**Building Energy Simulation**

*For Users of EnergyPlus, SPARK, DOE-2, BLAST, GenOpt, Building Design Advisor, ENERGY-10 and their Derivatives*

**What's New?**

**EnergyPlus Beta 3**
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The third of four planned beta test versions of EnergyPlus was released in July. To get a no-cost license for Beta 3 go to


If you already have a license for Beta 1 or 2 you don’t need a new license for Beta 3; you’ll be informed when Beta 3 is ready for downloading.

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**Building Simulation in the Classroom......**
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Educators: We need your help in bringing the next-generation building software to the next generation of engineers and architects. Please read about an exciting new collaboration on p. 9.

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**Efficient Windows Collaborative.................**
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Read their excellent electronic newsletter, *Word on Windows*, at

www.efficientwindows.org/newsletters.html

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**More software to Beta Test .............**
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- **Genopt 1.1**: Beta 2 of Genopt 1.1 is ready; see p. 10.
- **Energy-10**: Version 1.3 (includes WeatherMaker) is available; p. 13.

**What's Inside?**

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16 IBPSA’s Building Simulation 2001
BESTEST (Building Energy Simulation TEST) is a comparative testing procedure for thermal building simulations primarily related to the building envelope. These tests build upon each other and evaluate a range of model effects including thermal mass, direct solar gain windows, window-shading devices, internally generated heat, infiltration, sunspaces, earth coupling, and deadband and setback thermostat control. In addition, a large number of diagnostic tests can be run if the program fails any of the primary tests. The tests start with the basic structure (a “shoebox” shape) which is then manipulated by moving the windows, adding exterior shading, changing the wall constructions, modifying the coupling with the ground, adding sunspaces, etc.

Background

Numerous software programs are available to simulate energy performance in buildings. But these programs often produce widely divergent results — even on the same building. Consequently, architects and engineers have not trusted the programs and have continued to design buildings without focusing on energy use.

BESTEST was created to systematically compare whole-building energy software programs and diagnose the sources of prediction differences. Originally designed to help software developers produce reliable energy software, BESTEST is also used to assure potential software users (architects and engineers) that a particular simulation program gives reasonable results or that a program is appropriate for their particular application.

The BESTEST technique applies a series of carefully specified test case buildings that progress systematically from the extremely simple to the relatively realistic. Output values for the cases—such as annual loads, temperature ranges, and peak loads—are compared and diagnostic logic used to pinpoint the algorithms responsible for prediction differences.

The more realistic cases, although geometrically simple, test the ability of the programs to model effects such as thermal mass, direct solar gain windows, window-shading devices, internally generated heat, infiltration, sunspaces, earth coupling, and deadband and setback thermostat control. The more simplified cases facilitate diagnosis by allowing excitation of certain heat transfer mechanisms.

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1 BESTEST is the result of a collaboration between the International Energy Agency (IEA) and the U. S. National Renewal Energy Laboratory (NREL). Please direct technical questions to Ron Judkoff of NREL (R_Judkoff@nrel.gov).
Field trials of the method were conducted with a number of "reference" programs selected by the IEA researchers to represent the best of the state-of-the-art detailed simulation capability in the US and Europe. These included BLAST, DOE-2, ESP, SERIRES, S3PAS, TASE, TRNSYS, CLIM2000, and DEROB.

Three versions of BESTEST are currently available:

- IEA BESTEST (detailed hourly (or shorter) time-step simulation programs),
- HERS BESTEST (detailed and simplified programs with an emphasis on modeling houses), and
- Florida BESTEST (hot-humid climates).

**EnergyPlus BESTEST Results**

In July the EnergyPlus program (Beta 3) was run by GARD Analytics on the BESTEST cases. The results are shown in the next 11 figures. (The DOE-2 values shown in these figures were obtained by GARD Analytics using the Windows version of DOE-2.1E available from ESTSC, p. 19.)
BESTEST Comparison (Denver, dry/cold)
Low Mass Building Annual Heating
EnergyPlus Beta 3, 7/19/00, Build 16, Anisotropic Sky

BESTEST Comparison (Denver, dry/cold)
Low Mass Building Peak Heating
EnergyPlus Beta 3, 7/19/00, Build 16, Anisotropic Sky
BESTEST Comparison (Denver, dry/cold)

Low Mass Building Peak Cooling

EnergyPlus Beta 3, 7/19/00, Build 16, Anisotropic Sky

BESTEST Comparison (Denver, dry/cold)

High Mass Building Annual Heating

EnergyPlus Beta 3, 7/19/00, Build 16, Anisotropic Sky
BESTEST Comparison (Denver, dry/cold)
High Mass Building Peak Cooling
EnergyPlus Beta 3, 7/19/00, Build 16, Anisotropic Sky

All SERIRES results and TASE Case 930 results disregarded by ASHRAE Standard 140P due to known errors.

BESTEST Comparison (Denver, dry/cold)
Free Floating Maximum Temperature
EnergyPlus Beta 3, 7/19/00, Build 16, Anisotropic Sky

All SERIRES results disregarded by ASHRAE Standard 140P due to known errors.
Calling all Simulation Educators

The U.S. Department of Energy (DOE) is seeking advice from building simulation educators who currently use DOE-2, BLAST or similar programs in the classroom.

We envision a collaboration to plan and develop curricula for teaching building simulation in the future. The curricula would present basic simulation methodologies and abstraction techniques and would be suitable for teaching either as one- or two-semester courses in engineering or architecture schools. All information would be shared on a common web site.

Of particular interest to DOE is extending a basic curriculum to include how to use the soon-to-be released EnergyPlus simulation program in university classrooms.

DOE proposes to facilitate the development of building simulation curricula through a series of conference calls among interested educators. Conference calls will begin in Fall 2000; dates and times will be established to accommodate the majority of educators. These conference calls will discuss the most effective way to develop appropriate documentation for teaching building simulation (and EnergyPlus).

Interested educators should contact Jeff Haberl (JHaberl@esl.tamu.edu) at Texas A&M University. In the email, please include the phrase "EnergyPlus Educator Forum" in the title to speed the assembly of the list of participants.

Any questions, please contact either Dru Crawley (Drury.Crawley@ee.doe.gov) or Jeff Haberl.

We look forward to hearing from you.

