

Revolutionary digital learning for science, math and engineering

Integrating Solarize Mass and STEM education through powerful simulation technologies

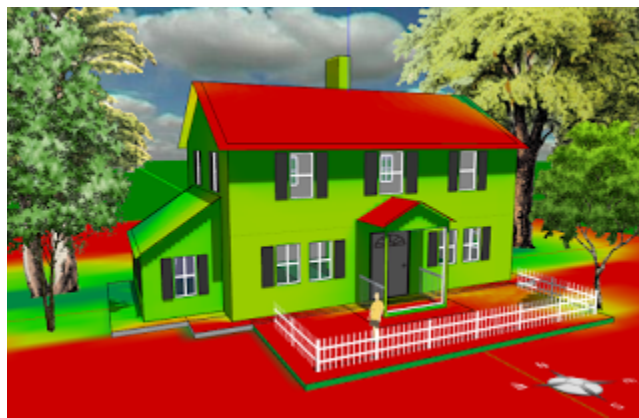


Fig.1: Solar simulation in Energy3D.

[Solarize Mass](#) is a program launched by the [Massachusetts Clean Energy Center](#) that seeks to increase the adoption of small-scale solar electricity in participating communities. In 2016, the towns of [Natick](#) and [Bolton](#) were selected to pilot for Solarize Mass. According to the Town of Natick, "Solarize Mass Natick is a volunteer initiative run by Natick residents. Our goal is to make going solar simple and affordable for Natick residents and small business owners as part of a 2016 state-sponsored program. But it is a limited-time program: the deadline for requesting a site visit is August 1, 2016."

Solar energy does not need to be a limited-time offer. The question is to figure out how residents can do their own site assessment while the guys are not in town to give free consultation. Sure, residents can use [Google's Sunroof](#) to quickly check whether solar is right for them (if their areas are covered by Sunroof). But what Sunroof does is only to screen a building based on its solar potential, not to provide a more informative engineering solution to help homeowners make up their minds. The latter has to

be done by a solar installer who will provide the PV array layout, the output projection, the financial analysis, etc., in order to run a convincing business. But this is a time-consuming process that poses financial risks to solar installers if the homeowners end up backing out. So we need to find some other creative solutions.

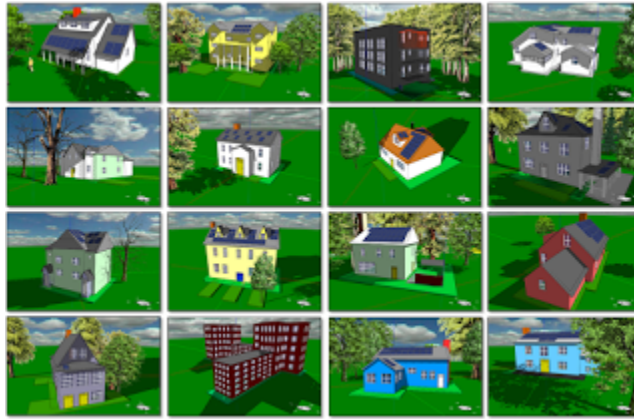


Fig. 2: Student work from a Massachusetts school in 2016.

Funded by the National Science Foundation (NSF), we have been working at the Concord Consortium on exploring meaningful ways to combine solar programs with STEM education that will effectively boost each other. We have been developing a powerful computer-aided engineering system called [Energy3D](#) that essentially turns an important part of solar engineering's job into something that even a middle or high school student can do (Figure 1). In a [recent case study](#), we found that Energy3D's prediction outperforms a solar installer's prediction for my colleague's house in Bolton, MA. In a pilot test in an Eastern Massachusetts school in June 2016, we found at least 60% of the 27 ninth graders who participated in the 8-hour activity succeeded -- with various degrees -- in coming up with a 3D model of her/his house and designing a solarization solution based on it (Figure 2). Giving the fact that they had to learn both Google Earth and Energy3D in a very short time and then perform a serious job, this result is actually quite encouraging. Our challenge in the NSF-funded project is to improve our technology, materials, and pedagogy so that more students can do a better job within a limited amount of time in the classroom.

With this improving capacity, we are now asking this question: "**What can middle or high school students empowered by Energy3D do for the solarization movement?**" Fact is that, there are four million children entering our education system each year in the US. If 1% of them become little solar advocates or even solar engineers in schools, the landscape for green energy could be quite different from what it is now.

Starting from three years ago, STEM education in the US is required to incorporate science and engineering practices extensively into the curriculum by the [Next Generation Science Standards](#) (the



Fig. 3: Energy3D supports rich design.

equivalent of Common Core for science). The expectation is that students will gradually think and act like a real scientist and engineer through their education careers. To accomplish this goal, an abundance of opportunities for students to practice science and engineering through solving authentic real-world problems will need to be created and researched. On July 8, 2016, NSF has also made this clear in the a proposal solicitation letter about what they call [Change Makers](#), which states: "**Learners can be Change Makers, identifying and working to solve problems that matter deeply to them, while simultaneously advancing their own understanding and expertise. Research shows that engaging in real world problem solving enhances learning, understanding, and persistence in STEM.**" Specifically, the letter lists "**crowd-sourced solutions to clean energy challenge through global, public participation in science**" as an example topic. An NSF letter like this usually reflects the thinking and priority of the funding agency. From a practical point of view, considering the fact that the choices for engineering projects for schools are currently quite limited, there is a good chance that schools would welcome solar engineering and other types of engineering as an alternative to, say, robotic engineering.

The overlap of timing for the ongoing solarization movement and the ongoing education overhaul poses a great opportunity for uniting the two fronts. We envision that Energy3D will play a vitally important role on making this integration a reality because 1) Energy3D is based on rigorous science and engineering principles, 2) its accuracy is comparable to that of other industry-grade simulation tools, 3) it simulates what solar engineers do in the workplace, 4) it covers the education standards of scientific inquiry and engineering design, 5) it supports many architectural styles (Figure 3), 6) it works just like a design game (e.g., Minecraft) for children, and 7) last but not least -- it is free! With more development under way and planned for the future, Energy3D is also on the way to become a [citizen science](#) platform for anyone interested in residential and commercial solar designs and even [solar power plant designs](#).

Exactly how the integration will be engineered is still a question under exploration. But we are very excited about all the possibilities ahead and we are already in an early phase to test some preliminary

ideas. If you represent a solar company and are interested in this initiative, please feel free to [contact us](#).

This entry was posted in Molecular Workbench and tagged CAD, Computer-aided design, Computer-Aided Engineering, Energy3D, SmartCAD, Solar energy, Solar radiation modeling on July 11, 2016 [<http://blog.concord.org/integrating-solarize-mass-and-stem-education-through-powerful-simulation-technologies>] by Charles Xie.

One thought on “Integrating Solarize Mass and STEM education through powerful simulation technologies”



Melissa Disque

July 14, 2016 at 12:30 pm

This sounds very interesting. I am not sure I understand how to incorporate this program into my curriculum. Is there any training being offered for educators?

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