# DOE-2 USER NEWS PUB-439

*DOE-2: A COMPUTER PROGRAM FOR BUILDING ENERGY SIMULATION*

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## * * * HANDS ON * * *

☞ **Bugged by 2.1C??** To date, 47 bugs in 2.1C have been fixed. If you would like to "trade-in" your old 2.1C tape for our bug-free version, please call Kathy Ellington (415-486-5711) for instructions.

☞ **Ah, PEAR!** A super-fast microcomputer program called PEAR (Program for Energy Analysis of Residences) has been developed by LBL's Energy Analysis Program; it is a simplified computer tool for estimating energy use in new residential buildings. PEAR accesses a large base of DOE-2 runs that was compiled by LBL in support of the "Affordable Housing Through Energy Conservation" project sponsored by the U.S. Department of Energy. Please see the article on page 2.

☞ **It's a Bird! It's a Plane!** — No, it's **SUPERLITE 1.0!** SUPERLITE is a new daylighting program developed by the LBL Windows and Daylighting Group. SUPERLITE finds the daylight illuminance at all points in a room given information such as sky condition, room and window geometry, glazing type, and surface reflectances. SUPERLITE's calculation technique is very detailed; it can handle cases which the daylighting routines in DOE-2.1C cannot. These include light shelves, deep light wells, L-shaped rooms, and rooms with partitions. SUPERLITE calculates illuminance only; it does not simulate lighting controls or calculate thermal loads. However, with some effort, SUPERLITE can be linked to DOE-2 by first running SUPERLITE to get daylight factors for different sky conditions, then reading these factors into DOE-2 using the "functional value" features. This procedure will be discussed in a future issue of the User News.

SUPERLITE 1.0 is available in mainframe and microprocessor versions on diskette, tape, or via BITNET transfer. For information, contact: Michael Kroelinger, Architecture/Environmental Design, Arizona State University, Tempe, AZ 85287 — Phone: (602) 965-5561 or -3216 messages.

The "SUPERLITE 1.0 Evaluation Manual" is available through Tony Ksprzyk, Kinko's Copies, 715 South Forest, Tempe, AZ 85281. Cost is $12.00 + postage; call Kinko's at (602) 894-9588 for postage rates and ordering instructions.

If you would like more general information on SUPERLITE, please request publication DA-205 from Michael Wilde, Windows and Lighting Program, Bldg. 90 — Room 3111, Lawrence Berkeley Laboratory, Berkeley, CA 94720.

## — PEAR —

## A Microcomputer Program for Residential Energy Analysis

Over the past several years, a comprehensive database on the effects of different conservation measures on residential energy consumption has been created at LBL. The single-family portion of the database, which consists of over 12,000 computer simulations using the DOE-2 simulation code, was used to develop voluntary performance guidelines for new single-family residences and mandatory standards for Federal residential buildings. It also serves as the basis for the current revision to the ASHRAE-90.2 standard for energy efficient new residences.

This valuable information has been transformed into a simplified energy analysis tool. PEAR (Program for Energy Analysis of Residences) is a software package designed with user-friendly input and output; it runs on an IBM or IBM-compatible PC. PEAR provides a fast, easy-to-use compilation and extrapolation of the comprehensive DOE-2 database. The current version, which covers five residential building prototypes in over 800 climates, estimates energy and cost savings resulting from typical conservation measures such as ceiling, wall and floor insulation, double glazing, reduced infiltration levels, and higher equipment efficiency. It also allows the user to adjust for optional measures including roof or wall color, movable insulation, whole-house fans, night temperature setback, reflective or heat absorbing glass, thermal mass on external walls, and attached sunspace. PEAR is designed to be used both as a research tool by energy and policy analysts and as a non-technical energy calculation method by architects, home builders, home owners, and others in the building trade.

PEAR offers a simple and reliable way to determine the energy and cost-effectiveness of different conservation options in residential buildings. It allows the user to consider regional differences in climate, building design and materials, energy prices, interest rates, and fuel types.

The database is being expanded so that it can be used to predict the effects of any single building parameter independent of all other parameters. The benefit of properly accounting for such interactions will increase the accuracy and flexibility of PEAR and will permit it to be converted into a design optimization tool. An optimizing capability will allow the user to choose optimum levels of building parameters given any performance criteria (e.g., minimum life-cycle cost, minimum energy consumption, code compliance, etc.).

Two apartment prototypes, which were analyzed in conjunction with a low-rise multi-family buildings research project, are being added to the database. An analysis of the effects of heavy mass construction on building energy use is being extended. From this research effort, a better understanding of the interaction between solar gain and thermal mass including such variables as shading, window area and orientation, ventilation rate, and amount of interior mass will be developed.

Additionally, further analyses of the database are being performed which will enable the user to make modifications for different window shading options, conductance schedules, internal loads, and thermostat settings.

