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BUILDING ENERGY SIMULATION USER NEWS

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

What's New ?

.....VisualSPARK 1.0.1

Version 1.0.1 of VisualSPARK will be available for free download in January, 2002. Some of the new features in Version 1.0.1 are described on p. 2

.....EnergyPlus

You may download EnergyPlus (version 1.0) by visiting our web site (http://SimulationResearch.lbl.gov) and clicking on "EnergyPlus 1.0" in the left menu. Version 1.0.1 is scheduled for release in January 2002. It will have many new features, including window blinds, system auto-sizing, air-to-air heat pump, zone multipliers and improved ground heat transfer.

.....New! 1,000-Zone DOE-2

DOE-2.1E modifications that allow users to model up to 1,000 zones have been sent to the Energy Science and Technology Software Center. Contact **Ed Kidd** or **Walt Kelly**.

NCI Information Systems, Inc.
ESTSC
P.O. Box 1020
Oak Ridge, TN 37831
estsc@adonis.osti.gov

Also, the DOE-2.1E *BDL Summary* has been updated to reflect the new limits on zones and other components. Download Update #4 from our web site. Details are on p. 6.

What's Inside ?

In January 2002, a new version, VisualSPARK 1.0.1, will be available free of charge from Lawrence Berkeley National Laboratory.

VisualSPARK allows you to build customized models of complex physical processes by connecting calculation objects. It is aimed at the simulation of innovative and/or complex building systems that are beyond the scope of programs like DOE-2 and EnergyPlus.

The main elements of VisualSPARK are a **user interface**, a **network specification language**, a **solver** for solving simultaneous algebraic and differential equations, and a **results processor**. With the network specification language you create equation-based calculation objects, and link the objects into networks that represent a building's envelope or HVAC components or systems. The solver solves this network for user-specified input parameters. With the results processor you graphically display the results of the calculation. VisualSPARK runs under the Windows 95/98/NT/2000, SunOS, Solaris and Linux operating systems.

The 1.0.1 version includes the following improvements:

Changes to the Graphical User Interface

- Version number now appears in all window title bars.
- Balloon messages have been added to the Component Preference Editor.
- Layout of the Component Preference Editor has been changed to a more logical format with parts enabled only when they are allowable.
- Multiple trace files are now allowed, one for each trace type.
- Time units have been added to the X-axis title on graphs.
- Multiple units (e.g. "[W, deg C]") have been added to Y-axis titles on graphs.
- Graph lines are now thicker to improve visibility.
- On graphs, curves that are mapped to the Y2 axis are grouped after curves mapped to the Y1 axis are in the legend.
- Yellow curve color has been changed to gold for visibility.
- The run.log file now pops up in addition to the error.log file if there is a run-time problem while running the solver.
- New examples have been added to the tutorial.
- The class directory name for the current project has been changed from "." to ". (project)".

Changes to Documentation

- The separate Windows and Unix *Installation and Usage Guides* have been combined into a single document called the *VisualSPARK 1.0.1 Users Guide*.
- The *Users Guide* now contains an extended tutorial that shows step-by-step how to set up a SPARK model of an air-conditioned room with a PI temperature controller.

Changes to Parser

- The LINK statement can now create a variable without specifying any connections.
- The PORT statement has a new keyword of the form LIKE=anotherPortName. This copies the properties (including the subports) of the port named 'anotherPortName', to the port currently being defined.

Changes to Setup

- The format of the problem.cpp file generated by setup has been modified to support the runtime loading scheme. See "Changes to Solver" for more details.

