Energized!

A Crash Course in Fuels of the Future

by Alexander Lai

LIKE MOST PEOPLE, I NEVER GAVE IT MUCH THOUGHT WHEN I PLUGGED MY PHONE CHARGER INTO AN ELECTRICAL SOCKET. I CERTAINLY NEVER THOUGHT ABOUT ALL THE TIME, PEOPLE, AND RESOURCES IT TAKES TO POWER THE LIFESTYLE I TOOK FOR GRANTED. BUT WHEN MY SISTER, WHO HAD ATTENDED THE DUKE ENERGY ACADEMY AT PURDUE UNIVERSITY TWO YEARS AGO, SUGGESTED THAT I APPLY, I BEGAN TO THINK ABOUT ENERGY. WHERE DOES IT COME FROM? HOW MUCH DO WE USE? WILL IT ALWAYS BE THERE? BY THE TIME THE APPLICATION DEADLINE ROLLED AROUND IN JANUARY, I HAD SO MANY QUESTIONS THAT I KNEW I HAD TO APPLY.

The Adventure Begins

The Duke Energy Academy at Purdue is a free weeklong experience that focuses on different types of energy, the advantages and disadvantages of each, and the future of our energy grid. The application process entailed writing an essay and answering a few questions about the classes I had taken. Because everything—including food, housing, and even transportation—was paid for, once I received my acceptance two months later, all I had to worry about was deciding what to pack.

When June 22 arrived, I could not contain my excitement. Since I live so close to Purdue, I was one of the first to arrive at the residence hall where we were staying, but it wasn't long before high school students from around the country were beginning to pour in. By the time the icebreaker activities began, there were about 50 participants in the room—all of them as eager as I was to learn about the world of energy. During these activities, we were separated into seven groups, each of which would focus on a different energy-related topic during the week. I was part of the yellow group—which included seven other participants, as well as a night and day counselor and several teachers—who would focus on photovoltaic solar cells or solar panels.

The next day, the fun began. After breakfast, Purdue University President Mitch Daniels officially kicked off the program, and Dr. Pankaj Sharma, the director of the Energy Academy, gave an orientation describing the premise of the program. Each of the seven groups would conduct an experiment related to their topic and then create a presentation about it. We would have time to work on the research project at the end of every day, but we would spend most of our time participating in tours, interactive lectures, and hands-on activities. The schedule of the program was extremely full, so immediately after orientation, we jumped right in to exercises and lectures.

Going All In

The next few days went by in a blur, but I still clearly remember many of the highlights. One day, we visited the Benton County Wind Farm, which spans 11 square miles and contains 87 wind turbines. During the tour, we had the chance to stand next to a wind blade, and I was amazed at its size: its width was almost twice my height! Seeing them only from a distance, I never realized how big individual wind turbines or wind farms could be.

Building on what we learned, the next day we did a hands-on activity in which we created our own wind blades out of materials such as construction paper, cardboard, and hot glue. My group's design didn't produce much power, but it was interesting to see which designs were the most effective. I was surprised that some of the most effective designs used extremely small blades made of bent construction paper instead of complex three-dimensional blades.

Hands-on activities at the Energy Academy included constructing wind turbines from construction paper (top) and creating solar cells with berry juice.

Other activities during the week involved LEGO MINDSTORMS, Snap Circuits, solar panels, and wind turbine positioning. Each emphasized a different area of science, engineering, or mathematics, and each tested our skills in problem solving, teamwork, and creativity. By the end of each activity, there was always a sense of achievement because we always learned something new, and we always gained another necessary skill to help change the future.

One of my favorite experiences during the program was our trip to the Duke Energy Cayuga Generation Station. This tour really opened my eyes to the scale of the energy grid. The Cayuga power plant is an enormous facility that burns coal to generate massive amounts of electricity. We braved heights and scorching heat from the furnace to see only a small portion of the operation. Surrounded by cacophonous machinery in a facility that towered several stories and spanned several acres of land, it was incredible to realize that all of this was necessary to produce electricity for only a segment of one state. Although it might seem counterintuitive that we were learning about coal in a program about renewable energy, we understood from classes earlier in the week that renewable sources such as wind and solar are variable. To generate a continuous stream of electricity for the grid, it is important to maintain a mixture of all forms of energy.

A Classroom for the Future

Although lectures might not sound exciting compared to hands-on labs and tours, I considered them treasure troves of information. Several different speakers came to talk to us throughout the program, including respected professors, CEOs, and engineers who talked about everything from the implementation of a smart grid to applications of scientific knowledge in business. Some of the guest speakers talked about photovoltaic solar cells, which helped prepare me for our research project.

My group's experiment involved creating solar cells with berry juice, a feat I had never known was possible. In a Purdue lab, in white lab coats, and with the help of Purdue graduate students, we created our own berry solar cells. It took about an hour and a half for each person in the group to make their own solar cell using pencil graphite, titanium dioxide (a powder found in sunscreen), and mashed up blackberries. We later tested our solar cells with equipment that simulated sunlight to see which of our cells produced the most power. As expected, our homemade solar cells produced very little power. The best solar cell, which a teacher produced, generated only 0.8 volts when placed under light; the group average was around 0.6 volts! But that they produced power at all opened our eyes to sources of energy we never considered before.

At the end of the week, all the groups presented their work, which covered a wide variety of topics. The blue group (batteries), for example, described the process they used to create their own coin batteries, while the red group (nuclear energy) explained how they measured radiation around the Purdue campus with Geiger counters. Combined with what I'd learned about solar cells, these presentations taught me so much about energy in general and where it's headed.

It's no exaggeration to say that this program helped shape my future. My experience at the Energy Academy helped me decide to become an engineer. I was on the fence between medicine and engineering, but this program inspired me to be part of a field that is already changing the world. Now, no matter what I do or where I go, the topic of energy is always in the back of mind. Energy, I realized, is everywhere—not just in a socket in the wall. ■

Alexander Lai is a senior at Harrison High School in Indiana, where he is a member of the tennis team and the FIRST robotics team. After attending the Duke Energy Academy, he decided to apply to Purdue, where he will enroll in the fall as an engineering major. Alexander enjoys drawing during his free time.

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