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Pioneer Valley High School science students from left, Tiffany Rios, 17, Melissa Tinoco, 16, Jenn Atmaja, 16, and Tami Mau, 16, pose for a picture with the wave-energy generator they built. The group worked on the five-week alternative energy project in collaboration with the Santa Maria chapter of the Society of Petroleum Engineers. //Mark Brown/Staff

One of the most important discoveries made this summer by the four girls working on a wave-energy project in the Pioneer Valley High School Summer Science Institute had nothing to do with voltage, engineering or hydrodynamics — it had to do with overcoming failure.

“Science is a process and it always doesn’t go like you expect the first time,” said Tiffany Rios, who along with Jenn Atmaja, Tami Mau and Melissa Tinoco have developed a device that produces electricity from ocean waves.

The group worked on the five-week alternative energy project in collaboration with the Santa Maria chapter of the Society of Petroleum Engineers. The project is a pier-based device that successfully generated electricity in relatively calm seas during its test.

But getting the generator to produce that voltage wasn’t as easy as flipping a switch.

The device, which utilizes an overhead garage door shaft and spring, a buoy and a DC motor, took the group about a week to build. Refining the device and making their computer software work with it took some real ingenuity.

Tami and Tiffany replaced the motor more than once. They also had to upgrade the original motor to a direct current model that would handle higher revolutions per minute.

The girls also had to replace a data logger three times before they found one that was able to generate the research data they were seeking. The result was a device that produced 77 volts of energy in a two-hour test and 20,000 data points recorded into their computer.

“Science requires a lot of patience,” Tami said. “You have to be patient and want to do this.

“This is new science. There isn’t a lot out there in wave energy.”

The group’s research showed that there are only 14 commercial wave energy generators in use in the world, with most of them in Europe.

Jenn and Melissa ran into some engineering challenges, too. Their portion of the project was to gauge the environmental impact their device had on marine life.

First, the girls had to figure out how to get proper underwater sound readings. A boogie board and hydrophone eventually proved successful.

They also had to work with computer software to differentiate the noise their device created from background ocean noise, some of which was provided by a friendly pod of dolphins playing near the Venoco pier in Carpinteria. The dolphins actually gave the girls a little more scientific insight.

“The sound of the device does affect fish, but not dolphins,” Melissa said.

Before conducting the test, none of the girls had ever seen a dolphin. After the test, they knew what sound frequencies the ocean mammals can hear.

They not only got to observe the dolphins playing in the surf, their hydrophone recorded the whistles and clicks dolphins use to communicate.

The girls wrap up their summer project next week. In addition to building their generator and monitor, they are analyzing the data they collected and preparing presentations for the Society of Petroleum Engineers, the Santa Maria Joint Union High School board of education and the Santa Barbara County Science Fair, which is their ultimate goal.

“This has been a phenomenal project. The kids have learned a lot. I’ve learned a lot,” said Riccardo Magni, Pioneer Valley High science department head. “When they move on to college, very few of their peers will have had an experience like this.”

Magni, a former college basketball player, posts a tidbit of wisdom from legendary UCLA coach John Wooden above the white board at the front of his classroom. He said he feels it’s appropriate to teaching high school students, particularly those in his advanced placement (AP) classes.

It reads: “It’s what you learn after you know it all that counts.”

Project contributors are: Kevin Yung, Santa Maria Pacific, LLC; Derek Paulgaard, Venoco, Inc.; Hector Guerra, PVHS Ag department; SMJUHS maintenance and information technology departments; Abro Computers; Hamon Overhead Doors; Central City Tool Supply; Perry’s Electric Motors; Lahr Electric Motors; Frazee Paint; and makeitlouder.com.