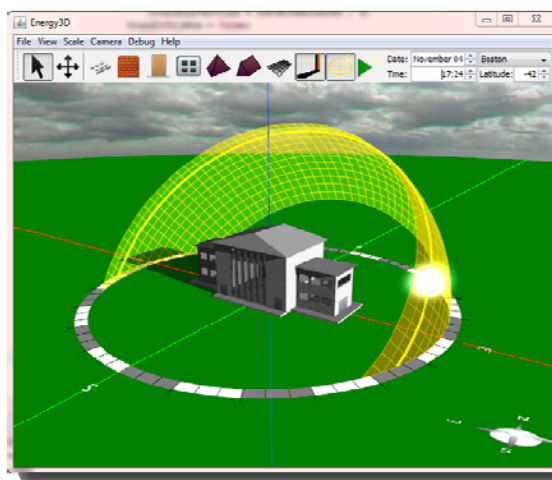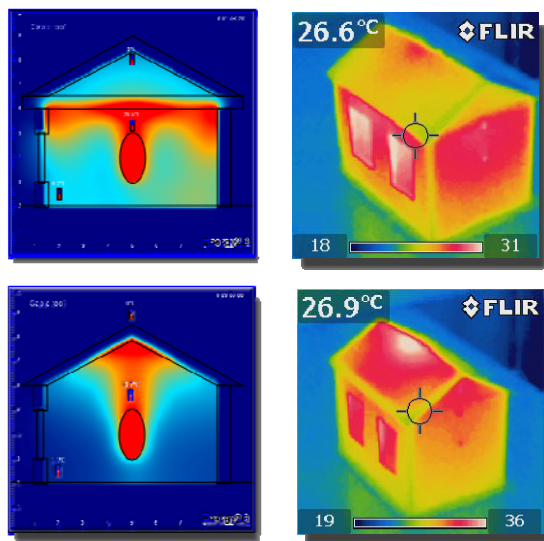# ENERGY2D & ENERGY3D
energy.concord.org

Created by Drs. Saeid Nourian and Charles Xie (qxie@concord.org)

Known as the "fifth fuel," energy efficiency is one of the largest and fastest growing clean energy sectors. With residential and commercial energy consumption accounting for nearly 40% of the total energy usage in the U.S., green building technologies hold a crucial key to a sustainable future. In the wake of the worst environmental disaster in the nation's history caused by an oil spill, the need for an educated energy-aware public has never been greater.

Energy2D and Energy3D are a suite of free, open-source software tools that are being developed to support and promote science and engineering education in preparation for this Grand Energy Challenge. The future lies in the hands of next generation scientists and engineers whom we must cultivate now.

A house under a heliodon shown in Energy3D.

Energy flow simulations using Energy2D, in comparison with infrared imaging results.

We're telling America's scientists and engineers that if they assemble teams of the best minds in their fields, and focus on the hardest problems in clean energy, we'll fund the Apollo projects of our time.

—President Obama, State of the Union Speech, 2011

Interactive Heat Transfer Simulations

Visualizing heat and temperature

Looking for a tool to teach heat transfer in your science classes? Look no further.

Energy2D is the only tool you need to teach basic concepts such as thermal equilibrium, heat storage, conduction, convection, and radiation. Energy2D simulations bring the dynamic processes of heat transfer onto the computer screen and enable your students to experiment with them in real time. Over 30 sample simulations are ready for you to use.


Creating your own online energy simulations

Energy2D is a powerful application that can be used to design and run heat transfer simulations. The simulations you created can be placed anywhere on the Internet—your home pages, wikis, or blogs. Any existing simulations can be easily adopted and modified for your own use.

