AUTODESK UNIVERSITY 2013

# Performance-Based Sustainable Design Thinking Through Autodesk BPA Education

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**ED3609**

Reducing energy use and carbon emissions from buildings is essential for solving the global climate crisis. Although the earth's atmosphere just exceeded the critical threshold of 400 ppm of carbon in the atmosphere, many of today's architects and engineers are not equipped to tackle this problem with sound building science and useful energy analysis. This is true for both graduating students and practicing professionals. In response to this need, the Autodesk education team, sustainability team, and product teams are working together to deliver a suite of educational programs. Hear from the people creating these programs and the people using them, and learn how they can help you, your classroom, and your firm.

## Learning Objectives

At the end of this class, you will be able to:

- Explain the importance of building science and building performance analysis
- Describe how the tools across Autodesk's portfolio of building design software can help reduce energy use
- Identify an educational program that is right for them, and that they can participate in after Autodesk University
- Describe Autodesk's strategic direction for software tools and education related to building performance analysis

## About the Speaker

***Stephanie Egger*** – *stephanie.egger@autodesk.com*

*Stephanie Egger is the Building Science Education Specialist on the Autodesk Sustainable Design team. She manages the Building Performance Analysis Certificate in addition to the new BPA Professional Credits program. In her role at Autodesk she bridges the gap between software documentation and fundamental building physics knowledge. She is also a recent graduate of the University of Southern California's Master of Building Science Program.*

***Adam Menter***

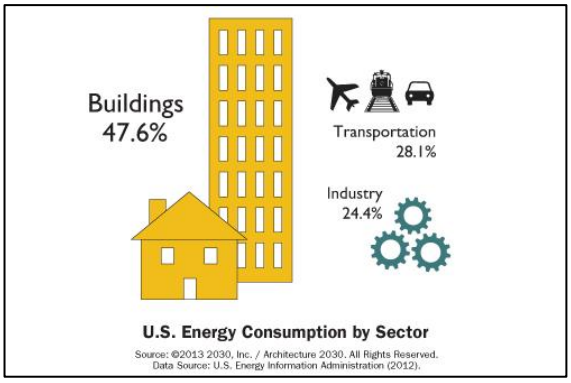
*Adam supports Autodesk's sustainable design program on projects related to product development, strategy, and education. For the past year or so he's focused on education for building performance analysis and created the Autodesk Building Performance Analysis Certificate Program. The BPA*

*Certificate is a free, online self-paced educational program, for students, educators and professionals, that will help improve your knowledge of building science fundamentals and Autodesk building performance analysis tools.(Learn more: http://sustainabilityworkshop.autodesk.com/bpac)He has worked as a design strategist at Jump Associates and holds both a mechanical engineering degree and an MBA from Vanderbilt University. He is a LEED accredited professional and a leader of the San Francisco Net Impact chapter.*

*This handout has been adapted from a paper the speaker presented at the 2013 Building Enclosure Sustainability Symposium (BESS) Sustainable Buildings Conference.*

## Need for Building Science Education & Building Performance Analysis

In the building science community, it is a well-known fact that buildings account for over 40% of energy consumption in the US. This attention grabbing fact often acts as a call to action for the building industry to reduce the energy consumption of buildings. Coupled with this plea are initiatives, legislation, and regulations like Architecture 2030, California Energy Commission's Title 24, and the US Green Building Council's LEED building rating system. The reduction of building energy consumption is quickly maturing from a want to a need. The problem is that many designers and engineers do not have the skills and experience to fill that need.




A recent survey of 448 American Institute of Architects (AIA) members found that 56 percent of the firms surveyed "reported difficulty finding employees with adequate green skills." For small firms, that number is even higher at 72 percent. (Hanley, 2012) This skills gap must be filled in order for the building industry to be able to reduce its energy consumption and environmental impact, and it starts by filling a gap in building science education.

**We've found that…**

- Architecture students don't learn enough building science and analysis.
- Many engineering students don't learn about buildings.
- Professionals are being asked to use new tools and processes.

Students are constantly told to make the world a better place. For students interested in building design and construction, this often aligns with sustainability and lessening the environmental impact of buildings.

Unfortunately, sustainable building design practices are usually not yet part of the mandatory curriculum for architecture and engineering students. The topic is still slowly being introduced into academia, if at all. Academia is falling behind industry practice and industry demand (Mazria, 2012).

Thus, students are often left to their own devices to teach themselves sustainable design tools and practices. Given that there are numerous resources, concepts, and analysis tools that need to be understood, this self-teaching process can be confusing, cumbersome, and discouraging. Educators often want to incorporate building performance and energy analysis into their courses, however they too frequently run short of accessible and reliable resources, or become overwhelmed at the amount of material.

To fill the current void in education, students need to be supported in learning building science fundamentals, and how to put these fundamentals into practice through software simulation. Educating students about fundamental design concepts and software practices together, will increase the student's understanding and make them more fluent in putting these ideas into practice.

## Autodesk Building Performance Analysis Tools

Autodesk makes a variety of products for building design. Autodesk's core BIM tools with BPA capabilities are: Revit, Vasari, and Green Building Studio. These tools work together and can be used for modeling and analysis from the conceptual to detailed design phase.