Continued on page 3

New Version, VisualSPARK 1.0.1 – *Continued*

Changes to Solver

- A runtime loading scheme has been added to solver in order to load the problem description contained in the problem.cpp file at runtime, during startup, as opposed to during the compilation step. This overcomes a compiler limitation that was encountered with large SPARK problems and also provides a faster way of loading problems during the problem testing phase.
- The scaling scheme was modified to compute the weighted Euclidean norm of the residual function that is displayed to the *cout* stream in the detailed diagnostic mode (i.e., when DiagnosticLevel (1 ()) or DiagnosticLevel (3 ()) is specified in the problem.run file). The scale is now the absolute value of the break variable instead of the arithmetic mean of the value of the break variable and of the value returned by the inverse associated with the break variable. Thus, the residual norm is no longer limited to a maximum value of 2. This new scaling scheme also improves the line-search backtracking step control. The time units of the Clock and DT links are now overridden with the corresponding unit strings specified in the problem run file. This allows the correct units to be displayed in the header portion of the output, trace and snapshot files.
- In the computation of the Secant method (based on the Broyden's update formula), fixed a bug that was returning a constant positive value for any negative partial derivative.
- Input files are now checked at runtime to make sure that the time stamps for the input values are specified in increasing order.
- The SPARK library functions defined in the file *spark.h* are now declared as part of the SPARK namespace (still in the same header file). This is to avoid potential name collision with user-defined functions in the atomic classes. The atomic classes defined in the globalclass directory and in the hvactk/class directory have been modified accordingly by adding namespace scope resolution before the function names (e.g., "::IsInitialTime()" is now "SPARK::IsInitialTime()").

If you would like to get an idea of what the program does before you download it, you can review the *SPARK Reference Manual* and the *VisualSPARK Users Guide*, which can also be downloaded from the VisualSPARK site. To obtain a free copy of the program, go to
http://SimulationResearch.lbl.gov > VisualSPARK

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

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You are invited to test **DoeRayMe**, a new DOE-2.1E screening tool application currently being developed by Jason Glazer, P. E., of GARD Analytics, Inc. **DoeRayMe** is a simple and flexible interface that uses a specially developed DOE-2 input file (template) that contains special codes describing the parameters available to be changed in the user interface. This allows new screening tools to be developed by any DOE-2 user. Please visit the **DoeRayMe** web site at http://www.gard.com/DoeRayMe.

EnergyPlus Version 1.0.0

To download a free copy of the program go to

http://www.eren.doe.gov/buildings/energy_tools/energyplus

EnergyPlus Training Teleconference

January 7-9, 2002, 10am to 1pm , Chicago time (1600-1900 GMT)

Join us for the first EnergyPlus training event. EnergyPlus includes many innovative simulation capabilities including time steps of less than one hour and modular system simulation modules that are integrated with a heat balance-based zone simulation. With the many new features available in EnergyPlus, even those who have used other energy simulation software will benefit from these training sessions.

This informal introduction to EnergyPlus will provide an overview of EnergyPlus input requirements and help you to use the program more effectively. The format will be a teleconference supported with presentation files, EnergyPlus documentation files and example input files. Participants will receive the files via e-mail prior to the teleconference and will view the files on their own computers as guided by the instructor. Time for questions and answers will be provided for each topic.

The EnergyPlus Training in January will be a voice-only telephone conference call requiring no special hardware or software other than a telephone, Adobe Acrobat Reader (4.0 or later), a text file editor, and a spreadsheet program (to view csv files).

Early registration fees are $300 for all three days or $110 for each three- hour session, through December 30.

Join the EnergyPlus User Group

The developers of EnergyPlus have formed a support group in order to foster discussion and maintain an archive of information for program Users. We invite questions about program usage and suggestions for improvement to the code. This group is not meant to replace the primary support at EnergyPlus-Support@GARD.com.

EnergyPlus is being developed by the University of Illinois, CERL, and Lawrence Berkeley National Laboratory, with the assistance of the Florida Solar Energy Center, GARD Analytics, the University of Wisconsin, Oklahoma State University and others.

Join the BLDG-SIM Mailing List

BLDG-SIM is a mailing list for users of building energy simulation programs like EnergyPlus, DOE-2, Trace-600, HAP, BLAST, ESP, SERIRES, TRNSYS, TASE, ENERGY-10 and others. Because building simulation professionals are located worldwide, the BLDG-SIM list is an attempt to foster the development of a community of those users. Users of all levels of expertise are welcome and are encouraged to share their questions and insights about these programs. To subscribe, send a blank email message to BLDG-SIM-SUBSCRIBE@GARD.COM

The web page for BLDG-SIM is http://www.gard.com/bldg-sim.htm

Jason Glazer, P.E., Of GARD Analytics, Inc. Is the list administrator (jglazer@gard.com).

