The Blazer

It's <u>your</u> school paper

November 2013 ~ Daniel Boone Area High School ~ Birdsboro, PA 19508

Bioreactor Premiere: *Go Clean, Go Green, Go Algae!*

Lynn Thompson

A group of nine students from Daniel Boone High School's Bioreactor Research Group decided to *Go Clean, Go Green, Go Algae* and join in The Lexus Eco Challenge #2 -The Air and Climate Change. The Lexus Eco Challenge is a way for students to get involved to educate and make a difference in our community. They have entered the contest under the topic, <u>Fossil Fuels and Renewable Energy.</u> On November 6th, 2013, the team held a premiere night to teach parents, students, professors, news reporters, and businessmen why algae will become a more important part of our life.

The team consists of Noah Coats, Alex Doyle, Dan Downs, John Dugan, Megan Jolivette, Ian Kurtz, Elizabeth Levy, Stephanie Sievers, and Courtney Vidovich. The team advisors are Mr. Sid Harwood and Mr. Shannon W. Helzer, two physics teachers here at Daniel Boone High School. These hard-working, determined students have spent hours upon hours doing research and trial-and-error experiments. The team is already ahead of schedule, and plan to continue their research for the future.

What We Learned

In 2011, 93% of non renewable fossil fuel energy was used. It is estimated that in time, we will run out of fossil fuel. British Petroleum (BP), says that eventually we will run out of oil and will need an alternative. The Daniel Boone Bioreactor Research Group has found a solution for that - Algae! Specifically, turning algae into diesel biofuel.

Daniel Boone Guidance Counselor Mr. Bruce Richie harvest algae from the bulk growth bioreactor. Mr. Richie represents one of 24 faculty and staff members who turned out to support the Green Team. Thank you to each and every one of you

Why Choose Algae?

As a biofuel product, corn is able to only produce 420 gallons of fuel per year per acre, whereas algae is able to produce over 5000 gallons of fuel per year per acre. It is a good renewable energy source, grows fairly quick, thrives, and is completely free. Algae should be grown vertically so that it can be hit by the sun to be grown more efficiently.

Biodiesel over diesel. Producing and having biodiesel will allow the United States of America to become more reliant on ourselves rather than other countries. Having biodiesel will allow air quality be less polluted.

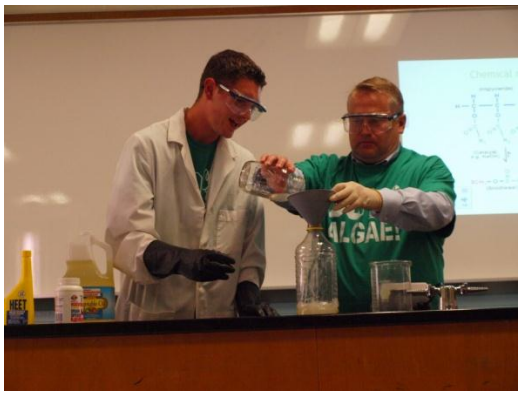
How Does it Work?

The team put different strands of algae in long tubes, called vessels, and added different nutrients in each vessel to discover which strand and nutrient will work best to be turned into diesel

biofuel. Behind these vessels are lights that act in place of the sun. The team can regulate the amount of light the algae receives to give an estimate on how to better the growth of the algae.

Alex Doyle assists BEC student Brett Hartzell, son of Daniel Boone High School's Athletic Trainer Mr. Bob Hartzell, in "nourishing" the algae growing in the experimental bioreactor.

Once they are ready to process the algae into biofuel, they must first take the algae through the drying process. First you must press as much water out of the algae as you can. The left over water is not wasted; it is poured into a reactor to keep things clean. The algae are set out for a few days to become dried out. Algae are then pressed again, allowing the lipid oils to come out due to breakage. Next, algae is soaked into a solvent called Hexane, and then pressed for another time. The lipid oils are heated and chemically mixed, then put away in a dark room for 24 hours. After 24 hours you are left with Glycerol and Diesel. The Glycerol is separated so you're left with your final product: Biodiesel.



Rosemont College's Dr. John Ullrich and Daniel Boone's Noah Coates chemically transform vegetable oil into diesel fuel during a lab demonstration during the Algae Bioreactor Premiere on November 6, 2013.

Overall

When given the question, "What did you learn from working with these students?" Mr. Shannon Helzer, one of the team advisors said, "Giving these kids an A+ would be a severe understatement." He mentioned it confirmed that students, when given a challenge, can work together and overcome a given task. This is very true, our teenage generation right now as a whole needs to start looking and planning for the future. Not only to better ourselves but also to better the community and, eventually, change the world. These nine young men and women have done a tremendous job in a short amount of three weeks. Imagine what they could get accomplished in two months-time.

