target environments. A translator parses NMF model descriptions and generates environment code, e.g. TRNSYS TYPE subroutines.

An NMF model is essentially a strictly structured way of stating equations, variables and component model boundaries. An equation based language facilitates - given current numerical and computer algebra techniques - automatic generation of algorithmic model descriptions as required by, e.g., TRNSYS. Reverse translation, i.e. from algorithmic to equation based code, is not generally feasible.

As of today, research translators have been written for SPARK and ESACAP. A production quality translator for TRNSYS, HVACSIM+, and IDA has been developed

The Neutral Model Format

A Simulation Model Source Language for Tool Developers

Per Sahlin, KTH, Stockholm, plurre@engserv.kth.se

at KTH in Stockholm, mainly based on ASHRAE funding. Several component model libraries have been directly developed in NMF. Others have been manually translated into NMF, e.g. the IEA Annex 10 & 17 group of models. An ASHRAE subcommittee of Technical Committee 4.7 has assumed responsibility for the NMF definition, pending further standardisation efforts.

A beta version for Windows of the ASHRAE translator can be downloaded as a self-extracting file:

ftp://urd.ce.kth.se/pub/rp839/nmfwin.exe

(remember to transfer as binary).

With the translator delivery comes also the NMF reference report and handbook (in rtf and postscript) as well as a large number of sample NMF component models. The translator is a 32-bit application. To run it under Windows 3.x, a 32 bit extension from Microsoft must be installed. A copy of this Win32s extension is also, for convenience, located in the same directory (file pw1118.exe.)

An e-mail list for NMF has been established on the U.K. mailbase facility. To join the IBPSA-NMF list send an e-mail message to:

mailbase@mailbase.ac.uk

The Subject line is irrelevant, but the body of the message should read:

join ibpsa-nmf <Yourfirstname> <Yourlastname>.

Let us now turn to the details of NMF. Internal component model behavior is described by a combination of algebraic and ordinary differential equations. Equations may be written in any order and in the form:

<expression> = <expression>;

NMF only states equation models, while solution of equations is, in some cases, left to the target environment (e.g. IDA, or SPARK), or the NMF translator in others (e.g. TRNSYS, or HVACSIM+).

NMF supports model encapsulation through a link concept, i.e. models may only interact via variables appearing in LINK statements. To enhance and encourage model plug compatibility, links and variables are globally typed. The idea is that a basic list of such types should be included in each revision of the standard, but that users may add to the list as need arises. A selection of such global types is:

```
QUANTITY_TYPES
/* type name   unit          kind */

  Area         "m2"          CROSS
  Control      "dimless"     CROSS
  Density      "kg/m3"       CROSS
  Factor       "dimless"     CROSS
  HeatCap      "J/(K)"       CROSS
  HeatCapA     "J/(K m2)"    CROSS
  HeatCapM     "J/(kg K)"    CROSS
  HeatCond     "W/(K)"       THRU
  HeatFlux     "W"           THRU
  HeatFlux_k   "kW"          THRU
  Temp         "Deg-C"       CROSS

LINK_TYPES
/* type name   variable types... */

/* generic    (arbitrary, arbitrary,...) implicitly
defined */
  Q            (HeatFlux)
  T            (Temp)
  PMT          (Pressure, MassFlow, Temp)
  PMTQ         (Pressure, MassFlow, Temp, HeatFlux)

  MoistAir     (Pressure, MassFlow, Temp, HumRatio)
  BidirFlow    (Pressure, MassFlow, Enthalpy, HeatFlux)
```

A quantity type includes a physical unit and information about potential (across) or flow (through) type. A link type is simply an ordered list of quantity types. Let us now look at an example of an NMF model of a wall using the heat equation in one dimension.

```
ABSTRACT
"A 1D finite difference wall model. One homogeneous
layer.
TQ interfaces on both sides."

EQUATIONS
/* space discretized heat equation, for
   extreme nodes */
  c_coeff * T'[1] = Taa - 2.*T[1] + T[2] ;
  c_coeff * T'[n] = T[n - 1] - 2. * T[n] + Tbb ;

/* .. and for internal nodes*/
  FOR i = 2, (n -1)
```

```
    c_coeff * T'[i] = T[i - 1] - 2. * T[i] + T[i + 1];
  END_FOR ;

/* boundary equations */
  0 = -Ta + .5 * (Taa + T[1]) ;
  0 = -Tb + .5 * (T[n] + Tbb) ;
  0 = -Qa + d_coeff * (Taa - T[1]) ;
  0 = -Qb + d_coeff * (Tbb - T[n]) ;

LINKS
/*type    name      variables ....   */
  TQ      a_side    Ta, POS_IN Qa ;
  TQ      b_side    Tb, POS_IN Qb ;

VARIABLES
/* type     name   role   description*/
  Temp      T[n]   OUT   "temperature profile"
  Temp      Ta     OUT   "a-side surface temp"
  Temp      Tb     OUT   "b-side surface temp"
  Temp      Taa    OUT   "a-side virtual temp"
  Temp      Tbb    OUT   "b-side virtual temp"
  HeatFlux Qa      IN    "a-side entering heat"
  HeatFlux Qb      IN    "b-side entering heat"

MODEL_PARAMETERS
/* type     name   role   description   */
  INT       n      SMP   "number of temp layers"

PARAMETERS
/*type      name   role      description*/

/* supplied parameters */
  Area       a         S_P    all area"
  Length     thick     S_P    "wall total thickness"
  HeatCondL lambda     S_P    "heat transfer coeff"
  Density    rho       S_P    "wall density"
  HeatCapM   cp        S_P    "wall heat capacity"

/* computed parameters */
  generic    d_coeff C_P    "lambda*a/dx"
  Length     dx        C_P    "layer thickness"
  generic    c_coeff C_P     "rho*cp*dx*dx/(lambda*3600.)"

PARAMETER_PROCESSING
  dx := thick / n ;
  c_coeff := rho * cp * dx * dx / (lambda * 3600.) ;
  d_coeff := lambda * a * dx ;

END_MODEL
```

To enable direct model translation to input-output oriented environments (e.g. TRNSYS or HVACSIM+), variable declarations have a role attribute indicating IN for given variables and OUT for calculated ones.

Variables and parameters may be vectors or matrices. A parameter must remain constant throughout a simulation. Links may also be vectors, thus allowing models with variable number of ports. Vector and matrix dimensions are governed by a special type of parameter, model parameters. Regular and model parameters are divided into two categories, user supplied and computed, the algorithmic computation of which is described in the parameter processing section. Arbitrary foreign functions in Fortran 77 or C may be defined, either globally or locally within a model. Special functions are defined to handle discontinuities, hysteresis, linearization, and errors.

If NMF seems interesting, please try the translator and join the ibpsa-nmf list on Mailbase. Please send comments and error reports to plurre@engserv.kth.se.

IBPSA Mission and Goals

The professional association devoted to improve the built environment through computer simulation and analysis

MISSION

The International Building Performance Simulation Association (IBPSA) was founded to advance and promote the science of building performance simulation in order to improve the design, construction, operation and maintenance of new and existing buildings worldwide.

Goals

- Along with building designers, owners, operators and developers, identify problems with the built environment that may be solved by improved simulation tools and techniques
- Identify the performance characteristics of buildings on which simulation should be focused
- Identify building performance simulation R & D needs and transfer new developments to the user
- Promote standardization of the building simulation industry
- Inform and educate its members and the public regarding the value and the state-of-the-art of building performance simulation.

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Building Codes and Energy Simulation

Michael Donn, Nigel Isaacs, Jacky Lee[1], Paul Bannister[2], Mark Bassett, Albert Stoecklein[3]

The Centre for Building Performance Research at Victoria University School of Architecture has recently concluded R&D for the Energy Efficiency Clause of the New Zealand Building Code. This report, contributed to the BEPAC Newsletter, discusses some of the issues that arose in the course of the work.

I would like to begin with definitions of the awfully dry terminology of the NZ Building Code (1 July 1993). If you bear with me on this, I hope you will find that building codes provide a unique test of the validity and practical application of simulation. In the Code a performance statement is supported by non-mandatory **Approved Documents** which may be used to demonstrate compliance. These may include an **Acceptable Solution** ('this answer is acceptable') and / or a **Verification Method** ('this "test" can be used to verify compliance'). The current **Clause H1: Energy Efficiency** has an Acceptable Solution for housing (a table of R-values dating back to 1977); and a Verification Method (a numerical Building Performance Index calculated using Annual Loss Factors (ALF[1])). For all other building types, there is only a Verification Method, which is a simple checklist of measures the designer "shall take (into) account."