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 (KLEllington@lbl.gov). Direct BLAST-related inquiries to the Building Systems Laboratory (support@blast.bso.uiuc.edu).
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ENERGY-10, Version 1.3 with WeatherMaker

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 ft^2 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 MB of RAM is recommended.

Douglas K. Schroeder
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Washington, DC 20004

Tel: 202.628.7400 ext 210
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www.sbicouncil.org

Sustainable Buildings Industry Council (SBIC)

PC Version of DOE-2.1E from ESTSC

New! DOE-2.1E (1000-zone version). Call ESTSC for availability.

DOE-2.1E (version 110) for Windows is an updated version of DOE-2. Cost is as follows:

$ 300 U.S. Government, non-profit Educational
$ 575 U.S., Mexico, Canada
$ 1075 Other Foreign

DOE-2 Documentation on a CD from ESTSC - Cost US$100

What is included on the CD?

- DOE-2 Reference Manual (Part 1)
- DOE-2 Reference Manual (Part 2)
- DOE-2 Supplement to the Reference Manual (2.1E)
- DOE-2 BDL Summary (2.1E)
- DOE-2 Engineers Manual (2.1A)

Order Software and ESTSC Documentation

Ed Kidd
NCI Information Systems, Inc.
Energy Science and Technology Software Center
P.O. Box 1020
Oak Ridge, TN 37831

Phone: 865/576-1037
Fax: 865/576-6436
Email: estsc@adonis.osti.gov

Free DOE-2 Documentation

- DOE-2 Basics (2.1E)
- Update Package #1:
  DOE-2.1E Basics, the Supplement and BDL Summary
- Update Package #2: (Version 107, DOE-2.1E)
  BDL Summary and Supplement.
- Update Package #3:
  Appendix A of the Supplement.
- Update Package #4: (1000-zone DOE-2.1E)
  BDL Summary.

DOE-2 Basics Manual and Update Packages 1, 2, 3 and 4, not included on the ESTSC CD, consist of scanned pdf files and may be downloaded from our web site. You may also request the same information on a CD by sending email to klellington@lbl.gov.

The files need to be printed and pages inserted into your existing DOE-2 manuals.

Note that Update Packages are **not** cumulative and each one contains different information. You have to download all four packages to update the DOE-2 documentation completely.

Purchase DOE-2 Documentation

DOE-2 Sample Run Book (2.1E) -- The Sample Run book is the only remaining DOE-2 manual not available electronically. It must be purchased separately from NTIS; information is at http://SimulationResearch.lbl.gov > DOE-2 > Documentation

DOE-2 Help Desk

Contact the Simulation Research Group with your questions (email preferred) email: klellington@lbl.gov, Phone: (510) 486-5711, Fax: (510) 486-4089

DOE-2 Training	Private or group DOE-2 courses for beginning and advanced users: Contact Marlin Addison at (602) 968-2040, or send email to marlin.addison@doe2.com

Building Design Advisor 2.0

Decision making through the integrated use of multiple simulation tools and databases

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. Version 3.0 of the BDA is now available for Beta testing and includes links to three main simulation tools for daylighting, electric lighting and energy analyses:

- **DCM**, a simplified daylighting simulation tool,
- **ECM**, a simplified electric lighting simulation tool, and
- the **DOE-2.1E** building energy simulation program.

ECM, the **new electric lighting simulation tool** in BDA 3.0 beta, is integrated through BDA with DOE-2. BDA's Schematic Graphic Editor allows placement of electric lighting luminaires and specification of reference points for daylight-based electric lighting controls. Moreover, BDA now has the capability of **running DOE-2 parametrically** to generate a plot that shows the relationship between effective aperture and energy requirements. BDA 3.0 beta provides the added functionality of working with either **English units or Metric units**.

