

COMMUNITY GRANTS PROGRAM



CASE STUDY

Biodiesel Provides a More Sustainable and Cleaner Alternative to Fossil Fuels

Founded in 2005, Engineers for a Sustainable World (ESW) at Rensselaer Polytechnic Institute (RPI) bring together the RPI community to improve both the quality of life and the condition of our planet. The ESW chapter at Rensselaer is dedicated to mobilizing RPI students and professionals through education, technical projects, and collaborative action to meet local and global sustainability challenges.

Challenge

Recently ESW decided to analyze alternatives to traditional fossil fuels. Biodiesel is a renewable, clean burning diesel that can be used in almost any standard diesel engine without any design changes and is more sustainable than petroleum or fossil fuels, since it doesn't contain elements like sulfur. By substituting the use of traditional petroleum fuels, ESW's biodiesel will generate 78% less carbon dioxide, 79% less wastewater, and 96% less hazardous waste.

ESW's goal is to promote biodiesel usage throughout the region by forming partnerships with schools and community organizations. In order to accomplish this ESW will need to educate students and community members on the production process, potential uses, and the advantages of producing biodiesel.

Solution

This project focused on educating three demographics about the benefits of biodiesel: college students, high school students, and interested community members. While immediate education of the Troy community is the primary focus of this project, it will also have significant educational merit for RPI students in the long term. Few students have the opportunity to apply their engineering and chemistry knowledge to practical applications. For individuals looking to produce their own fuel, it can be difficult to understand the procedure just by reading about it. Once the facility is successfully installed, it will be used as an academic resource.

Results

The ESW team developed a methodology for producing biodiesel in the lab. Experiments were conducted both at the bench scale and the pilot plant scale. The experiments included the use of various catalysts ranging from alkalis to acids to enzyme catalysts. Further research was done on the pretreatment of the raw materials and post-treatment of the resultant biodiesel. All of these efforts resulted in achieving the highest quantity and quality of biodiesel fuel possible while minimizing costs.

This technique was then used in educational materials and workshops designed to incorporate the hands-on experience to RPI students. ESW partnered with two groups in the community: Transition Troy and the Tech Valley Center of Gravity to host outreach events open to the public. These workshops highlighted the benefits of biodiesel production and how to produce it safely and efficiently. Beyond local organizations, ESW also established a partnership with the RPI Center for Future Energy Systems for Technical Expertise with Sodexo to outsource their waste vegetable oil.

To further educate students and community members, ESW held several outreach events with over sixty attendees. A workshop/lecture was also given to a class of twenty-four high school students and additionally collaborated with a team of undergraduates to deliver a presentation for an undergraduate course. At each of these events, educational flyers and pamphlets were distributed. In total, 200 educational materials were shared with the public.

Finally, ESW developed a website to store their materials and serve as a source of information to support individuals interested in starting their own biodiesel project.

CHALLENGE

- Increase education and awareness of RPI students and the local community on the uses of biodiesel

SOLUTION

- Developed new educational materials about biodiesel
- Established an on-campus process to convert waste vegetable oil into biodiesel to educate students and promote waste recycling
- Educated the community through hands-on workshops

RESULTS

- 200 educational flyers and pamphlets were distributed
- Two community partnerships were established
- Over 60 community individuals attended biodiesel workshops
- 24 high school students attended an educational lecture
- A website was created to store materials and serve as a resource for other individuals on the benefits of biodiesel

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Rensselaer



RPI student Ray Parker describes their biodiesel project to DEC Commissioner Joseph Martens

Social Media

[Website](#)
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Resources

RPI Biodiesel Flyer




RPI BIODIESEL



What is the Purpose?
To provide a renewable source of fuel to the campus and give students an opportunity to experience plant design while providing a continuing teaching example to the students on campus

- Advantages of Biodiesel**
- Biodegradable
- Non-toxic for environment
- Reduces CO₂ Emissions
- Can be used in any vehicle engine without modifications (within vehicle warranty limits, typically 10-20% blend)
- Can be produced locally, meaning less expensive for consumers

Did You Know?
Did you know that Biodiesel production reduces wastewater by 79% and hazardous waste by 96%?

A to-go latte takes 26 times more water to be produced than a gallon of biodiesel

Below is data acquired by the U.S. Energy Information Administration that shows oil consumption around the world from the years 2009-2013

	2009.3	2010.6	2011.9
North America	20,020.3	19,555.6	20,346.9
Bermuda	4.5	4.5	4.5
Canada	2,184.2	2,203.4	2,301.1
Greenland	5.0	6.5	7.0
Mexico	2,089.6	2,081.4	2,112.9
Saint Pierre and Miquelon	0.6	0.6	0.6
United States	18,771.4	18,180.1	18,882.1

As you can see, from the past few years, the United States has consumed over 18.69 million barrels of petroleum per day and has maintained a steady rate. In order to reduce the harmful effects that harvesting oil can have on the Earth, biodiesel is one alternative route we can take.

Our Plan
This year at RPI, our team has acquired used vegetable oil from our own dining oil that has been used to make french fries, etc. Using means of organic chemical reactions, it is our hope that we can make biodiesel from waste vegetable oil and donate them to local charities.

Our second objective for our school year is to use the biodiesel that we have produced and apply it to an RC Car for demo purposes for prospective clientele.




The Procedure

1. Dewatering Vegetable Oil
2. Filtering Vegetable Oil
3. Titration of Vegetable Oil
4. Production of Biodiesel



Future Steps
We hope to produce biodiesel through vegetable oil at a faster rate and find a large scale permanent facility for ease of production.

TESTIMONIAL

"Thanks to the New York State Pollution Prevention Institute a large group of RPI students, and many Troy community members, were able to learn more about biodiesel in a hands-on way. This experience will shape their academic and personal careers in a real way, thank you."

– Trevor Simmons,
Research Scientist at RPI

NYSP2I PARTNERS



New York Manufacturing Extension Partnership

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