In 1993, specification of ALF as a Verification Method placed New Zealand at the forefront of countries developing energy efficiency codes. Using it, a designer is able to account for direct solar heat gains as well as conductive heat losses. Unfortunately, the "index" of performance in the Code (units: $kWh.m^{-2}.DegDay^{-1}$) is normalised for climate coldness, so that it produced the same index of performance in climates with New Zealand latitudes as widely varying as Seville and Munich or Los Angeles and Portland (Oregon). Code compliant construction is therefore the same throughout the country.

The overall code is performance based. It defines only minimum standards, not "good design" and was introduced in response to industry dissatisfaction with the heavy costs of meeting the previous complex web of legislative requirements. Recent government moves to respond to international climate change agreements, and a desire to place the Energy Efficiency Clause of the NZBC in a performance formulation provided an opportunity to update the requirements for both residential and non-residential buildings.

A review of data on all buildings constructed since 1970 suggested a separation of building code provisions according to building size (under and over 300 square metres) and height (under and over 3 storeys). Following this review, the R&D followed a conventional international pattern[2]. Modelling of minimum design alternatives was conducted in the simulation programs SUNCODE-PC[3] and DOE 2.1E[4]. For the NZBC, the main differences from convention have been requirements to focus on: minimum acceptable levels of performance; net positive economic life-cycle benefits; and energy efficiency (improving benefits) rather than energy conservation (less energy use).

Two stand alone houses, of nominal floor area 100 m² and 200 m², were modelled using SUNCODE-PC, in four climates. For commercial office buildings, two buildings of nominal floor area 3,000 m² and 15,000 m² were modelled using DOE 2.1E in the same four climates. Sensitivity studies were carried out on the assumed internal loads, the window to wall ratio, the operating schedules and the HVAC system type. Additional studies were conducted on eight (8) other building uses: Supermarket; Retail Warehouse; School; Apartment Tower; Hotel Tower; Retail Tower; Motel Row; and Retail/Office Row.

An early personal goal of the R&D team was development of a single energy performance coefficient for all building types that could be used as the target in a Verification Method. However, it soon became apparent that there was a reluctance in government to incorporate into the legislation the full technical complexity of all potential combinations of location, occupancy types, hours of operation etc. These were to be left to the Acceptable Solution(s). Consequently, on release in 1995 of the draft revised Clause some lobbyists pointed out that contrary to the exact performance specifications in other Clauses of the Code the energy efficiency Clause had no specific numerical performance "index". The most recent draft includes a performance "index" for houses. Whilst similar to its climate normalised predecessor, it does differentiate between the performance of a house in a cold and a warm climate. All other quantified (numerical) requirements have been incorporated into Acceptable Solutions. Each Acceptable Solution, in turn, has been developed with three levels of tools - a Schedule Method (a table of R-values), a Calculation Method and a Modelling Method.

As each tool requires significant development, it was necessary to determine which building type(s) would be covered by each tool. This determination was made on the basis of an analysis of NZ construction over the past 24 years. This clarified the development priorities for design support tools. The greatest benefits were thought to come from providing tools which simplify the compliance process for the 13,200 small and low residential buildings constructed each year. Conversely, the complexity and individuality of the 58 large and tall buildings constructed each year make development of support tools costly and reduce the likelihood of any one code tool providing a major benefit.

The benefits of implementation in the small low residential buildings include: energy efficiency improvements in this sector affect some 60% of the total floor area constructed per year; and, skilled energy design analysts are unlikely to be involved

[1] *Centre for Building Performance Research, Victoria University School of Architecture, New Zealand*
[2] *Energy Research Otago Limited, New Zealand*
[3] *Building Research Association of New Zealand*

so simple design tools are likely to be highly sought after. A survey of 80 designers, builders and enforcement officials[5] found New Zealand designers, builders and code officials have some interest in the creation of improved energy efficiency in their buildings. Most believe that energy efficiency in buildings is a worthy goal, but implementation is limited by their perceptions, owner disinterest or the belief that energy efficiency is associated with additional costs. There is a perceived client requirement for a minimum capital cost design rather than a minimum lifetime cost. Any tools for the majority of the design professions represented by this snapshot sample of the industry must be simple and cheap to apply.

This conclusion is supported also by the differences in practice amongst the designers surveyed: the existing advisory standard for commercial building energy efficiency (NZS4220:198?) had been used by over half the engineers for code compliance in the previous year. ALF, the more simple to use residential code compliance method was used the least; only (9%) of the respondents had used it in the past year.

It is presumed that the current lack of interest in verification methods will change as the required thermal performance levels become more stringent. New Zealand industry's acceptance of verification methods for structural compliance would tend to support this conclusion as would the California energy efficiency experience: "Currently [in California] it is estimated that 80% of houses use the computer methods, and only 5% use the prescriptive packages."[6]

The Calculation Method in the Acceptable Solution uses an area-weighted envelope thermal resistance formula similar to the ASHRAE OTTV[7] procedure. For the first time in New Zealand, glazing heat losses must be included in this calculation. The area weighted envelope thermal heat loss is calculated for both a Reference Building and for the Proposed Building, and the heat loss for the Proposed Building must be no worse than for the Reference Building.

The Modelling Method also requires that a Reference Building's energy performance may not be exceeded by the Proposed Building. The Modelling Method permits almost any "model" to be used. In the industry survey some computer "simulation" tools were used for calculating air conditioning requirements. There was no commonality in the tools used. Rather than test every computer thermal modelling program available throughout the world, the IEA's "Building Energy Simulation Test (BESTEST) and Diagnostic Method" is proposed as a means to evaluate the suitability of thermal simulation programs[8]. This test is based on single "room" test cell data. There are undoubtedly questions which could be asked about its suitability as a certification process for performance calculation tools which will primarily be used to model complex multi-storey buildings. The only measure of reassurance we have been able to draw is that the new Clause does not specify HVAC performance, it concentrates on building fabric and lighting.

With the exception of the engineers, most professional groups surveyed showed a preference for checklist type design support tools. Manual calculations were least favoured, with computer calculations coming in between in popularity. Engineers favoured computer calculation over the checklist. Architectural designers were equally divided in preference for checklists and computer tools. Taking CAD use as an indicator of high level computer use, 83% of the engineers use CAD and thus could be expected to be able to utilise complex computer based design support tools with most ease. However, although 89% of those surveyed did some kind of computing, the overall industry use of CAD is only 42.5%!

Respondents were asked at which stage of design they would like tools to be applicable. Preference was very clearly towards tools that could be used "early in the design process". Preference was also clearly expressed for tools that could inform the energy design process rather than just produce code compliance reports. Translating these preferences into useful tools for the future remains the challenge for all of us in building simulation.

REFERENCES

1 Bassett M.R., R.C. Bishop and & I.S. van der Werff 1993. *ALF Manual:1990 - Annual Loss Factor Design Manual, an aid to thermal design of buildings*. BRANZ : Wellington

2 The NZ process has benefitted from the extensive work and experience on other building energy codes including: the California Energy Commission's *Energy Efficiency Standards for Residential and Non-Residential Buildings - Effective July 1, 1995*; the Canadian Commission on Building and Fire Codes' proposed *National Energy Code for Houses 1995 (Public Review 2.0)* and *National Energy Code for Buildings 1995 (Public Review 2.0)*; the UK Department of the Environment and The Welsh Office's *The Building Regulations 1991. Approved Document L1. Conservation of Fuel and Power. 1995 Edition.*; and the Washington State Building Code Council's *Washington State Energy Code (1994 First Edition).*

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The Australian Nationwide House Energy Rating Scheme

A Progress Report

***Angelo Delsante, CSIRO Division of Building Construction and Engineering*[1]**

INTRODUCTION

The Australian Nationwide House Energy Rating Scheme arose as a result of a commitment by Commonwealth, State and Territory governments to improve the energy efficiency of buildings. The objectives of the scheme are:

- to assist the public and the building industry to identify the extent to which a new or existing house has the potential , through its design and construction, to be of high efficiency in its use of space heating and cooling energy;
- to facilitate rating of the thermal efficiency of dwelling design and construction, in a manner that is nationally coordinated and consistent, and is regionally sensitive to variations in climate, housing design and other factors.