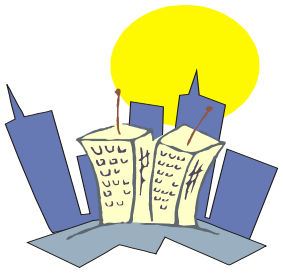
Current research and development efforts are focused on the development of links to **Desktop Radiance**, a Windows 95/98/NT version of the **Radiance** lighting/daylighting simulation and rendering software.

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

Minimum	**Recommended**
Pentium 75	Pentium 200 or better.
Windows 95, 98, NT 4.0.	Windows 95, 98, NT 4.0.
16 / 32MB RAM under Windows 95	24 / 64MB RAM under Windows NT 4.0.
30 MB of larger hard disk space.	60 MB of larger hard disk space.
640x480 or higher screen resolution.	1024x768 or higher screen resolution.

The BDA source code is available for licensing; if interested, please contact Dr. Papamichael at K_Papamichael@lbl.gov.
To learn more about the BDA software and to download a copy of the latest public version (BDA 2.0), please visit http://gaia.lbl.gov/BDA

For Beta Testing of BDA 3.0, please contact Vineeta Pal at VPal@lbl.gov.



Recent Reports

This report is available as a PDF document from http://www.eren.doe.gov/buildings/energy_tools/enegyplus/energyplus_bibliography.html

Modeling a Radiant Slab Coupled to a Cooling Tower using the New National Energy Analysis Program

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Introduction

What if? When one considers all of the questions that one might ask during the design of any building, product, technology, etc., the most intriguing questions might be the ones that begin with “what if”. Questions posed in such a way tend to be less from a practical standpoint and more from a visionary standpoint. In many cases, even when the thought posed in the “what if” question cannot be satisfied, the end result of asking such a question may be a better solution than if one had simply contemplated would could be done. In the design of a building, many “what if” questions might be posed by either the architect or the engineers associated with the project. Unfortunately, because a building tends to be a major investment, there is a natural tendency to be cautious and perhaps not push the limits of what is possible. Yet, if design solutions can be investigated without first going through the expensive building process, the number of “what if” questions might increase and the result might be improvements in design as well as energy efficiency of buildings. This is where thermal simulations can play a vital role in the design process. When appropriate models exist, architects and engineers can explore a wide variety of options that might improve the efficiency of buildings in the design phase before they are built. Simulation is an inexpensive means for exploring a plethora of different design options and HVAC systems.

Unfortunately, models do not always exists and even when they do exist they may not accurately account for the complex interactions that are encountered within a building. This has been a particular hindrance to radiant systems. Forced air conventional systems have dominated the American HVAC landscape for quite some time. Air-based systems are relatively easy to control, understand, and model, and this may partially explain their popularity with the general public. Radiant systems are less easily controlled and understood, and the models of radiant systems have not been able to achieve the same accuracy and flexibility as models for conventional systems.

With the release of the new national energy analysis program (EnergyPlus), this has changed. For the first time, a major, publicly available simulation program has an integrated radiant system model. Now, architects and engineers can ask the question “what if we install a radiant system in this building” and be able to come up with an answer as to whether that might improve the energy efficiency of the building. This paper endeavors to demonstrate that the new program is also a good tool for asking further “what if” questions such as “what if a floor slab radiant system is coupled to a cooling tower to use ‘free-cooling’ and the thermal mass of the floor slab is used to help the space coast through the day?” Moreover, “what if the building is in a less than ideal climate (one with relatively high humidity levels)?”

Cooling Frontiers Symposium, Arizona State University, Tempe, Arizona, 4-7 October 2001

