

May 18, 2012

Cramming for Degrees in Hybrids

By KEN BELSON

LIKE many college students, Katherine Bovee, a master's degree candidate at Ohio State University in Columbus, struggled to find a focus for her undergraduate studies. Wanting to sample a broad range of possibilities, she enrolled in a mechanical engineering program.

As of her junior year she still hadn't found the direction she was looking for, but things began to click when she signed up for courses in thermodynamics and internal combustion engines. Through her professor, Dr. Yann Guezennec of Ohio State's Center for Automotive Research, Ms. Bovee connected with the team working on the university's entry in EcoCAR, a green-technology competition conducted by the Energy Department and General Motors.

Solving real-world problems and working directly with an automaker proved so valuable that Ms. Bovee, 24, went on to join the EcoCAR 2 program, a three-year competition that aims to reduce the fuel consumption and tailpipe emissions of Chevrolet Malibus. Judging of the first year's work—the design and simulation phase—done by the 15 participating teams began Friday in Los Angeles and runs through Wednesday.

In this project—Ohio State's entry will use a sophisticated plug-in hybrid architecture—Ms. Bovee is concentrating on the systems that distribute energy from the vehicle's battery.

“Everything I'm doing now is based on what's in the automotive industry,” said Ms. Bovee, who received a research fellowship from the National Science Foundation, which she is using to study the control systems in hybrids.

“They're always amazed at the work we're doing, how we can build a car in three years,” she said of the auto company engineers she had been working with.

Ms. Bovee's shift in the emphasis of her studies, from mechanical to other engineering disciplines, mirrors changes under way not just in the auto industry but in the classes of engineers graduating from universities. As automakers increase their efforts to design vehicles that are more fuel-efficient and friendlier to the environment, engineering programs are likewise adapting their curriculums, preparing students to build vehicles increasingly powered by batteries and managed by computers.

Brian L. Yoder, a director at the American Society for Engineering Education, said that “mechanical engineering has come to be viewed as the general engineering degree,” while electrical engineering degrees were considered more specialized and less susceptible to “offshoring.” In other words, electrical engineering jobs are not as likely to be outsourced to engineers overseas.

To design hybrids, plug-in hybrids and pure-electric vehicles, students need a deep understanding of the battery technologies, computer controls and diagnostic programs that form the interconnected systems of modern vehicles. This imposes a collaborative approach on the development process, requiring engineers to work in groups and consider the entire vehicle, not just its individual components.

The growing complexity of these vehicles is one reason automakers, especially domestic brands that reorganized during the recession, are eager to work closely with universities to augment their downsized research and development departments. Instead of just donating money or parts to universities, automakers are expanding internships and other partnerships to help find students capable of creating autos that use alternative powertrains.

“G.M. needs to be much more externally focused because technology is going to move so rapidly that we need to gather new innovations from anybody and everybody,” said Thomas Stephens, who recently retired as chief technology officer of G.M., where he helped coordinate the company’s alliances with universities. “To compete, you’re going to have to have this innovation and you’re not going to be able to do it all yourself.”

G.M. is a lead sponsor of the EcoCAR 2 program, which is also supported by an array of industry suppliers. But automakers like Honda and Ford, as well as industry stalwarts like Allison, Cummins and Delphi, are also working with universities, providing parts to students involved in experimental programs and offering internships for engineers who may later become employees.

“We consider our competitions to be the minor leagues for the auto industry,” said Kristen De La Rosa of the Argonne National Laboratory, who directs the EcoCAR program as part of the Energy Department’s Advanced Vehicle Technology Competitions. “It’s absolutely about workplace development and developing the next generation of automotive engineers.”

The intersection of academia, automakers and the government is paying dividends, most notably for students. G.M. and other car companies hire about 80 percent of their interns because they are familiar with their development process and have shown they can work in groups, a critical skill in developing today’s highly complex vehicles.

Their course work, too, most likely included a multidisciplinary focus on next-generation vehicles. At Ohio State, courses are intended to push electrical engineers to know more about thermodynamics and mechanical engineers to know more about electrical engineering. Every automotive engineering course at the University of Michigan has been modified to include the electrification of the vehicle, even classes on crash tests. The university has also added new courses on energy systems.

“I want to have every electrical engineer comfortable in the machine shop and every mechanical engineer comfortable in the electrical lab,” said Giorgio Rizzoni, director of the Center for Automotive Research at Ohio State. “You need people who know so many things. Our observation is, the auto industry likes to hire people with an advanced degree who have been exposed to a broad level of disciplines.”

Despite the complexity of blending mechanical, electrical and chemical engineering with computers and other technologies, students are rising to the academic challenge. Schools are finding that prospective engineers arrive with an interest in hybrids and other advanced cars, viewing them less as outliers and more as the way all vehicles will look in the future.

“A lot of the undergraduates now were in elementary school when the Prius came out, so they’ve always lived with them,” said Gregory Shaver, an associate professor of mechanical engineering at Purdue University in Indiana. “They’ve grown up with alternative fuels.”

Purdue offers engineering candidates an opportunity to work on a larger scale. The university received a \$1 million Graduate Automotive Technology Education federal grant, which it is using to develop more efficient medium- and heavy-duty trucks.

While established automakers and parts suppliers remain favored destinations, a growing number of students are forgoing a bigger paycheck and more job security and going to work for start-ups and smaller companies, or in developing countries, where they can have greater influence, according to Margaret Wooldridge, director of the Automotive Engineering Program at the University of Michigan.

“There are personalities that don’t want to go to a big, old stable company,” Ms. Wooldridge said. “What’s different now is the change-the-world attitude. They’re very, very genuine and unusually willing to sacrifice.”