Although there have been previous attempts to develop such schemes in Australia, this is the first adequately-funded nationwide initiative of this type. The scheme has been undergoing development since 1993, when Professor John Ballinger, of the School of Architecture, was appointed Project Manager through UNISEARCH, University of New South Wales.

SCOPE OF THE SCHEME

As well as the very common detached single-family houses, the scheme will also encompass medium-density housing developments as well as low-rise apartment buildings (the last two are undergoing something of a boom at present in the inner suburbs of some of our major cities). It should be noted in passing that the energy efficiency of other building types, such as office towers, will be dealt with by the Building Energy Code of Australia, which is also currently under development.

At this stage, the NatHERS scheme does not include the efficiency of household appliances (e.g. hot water systems), nor the efficiency of the heating and cooling plant itself. That is, it concentrates on the efficiency of the building envelope, assessed in terms of space heating and cooling energy requirements. Appliances and plant efficiency may be included in the future.

The scheme will be applied Australia-wide. This imposes its own set of problems, owing to the very wide range of climates that must be accommodated, ranging from alpine to hot-humid. A consequence of this is the wide range of heating and cooling patterns, and more importantly, the fact that in some locations heating and cooling is not normally needed or used. While the rating scheme software now deals with unconditioned buildings, ratings issues for these cases are still to be addressed.

Dwellings will be rated on a scale of 0 to 5 stars. In recognition of the fact that this is a joint Federal/State initiative, the actual implementation of the scheme will be the responsibility of individual States, subject to consistency requirements.

TECHNICAL BASIS

It was decided quite early in the development process that the rating would be based on computer simulation of the building, using hourly calculations over a full year. The CHEETAH package, developed by the CSIRO Division of Building, Construction and Engineering, was chosen as the basis of the simulation tool (CHEETAH was one of the programs that participated in the recent IEA Task 21C/12B empirical validation exercise). To satisfy the needs of the scheme, CHEETAH underwent considerable development and enhancement. The resulting software package is called NatHERS.

The front-end

CHEETAH's DOS-based front-end was replaced by a Windows-based front-end using Borland's Object-Vision software. An early version had originally been developed by the Gas and Fuel Corporation of Victoria as a front-end to CHEETAH's simulation engine, and was therefore able to be modified quickly to meet the tight deadline for this phase of the development.

Data entry is via four main screens or forms: a Main form, which contains the basic job details and gives access to the other forms (Figure 1); a Construction form, which allows the user to select a main and two alternative constructions for the windows, walls, floors, etc from drop-down lists (Figure 2); the Dimensions form, in which lengths and/or areas are entered for the various elements on subsidiary zone forms; and a General form, in which information about infiltration and the potential for cross-ventilation is entered via simple Yes/No responses. Information about indoor and outdoor user-operable shading devices, and fixed shading from overhangs, pergolas and other buildings, is also entered in these forms.

The current front-end deliberately restricts the full flexibility of the simulation engine in the interests of keeping the data input requirements to a minimum. For example, only four habitable zones are allowed: Living, Bedroom, Other Conditioned (which must be classified as a type Living or Bedroom), and Unconditioned (e.g. laundries, attached garages and other service areas). Roofspace and sub-floor zones are formed automatically (if necessary). Similarly, because its primary purpose is as a rating tool, there is no provision for the user to change the data for occupant behaviour, e.g. times of heating and cooling, and operation of curtains, external blinds, and windows.

While the current front-end is adequate, it is clear that the choice of software has imposed some limitations and difficulties that we could all do without. Thus it is intended to replace the existing front-end by a much better version within a year or so.

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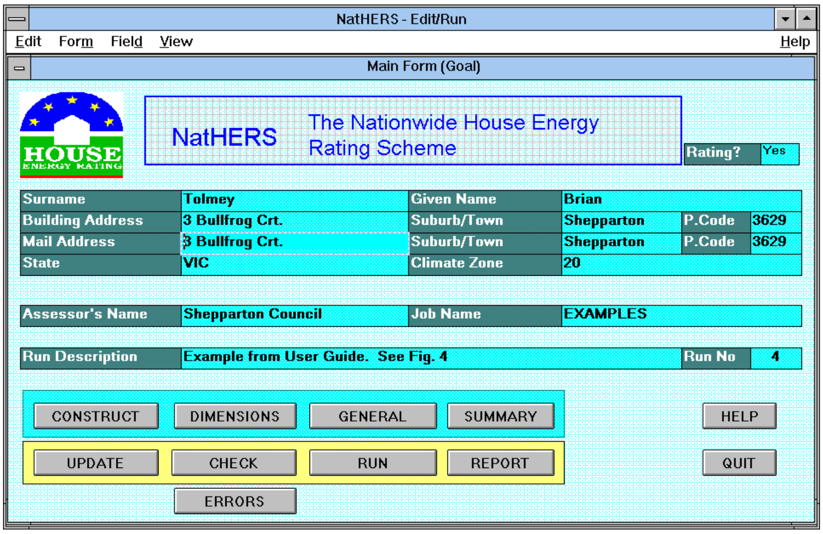

Figure 1 Main Form - Job Details and Menu

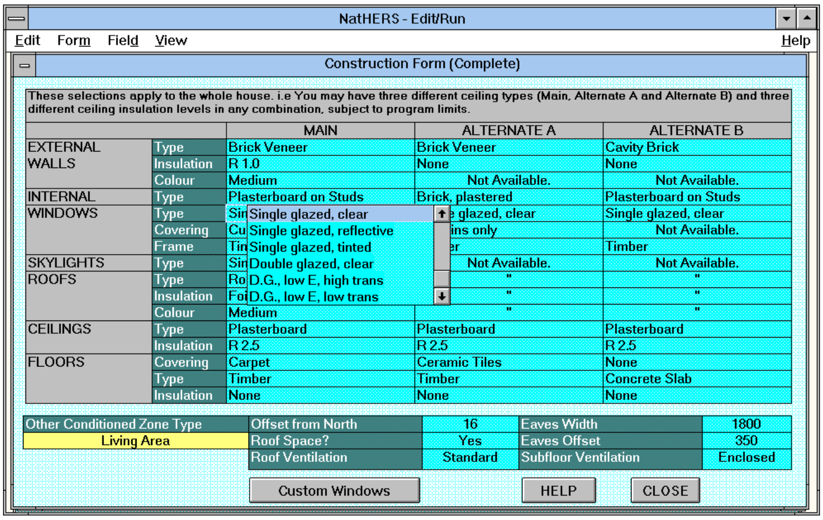

Figure 2 Construction Form - Select Constructions

The Simulation Engine

The CHEETAH simulation engine is based on the zone response factor method, which in turn is based on analytical solutions of one-dimensional heat flow through multi-layer building elements with constant properties. For the NatHERS development, the engine was enhanced in a number of ways. The most important were:

- An improved glazing model. The original engine used the shading coefficient concept to model any glazing other than clear single glazing. The new model directly uses data on the overall transmittance, and absorptance of each pane, as a function of angle of incidence, to calculate solar heat gains. Outdoor convective heat transfer coefficients are calculated from a correlation developed from the recent MoWitt measurements for low-rise glazing in the USA. This correlation depends on local wind speed and surface temperature. Interestingly, it yields considerably lower convective coefficients than have been used by some simulation programs. The modelling of the window frame is also improved, taking into account its area, solar absorptance as a function of angle of incidence, and *U*-value (but not its thermal capacitance).

  The new glazing model allows the NatHERS software to offer the user a list of six glazing types (three single glazings and three double glazings) and three frame types (aluminium unbroken, aluminium broken, and timber/PVC). Future developments will allow custom glazings to be simulated.
- An improved model of heat flow from concrete slab-on-ground floors. This is based on my mathematical model of steady-state and time-dependent slab heat flows, developed over a number of years and refined by others. However edge insulation is not yet included.
- Simultaneous heating and cooling in up to three zones. Unlimited heating and cooling capacity is assumed and inter-zonal heat flows are taken into account simultaneously, so that any combination of thermostat settings is always achieved at the end of each hour. While this precision is recognised as being rather unrealistic, it is useful for ratings purposes.