Software Available from Lawrence Berkeley National Laboratory

Free Downloads

BDA 2.0 (Building Design Advisor) *A beta version of 3.0 is also available from vpal@lbl.gov*	gaia.lbl.gov/bda/index.html
COMIS (multi-zone air flow and contaminant transport model)	www-epb.lbl.gov/comis
***EnergyPlus* 1.0** (new-generation whole-building energy analysis program, based on BLAST and DOE-2)	SimulationResearch.lbl.gov > EnergyPlus
***GenOpt*®1.1** (generic optimization program)	SimulationResearch.lbl.gov > GenOpt
RADIANCE (analysis and visualization of lighting in design) ***Desktop Radiance*** (integrates the Radiance Synthetic Imaging System with AutoCAD Release 14)	radsite.lbl.gov/radiance/ radsite.lbl.gov/deskrad/
RESEM (Retrofit Energy Savings Estimation Model) (calculates long-term energy savings directly from actual utility data)	eetd.lbl.gov/btp/resem.htm
SUPERLITE (calculates illuminance distribution for complex room geometries)	eetd.lbl.gov/btp/superlite20.html
THERM 2.1a (model two-dimensional heat-transfer effects in building components where thermal bridges are of concern)	windows.lbl.gov/software/therm/therm.html
VisualSPARK 1.0.1 (Simulation Problem Analysis and Research Kernel) (build simulations of innovative building envelope and HVAC systems by connecting component models)	For Windows, SUN, Linux, go to SimulationResearch.lbl.gov > SPARK
WINDOW 5 Beta (thermal analysis of window products)	windows.lbl.gov/software/window/window.html

Free Software / Request by Fax from 510.486.4089

RESFEN 3.1 (choose energy-efficient, cost-effective windows for a given residential application)	windows.lbl.gov/software/resfen/resfen.html

Web Based

Home Energy Saver (quickly compute home energy use)	hes.lbl.gov 
ADELINE 2.0 (daylighting performance in complex spaces)	radsite.lbl.gov/adeline/

BLAST*news*

www.bso.uiuc.edu

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The **Building Loads Analysis and System Thermodynamics (BLAST** program predicts energy consumption, energy system performance and cost for new or existing (pre-retrofit) buildings.

BLAST contains three major sub-programs:

- **Space Load Prediction** computes hourly space loads in a building based on weather data and user inputs detailing the building construction and operation.
- **Air Distribution System Simulation** uses the computed space loads, weather data, and user inputs.
- **Central Plant Simulation** 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. You can download a demo version of HBLC (for MS Windows) from the BLAST web site (User manual included).

HBLC/BLAST 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. The Building Systems Laboratory offers such training courses on an as needed basis typically at our offices in Urbana, Illinois.

WINLCCID 98
LCCID (Life Cycle Cost in Design) was developed to perform Life Cycle Cost Analyses (LCCA) for the Department of Defense and their contractors.

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

Program Name	Order Number	Price
PC BLAST Includes: BLAST, HBLC, BTEXT, WIFE, CHILLER, Report Writer, Report Writer File Generator, Comfort Report program, Weather File Reporting Program, Control Profile Macros for Lotus or Symphony, and the Design Week Program. The package is on a single CD-ROM and includes soft copies of the BLAST Manual, 65 technical articles and theses related to BLAST, nearly 400 processed weather files with a browsing engine, and complete source code for BLAST, HBLC, etc. Requires an IBM PC 486/Pentium II or compatible running MS Windows 95/98/NT.	3B486E3-0898	$1500
PC BLAST Package Upgrade from level 295+	4B486E3-0898	$450
WINLCCID 98: executable version for 386/486/Pentium	3LCC3-0898	$295
WINLCCID 98: update from WINLCCID 97	4LCC3-0898	$195

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.

Index to the User News

Volume 1, Number 1 (August 1980) through Volume 22, Number 6 (Nov/Dec 2001)

The index lists User News volumes, issues, and page numbers as follows: title of the article, program version that was current when the article appeared, volume number, issue number, and page number. Current and recent issues of the newsletter are available as PDF files on the Simulation Research Group web site at http://SimulationResearch.lbl.gov > Newsletter. All back issues are available free of charge; email requests to klellington@lbl.gov.

New in *GenOpt* 1.1 are an additional algorithm for multi-dimensional optimization, algorithms for one-dimensional optimization, and an algorithm for parametric runs in a multi-dimensional space. The new version 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 a *cost function*, such as annual energy use, calculated by an external simulation program like EnergyPlus, SPARK, DOE-2, BLAST, TRACE, 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.**

***GenOpt* 1.1 (with user manual) may be downloaded free of charge from**

http://SimulationResearch.lbl.gov > GenOpt