For more information, contact Joe Huang or Ron Ritschard of the Energy Analysis Program, Lawrence Berkeley Laboratory, telephone (415) 486-6328. Please request LBL Report LBL-20355, *PEAR: A Microcomputer Program For Residential Energy Analysis*, (1985), and LBL Pub-610, *PEAR 2.1, A User's Manual*.

# BUGS DISCOVERED IN DOE-2.1C, INTERIM SOLUTIONS AND BUG FIXES

Following is a bug discovered in the 2.1C version of DOE-2. Users are urged to document suspected bugs, and report them to us. We first describe each bug, and give its temporary (no code change) solution, and the date the permanent correction was moved to our 2.1C release files. If you received a tape sent by us after the date given in the bug description, then the bug fix is already on your tape in one of the "mod" files. In any case, before you fix a bug, make sure it has not already been corrected on your DOE-2.1C tape.

Following the bug description is the bug correction in the form of UPDATE modification directives. Bug fixes are independent of each other; they do not interact. Therefore, you can fix only those bugs you consider important. All the bugs for one program element are together; that is, all the corrections to BDL are under the heading "FILE BDL.BUG", then all the corrections to the keyword file, etc. Lines beginning with */ are UPDATE comment lines and can be left out.

All users who received the 2.1C version before April 4, 1986, should read the descriptions of bugs D-29 and D-30, and fix these bugs or avoid them.

Questions or comments should be directed (in writing) to Fred Buhl, Simulation Research Group, 90-3147, Lawrence Berkeley Laboratory, Berkeley, CA 94720.

### Bug D-47

In the weather processor, the user can input his own monthly ground temperatures, or by inputting -999. in columns 1-5 of the ground temperature record, ask the program to calculate ground temperatures using the monthly average air temperature and a soil diffusivity input by the user. The program does not calculate correct ground temperatures for the southern hemisphere - it gives the highest temperatures in the winter, and the lowest in the summer. Interim solution: Input your own ground temperatures.

Date moved to release file: September 18, 1987; fix is on file: wth.bug

### Bug Fix

```
*/
*/ THE GROUND TEMPERATURE CALCULATION IS INCORRECT
*/ IN THE SOUTHERN HEMISPHERE, GIVING HIGHER
*/ TEMPERATURES IN WINTER THAN IN SUMMER.
*/
*I GTEMP.2
*CALL /PACKEC/
*D GTEMP.18
C
C                CORRECT BO FOR THE SOUTHERN HEMISPHERE -
C                ITS SIGN DEPENDS ON THE STATION LATITUDE.
C
      BOP = (TMAX-TMIN)*0.5
      BO  = SIGN(BOP,XLAT)
----+----1----+----2----+----3----+----4----+----5----+----6
```

# IBPSA

## "International Building Performance Simulation Association"

IBPSA is a new professional association for the building simulation community. It came into being officially in January 1987, culminating over three years of meetings and discussions among building professionals. This new organization aims to promote the science of building performance simulation as a means of improving the design, construction, operation, and maintenance of all types of buildings. Organizers include members of the building industry who use building simulation software, researchers who develop this software, and members of governmental agencies concerned with building performance.

The formation of IBPSA is directly related to the need for new directions in building simulation software foreseen by workers in the field as early as 1983. At a DOE-sponsored conference in Leesburg in the Fall of 1983, industrial users of programs such as DOE-2, BLAST and proprietary codes met with program developers and researchers to evaluate the status quo and see what new developments were on the horizon or needed. This was followed by two years of discussion and proposals for new sponsored research to address the needs identified at Leesburg. A major milestone along the way was the DOE/ASHRAE sponsored Building Energy Simulation Conference in Seattle, held in August, 1985. Subsequently, a composite proposal for the Energy Kernel System was formulated by an international group working at Lawrence Berkeley Laboratory. That proposal, which was widely accepted, called for a collaborative effort with ongoing guidance provided by an international association. The first meeting of this association, which later became IBPSA, was held in San Francisco in January 1986. After two more meetings and lots of work in between, IBPSA was incorporated as a non-profit organization in Canada on January 26, 1987. Throughout this process, there has been a growing number of enthusiastic participants, anxious to make IBPSA into a major force in setting future directions in building simulation research and software development.

At its most recent meeting held in Nashville last June, IBPSA embarked on an ambitious program of activities, including plans for a major conference in Vancouver in June, 1989. This conference will bring together practitioners and researchers concerned with building energy analysis programs and other aspects of building simulation. In the meantime, there will be a quarterly newsletter and an annual bibliography of related literature. Other projects set in motion include the development of a long range research priorities list, and the formal elections of a Board of Directors and Officers.

If you are interested in helping guide the future of building performance simulation, perhaps you should consider joining IBPSA. A membership application is contained in this newsletter; for more information, please write: International Building Performance Simulation Association, P.O. Box 282, Orleans, Ontario, CANADA K1C 1S7.