Output Reporting

The reporting facility produces several simple output screens. The main screen gives a brief building description, and the annual total heating, sensible cooling and latent cooling energy requirements for the conditioned zones (in MJ/m^2 of conditioned floor area). If appropriate it also shows the star rating for the building, which is calculated from the energy total (Figure 3). When the building is run in rating mode, the Living, Bedroom and Other Conditioned (if it exists) zones are automatically conditioned and a star rating displayed. If the building is run in non-rating mode, the user can choose to heat and/or cool any or none of these zones. Energy totals are still displayed, but a star rating is not given.

Two other output screens are available, which give information about the temperatures in the zones. The user can configure the temperature reports by choosing the months or seasons of interest (the latter being user-definable), the zones, and, for each zone, the times of interest (e.g. waking or sleeping hours, or any sub-set of the 24 hours), and the upper and lower limits of the comfortable temperature range. The degree hours screen then gives the number of underheating and overheating degree hours for each zone chosen. The overheating degree hours are simply the cumulative difference between the zone temperature at each hour and the specified upper limit of the comfort range (whenever this is positive) for the chosen times and period. Underheating degree hours are defined similarly. Finally, the temperature information can be displayed as histograms of occurrences of temperatures in 1-degree bins, for the chosen zones, hours and period. Bars below the lower comfort limit are coloured blue, those within the comfort range are coloured green, while those above the comfort range are coloured red (Figure 4). If ceiling fans were chosen in a zone, the upper limit of the comfort range is increased by 3 degrees, which is an estimate of the effect of such fans on the apparent temperature.

The temperature information screens were developed as a first attempt to cater for warm-humid climates, where houses may be completely unconditioned. However, a method for deriving a star rating from temperature information for an unconditioned house has not yet been developed.

Weather Data

Hourly weather data (dry and wet-bulb temperature, wind speed, cloud cover and direct and diffuse solar radiation) for one year is required for the NatHERS software. The key problem is solar radiation. Solar radiation measuring stations are very sparse in Australia, and only 59 sites were available that contained sufficient data; even then for some sites the solar data was estimated from cloud cover and other parameters. A study of the problem of determining a suitable weather data set for every location in Australia showed that 28 sites could be used to adequately cover the country. Each postcode is associated with one of the 28 data sets. Long-term average data, simulation of building performance, and any other relevant information was used to determine the association where hourly data were not available. Some postcodes cover a very large area, and may straddle two or more climate zones. These have two or more data sets associated with them, one of which must be selected by the user. The relevant weather data file is automatically called up when the user enters the building's postcode on the main input data form.

Validation

As part of the development process, the enhanced CHEETAH engine (now known as CHENATH) underwent two specific validation exercises. The first was a repeat of the above-mentioned IEA Empirical Validation exercise (admittedly in non-blind mode). Initially the objectives were simply to check that the enhancements had not introduced errors into the program, and to further investigate areas of difficulty identified by the IEA results and report. As this work progressed, the new glazing model became available, and so this was compared with the old model. The exercise proved to be very useful: some of the problems that had been experienced with CHEETAH were simply due to differences in timing conventions between CHEETAH and the measurements (a common pitfall!), which disappeared when a new and more detailed method was developed to account for the

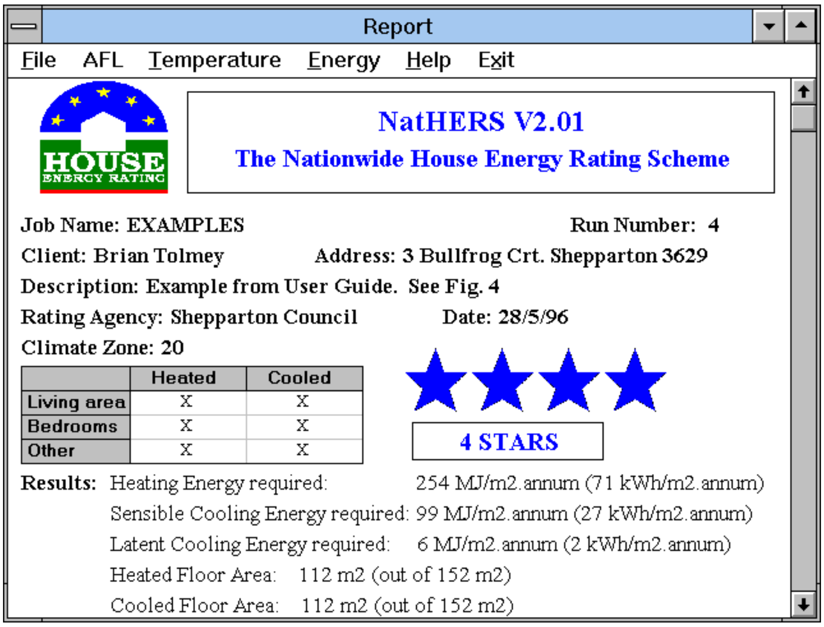

Figure 3 Main Form - Star Rating

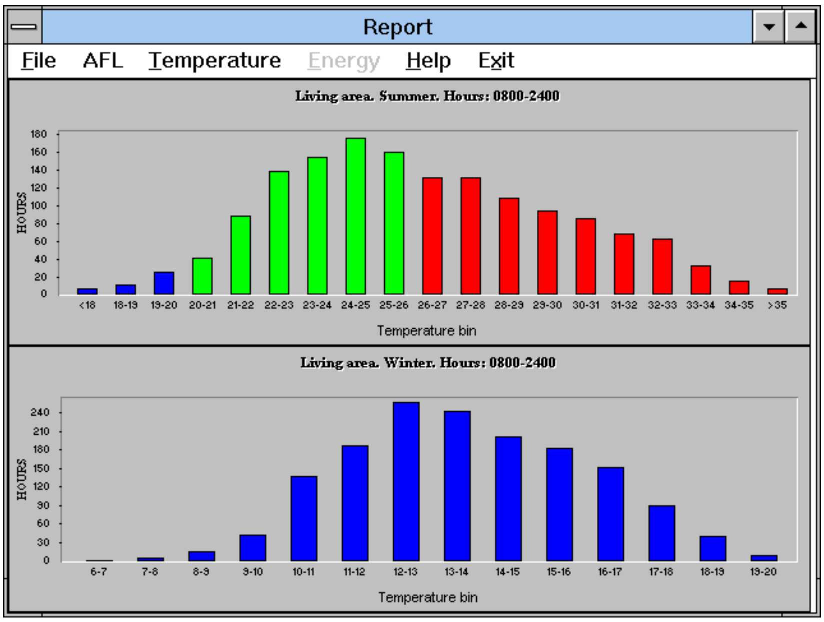

Figure 4 Temperature Report

differences. The comparisons also suggested that no new errors had been introduced. Finally, the new single-glazing model performed much better than the old in terms of free-running temperature predictions, and it was clear that the improvement was largely attributable to the lower convective heat transfer coefficients.

For the second exercise, CHENATH was put through the IEA BESTEST procedure, which was also very useful. No major errors could be detected. However, CHENATH consistently overpredicted annual cooling energy and peak heating and cooling demands. This was almost certainly attributable to the fact that the program calculates and controls an environmental temperature, not a pure air temperature. Further analysis of the results showed, encouragingly, that its prediction of percentage changes from a base case always agreed very well with the reference programs.

IMPLEMENTATION ISSUES

At present the NatHERS software does not convert annual energy requirements to a star rating, since this is still a subject of negotiation between the States and Territories. One of the problems with using absolute energies to determine star bands is that they become outdated as the software is improved or just changed (for example, if thermostat settings are changed). One proposal under consideration is to use relative values, by comparing results for a particular house to those obtained for a reference house using the same simulation program.

While the NatHERS software is the reference software for the scheme, it is not intended to be the only software that can be used to issue ratings. Other programs will be able to be used, provided that they have been accredited. The accreditation process is currently under development, and is likely to be based on the BESTEST concept. One example of other software already available is that developed by the Victorian Government, who developed their HERS before the Nationwide scheme. Their software is based on a points score system, whereby each building component is assigned a certain number of points, which are calculated from correlation equations between heating and cooling energy and building characteristics. These equations were distilled from many CHENATH runs of variations on a prototypical house. The aggregate points are then used to determine the star rating. The advantage of this system is that the calculation is instantaneous. The disadvantages are that it is less accurate, and tends to get out of step with the simulation engine as the latter is progressively improved.

