

Virginia Tech Students Bring Houses into the Future

Abby Slater

Alexa can tell you the weather before you step outside. Your car effortlessly links to your smartphone and lets you see around corners. Your coffee cup keeps your beverage at the temperature you set via Bluetooth. Thanks to innovative technology, everyday items have the ability to become extraordinary, personalized machines. Why should your house be any different?

In November 2018, Virginia Tech's FutureHAUS Dubai team will demonstrate their innovative approach to futuristic housing in the Solar Decathlon Middle East. The international competition, begun in 2002 and organized by the US Department of Energy, draws 21 student-led teams from around the globe to design and build sustainable, solar-powered houses. Virginia Tech stands alone as the only American team in the competition.

The team's design will focus on practical and technological innovations in insulation, energy usage, cost effectiveness, and spatial flexibility.

"When you think about it, housing hasn't changed much in the last 50 years," says Laurie Booth, an architecture student here at Virginia Tech. "What we're doing is looking for ways to make your house smart, almost smarter than you."

Laurie showed us around the LumenHAUS model on Virginia Tech's campus, which won the 2010 Solar Decathlon Europe. Meticulous planning and high-tech design are apparent in every detail. This "flexible living space" acts as the team's headquarters while they plan and design for the upcoming competition. The LumenHAUS incorporates spectacles such as NASA's aerogel insulation, pullout kitchen counter space, and a 5-foot turning radius in the bathroom to accommodate wheelchairs. The kitchen, built in 2008, is especially impressive. "You can Skype

your grandmother on the backsplash; there even are sensors in the fridge that will tell you when you're running out of milk," says Booth proudly.

The construction on the FutureHAUS Dubai began in January 2018, but the planning and design for the model date back almost a year. Tech students have worked tirelessly, studying past competitions and learning the newest technologies in order to build the most efficient and technologically advanced house possible.

The team used Revit, a 3D modeling program, to build a digital model of the house. Engineers and architects can design mechanical and electrical systems, and Revit will calculate energy output. The program helps them stay organized, and provides the documentation required for the Solar Decathlon Dubai.

There are also specific energy requirements set by the heads of the competition. Each house must perform a series of tasks during the competition period including heating water, charging an electric car, and cooking meals, to demonstrate the functionality and efficiency of the house. For one sub-contest, they must wash and dry six towels, all of which will then be weighed to prove efficiency. The team faces the challenge of balancing a high-tech house, full of sensors and appliances, with low energy output. But, Booth reassures, "We're currently producing more energy than we're using."

This year's competition will take place at Mohammed bin Rashid Al Maktoum Solar Park, the world's largest solar park, which offers the ideal climate for solar energy. The FutureHAUS team is working with SunPower, a solar energy company that will supply all 40 solar panels for the house. They will work together to design the most efficient and innovative panels for the specific environment; for example, the duo is working on rotating solar panels that will shed sand when in Dubai.

The FutureHAUS is an example of prefabricated modular housing, meaning its individual cartridges are built off-site at a factory, then shipped and assembled on-site. This is more efficient and cost effective, and will hopefully, according to Booth, change housing concepts and design forever. “Soon, you should be able to buy a house on Amazon,” she says.

This introduces a new challenge to the team: how to transport the house to Dubai in November. The Industrial Systems Engineering students are tasked with researching methods and strategies to ship the house. “We’re looking into flying the house as opposed to shipping it, just so we don’t lose our entire project into the ocean,” jokes Booth.

Insulation is a huge concern for the efficiency of the house. The team uses SIPs, structural insulated panels, which have an R-value of up to 41 in the FutureHAUS, to increase thermal resistance. They also employed the use of polystyrene foam, an extremely efficient material that Booth foresees as the future of housing technology. “Why are we still making houses out of 2x4’s?” Booth wonders aloud. “Why can’t we use a super exact material that’s also super insulated?”

The FutureHAUS team is also concerned with affording consumers the ability to age in place. The idea is that, as people age and have varying abilities, the house will adapt to them. It will essentially learn how to take care of its inhabitants as their needs change, so that people don’t have to constantly move and adapt to their living space.

Aside from publicity and prestige, the Solar Decathlon Middle East competition has brought many benefits to the students and faculty of Virginia Tech. The FutureHAUS team is incredibly interdisciplinary, relying on the knowledge of students and faculty from departments such as interior design, architecture, engineering, business, graphic design, industrial design, and landscape. Students are learning how to work on a team that integrates numerous skill sets. This

unique, international opportunity offers students all across campus the chance to learn real world skills while still in school. “This experience has added a realness to our education,” says Booth. Working directly with industry leaders as students offers a taste of what awaits them after graduation, and prepares the team members for success in the real world. Some students are even working with Kohler on a system to create potable water from waste water. Sponsors include Dupont, Philips, and Mitsubishi.

Faculty involvement has been an incredibly useful tool for the students. The project would not have been possible without the efforts of faculty advisor Joseph Wheeler, project manager Bobby Vance, construction manager Bob Schubert, lead mechanical engineer Mike Ellis, lead electrical engineer Igor Cvetcovic, and computer science faculty lead Denis Gracanin.

The model is currently being assembled by students in the Research Demonstration Facility at Virginia Tech. Summer 2018 will be spent testing final electrical components such as energy output and balance. Then, come November, the team has 7 days to complete the complex assembly at the competition site prior to the 10-day event.

The team has proven itself in years past, and we believe they can make Virginia Tech proud again this year at the Solar Decathlon Dubai. As for the future of housing technology, thanks to the innovative minds of the FutureHAUS team, the possibilities are limitless.