Dru Crawley
U.S. Department Of Energy

PC Version of DOE-2.1E from ESTSC

DOE-2.1E (version 107) for Windows is available from the Energy Science and Technology Software Center (ESTSC). Previously, ESTSC licensed only UNIX and VAX versions. This updated version of DOE-2 incorporates bug fixes and new features such as a Cooled Beam HVAC system and polygon input for walls, floors and ceilings. Like previous DOE-2.1E products from ESTSC, this version accepts textual BDL input but does not have a graphical user interface. To order, call Ed Kidd or Walt Kelly at ESTSC (423) 576-2606, or email to estsc@adonis.osti.gov. Cost of DOE-2.1E-WIN (Version 107) is broken down as follows:

- $ 300 U.S. Government, non-profits and educational institutions
- $ 575 U.S. public, Mexico, Canada
- $ 1075 Other Foreign

DOE-2.1E Documentation Update

Corrections to Appendix A (Hourly Report Variables) of the DOE-2.1E Supplement may be downloaded from the SRG web site (http://SimulationResearch.lbl.gov). Click on "Documentation" under DOE-2 in the left-handmenu. You want “Update Package #3.”

DOE-2 Help Desk

Bruce Birdsall - Phone/Fax: (925) 671-6942, M-F 10 a.m. to 3 p.m. PDT.
Contact Bruce if you have a DOE-2 problem or question. If you need to send a fax, please be sure to phone him first. This is a free service, supported by the U. S. Department of Energy.

DOE-2 Training

DOE-2 courses for beginning and advanced users: phone Marlin Addison at (602) 968-2040, or send email to marlin.addison@doe2.com
**U.S. DOE Launches High-Performance Building Project**

The U.S. Secretary of Energy, Bill Richardson, has announced that the Department of Energy (DOE) is creating a Commercial High-Performance Buildings project to increase the energy efficiency of commercial buildings. The effort, a joint partnership between the private sector and DOE, will also focus on improving the utility, comfort, quality and cost-effectiveness of commercial buildings.

"Thirty-two percent of the electricity generated in the United States goes to heat, cool, ventilate and light commercial buildings," said Richardson. "The actions we are taking to decrease building energy use will save businesses money and reduce the impact of energy generation on global climate change and environment."

The project will identify and publicize innovative ‘whole building’ approaches that increase the quality and efficiency of commercial buildings. Architects who subscribe to the whole-building approach consider the structure as a complete system, rather than as a collection of independent components. This can have significant effects on design and construction, resulting, for example, in a smaller, more efficient and less costly heating and cooling system.

The joint venture is part of DOE’s Commercial Whole Buildings Roadmap initiative (www.eren.doe.gov/buildings/technology_roadmaps/), which is bringing together diverse groups involved in the design and construction of commercial buildings as a means of accelerating the adoption of new energy efficient building technologies. DOE and its partners are inviting participation by building industry representatives and allied groups on a national basis. The project is being managed by Steven Winter Associates, Inc., an architectural research and consulting firm.

This article was extracted from the June 2000 issue of ISDesignET, the online version of Interiors & Sources Magazine (www.isdesignet.com/)


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**GenOpt® 1.1: Beta 2 Version**

The Beta 2 version of GenOpt 1.1 has been released. It contains an additional algorithm for multi-dimensional optimization, new algorithms for one-dimensional optimization, and an algorithm for parametric runs in a multi-dimensional space. The new version also allows processing of multiple function values and has an improved graphical user interface.

GenOpt is a multi-parameter optimization program, available free of charge from LBNL. It automatically finds the values of user-selected design parameters that minimize an *objective function*, such as annual energy use, calculated by an external simulation program like DOE-2, BLAST, TRACE, SPARK, TRNSYS, etc. GenOpt can be used with any simulation program that has text-based input and output. It also offers an interface for adding custom optimization algorithms to its library.

VisualSPARK
Available for Beta Testing

VisualSPARK allows you to build models of complex physical processes by connecting calculation objects. It is aimed at the simulation of innovative and/or complex building systems.

The main elements of VisualSPARK are a user interface, a network specification language, an HVAC toolkit containing calculation modules, a solver for solving the set of simultaneous algebraic and differential equations that correspond to the physical problem being simulated, and a results display processor for graphically plotting results. With the network specification language you link the calculation objects into networks that represent a building’s envelope and/or HVAC systems. The solver solves this network for the user-specified time step and run period.

The UNIX version of VisualSPARK runs under the SunOS, Solaris, Linux and HPUNIX operating systems. The PC version of VisualSPARK runs under the Windows 95, 98 and NT operating systems.

There is no charge for the beta version of VisualSPARK; however, a signed beta test license agreement must have been received by the Simulation Research Group at Lawrence Berkeley National Laboratory prior to testing. The agreement and all the instructions may be downloaded from the web address listed above. After the agreement is received, you will be emailed a password. If you would like to get an idea of what the program does before testing it, you can review the SPARK User’s Manual, which can be downloaded from http://SimulationResearch.lbl.gov > SPARK > SPARK User’s Manual.

VisualSPARK was developed by the LBNL Simulation Research Group and Ayres Sowell Associates, with support from the U.S. Department of Energy.

http://SimulationResearch.lbl.gov > SPARK

The Building Energy Simulation User News is published bi-monthly and distributed electronically by the Simulation Research Group at Lawrence Berkeley National Laboratory, with cooperation from the Building Systems Laboratory at the University of Illinois. Direct comments or submissions to Kathy Ellington, MS: 90-3147, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, or email KLEllington@lbl.gov or fax us at (510) 486-4089. Direct BLAST-related inquiries to the Building Systems Laboratory, email support@bso.uiuc.edu or phone (217) 333-3977. © 2000 Regents of the University of California, Lawrence Berkeley National Laboratory. This work was supported by the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technology, State and Community Programs, Office of Building Systems of the U.S. Dept. of Energy, under Contract No. DE-AC03-76SF00098

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The Building Design Advisor (BDA) is a Windows program that addresses the needs of building decision-makers from the initial, schematic phases of building design through the detailed specification of building components and systems. The BDA is built around an object-oriented representation of the building and its context, which is mapped onto the corresponding representations of multiple tools and databases. It then acts as a data manager and process controller, automatically preparing input to simulation tools and integrating their output in ways that support multi-criterion decision making. The latest public release of BDA (version 2.0) is linked to three main applications:

- A Schematic Graphic Editor (SGE), for graphic input of building components and systems,
- DElight, a simplified daylighting simulation tool, and
- the DOE-2.1E building energy simulation program.