CONCLUSION

The wide range of climates and patterns of heating and cooling found in Australia present a significant challenge to the development of a truly nationwide house energy rating scheme. Although some technical and administrative issues still remain to be resolved, considerable progress has been made over a short period of time. The next year or so should prove to be very interesting.

❖

A New User Interface for HTB2

Don K. Alexander, Welsh School of Architecture[1]

HTB2, a general purpose model for the simulation of energy flows and environmental conditions in buildings, will be re-released with a new PC/ Windows interface later this year. HTB2 has been thoroughly tested in IEA Annex 21 and other model comparison and validation exercises, and is well established within the research community in the UK. The new interface described in this paper will strengthen its exist-ing user base and make it more attractive for use in education and practice.

HTB2 is a multi-zone model capable of dealing with problems involving complex fabric, ventilation, services and occupancy. It can produce detailed output, at variable time and data rates, and is simple, flexible and extendible.

The core program is a descendent of research codes dating back to the mid '70s. The original HTB model was a simple finite difference model, but its capabilities have been progressively revised and extended. HTB2, released in 1985, made a major step forward in programming and documentation standards, as well as in functionality. In HTB2 the finite difference time slicing approach led to a simple framework in which each component could be isolated, but still fully featured. This was used to simplify the coding of the model, leading to an easily maintained and updated program.

HTB2 is aimed largely at research and education users; its structure is flexible, easily understood and modifiable. The detailed data structures allow the user to investigate both the operation of a particular feature, such as a thermal storage element, and the interactions of features, such as the effect of heating system types on the energy characteristics of a passive solar house design.

The new interface makes HTB2's power much more accessible. The PC package requires Windows 3.1 (or Windows95) and a DX386 or better processor. The software will be made available as a standalone program suite, or on request as a SDK with libraries and/or source code included. The core calculation engine is portable and has been tested on many platforms, ranging from 16bit PCs through to mainframe super-computers.

The fabric modelling facilities, summarised in figure 1, allow the thermal performance of building elements to be studied both in space and in time.

The flexibility of the heating system descriptions allow the system characteristics of a number of common systems to be

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emulated (figure 2).

The structure of HTB2 makes it easy to alter or to add new functionality: there are linkage points for external users' code within the calculation stream and data structures. These provide workbench access for testing and refining new algorithms or procedures. More fundamental changes in the code can also be undertaken; external users have linked HTB2 to other simulation software such as HVACSIM+ (a fully feature plant simulation) and ESL (a general simulation language). In these cases, HTB2 has become a module of the larger overall simulation, handling the calculation of the building components.

Despite all this flexibility HTB2 has remained conceptually simple. This has been a strength in research applications and makes the model particularly suitable for use in teaching. The recently developed Windows interface provides ease of use that was not possible in a text driven environment and makes it possible for undergraduates to start making effective use of powerful dynamic simulations very quickly.

The *Scheme* and *Construction* editors allow the creation and modification of building descriptions.

The *Scheme* editor (figure 3) highlights the underlying thermal network rather than the physical appearance of the design. This forces designers to consider their design in thermodynamic components. The *Construction* editor allows composite elements such as walls to be created, either from scratch or by editing standard types from a library, using a simple display of the properties of their components.

The *Run Monitor* (figure 4) facilitates control and monitoring of the simulation calculations. It provides a view into the calculation results as they proceed, through configurable strip-charts. This allows both the validity of a simulation to be verified, and the development of insight into the operation of the simulated building.

A *Data Viewer* allows the extraction and translation of HTB2 calculation results. As well as simple printout and graphic views of results, the Data Viewer exports data to other more complex analysis or reporting software.

HTB2 is used as a demonstration and teaching medium within the Welsh School of Architecture in both the undergraduate and postgraduate courses. Developments to the new interface provide "real-time" views of the effect and interactions of thermal mass, solar gains, shading and occupancy regimes. The model has few constraints on the input problem. As a result it is possible to move from a simple tutorial visualising the temperature and heat flows in an isolated wall that result from a periodic fluctuation in "external" temperature, through to a full simulation of the environment conditions within an office block, within the same programme.

The enhanced functionality and ease of use provided by a Windows interface opens new doors in the preparation of demonstration material. This applies not only within a University environment but also in practice, where targeted Computer Aided Teaching courses using simulation to explore the thermal issues arising in passive solar design, solar shading, ventilation etc. can be prepared to develop practitioners' professional skills as well as their designs.

For further information about HTB2 please contact Don Alexander.

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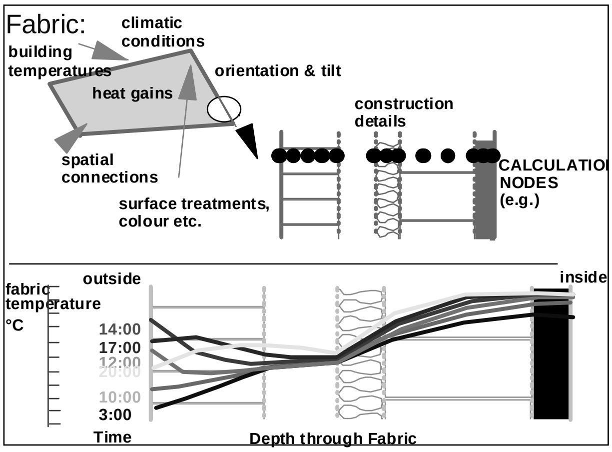

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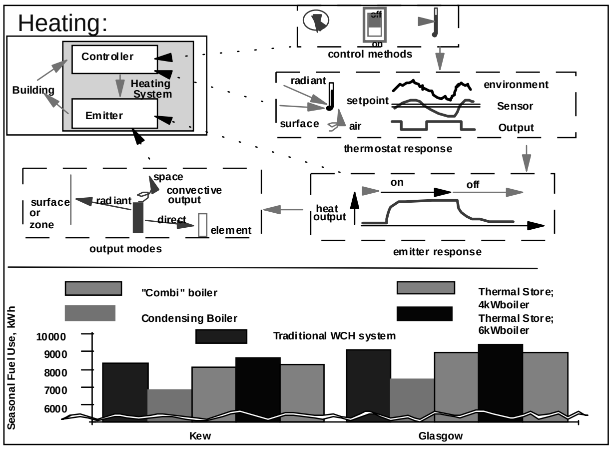

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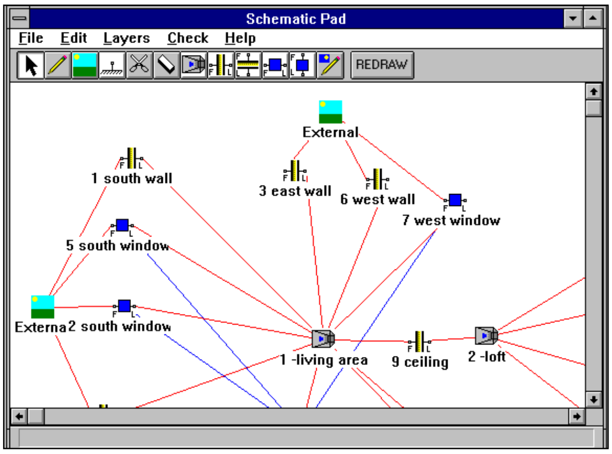

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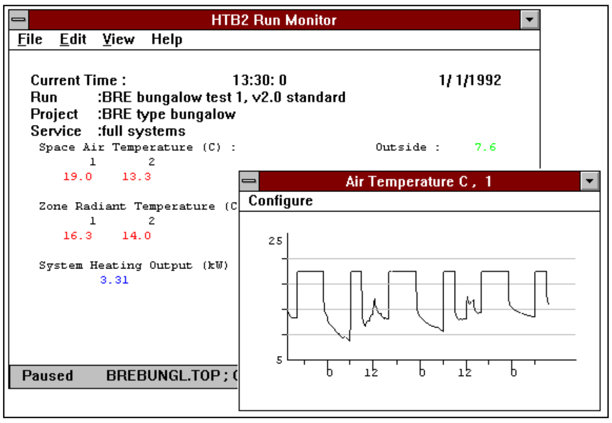

COMIS 3.0

A new simulation environment for multizone air flow modelling

Roger Y. Pelletret, CSTB

One of the aims of IBPSA is to transfer simulation technologies to practitioners. This is precisely what IEA/ECB Annex 23 has tried to achieve in the field of multizone air flow and pollutant transport modelling. The result is COMIS 3.0, a brand new simulation environment.