The Daniel Boones Bioreactor Research Group's plans for the future are to broaden their education and reach out to the younger classes. They hope to have a demonstration given to the underclassmen by February of next year. They hope to reach out and inform the Daniel Boone Middle School by Christmas time this year. In May, 2014, they hope to have a portable reactor and give demonstrations to the elementary students and get them interested in Science & Technology.

For information about The Lexus Eco Challenge, go to this website: http://lexus.scholastic.com/

For more information about the Daniel Boone Bioreactor Research Group, go to this website: http://gocleangogreengoalgae.weebly.com/

Biodiesel Fuel May Save the Future

By: Morgan DeCray

On November 6th, 2013, a team of Daniel Boone students called the Go Clean Go Green Go Algae introduced their idea of taking everyday

algae and converting it into biodiesel fuel. They presented it to parents, faculty, Dr. Ullrich, a professor at Villanova University, the vice president of MARS Fish Care, Mr. Gary Jones, and the mayor all attended the event. These students took six years of research and started putting it to the test by building their own bioreactors and harvesting algae to create biodiesel fuel.

Daniel Boon High School's Green team.

The team consists of five seniors: Daniel Downs, Elizabeth Levy, Noah Coates, Alex Doyle, and Ian Kurtz, along with four juniors: Stephanie Sievers, Megan Jolivette, Courtney Vidovich, and John Dugan. With the help of Mr. Shannon Helzer, Mr. Sid Harwood, and some outside sources, this team is not only testing different experiments with the algae, they are also trying to spread the word about the wonders of biofuels.

THE "HOW":

There are several steps to the process that turns algae into a renewable resource.

The first step is being able to find and harvest a strain of algae that will grow fast and use up less amount energy. To find the right strain of algae, these students had to build several bioreactors to help them determine what types of nutrients would help speed up the growth process, how much oxygen is required, and how much light is required. For example, the nutrients such as nitrogen, phosphorous, and carbon are essential for algae growth. Finding the right strain will help to determine what type of algae will be more temperate and easier to grow.

While showing how these bioreactors work, Alex Doyle explained, "We can take all of these tubes and put different nutrient combinations into each one to see what combinations work the best."

Once they found the right strain the team then placed them into a large "A" frame construction that can hold up to 16 five-gallon water jugs where the algae strains will grow until it is ready to be harvested.

You can tell when the algae are ready to be harvested by the smell. When the smell is a "good/bad" kind of smell that means it is ready to be harvested and ready for drying.

The second step is to dry the algae. Stephanie Sievers' demonstration the process of drying algae with a firm backing, a window screen, and a ceramic tile float.


Fleetwood School District teacher Molly Sherman enjoys the smell of the algae as she assists Stephanie Sievers in removing excess water from the Algae.

Sievers compared the algae's cell membranes to spaghetti, "If I take cooked pasta and I try and bend it, then it's going to be pliable. It will just bend, and it's not really breakable. If I were to take uncooked pasta, then I would be able to snap it. This snapping is what we want to occur with the cell membranes."

Once the algae are dried, it will be placed inside of an algae press to squeeze out the entire

lipid oils inside of the cell membrane. When the algae are squeezed, it then needs to sit in a solution called Hexane. After 24 hours of soaking, the algae is put through the press once more to get all of the lipid oils that were missed the first time.

This then leads to the final step, separating the hexane from the lipid oils to create biodiesel fuel. Noah Coates showed the crowd how taking a base of Sodium Hydroxide and Methanol added to vegetable oil (represents the lipid oils) and shaking for five minutes will allow the base mixture to act as a catalyst and bond with the Hexane inside of the oils. After sitting for 24 hours in a dark and cold place, the mixtures will separate so that the Hexane and the base solution will turn a red color and sink to the bottom of the pool of oil. Finally the biodiesel fuel is poured out and then cleaned with hot distilled water.

THE "WHY":

Non-renewable resources, such as coal and oil pollute our environment and are quickly running out. According to BP, in the next forty years our oil supplies will be either gone or barely even there!

The "Why" team presents to a packed crowd.

Megan Jolivette said, "Our generation needs to take a stand against this because it will affect us all in the long run."

Using biodiesel and educating our youth about the advantages of biodiesel fuels insures our generation and the generations to come. This algae project will help develop a renewable and usable energy source that will save countless habitats while keeping humans on the go.

The team's long term goals are to keep this program strong and continue educating future classes about the advantages of biodiesel fuels. They hope to construct a greenhouse in one of the high school's courtyards. Half of the greenhouse will be for the bioreactors and the other half will be a green classroom where classes can go to learn about the bioreactors and how they work.

This team's true purpose is to inform the community about biodiesel fuel and how it could not only save time and money, but also this generation's future.