The following enhancements have been made to BDA 2.0 (as of 09/15/00):

- Greater flexibility in project development with features such as "Save as..
- Greater user control over object properties with editing of Solution and Story properties, building azimuth, etc.
- User interface enhancements which allow easier navigation of the building model, with less ambiguities.
- Several bug fixes.
- Extended documentation.

Current research and development efforts are focused on the development of links to:

- A new Electric Lighting module with simplified calculations for workplane illuminance due to electric lighting,
- Desktop Radiance, a Windows 95/98/NT version of the Radiance lighting/daylighting simulation and rendering software, and
- Athena, a life-cycle analysis of embodied energy and environmental impact of materials.

With the completion of these development efforts BDA will have links to advanced as well as simplified tools for daylighting and electric lighting, and advanced tools for energy analysis and life-cycle analysis.

The minimum and recommended system requirements to run the BDA software are as follows:

**Minimum**
- Pentium 75
- Windows 95, 98, NT 4.0.
- 16 / 32MB RAM under Windows 95
- 30 MB of larger hard disk space.
- 640x480 or higher screen resolution.

**Recommended**
- Pentium 200 or better.
- Windows 95, 98, NT 4.0.
- 24 / 64MB RAM under Windows NT 4.0.
- 60 MB of larger hard disk space.
- 1024x768 or higher screen resolution.

To learn more about the BDA software and to download a copy of the latest public version, please visit [http://kmp.lbl.gov/BDA](http://kmp.lbl.gov/BDA).

The BDA source code is available for licensing; if interested, please contact Dr. Papamichael at K.Papamichael@lbl.gov.
ENERGY-10, Version 1.3

Version 1.3 of ENERGY-10 is now available; it includes the much-anticipated WeatherMaker function. WeatherMaker allows users to create their own weather files based on information available from nearly 4,000 weather stations throughout the U.S. Revisions to the program itself include some minor fixes, an improved and expanded Help section, and greater clarity in titling and identification of various sections. Contact the Sustainable Buildings Industries Council for more information, or to order your upgrade disc (the cost is $15, which covers production and shipping).

ENERGY-10, written in C++, is a design tool for smaller residential or commercial buildings that are less than 10,000 ft² floor area, or buildings that can be treated as one- or two-zone increments. It performs whole-building energy analysis for 8760 hours/year, including dynamic thermal and daylighting calculations. ENERGY-10 was specifically designed to facilitate the evaluation of energy-efficient building features in the very early stages of the design process.

Input: Only four inputs required to generate two initial generic building descriptions. Virtually everything is defaulted but modifiable. As the design evolves, the user adjusts descriptions using fill-in menus (utility-rate schedules, construction details, materials).

Output: Summary table and 20 graphical outputs available, generally comparing current design with base case. Detailed tabular results also available.

Platform: PC-compatible, Windows 3.1/95/98, Pentium processor with 16 megabytes of RAM is recommended.

New construction in California?? Be sure to read the Blueprint is the newsletter of the California Energy Commission and its Energy Efficiency Division's Efficiency Standards Office. It focuses on California's Title 24 Building Efficiency Standards, which took effect July 1, 1999. Always informative, Blueprint features a question-and-answer column for residential and non-residential building code issues, along with training schedules, new publications, etc. Read the current and past issues at:

http://www.energy.ca.gov/efficiency/blueprint/index.html
From the University of California at Los Angeles - School of the Arts and Architecture

ENERGY DESIGN TOOLS: [http://www.aud.ucla.edu/energy-design-tools/](http://www.aud.ucla.edu/energy-design-tools/)

All the Energy Design Tools are fast, easy to use, and highly graphic. Each has a built-in demonstration. SOLAR-5 also includes a tutorial and prints its own Users Manual. Each program has an INSTALL routine and a READ.ME file explaining how to use it. They run on PC compatible microcomputers with DOS 3.1 or higher including Windows 95/98/NT unless stated otherwise.

### SOLAR-5.7
Displays 3-D plots of hourly energy performance for the whole building or for any of 16 different components. It also plots heat flow into/out of thermal mass, and indoor air temperature, output of the HVAC system, cost of electricity and heating fuel, and the corresponding amount of air pollution. It uses hour-by-hour weather data, and can call RATES in the background to calculate detailed electricity costs. It has many special commands like overlay, post-it, and compare. Also included is RATES, a utility that contains over 170 residential and commercial electric rates. It lets SOLAR-5 show ratepayers a detailed picture of their energy costs. A manual for RATES is included in WordPerfect format.

### TMY CLIMATE DATA
You can convert any of the 239 TMY2 (Typical Meteorological Year 2) data files into a format that will run on Climate Consultant 2.0 and Solar 5.4; two of UCLA’s Energy Design Tools. These sites include cities in all 50 states in the U.S. and some of it’s territories were developed at the Natural Renewable Energy Laboratory.

### SOLAR-2
Plots sunlight penetrating through a window with any combination of rectangular fins and overhangs. Also plots hour-by-hour 3-D suns-eye view ‘movie’ of the building. Prints annual tables of percent of window in full sun, radiation on glass, etc.

### OPAQUE
Draws a detail of wall or roof sections, calculates U-value, Time Lag, and Decrement Factor. It plots temperature drop through the section. Draws 2-D daily and 3-D annual plots of Outdoor and Sol-Air Temperatures, Normal and Total Surface Radiation, and Heat Flow through the envelope. It was originally called SOLAR-3.

### DAYLIT
For any combination of up to four different skylights or windows with fins, overhang, light shelf, reflecting sill. Draws a section of the room, then plots illumination perpendicular to the window. It can also include electric lighting in up to three zones with manual or photocell-control. It also provides 3-D annual plots of illumination at various points in the room, plus total KWHR and thermal loads. It uses the IES Lumen Method of Sidelighting. Prints its own 60 page manual.