To our knowledge this is the first time that the main objective of an IEA/ECB Annex has been to produce validated software designed for practising engineers and consultants as well as for research.

Annex 23 Subtask 1 aimed to develop a multizone air flow modelling system (COMIS - Conjunction of Multizone Infiltration Specialists) encapsulated in a Simulation Environment designed to make it easy to use. An additional goal was to demonstrate the coupling of COMIS with Building Energy Performance Simulation codes such as TRNSYS .

COMIS 1.0, a Bernoulli equation based program, was developed in the late eighties at LBL by an international team. Building on COMIS 1.0, the objectives of Annex 23 Subtask 1 were:

- to develop a new, validated, program to compute air flow and pollutant transport in multizone buildings
- to facilitate the use of this program in order to ease its dissemination.

To make COMIS as easy to use as possible, a Simulation Environment (called IISiBat) has been developed by CSTB (France) and applied to COMIS. IISiBat is an implementation of CSTB's generic R&D program called ISE (Intelligent Simulation Environments). ISE tackles the problem of facilitating the transfer of simulation technologies from research centers to engineers. It provides end-users as well as advanced users with many modules designed to help them make effective use of advanced simulation tools like COMIS in simulating complex systems. ISE concepts have been presented in detail at IBPSA conferences; interested readers are referred to the conference proceedings for more information.

What does COMIS do? The program includes a wide range of modules, from air flow components such as cracks, test data, windows, doors, vertical apertures (2-way flow), ducts and duct fittings, fans and flow controllers to pollutant sources and occupants. The operation of most of these can be scheduled, for example to relate the closing and opening of windows to occupant behavior. Together, they allow a wide range of issues to be addressed, including:

- sizing of mechanical ventilation systems
- effects of retrofitting measures on ventilation efficiency of buildings
- transport of contaminants (between zones but also from outside)
- ventilation effectiveness
- pollutant removal efficiency
- age of air
- smoke propagation
- assessment of ventilation heat losses
- passive cooling
- heat transport between zones

COMIS 3.0 provides a variety of useful output options. These include mass air flow rates per zone, mass flow matrices, outdoor air flow rates, air change rate, building and room mean age of air, air change efficiency, and building and room air change indices.

I hope this short description has made you curious to know more about COMIS 3.0. There will be an opportunity to hear more about the program at the next ROOMVENT conference in Tokyo (or to read about in the proceedings). Alternatively, contact me at CSTB.

Dr Roger Pelletret is Head of Software Development and Software Accreditation Division at CSTB and Leader of IEA/ ECB/Annex 23-Subtask 1. He is currently setting up IBPSA-France. He can be contacted at CSTB, BP 209 06 904 Sophia Antipolis, France. e-mail: pelletret@cstb.fr

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BUILDING SIMULATION '97

Fifth International Conference
International Building Performance Simulation Association
Prague, Czech Republic
8-10 September 1997

ANNOUNCEMENT AND CALL FOR PAPERS

Computer modeling and simulation is arguably the most powerful approach for addressing the complex interactions encountered in buildings and the systems which service them. Modeling and simulation is evolving rapidly, and techniques not feasible just a few years ago are now becoming commonplace.

The International Building Performance Simulation Association (IBPSA) was founded in 1986 to advance and promote the science of building performance simulation, with application to the design, construction, operation, and evaluation of new and existing buildings worldwide. Previous conferences in Vancouver, Canada (1989), Nice, France (1991), Adelaide, Australia (1993), and Madison, United States (1995) have contributed to these goals.

Given the rapidly growing interest in building simulation from educators, researchers, developers and practitioners in eastern and central European (ECE) countries, we feel that the time is right to organize BS '97 in Prague.

CONFERENCE THEMES

BS '97 will address the following themes:

1 Fundamentals and approaches for building related phenomena, such as heat, moisture, air, fluid and power flow, artificial and day lighting, fire acoustics, indoor air quality and environmental impact.

2 Implementation, integration, and quality assurance of modeling and simulation tools.

3 Application of modeling and simulation in design of new and refurbished buildings and HVAC systems.

4 Integration of modeling and simulation in higher education.

5 Use of modeling and simulation in practice.

The conference program will allow for hardware and software demonstrations, and a side-programme is envisaged for student presentations of short papers.

VENUE

Prague (or Praha), the city of the hundred spires or the "Golden City" in the picturesque valley of the Vltava river, is the capital and centre of industry, science, and culture of the Czech Republic.

Prague is located in the centre of Europe and belongs among the best preserved historical cities with unique collections of architectural and cultural monuments.

The Dean of the Faculty of Mechanical Engineering welcomes you to the Czech Technical University in Prague (CTU) which will host BS '97.

CTU is situated just north of the centre of Prague, and is in easy reach from almost anywhere in Prague by the excellent metro system.

REGISTRATION FEES

The planned registration fees and dates are:

Early registration (before 15 May 1997):

ECE participants	US$ 125
Full time students	US$ 125
Others	US$ 250

Late registration (after 15 May 1997): US$ 300

Accompanying persons: US$ 100

IBPSA members will receive a **US$ 25 discount**.

The registration fee includes conference attendance, proceedings, lunches, morning and afternoon refreshments, early-bird reception, welcome reception, and banquet. The accompanying persons registration excludes conference attendance and proceedings.

ACCOMMODATION

CTU co-owns a hotel (810 beds) which charges very competitive rates. Due to its popularity, Prague has accommodation available to suit every taste, from very economic to world-class.

ADVANCE REGISTRATION FORM

If you wish to attend Building Simulation '97 as an author or a participant, or if you would like to be on the mailing list to receive further information, please complete and return a Xerox of this page.

Surname ....

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IBPSA international conferences provide the ideal forum for the exchange of information and ideas on building modeling and simulation between researchers, educators, and practitioners in engineering, architecture, and computer science.

CALL FOR PAPERS

Please submit extended abstracts (maximum of two pages) to the Conference Secretariat. Only original papers not published elsewhere will be accepted. All accepted papers will be published in the Conference proceedings. The official language for the conference and papers is English.

Abstracts due	**15 September 1996**
Abstracts accepted	**1 November 1996**
Manuscripts due	**15 February 1997**
Papers accepted	**15 April 1997**
Camera-ready papers due	**15 June 1997**

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Latest news: **http://www.fsid.cvut.cz/bs97**

ORGANIZING COMMITTEE

Karel Broz, Czech Republic
Frantisek Drkal (Chair), Czech Republic
Petr Fischer, Czech Republic
Jan Hensen, (IBPSA Liaison), Scotland
John Mitchell, United States
Dusan Petras, Slovak Republic
Jiri Sedlak, Czech Republic
Terry Williamson, Australia

SUPPORTS

Czech Energy Agency
Czech Power Utility (CEZ)
Slovak Society of Environmental Technology
Society for Environmental Technology of the Czech Republic
Department of Energy, United States of America

Minutes of IBPSA/BEPAC Joint Board Meeting

12-13 March 1996
Ross Priory, Scotland

Members present: Marion Bartholomew, Joe Clarke (Chair), Dru Crawley, Larry Degelman, Frantisek Drkal, Chris Hancock, Philip Haves, Kevin Lomas, Lori McElroy, Curtis Pedersen, Roger Pelletret, Paul Ruyssevelt, Dan Seth, Ed Sowell, Jeff Spitler, Sinisa Stankovic, Richard Walker, Terry Williamson

AGENDA

Tuesday, 12 March

A. Introductions and review of meeting objectives.
B. Separate IBPSA and BEPAC board meetings.
C. Regionalization activities.
- objectives of regionalization
- reports from regional affiliates (Australia, Canada, Czech Republic, UK, US, other (?))

D. Regionalization activities, continued.
- perceived benefits: IBPSA<-> regional affiliates
- form and operation of the IBPSA network
- future actions

E. Drafting of joint declaration on aims and protocols.

Wednesday, 13 March

F. Management structure.
- regional boards
- central board

G. Finance.
- regional level
- central level

H. Future activities.
- Building Simulation '97 conference (report from Prague)
- other activities

I. Drafting of joint declaration on management and finance.
J. Review of actions, future directions.
K. Old/new business.
L. Adjourn.