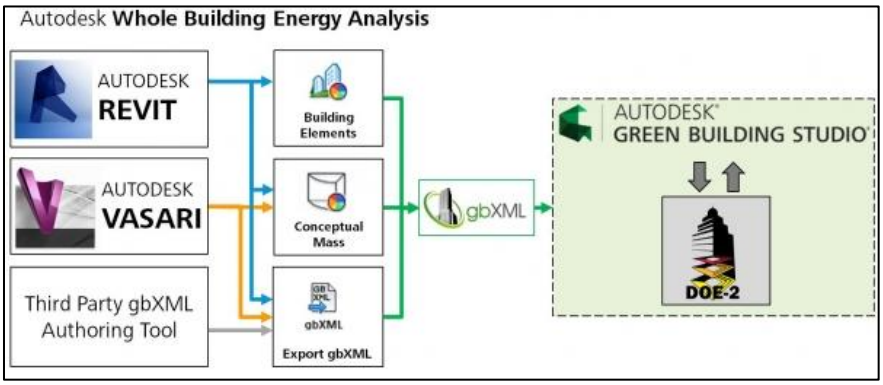
**Autodesk Building Performance Analysis Tools**

**Green Building Studio** is a web-based simulation engine for whole building energy analysis. It is based on the DOE-2 simulation engine and powers the whole-building energy analysis tools across Autodesk products. It can perform analysis on any gbXML file and does not have modeling capabilities.

**Revit** is Autodesk's flagship BIM product for use throughout the design process. Revit models use "Building Elements" like walls, roofs, windows, and floors to create 3D models. There are also conceptual massing capabilities, using basic shapes to model building form and orientation earlier in the design process.

**Vasari** is a simplified, parametric BIM tool that uses the same modeling conventions as Revit's conceptual massing tools – and the same file format as Revit.

Green Building Studio is Autodesk's core whole building energy simulation engine, and powers the analysis in both Revit and Vasari. Revit supports energy analysis for both conceptual forms and detailed architectural models. Vasari supports energy analysis only for conceptual forms.




Whole building energy simulation measures expected energy use (fuel and electricity) based on the building's geometry, climate, building type, envelope properties, and active systems (HVAC & Lighting). It takes into account the interdependencies of the building as a whole system, so it is a particularly useful way to "keep score" as you work to reduce building energy use.

In addition to whole building energy analysis, design studies can also be conducted through Revit and Vasari and related plugins. Design studies are useful for understanding fundamental concepts such as the sun path, solar radiation, wind, airflow, climate, and daylighting. They can be used to get a better understanding for how to improve human thermal and visual comfort.

## Autodesk Building Performance Analysis Courses

Academia and the industry need to learn about building science and use building performance analysis in order to reduce the energy consumption and environmental impact of buildings. Autodesk is currently working on building online courses for students and professionals based on the content available on the Autodesk Sustainability Workshop and Autodesk product help. Current offerings include the Autodesk Building Performance Analysis Certificate and Autodesk BPA Credits.

### Autodesk Building Performance Analysis (BPA) Certificate

The BPA Certificate is designed to meet the current education needs in sustainable building design. Bigger picture, the program tries to provide students with the skills and knowledge required to drive an industry-wide transition to performance-based sustainable design.

The program ties building science fundamentals to Autodesk building performance analysis tools through an online course. It has been designed for architecture and engineering university students seeking to improve their ability to design and optimize high-performance buildings.

Learning is supported by reference articles, videos, case studies, software workflow tutorials, and links to external content for more detailed information. This online learning content is freely available on the

Autodesk Sustainability Workshop website. Online quizzes and software exercises then assess the students' understanding and ability to synthesize these concepts.

While the program is self-paced and allows students to complete it on their own, the BPAC program has also been designed to be synergistic and supplemental to coursework such as studio projects or design competitions like the Solar Decathlon.

The topics currently covered are:

1. Introduction to Building Performance Analysis
2. Energy Literacy & Building Loads
3. Climate & Weather Analysis
4. Sun & Shadow Studies
5. Solar Radiation Analysis
6. Whole Building Energy Analysis
7. Wind & Airflow Analysis
8. Daylighting Analysis

For each topic, there are two types of quizzes, fundamentals quizzes and software exercises. In total, the course takes about 25 hours to complete.

The fundamentals quizzes are meant to test students on the basic concepts of the topics such as terminology, common practices, and case study interpretations. Questions are designed to require the students to synthesize and interpret the concepts, not just locate and regurgitate information.

The software exercises evaluate student's proficiency in Autodesk software, and their ability to apply these fundamental concepts to design optimization. With datasets provided and instructions given as to what specific analyses to perform in the software, the questions ask students to interpret the results and make conclusions about design decisions.


After being piloted for a year, the full certificate course was launched globally in August 2013. To date, over 4,500 students have signed up for the course are currently earning certificates.

## Autodesk Building Performance Analysis (BPA) Credits

From the early success of the BPA Certificate, it became evident that an online course for professionals was also needed. Twenty-five percent of users enrolled in the BPA Certificate are professionals. However, a 25 hour course is not as achievable for professionals as it is for students.

Autodesk BPA Credits are shorter lessons of the BPA Certificate (typically taking 3-4 hours to complete). They are for professionals to improve their knowledge of building science fundamentals and Autodesk building performance analysis tools and workflows. Like the student BPA Certificate, the courses are free, online, and self-paced. The courses also offer USGBC and AIA continuing education units.

The courses are currently be piloted through January 30th. After the pilot, the courses will be revised based on feedback from users and re-opened in early 2014.

## REFERENCES

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