### DATALIT
Automatically manages experiments to periodically record light levels in an actual room, or in a model. Displays illumination distribution on a room section drawing.
# Software Available From Lawrence Berkeley National Laboratory

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<th>Downloads</th>
<th>Web Address</th>
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<tr>
<td><strong>BDA (Building Design Advisor)</strong></td>
<td>kmp.lbl.gov/BDA</td>
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<tr>
<td><strong>COMIS</strong> (multi-zone air flow and contaminant transport model)</td>
<td>www-epb.lbl.gov/comis</td>
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<tr>
<td><strong>GenOpt®</strong> (generic optimization program)</td>
<td>SimulationResearch.lbl.gov &gt; GenOpt</td>
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<tr>
<td><strong>RADIANCE</strong> (analysis and visualization of lighting in design)</td>
<td>radsite.lbl.gov/radiance/license.html</td>
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<tr>
<td><strong>Desktop Radiance</strong> (integrates the Radiance Synthe-tic Imaging System with AutoCAD Release 14)</td>
<td>radsite.lbl.gov/deskrad</td>
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<tr>
<td><strong>RESEM (Retrofit Energy Savings Estimation Model)</strong></td>
<td>eetd.lbl.gov/btp/resem.htm</td>
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<tr>
<td><strong>SPARK (Simulation Problem Analysis and Research Kernel)</strong></td>
<td>For Windows, SUN and UNIX operating systems, go to SimulationResearch.lbl.gov &gt; SPARK</td>
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<tr>
<td><strong>SUPERLITE</strong> (calculate illuminance distribution for room geometries)</td>
<td>eetd.lbl.gov/btp/superlite20.html</td>
</tr>
<tr>
<td><strong>THERM</strong> (model two-dimensional heat-transfer effects in building components where thermal bridges are of concern)</td>
<td>windows.lbl.gov/software/therm/therm.html</td>
</tr>
<tr>
<td><strong>WINDOW 4.1</strong> (thermal analysis of window products)</td>
<td>windows.lbl.gov/software/window/ window.html</td>
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<th>Request by Fax from 510.486.4089</th>
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<tr>
<td><strong>RESFEN 3.1</strong> (choose energy-efficient, cost-effective windows for a given residential application)</td>
<td>windows.lbl.gov/software/resfen/resfen.html</td>
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<th>Web Based</th>
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<tr>
<td><strong>Home Energy Saver</strong> (quickly compute home energy use)</td>
<td>hes.lbl.gov</td>
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<th>Purchase</th>
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<tr>
<td><strong>ADELINE 2.0</strong> (day/lighting performance in complex spaces)</td>
<td>radsite.lbl.gov/adeline/HOME.html</td>
</tr>
<tr>
<td><strong>SPARK (Simulation Problem Analysis and Research Kernel)</strong> (build simulations of innovative building envelope and HVAC systems by connecting component models)</td>
<td>For Windows and UNIX operating systems, go to SimulationResearch.lbl.gov &gt; SPARK</td>
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13-15 August 2001
BUILDING SIMULATION
Rio de Janeiro, Brazil

The International Building Performance Simulation Association (IBPSA) aims 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. Any good quality paper related to this mission will be acceptable.

Topics under discussion at this conference will be modeling and simulation of:

- **building physics** including heat, air and moisture flow, heating and cooling loads, electric and day lighting, acoustics, smoke transport ...
- **heating, ventilation and air-conditioning systems** ...
- **energy supply systems** including renewable energy systems, thermal storage systems, district heating and cooling, combined heating and power systems ...
- **human factors** including health, productivity, thermal comfort, visual comfort, acoustical comfort, indoor air quality ...
- **building services** such as lighting systems, sound/vibration control systems, fire/smoke and emergency control systems, cold/hot water supply systems, sewerage systems ...
- **advances and recent developments in modeling and simulation technology** including coupling with CAD, product modeling, software interoperability, user interface issues, validation and calibration techniques ...

All these topics may be addressed
- **at different levels of resolution**
- **for different stages in the building life cycle**

**Timeline**

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<th>Event</th>
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<tr>
<td>Abstracts due</td>
<td>September 15, 2000</td>
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<tr>
<td>Abstract acceptance</td>
<td>November 15, 2000</td>
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<tr>
<td>Manuscript due</td>
<td>February 15, 2001</td>
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<tr>
<td>Papers acceptance</td>
<td>April 15, 2001</td>
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<tr>
<td>Final papers due</td>
<td>June 1, 2001</td>
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<tr>
<td>Pre-registration deadline</td>
<td>June 30, 2001</td>
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For complete details, please go to the Building Simulation 2001 web site:

[HTTP://WWW.LABEEE.UFSC.BR/BS2001/](http://www.labeee.ufsc.br/bs2001/)
If you are interested in Building Simulation 2001, please complete the online registration form at www.labee.ufsc.br/bs2001/. Alternatively, please return this form by fax. The second announcement, which will include detailed information about registration and accommodations, will be mailed using the details provided below.

Surname
First Name
Title
Affiliation
Mailing Address
City with Zip Code
State
Country
Phone Fax
Email

☐ I am interested in Building Simulation 2001 ☐ I plan to attend Building Simulation 2001

☐ I intend to submit an abstract/paper for this theme:

_________________________________________________________________________________

☐ I want to demonstrate software ☐ I want to demonstrate commercial products or services at the exhibition

☐ I will be accompanied by _____ person(s) ☐ I am interested in cultural tours

Fax or send to:
Prof. Roberto Lamberts, Secretariat Building Simulation 2001
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Departamento de Engenharia Civil
Núcleo de Pesquisa em Construção
Campus Universitário - CTC/ECV
88040-900 Florianópolis, SC
BRAZIL

www.labee.ufsc.br/bs2001
Fax: +55 48 331-9770
Email: bs2001@labee.ufsc.br
The Building Loads Analysis and System Thermodynamics (BLAST) system is a comprehensive set of programs for predicting energy consumption and energy system performance and cost in buildings. The BLAST system was developed by the U.S. Army Construction Engineering Research Laboratory (USACERL) under the sponsorship of the Department of the Air Force, Air Force Engineering and Services Center (AFESC), and the Department of the Army, Office of the Chief of Engineers (OCE). After the original release of BLAST in December 1977, the program was extended and improved under the sponsorship of the General Services Administration, Office of Professional Services; BLAST Version 2.0 was released in June 1979. Under the sponsorship of the Department of the Air Force, Aeronautical System Division, and the Department of Energy, Conservation and Solar Energy Office, the program was further extended: BLAST Version 3.0 was completed in September 1980. Since 1983, the BLAST system has been supported and maintained by the Building Systems Laboratory at the University of Illinois at Urbana-Champaign.