PROCEEDINGS

Tuesday, 12 March

10:08 Opening: President **Clarke** called the meeting to and welcomed everyone to Ross Priory. Attendees introduced themselves and observed that there were 8 universities, 7 government labs and 3 practitioners represented.

10:25 Objectives for the meeting were discussed, including:
- Design an acceptable regional network plan.
- Design an acceptable mechanism for regional exchange of information.
- Agree on a set of actions beyond this meeting.

10:45 Separate Board Meetings of IBPSA and BEPAC

13:15 Lunch

14:20 Clarke introduced afternoon session.
Regionalization activities:
- IBPSA-UK (BEPAC) - **Ruyssevelt** described BEPAC activities of 1995. Presented several SIG's on lighting, ventilation, acoustics, and education. BEPAC currently has around 200 members.
- IBPSA-US - **Sowell** pointed out that the US affiliate members were formerly all members of IBPSA Central and are now reorganizing their efforts toward developing a new constitution and by-laws with regional objectives.
- IBPSA-CA - **Seth** presented status of the Canadian members, stating their intent to become an affiliate. He covered several plans for a newsletter, funding of regional activities, and encouraging of student memberships. He indicated that CABA (Canadian Automated Buildings Association) may become the foundation for the IBPSA-CA membership.
- IBPSA-Australasia - **Williamson** stated that the probable makeup of the Australasia affiliate would be Australia, New Zealand, Hong Kong, Korea, Singapore and Japan (about 30 members expected). They are currently planning a regional workshop to be held in N.S.W.

- IBPSA-Czech Republic - **Drkal** presented a discussion of the formation of the Czech affiliate. He has begun to survey professionals and academicians in Czech as to their interest in IBPSA activities. Their region will most likely include the Czech Republic, Hungary, Poland and Slovakia.

EDAS (Energy Design Advice Scheme) - UK was presented by **McElroy**. Regional design advice has been offered since 1989 on at least 950 projects, resulting in 7 million pounds of energy cost savings. In most cases the savings to investment ratio has been around 10:1.

Clarke summarized the regional presentations by offering the idea that IBPSA Central would become essentially an alliance of regions. Discussion ensued on the role of IBPSA as to how it is to be identified as being distinct from the regions. The conclusion was that IBPSA Central would best serve the functions of — networking, accreditation, publication of state-of-the-art modeling methods, and Web communication support.

16:45 Regionalization network structure
Clarke presented a structure for IBPSA Central and its affiliated regional chapters. A two-hour discussion ensued resulting in a list of 14 resolutions as to how to reorganize the IBPSA management structure. The resolutions are shown in a later list.

19:00 Dinner

Wednesday, 13 March

10:00 Resolutions: Sowell led a discussion on the IBPSA by-laws, noting that the naming of regional affiliates to the makeup of the IBPSA board would require no substantive changes to the constitution or the by-laws. After further discussion, the board members voted unanimously to approve the resolutions.

11:35 Finance: Details were discussed as to how the regional finances would differ from the central finances. The main source of income for the regions would be from member dues, and a brief discussion revealed that there is a close parity between the dues amounts currently being paid or contemplated for all the regions. The main source of income for IBPSA Central would be from the conferences; however, the regions are to also share in any profits derived from the conduct and/or sponsorship of the conferences. The formula for profit sharing under resolution 13 (see list) approved unanimously by the board members.

12:55 Lunch and walk break

14:25 BS Conferences: Sowell introduced the afternoon session and summarized **John Mitchell's** final report from BS '95. **Drkal** then described plans for BS '97, hosted by the Czech Technical University in Prague. He showed a video tape about the CTU and discussed facilities and the budgets for 100-delegate and 130-delegate scenarios. The technical committee, chaired by **Spitler**, is to investigate putting the conference papers on CD.

15:30 Other Activities:

a) Teleconferencing- Possibly a portion of the future board meetings, e.g., one hour, could be dedicated to issues deserving of a teleconference. **Jeff Hirsch** investigate how to implement this.
b) The BEPAC Newsletter will next be published in late June by Bartholomew Associates in the U.K. It was generally agreed that the IBPSA newsletter could be published in the same office around the same time. The group agreed to send articles to **Bartholomew** by early June.
c) Web page- **Crawley, Pedersen, Spitler, and Chip Barnaby** will investigate the establishment of a permanent web page for IBPSA
d) IBPSA-CA - **Seth** distributed a proposal to establish an IBPSA affiliate in Canada accompanied by a request for startup funds. The board voted unanimously to approve the motion. **Seth** added that IBPSA-CA would probably raise significant funds to sponsor BS '97 in Prague.
e) IBPSA-Czech - The Czech Republic will probably create its organization in parallel with the efforts to host BS '97 and will formalize its structure later.
f) Server communications - For the time being, the group saw no reason to discontinue use of the server in the U.K. There was some additional discussion about forming a web page to announce the conference (BS '97). **(See note "c" above.)**

16:30 Creation of Management Board for IBPSA: An in-depth discussion took place on the constituency of the IBPSA management board and how it relates to the regions. The results of this discussion are presented in a separate segment of the Newsletter.

17:10 Next Board Meeting: The next board meeting was announced for 11 September 1997 just following the conference in Prague.

17:18 The board recognized and thanked ESRU and the University of Strathclyde for their efforts and support of a successful and rewarding two-day meeting. The meeting then adjourned.

Submitted by: **Larry O. Degelman**, IBPSA Secretary

NEW IBPSA REGIONAL AFFILIATE PROGRAM

The regional affiliate program is in place. Autonomous regions are to be supported by fees (dues) from the regional members. The purpose of the region is to provide member services and to stimulate the regional member's interest through new initiatives such as workshops, seminars and regional newsletters. In contrast, the purpose of IBPSA Central is to maintain the Building Simulation conference and publication series, be responsible for networking and ensuring regional interchanges of information and ideas. IBPSA Central will be governed by the Board who will decide on finances for contracting any special services for international uses (such as the IBPSA Newsletter), sponsoring of special international (or regional) projects (such as initiation funds for a new affiliate or achievement awards), and transplanting products from region to region (e.g., software or member lists).

Prospective IBPSA members can now choose to join an affiliate in their region or, if one is not available, to join IBPSA directly. In any case, the dues amount is expected to be about the same. (See membership application form.) The Regional Affiliates in place or beginning to form charters are:

Affiliate	Contact
IBPSA-Australasia	Terry Williamson, Adelaide, AUS
IBPSA-CA	Dan Seth, Ottawa
IBPSA-Czech Republic	Drkal Frantisek, Prague
IBPSA-France	Roger Pelletret, Sophia-Antipolis
IBPSA-UK	Joe Clarke, Glasgow
IBPSA-US	Ed Sowell, Placentia, CA
IBPSA-Greece	Costas Balaras, Athens

Any region wishing to initiate a new regional affiliate should prepare a brief proposal containing:

- the geographical area to be covered
- expected membership type and size
- organizational structure
- amount of start-up funds requested and intended use

The proposal should be sent to the IBPSA Secretary with a copy to the President.

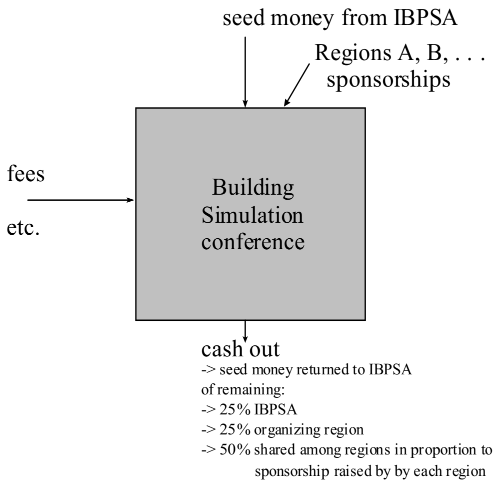
STRUCTURE OF THE IBPSA CENTRAL MANAGEMENT

The governing board of IBPSA will be a management committee made up of one member from each regional affiliate. Regions (currently standing at five) are to nominate their member of the board by September. Each of the regional nominations are to be supervised by their respective delegate (Marion Bartholomew (UK), Frantisek Drkal (Czech Rep.), Dan Seth (CA), Ed Sowell (US), and Terry Williamson (Aus.)), and provide the names to IBPSA Central.