Exploring the depth of science

Energy2D is based on computational fluid dynamics. With its computational power, your students can investigate many interesting phenomena in fluid mechanics and heat transfer using the tool.
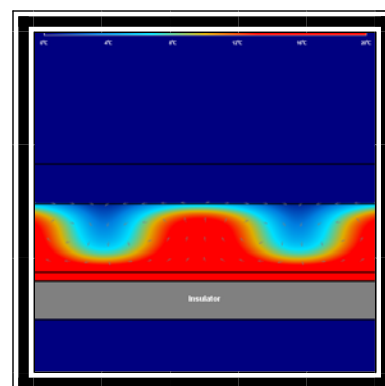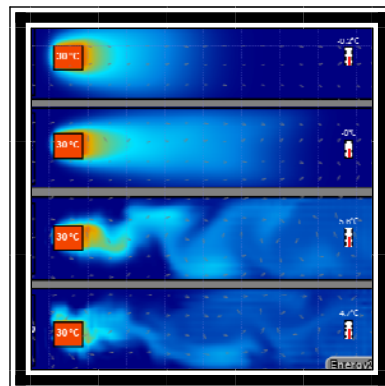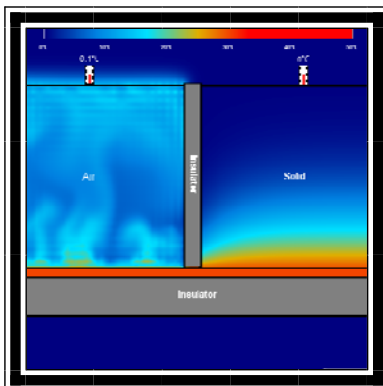

Computer simulations provide opportunities for students to explore, observe, discover, and learn.

Building Your Model Houses

Energy3D: Design, Print, Cut, and Assemble Your Model Houses

Want to have your students design and build their own houses and learn about engineering design and energy efficiency? Energy3D allows users to design a house in a What-You-See-Is-What-You-Get style in 3D just like Google's SketchUp and then evaluate its environmental friendliness.

After you have designed a house, the Blueprint Wizard of Energy3D automatically deconstructs it into 2D pieces and arranges the pieces on paper for printing. They can then be cut out directly or used as guides for a larger-scale building with other materials such as cardstock or foam board. The entire deconstruction process is animated so that the user has an intuitive understanding of the relationship between the 3D structure of the house and the 2D pieces in the blueprint.
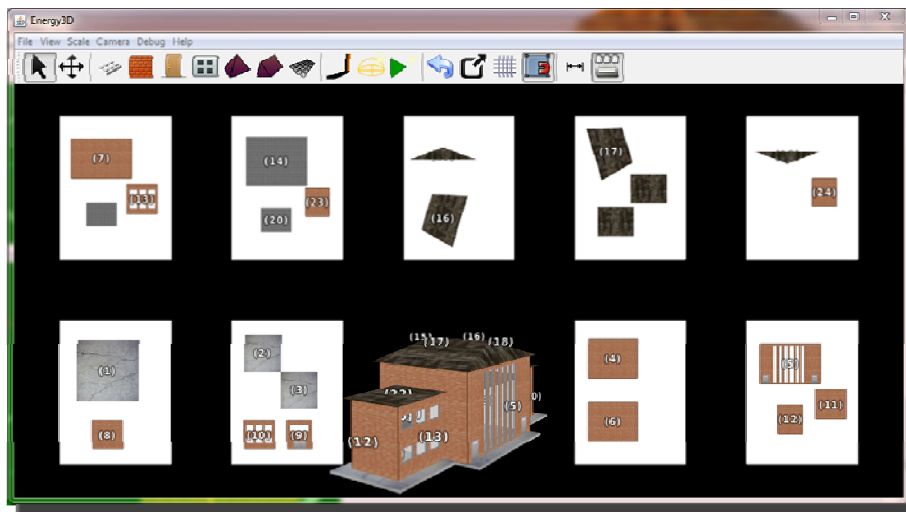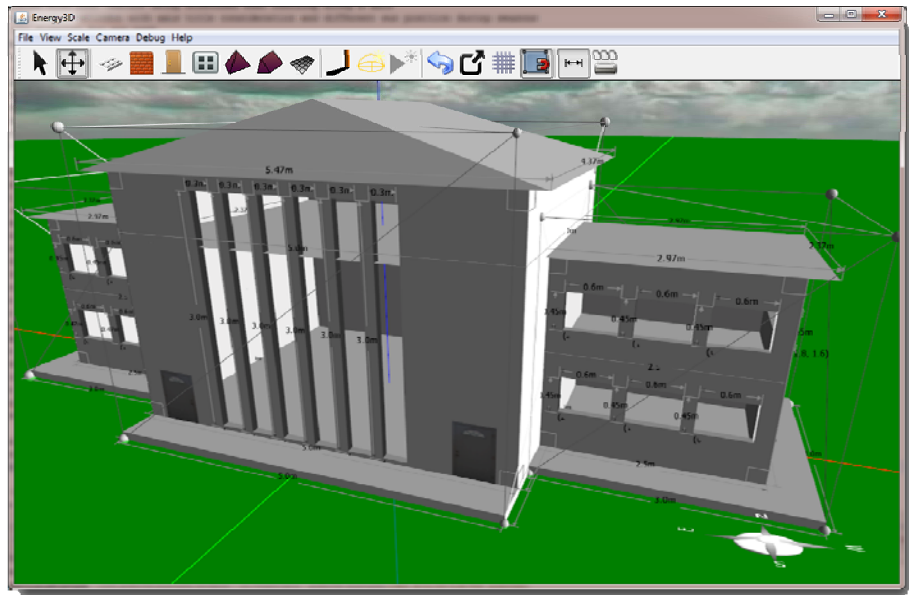
Energy3D has a heliodon that can be used to simulate the solar path at different times or in different seasons at different locations on the earth (see the first image on the cover page).