BLAST can be used to investigate the energy performance of new or retrofit building design options of almost any type and size. In addition to performing peak load (design day) calculations necessary for mechanical equipment design, BLAST also estimates the annual energy performance of the facility, which is essential for the design of solar and total energy equipment. BLAST also estimates the annual energy performance of the facility, which is essential for the design of solar and total energy (cogeneration) systems and for determining compliance with design energy budgets. Repeated use of BLAST is inexpensive: it can be used to evaluate, modify, and re-evaluate alternate designs on the basis of annual energy consumption and cost.

The BLAST analysis program contains three major subprograms:

- The **Space Load Prediction** subprogram computes hourly space loads in a building based on weather data and user inputs detailing the building construction and operation.
- The **Air Distribution System Simulation** subprogram uses the computed space loads, weather data, and user inputs describing the building air-handling system to calculate hot water, steam, gas, chilled water, and electric demands of the building and air-handling system.
- The **Central Plant Simulation** subprogram uses weather data, results of the air distribution system simulation, and user inputs describing the central plant to simulate boilers, chillers, on-site power generation equipment, and solar energy systems; it computes monthly and annual fuel and electrical power consumption.

**Heat Balance Loads Calculator (HBLC)**

The BLAST graphical interface (HBLC) is a Windows-based interactive program for producing BLAST input files. HBLC allows the user to visualize the building model as it is developed and modify previously created input files. Within HBLC, each story of the building is represented as a floor plan which may contain several separate zones. Numerous other building details may be investigated and accessed through simple mouse operations. On-line help provides valuable on-the-spot assistance that will benefit both new and experienced users. HBLC is an excellent tool which will make the process of developing BLAST input files more intuitive and efficient. You can download a demo version of HBLC (for MS Windows) from the BLAST web site (User manual included!).

**HBLCT/LAST Training Courses**

Experience with the HBLC and the BLAST family of programs has shown that new users can benefit from a session of structured training with the software. Such training helps to define the steps necessary to produce accurate and consistent output from BLAST and its auxiliary programs and gives users a solid foundation from which they can explore the more advanced features of the program with confidence. The Building Systems Laboratory offers such training courses on an as-needed basis typically at our offices in Urbana, Illinois and lasting 2 or 3 days depending on the specific needs of the participants. Call the Building Systems Laboratory for additional information on pricing and availability.

**WINLCCID 98**

LCCID (Life Cycle Cost in Design) has been a standard in the DOD community since its initial release in 1986. LCCID was developed to perform Life Cycle Cost Analyses (LCCA) for the Department of Defense and their contractors, yet it goes far beyond being just a DOD study tool by providing many features of a general purpose life cycle costing tool. With LCCID, it’s easy to carry out “what-if” analyses based on variables such as present and future costs and/or maintenance and repair costs. LCCID allows an analysis based on standard DOD procedures and annually updated escalation factors as well as Energy Conservation Investment Program (ECIP) LCCA. You can download a demo version of WINLCCID 98 (for MS Windows) from the BLAST web site [http://www.bso.uiuc.edu](http://www.bso.uiuc.edu) [see User News Vol. 16, No. 4, p. 5].

To order BLAST-related products, contact the Building Systems Laboratory at the address above.

<table>
<thead>
<tr>
<th>Program Name</th>
<th>Order Number</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC BLAST Package</td>
<td>38486E3-0898</td>
<td>$1500</td>
</tr>
<tr>
<td>WINLCCID 98: executable version for 386/486/Pentium</td>
<td>3LCC3-0898</td>
<td>$295</td>
</tr>
<tr>
<td>WINLCCID 98: update from WINLCCID 97</td>
<td>4LCC3-0898</td>
<td>$195</td>
</tr>
</tbody>
</table>

The last four digits of the catalog number indicate the month and year the item was released or published. This will enable you to see if you have the most recent version. All software will be shipped on 3.5" high density floppy disks unless noted otherwise.

**Visit our web site at http://SimulationResearch.lbl.gov**

**Building Systems Laboratory (BSL)**

30 Mechanical Engineering Building
University of Illinois
1206 West Green Street
Urbana, IL 61801
Telephone: (217) 333-3977 / Fax: 244-6534
support@blast.bso.uiuc.edu / www.bso.uiuc.edu
### ESTSC Versions of DOE-2

<table>
<thead>
<tr>
<th>Program Name</th>
<th>Description</th>
<th>Cost</th>
<th>Windows</th>
<th>SUN-UNIX</th>
<th>VAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOE-2.1E</td>
<td>Source code, executable code and complete current documentation for: DOE-2.1E/Version 103 for Windows and SUN UNIX DOE-2.1E DEC-VAX Operating System: Windows, SUN UNIX, DEC-VAX Support From ESTSC, limited operational support (telephone assistance concerning installation, media or platform questions). Help with modeling available free of charge from Bruce Birdsall at (925) 671-6942 10am to 3pm Pacific time.</td>
<td>Govt/Educ: $300 $455 $500 US, Mexico, Canada: $575 $1365 $1835 Other Foreign: $1075 $2120 $2716</td>
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</table>

### Commercial Versions of DOE-2

<table>
<thead>
<tr>
<th>Program Name</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADM-DOE-2</td>
<td>Use on 386/486 PCs with a math co-processor and 4MB of RAM. The package contains everything needed to run the program: program files, utilities, sample input files, and weather files. More than 300 weather files available. Based on J.J. Hirsch DOE-2.1E. Operating System: DOS, Windows 95 Support Unlimited, except modeling advice. On-line help.</td>
<td>$395 + $15/SH including one set weather data (your choice) and documentation</td>
</tr>
<tr>
<td>Compare-IT</td>
<td>Compare-IT allows DOE-2 professionals to add value to their projects by giving clients “what-if” scenarios using DOE-2. The interface is designed for novice energy analysts and the GUI can be customized for each client's particular interests. Based on J.J. Hirsch DOE-2.1E. Operating System: DOS, Windows (98, 95, NT) Support Documentation available</td>
<td>$500 consultant $2000 client</td>
</tr>
</tbody>
</table>

1. We list third-party DOE-2-related products and services for the convenience of program users, with the understanding that the Simulation Research Group does not have the resources to check the DOE-2 program adaptations and utilities for accuracy or reliability.
### Commercial Versions of DOE-2 (continued)