IBPSA also has officers to run the day-to-day business of IBPSA Central. Nominations for the officers of IBPSA will be developed by the delegates and will be voted on by the membership at large. The IBPSA Secretary will organize ballots for this election and send these to the regional representatives by November. Elections will take place in January of 1997. The existing officers would remain in place until these. Current Officers are: President (Joe Clarke), Vice President (Per Sahlin), Treasurer (Ed Sowell), Secretary (Larry Degelman).

BOARD RESOLUTIONS PASSED AT THE ROSS PRIORY MEETING

1. The executive officers of IBPSA (president, vice president, secretary, and treasurer) are nominated by the IBPSA board and elected by the IBPSA membership. The executive officers serve a two-year term and they cannot be re-elected to the same position.
2. The role of the IBPSA executive is to deal with administrative services, the biannual Building Simulation conference, and special projects at the international level (such as regions, cross fertilization, sponsorship and IBPSA scholarships and awards).
3. It is anticipated that the primary source of income for IBPSA is the biannual Building Simulation conferences.
4. IBPSA regional affiliates are autonomous and are the primary means of serving local needs.
5. IBPSA regional affiliates collect membership dues and generate income through other activities to support local needs and member services.
6. Each regional affiliate will nominate a representative to the IBPSA board (by whichever process the regional affiliate chooses). Additional at large members of the board may also be nominated. The board will be elected by the entire IBPSA membership. Board members shall serve a two-year term and may be re-elected.
7. Members of IBPSA regional affiliates are members of IBPSA.
8. New members of IBPSA may select a regional affiliate to join if there is not a functioning regional affiliate covering their area.
9. The biannual Building Simulation conference should be self-supporting. Risk and profit are shared by the host regional affiliate, regional affiliates of sponsoring organizations, and IBPSA.
10. The biannual Building Simulation conference has two primary focuses: specialist knowledge (as in previous conferences) and regional interchange.
11. The IBPSA newsletter shall synthesize the regional affiliate news, articles, and information (existing regional affiliate newsletters) and provide a forum for international discussion of issues of interest to IBPSA members.
12. IBPSA commits to promote services for the benefits of its regional affiliates (e.g., electronic servers, forums, and other means of encouraging international exchange).
13. After the final accounts for a Building Simulation conference are agreed, surplus cash will be divided as follows:
    - Any seed money provided by IBPSA will be repaid first.
    - Of remaining amount, 25% will go to IBPSA, 25% will go to the organizing region, and 50% will be shared among IBPSA regional affiliates in proportion to sponsorship raised by each region.
14. In the event that the conference makes a loss the risk of IBPSA and IBPSA regional affiliates will be limited to extent of the seed money provided by IBPSA and the sponsorship raised. Sponsorship funds will be held in trust by IBPSA until the conference final accounts are agreed.



BS Conference Income and Proceeds Distribution

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Announcements

IPBSA AWARDS

The International Building Performance Simulation Association (IBPSA) makes two awards for outstanding work in the building simulation field. In the past, these awards have been made on a biannual basis at each Building Simulation Conference. Because there is a "backlog" of well-qualified nominees for the Distinguished Service Award, the IBPSA board has decided to award the Distinguished Service Award on an annual basis, starting with 1996. However, both the 1996 and 1997 awards will be presented at the Building Simulation '97 conference in Prague.

The award descriptions are:

IBPSA Award for Distinguished Service to Building Simulation

This award recognizes an individual who has a distinguished record of contributions to the field of building simulation, over a long time period. The award consists of a certificate and $500 (US). Nominations should summarize the individual's contributions to the field and history of involvement with building simulation.

IBPSA Outstanding Young Contributor Award

This award recognizes a young individual who has demonstrated potential for significant contributions to the field of building simulation. The award consists of a certificate and $500 (US). Nominations should summarize the individual's contributions to the field and assessment of potential for future contributions.

These awards will be made next at the Building Simulation '97 conference in Prague. Evaluation of nominations will be made by the Honors and Awards committee of the IBPSA. Final decisions will be made by the IBPSA Board of Directors. In order to be considered, nominations should be sent by November 1, 1996 to the chairman of the Honors and Awards committee:

Jeffrey Spitler PhD PE
Associate Professor
School of Mechanical and Aerospace Engineering
Oklahoma State University — *telephone (405) 744-5900*
218 Engineering North — *fax (405)744-7873*
Stillwater, OK 74078 — *e-mail spitler@osuunx.ucc.okstate.edu*

E-mail nominations are encouraged.

CLIMA 2000

The 6th CLIMA 2000 conference is in Brussels, Belgium from 30 August through 2 September (just before the BS'97 in Prague). Its main objective is to make it possible for researchers, educators, consulting engineers, manufacturers, operators, etc. to talk to each other, and to provide the opportunity to government employees, building owners, architects, developers, general contractors, and others involved in the building sector to meet with large numbers of building services engineers.

The technical programme includes sessions on the indoor environment; HVAC applications in domestic, commercial, industrial and agricultural buildings; energy and environment; control and management; refrigeration; building envelope physics; modeling; and software.

For more information, contact:

CLIMA 2000 '97
c/o SRBII
Ravenstein 3 — *telephone +32-(0)2-5117469*
B-1000 Brussels — *fax +32-(0)2-5117597*

IBPSA Membership Application

Dues for IBPSA are paid directly to the regional affiliate to which the member belongs. At this time, there are affiliates in Australasia, Canada, Czech Republic, UK, and the US. Members of the affiliate organization are automatically considered full members of IBPSA-Central. Please inquire as to the affiliate organization in your region, or contact the representative shown elsewhere in this Newsletter. If joining an affiliate is not in your best interest because of your location, you may join IBPSA directly by completing the application below.

MEMBERSHIP CLASSIFICATION DESIRED (check one): (Effective dates: Jan. through Dec.)

- Sustaining member US$ 500/year [ ]
  An individual, company, or institution in related practice.

- Member US$ 75/year [ ]
  A graduate from a college or university, or a registered professional engineer or architect.

- Student Member US$ 25/year [ ]
  An individual who is a full-time student.

Amount Enclosed: US$ _________

PERSONAL DETAILS

Name: ______________________________

Title: ______________________________

Organization: ______________________________

Street Address: ______________________________

City, State, Zip: ______________________________

Country: ______________________________

Telephone: ______________________ Fax: ______________________________

e-mail address: ______________________________

Please pay by **Check** or **M.O.** to: **IBPSA** c/o Larry Degelman, Dept. of Architecture, Texas A&M University, College Station, TX 77843-3137, USA. Tel: (409) 845-1015, Fax: (409) 862-1571, e-mail: larry@archone.tamu.edu.

or by **Purchase Order** by faxing this signed form to **IBPSA** c/o Larry Degelman (409) 862-1571:

Purchase Order Number: ______________________________

Date: ______________________ Signature: ______________________________

IBPSA Publications Order Form

Proceedings of IBPSA's Building Simulation conferences are available from the Secretary as long as stocks last.
Prices are:

Item #	# Papers / pages	Member Price*	Non-Member Price*	Number ordered
BS-85 (Xerox copy)	59 / 416	US$ 40	US$ 75	[ ]
BS-89 (Xerox copy)	54 / 300	US$ 40	US$ 75	[ ]
BS-91 (in stock)	85 / 675	US$ 55	US$ 90	[ ]
BS-93 (in stock)	71 / 570	US$ 55	US$ 90	[ ]
BS-95 (in stock)	81 / 717	US$ 70	US$ 105	[ ]

* Orders for two or more sets of proceedings are US$ 40 each for members and US$ 75 each for non-members

NOTE: Add 15% to all orders shipped within North America.
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or by **Purchase Order** by faxing this signed form to **IBPSA** c/o Larry Degelman (409) 862-1571:

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Date: ______________ Signature: ______________________________

*IBPSA welcomes contributions to ibpsa***NEWS**. *If you would like to submit an article or other material, please contact Marion Bartholomew on:*

phone/fax: +44-1734-842861

e-mail: 100572.3163@compuserve.com

IBPSA reserves the right to reject papers submitted, and to edit those that are published.

This edition of *ibpsa***NEWS** was designed and produced by David Bartholomew Associates, 16 Nursery Gardens, Purley on Thames, Reading RG8 8AS, UK Phone/fax +44-1734-842861 email 100572.3163@compuserve.com

ibpsa NEWS

VOLUME 8 NUMBER 1 JULY 1996