The Blueprint Wizard of Energy3D deconstructs your house into 2D pieces and automatically lays them out on paper.

Energy3D brings modern engineering design methodology to the classroom.
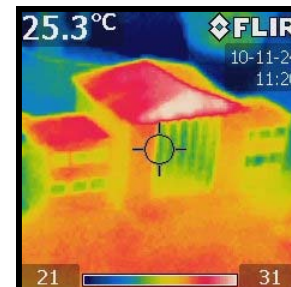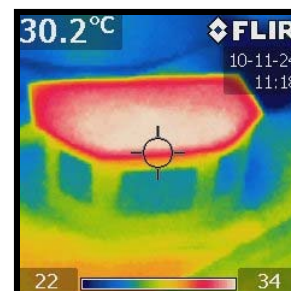
21ˢᵗ Century Engineering Education

Design...
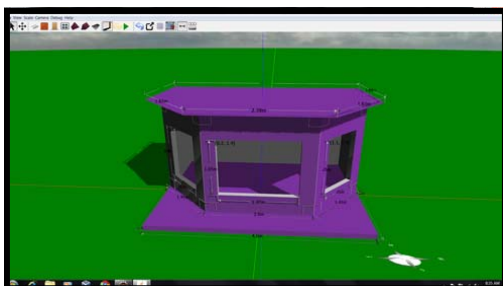
Build...

Test...

K-12 engineering doesn't need to be an unattractive, irrelevant, and low-tech subject. This project is, in part, an ongoing effort to enhance engineering education in K-12 classrooms through extensive use of technology. The project will engage students in designing and building a scale model house and improve its energy efficiency. The temperature distribution and energy flow in the scale model house under various weather conditions can be visualized and analyzed by using fast-response sensors and infrared cameras. Advanced simulation software such as Energy2D and Energy3D will be used to connect science and engineering seamlessly and support both scientific inquiry and engineering design. The use of these cutting-edge tools in the classroom promises to improve 21ˢᵗ century engineering education.

More at
energy.concord.org

System Requirements

Operating Systems	Windows 2000, Windows XP, Windows Vista, Windows 7, Mac OS X 10.4+, Linux
Memory	At least 128 MB
Required Software	Java 5.0+ (Download from http://java.com)