<table>
<thead>
<tr>
<th>Program Name</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EnergyPro</strong></td>
<td>Performs nonresidential load calculations for HVAC equipment sizing. Electronically exports forms to AutoCad for inclusion on blueprints. On-line help. 344 weather files for the U.S. and Canada. <strong>Operating System:</strong> DOS, Windows (95, NT). <strong>For California Users:</strong> Performs Title 24 compliance calculations, includes state-certified HVAC and DHW Equipment directories. Title 24 tailored lighting calculations. Based on ESTSC DOE-2.1E.</td>
<td><strong>Input:</strong> Graphical, <strong>Output:</strong> Graphs, forms, <strong>Support:</strong> Unlimited support</td>
</tr>
<tr>
<td>(D. Vonderkule) <a href="mailto:demian@energysoft.com">demian@energysoft.com</a></td>
<td><strong>Doe-2 Module:</strong> Non-residential $700&lt;sup&gt;1,2&lt;/sup&gt;, Residential $250&lt;sup&gt;1,2&lt;/sup&gt;, Program Interface $195&lt;sup&gt;3&lt;/sup&gt;, price reflects cash discount, required</td>
<td><strong>$495 w/documentation</strong></td>
</tr>
<tr>
<td>Gabel Dodd/EnergySoft LLC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 Galli Drive #1 Novato, CA 94949-5657</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ph: 415-883-5900, Fx: 883-5970</td>
<td></td>
<td></td>
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<tr>
<td><a href="http://www.energypro.com">www.energypro.com</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EZDOE</strong></td>
<td>Provides full screen, fill-in-the-blank data entry, dynamic error checking, context-sensitive help, mouse support, graphic reports, a 750-page user manual, and extensive weather data. Full implementation of DOE-2 on DOS-based 386 and higher computers. On-line help. Some weather files. Based on J.J. Hirsch DOE-2.1E. <strong>Operating System:</strong> DOS.</td>
<td><strong>Input:</strong> Fill-in-the-blanks, <strong>Output:</strong> Standard DOE reports plus some custom graphic reports, <strong>Support:</strong> Unlimited phone support</td>
</tr>
<tr>
<td>(Bill Smith) <a href="mailto:bsmith@elitesoft.com">bsmith@elitesoft.com</a></td>
<td><strong>$1295 w/documentation</strong></td>
<td></td>
</tr>
<tr>
<td>Elite Software P.O. Box 1194 Bryan, TX 77806</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ph: 409-846-2340 / Fx: 846-4367</td>
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<tr>
<td><a href="http://www.elitesoft.com">www.elitesoft.com</a></td>
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<tr>
<td><strong>FTI/DOE2</strong></td>
<td>FTI/DOE 100% compatible with LBNL version. Source code versions will compile with most F77-compliant compilers. On-line help: 344 weather files for the U.S. and Canada. Based on ESTSC DOE-2.1E. No demo, 30-day trial period. <strong>Operating System:</strong> DOS, Windows (3.x, 95, NT). AIX, ULTRIX, VMS, Linux, NeXTStep,</td>
<td><strong>Input:</strong> Version 2.x: text based, <strong>Version 3.x: graphical</strong>, <strong>Output:</strong> All standard DOE-2 reports, <strong>Support:</strong> 90-days free; then cost is $35 each email per incident, $55 per hour per incident, $125 per hour for engineering advice.</td>
</tr>
<tr>
<td>(Scott Henderson) <a href="mailto:info@finite-tech.com">info@finite-tech.com</a></td>
<td><strong>$995.99 US w/documentation, $1066 Int’l w/documentation, $4999.99 Source code</strong></td>
<td></td>
</tr>
<tr>
<td>Finite Technologies Inc. 3763 Image Drive Anchorage, Alaska 99504</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ph: 907-333-8937, Fx: 333-4482</td>
<td></td>
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<tr>
<td><a href="http://www.finite-tech.com">www.finite-tech.com</a></td>
<td></td>
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</tr>
<tr>
<td><strong>PRC-DOE2</strong></td>
<td>Text-based version of DOE-2 includes documentation. Extensive information on new features, including information on new system types, new commands, new options, etc., added to later versions of 2.1E. <strong>Operating System:</strong> DOS, Windows (95, NT)</td>
<td><strong>Input:</strong> Standard text-based, <strong>Support:</strong> Unlimited support.</td>
</tr>
<tr>
<td>(Paul Reeves) <a href="mailto:Paul.Reeves@DOE2.com">Paul.Reeves@DOE2.com</a></td>
<td><strong>$495 w/documentation</strong></td>
<td></td>
</tr>
<tr>
<td>Partnership for Resource Conservation 140 South 34&lt;sup&gt;th&lt;/sup&gt; Street Boulder, CO 80303</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ph: 303-499-8611, Fx: 554-1370</td>
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<tr>
<td><a href="http://www.streetpartnership.org">www.streetpartnership.org</a></td>
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</table>
### Commercial Versions of DOE-2 (continued)

<table>
<thead>
<tr>
<th>Program Name</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>VisualDOE 2.61</td>
<td>Fast construction of building geometry using pre-defined blocks and/or drawing interface. Import zone shapes from CADD file (dxf format). Point- and-click to define zone properties and HVAC systems. Rotatable 3-D image of model. Custom hourly outputs, custom-ized graphs. On-line help. 400+ US weather files, 12+ for Canada, plus selected locations around the world.</td>
<td>Version 2.61 is $495 w/documentation Source code not available.</td>
</tr>
<tr>
<td>Visualize-IT</td>
<td>Fast construction of building geometry using pre-defined blocks and/or drawing interface. Import zone shapes from CADD file (dxf format). Point- and-click to define zone properties and HVAC systems. Rotatable 3-D image of model. Custom hourly outputs, custom-ized graphs. On-line help. 400+ US weather files, 12+ for Canada, plus selected locations around the world.</td>
<td>Version 2.61 is $495 w/documentation Source code not available.</td>
</tr>
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</table>

### Pre- and Post Processors for DOE-2

<table>
<thead>
<tr>
<th>Program Name</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>DrawBDL</td>
<td>DrawBDL, Version 2.1, is a graphic debugging and drawing tool for DOE-2 building geometry. DrawBDL reads your BDL input and makes a rotateable 3-D drawing of your building with walls, windows, and building shades shown in different colors for easy identification. Operating System: DOS, Windows (3.1, 95, NT) [Works with 2.1E]</td>
<td>$125.00 plus shipping</td>
</tr>
<tr>
<td>PRC-TOOLS</td>
<td>PRC-Tools aid in extracting, analyzing, and formatting DOE-2 output. PRC-Grab automates the process of extracting any number of answers from DOE-2 standard output files. PRC-Hour and PRC-Peak format the hourly output and create Peak-Day and Average-Day load shapes for any number of periods and for any combination of hourly values. Operating System: Windows (95, 98, NT) [Works with 2.1E]</td>
<td>$99.00</td>
</tr>
<tr>
<td>Visualize-IT</td>
<td>Visualize-IT 2.0 is a Windows application designed to help you explore and summarize short-interval time series data, e.g., measurements taken once every 15 minutes over a period of weeks, months or years. Visualize-IT has been developed specifically for electric and gas load data measuring class profiles, market-segments, individual customer sites or specific end uses. Customized DOE2.1e hourly input importer. Visualize-IT is highly useful and informative for looking at DOE2 output and/or comparing to interval metered data. It is equally useful for other time series measurements such as weather, industrial process control, and water quality. Operating System: Windows 95, 98 and NT</td>
<td>$500.00 per set Volume Discounts Available</td>
</tr>
<tr>
<td>Program Name</td>
<td>Description</td>
<td>Cost</td>
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<tr>
<td>------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>DesiCalc GRI-98/0127 (Doug Kosar)</td>
<td><a href="http://www.desicalc.com">www.desicalc.com</a> Order from: GRI Fulfillment Center Ph: 773-399-5414, Fx: 630-406-5995</td>
<td>$295 w/doc +8.75% tax in IL +4.5% tax in VA S/H add $20</td>
</tr>
<tr>
<td></td>
<td>DesiCalc screens desiccant cooling applications. It estimates annual or monthly energy loads, using hour-by-hour simulations, and costs for 11 typical commercial buildings in 236 geographical locations in the US. Includes the latest TMY2 meteorological database [Based on DOE-2.1E] Operating System: Windows 3.1, 95, 98, NT</td>
<td></td>
</tr>
<tr>
<td>Energy Gauge USA  (Danny Parker)</td>
<td>Energy Gauge USA allows the simple calculation and rating of residential building energy use in the US. The simulation calculates a six-zone model of the residence (conditioned zone, attic, crawlspace, basement, garage and sunspace) with the various buffered spaces linked to the interior as appropriate. TMY weather data for the program are available for 239 US locations. [Based on DOE-2.1E] Operating System: Windows 95, 98, NT</td>
<td>Contact Danny Parker at FSEC for availability.</td>
</tr>
<tr>
<td>Home Energy Saver            (Residential DOE-2)</td>
<td>Calculates heating and cooling consumption using DOE-2.1E. The program performs a full annual simulation for a typical weather year (involving 8760 hourly calculations) from 239 locations around the United States in about 10-20 seconds. [Based on DOE-2.1E] Operating System: Web-based</td>
<td>Free! Interactive web site at hes.lbl.gov</td>
</tr>
<tr>
<td>PERFORM 98</td>
<td>Created for the State of California Energy Commission’s, Title 24 energy code. Perform 98 is an interface shell with DOE-2 as the engine. DOS input. Output is only California Title 24 compliant. Technical support available for $100/year from Gabel-Dodd Energy Soft LLC, 100 Galli Drive #1, Novato, CA 94960. Call 415-883-5900 for details. [Based on DOE-2.1E]</td>
<td>$250 including PERFORM 98, Version 100 program and manual. (VISA/MC) Order #P440960006</td>
</tr>
<tr>
<td>RESFEN-3.1</td>
<td>RESFEN calculates the energy and cost implications of a building’s windows compared to insulated walls. The relative energy and cost impacts of two different windows can also be compared against each other. RESFEN calculates the heating and cooling energy use and associated costs, also the peak heating and cooling demand for specific window products. [Based on DOE-2.1E] Operating System: Windows 95, 98, NT</td>
<td>Free! Download from windows.lbl.gov/software/resfen</td>
</tr>
</tbody>
</table>

How to contact us:
Simulation Research Group MS: 90-3147
LAWRENCE BERKELEY NATIONAL LABORATORY Berkeley, CA 94720-0001 U.S.A.
Fax: (510) 486-4089
Email: KLEllington@lbl.gov
Web: http://SimulationResearch.lbl.gov

Run for safety, foolish pedestrians!
**INTERNATIONAL DOE-2 RESOURCE CENTERS**

The people listed here have agreed to be primary contacts for DOE-2 program users in their respective countries. Each resource center has the latest program documentation, all back issues of the User News, and recent LBNL reports pertaining to DOE-2. Users may make arrangements to photocopy the new material for a nominal cost. We hope to establish centers in other countries; please contact us if you want to establish a center in your area.

<table>
<thead>
<tr>
<th>Australasia</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. C. Thomas, SOLARCH, University of New South Wales, Sydney 2052, Australia</td>
</tr>
<tr>
<td>Tel: +61 2 9385 6373 / Fax: +61 2 9385 6735, email: <a href="mailto:PC.Thomas@unsw.edu.au">PC.Thomas@unsw.edu.au</a>  <a href="http://www.fbe.unsw.edu.au/units/solarch">www.fbe.unsw.edu.au/units/solarch</a></td>
</tr>
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<table>
<thead>
<tr>
<th>Australia</th>
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<tbody>
<tr>
<td>Murray Mason, ACADS BSG, 16 High Street, Glen Iris, VIC. 3146, Australia / Tel: +61 885 6586 / Fax: +61 885 5974</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Brazil</th>
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</thead>
<tbody>
<tr>
<td>Prof. Roberto Lamberts, Universidade Federal de Santa Catarina, Campus Universitario-Trindade, Cx. Postal 476, 88049-900 Florianopolis SC, BRASIL</td>
</tr>
<tr>
<td><a href="mailto:lamberts@ecv.ufsc.br">lamberts@ecv.ufsc.br</a> / Tel: +55 48 331 9272 / Fax: +55 48 331 9770</td>
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<table>
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<tr>
<th>Czech Republic</th>
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<tbody>
<tr>
<td>Ing. Zuzana Krtkova, Faculty of Civil Engineering, Dept. of Environmental and Building Services Engineering, Czech Technical University in Prague, Thakurova 7, 166 29 Praha 6, CZECH REPUBLIC  <a href="mailto:krtkova@fsv.cvut.cz">krtkova@fsv.cvut.cz</a>  Tel: +42 2 2435 4327</td>
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<table>
<thead>
<tr>
<th>Egypt</th>
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<tbody>
<tr>
<td>Dr. Ossama A. Abdou, Center for Building Environmental Studies and Testing (C-Best), 15-El-Shibani Street, Almanza, Cairo, Egypt  Tel: +20 2 391 1137 or +20 2 417 4583 / Fax: +20 2 519 4343 / <a href="mailto:oabdou@hotmail.com">oabdou@hotmail.com</a></td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Germany</th>
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<tbody>
<tr>
<td>B. Barath or G. Morgenstern, Ingenieurburo Barath &amp; Wagner GmH, Postfach 20 21 41, D-41552 Kaarst, Germany</td>
</tr>
<tr>
<td>Tel: +49 2 131 7574 9012  G. Morgenstern / Fax: +49 2 131 7574 9029</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hong Kong, China, Taiwan, Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Sam C. M. HUI or K.P. Cheung, Dept of Architecture, University of Hong Kong, Pokfulam Road, Hong Kong (SAR), CHINA  <a href="mailto:cmhui@hku.hk">cmhui@hku.hk</a> or <a href="mailto:kpcheung@hku.hk">kpcheung@hku.hk</a>  <a href="http://arch.hku.hk/research/BEER/DOE-2/DOE-2.htm">http://arch.hku.hk/research/BEER/DOE-2/DOE-2.htm</a></td>
</tr>
<tr>
<td>Tel: +852 2859 2123 Sam Hui / Fax: +852 2559 6484</td>
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<thead>
<tr>
<th>India</th>
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<tbody>
<tr>
<td>Jiten Prajapati or Anil K. Anand, Energy Systems Engineering, IIT-Mumbai, Powai, Mumbai 400 076, INDIA</td>
</tr>
<tr>
<td>Tel: +91 022 578 2545 x7378</td>
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<thead>
<tr>
<th>Italy</th>
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<tbody>
<tr>
<td>Marco Rapella, Via Bonfadini 33, I-23100 Sondrio, ITALY  Tel: +39 031 230373 or 230370  <a href="mailto:cenergia@tin.it">cenergia@tin.it</a></td>
</tr>
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<thead>
<tr>
<th>Korea (Chungnam)</th>
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<tbody>
<tr>
<td>Dr. Jun Tae Kim, Department of Architectural Engineering, Kongju National University, 182 Sinkwan-dong, Kongju, Chungnam 314-701, Republic of Korea  <a href="mailto:jtkim@knu.kongju.ac.kr">jtkim@knu.kongju.ac.kr</a>  Tel: +82 416 850 8653 / Fax +82 416 856 9388</td>
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</tbody>
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<tr>
<th>Korea (Taejon)</th>
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</thead>
<tbody>
<tr>
<td>Dr. Euy-Joon Lee and Jong-Ho Yoon, Passive Solar Research Team, Bldg 2, Room 202, Korea Institute of Energy Research, Daeduk Science Town, 71-2 Jang-Dong, Yusong-Gu, Taejon 305-343, Republic of Korea  Lee: <a href="mailto:ejlee@kier.re.kr">ejlee@kier.re.kr</a>,  Yoon: <a href="mailto:yesru@kier.re.kr">yesru@kier.re.kr</a></td>
</tr>
<tr>
<td>Tel: +82 42 860 3514 / Fax: +82 42 860 3132</td>
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</tbody>
</table>
### INTERNATIONAL DOE-2 RESOURCES CENTERS (continued)

<table>
<thead>
<tr>
<th>Country</th>
<th>Contact Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand</td>
<td>Tan Yune, Architecture Department, The University of Auckland, Private Bag 92019, Auckland, New Zealand <a href="mailto:tanyune@ccu1.auckland.ac.nz">tanyune@ccu1.auckland.ac.nz</a> / Tel: +64 9 373 7999 x5647 / Fax: +64 9 373 7410</td>
</tr>
<tr>
<td>Portugal, Spain, Italy, and Greece</td>
<td>Antonio Rego Teixeira, ITIME, Unidade de Energia, Estrada do Paco do Lumiar, 1699 Lisboa, Portugal <a href="mailto:ant@itime.ineti.pt">ant@itime.ineti.pt</a> / Tel: +35 11 350 2931 / Fax: +35 11 716 4305</td>
</tr>
<tr>
<td>Singapore, Malaysia, Indonesia, Thailand, and the Philippines</td>
<td>WONG Yew Wah (Raymond), Nanyang Technological University, School of Mechanical and Production Engineering, Nanyang Avenue, Singapore 2263, Republic of Singapore, <a href="mailto:mywwong@ntu.edu.sg">mywwong@ntu.edu.sg</a> / Tel: +65 790 5543 / Fax: +65 791 1859</td>
</tr>
<tr>
<td>South Africa</td>
<td>Prof. L. J. Grobler, School of Mechanical and Materials Engineering, University of Potchefstroom, Private Bag X6001, Potchefstroom 2520, South Africa, <a href="mailto:mgiljg@puknet.puk.ac.za">mgiljg@puknet.puk.ac.za</a> / Tel: +27 148 299 1328 / Fax: +27 148 299 1320</td>
</tr>
<tr>
<td>Switzerland</td>
<td>René Meldem, Meldem Energie SA, Avenue de Cour 61, CH-1007 Lausanne, Switzerland Tel: +41 21 401 4090, Fax: +41 21 401 4091, <a href="mailto:meldem.energie@bluewin.ch">meldem.energie@bluewin.ch</a></td>
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### INTERNATIONAL DOE-2 ENERGY CONSULTANTS

<table>
<thead>
<tr>
<th>Country</th>
<th>Contact Details</th>
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<tbody>
<tr>
<td>Australia</td>
<td>P. C. Thomas, Sustainable Building &amp; Energy Consultants, 6/52 Houston Road, Kingsford NSW 2032, Australia. Tel/Fax: +61 2 9662 0205, Mobile +61 417 405 478, <a href="mailto:pc_thomas@iname.com">pc_thomas@iname.com</a></td>
</tr>
<tr>
<td>Belgium</td>
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<td>Joel Neymark, PE</td>
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<td>Kurmit Rockwell, PE</td>
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