

# **Biodigestion**

**Subject Area:** Environmental Science    **Grade Level:** 10 – 12    **Date:** August 4, 2014

4 x 4 Block Schedule, 90 minutes classes.

## **Lesson Overview**

Students will learn how to use their food waste for collection in an anaerobic digester for microbes to produce methane. The methane will then power vehicles instead of fossil fuels, decreasing our carbon footprint. River City High School will be part of a sustainable solution to today's energy needs and part of a closed loop system of reusing resources to help meet our CA sustainability goal of using 33% Renewable resources by 2020.

Students will also learn how to use puppet pals or educreate or another video production resource, power point or create a trifold to advertise and teach how to collect food waste for biodigestion.

### **Materials Needed:**

Computer with:

Microsoft Power Point

Microsoft Publisher

Educreate

Puppet Pals

### **Materials Provided:**

**Guest Speaker:** Laura Halbasch, Atlas Disposal, Discussion on Food Waste Collection

Power Point on Renewable Energy

Access to computers, or I - pads

### **Expected Student Outcomes:**

- Students will need to use a computer to navigate the web to research biodigestion, companies, or industries that are relevant. Students will hone their researching skills for relevant information on the topic.
- Students will teach themselves how to use educreate and/ or puppet pals to create a video that is viewer ready. Students will improve their editing, public speaking and research skills.
- Some students will need access to the video production class or students in it, to record a video about biodigestion, how it is different from composting and how food waste will be collected. Students will improve their public speaking skills.
- Some students will use Microsoft Publisher to create a trifold that advertises the benefits of the refuel program, and how students and staff at RCHS (River City High School) can be part of the solution to close the loop on our resource use. Students will hone their creative and editing skills.

**Expected Student Deliverables:**

The students will create a video, or speech or a trifold about Clean Natural Gas as a renewable energy source using the Farm to Fork to Fuel Program. They will compare and contrast Biodigestion to Composting to educate the staff and students at RCHS so we can be more sustainable as a campus.

**Cost of the Lesson:**

The additional cost of the lesson is having the Refuel program implemented at RCHS. We have a 1 ton dumpster that is collected 1 x/ week. However this initial cost should break even due to food waste being non taxable. Approximately 30% of all trash is food waste meaning it can be Biodigested.

**Duration of the Lesson:**

The duration of the lesson will take 3 - 5 Days. The first day will be about Renewable Energy and our goal as a State by 2020 to have 33% of our energy needs come from renewable energy sources such as solar, biogas, small hydro, geothermal, or wind turbines. The second day Laura Halbasch will come speak to the class about the ReFuel Program at Atlas Disposal. The third through fifth day students will work on their Projects to advertise and educate the staff and students about the Refuel program through various media resources.

**Culminating Activity &/or Assessment:**

All quality videos will be viewed on Raider TV (River City High School) to advertise the collection of food waste, and the how and whys of the Refuel program. If students choose to produce a trifold all quality trifolds will be photocopied and passed out at Breakfast and lunch to advertise the program. All work will be graded, only A quality work will be advertised.

**Enrichment Suggestions:**

More guest speakers, possibly from SMUD or PG& E, local college such as UC Davis. I will possibly have Dr. Ruihong Zhang a professor at UC Davis in Biological and Agricultural Engineering guest speak about developing the biodigester in Sacramento as well as on the UC Davis campus.

Other enrichment suggestions if the funding permits, is to tour a site that has a biodigester. There are several Dairy farms along I- 5 that have federally funded biodigesters that add energy to the grid during peak energy times. Tours of the biodigester in Sacramento and at UC Davis are options also.

The Farm to fork movement is very strong in Sacramento, the month of September is when a two week (September 13<sup>th</sup> – September 28<sup>th</sup>), Farm to Fork Activities are held advertising eating locally to decrease pollution, increase our local economy, increase the quality of our food due to it's freshness and develop a positive relationship & communication with our local food suppliers. Students could volunteer at the Farm to Fork Festival on September 27<sup>th</sup> in downtown Sacramento between 3<sup>rd</sup> and Capital streets to monitor, advise and educate the general public about what is recyclable, waste and can be used for Food waste by directing them where to dispose of their potential resource.

**Additional Resources:**

A video production class is helpful in the presentation of the video to the school, community, or city. Another possibility could be to advertise with a local news station, such as KCRA 3 to get the word out about biodigestion and the benefits of keeping food waste out of our landfill and using it as a resource to fuel our vehicles or convert methane into electrical energy for the electrical grid.

**CTE Pathway Standards :** <http://www.cde.ca.gov/ci/ct/sf/ctemcstandards.asp>

## **D. Residential and Commercial Construction Pathway**

The Residential and Commercial Construction pathway provides learning opportunities for students interested in preparing for careers in construction and building design, performance, and sustainability. The standards focus on the manner in which residential and commercial structures are designed and built. The pathway includes instruction in the way in which these structures are built (Class B California License).

D1.0 Recognize the impact of financial, technical, environmental, and labor trends on the past and future of the construction industry.

D1.1 Understand significant historical trends in the construction industry.

D1.2 Understand the environmental regulations that influence residential and commercial design.

D1.3 Demonstrate knowledge of the California Environmental Quality Act (CEQA) and Environmental Impact Review (EIRs) impacts on residential and commercial construction.

## **Engineering, Technology & the Applications of Science**

ETS2B: Influence on Engineering, Technology, and Science on Society and the Natural World.

Standards: A1.0, A 2.0, A 3.0, A 6.0, A7.0, B7.0, D1.0

## **A. Environmental Resources Pathway**

The Environmental Resources pathway prepares students for employment, postsecondary education, and/or training in a variety of environmental industries.

A1.0 Identify energy resources and the effects of these resources on the environment.

A1.1 Classify energy resources by type: depletable, nondepletable, renewable, and nonrenewable.

A1.2 Discover new and emerging energy resources.

A1.3 Compare the advantages and disadvantages of energy resources in terms of the effects on the environment.

A1.4 List jobs in the community that result from, or are influenced by, processing and using energy resources.

A5.0 Identify the role and impact of waste management systems and their operations on the environment.

A5.5 Design solid waste disposal processes that lessen environmental impacts and improve recycling.

B7.0 Understand the interrelationships among components of systems.

B7.2 Understand the components and workings of the gas transmission and distribution network.

## **Lesson Plan Relevance to Externship**

Atlas Disposal sustainability approach is to collect food waste from restaurant and businesses that provide food waste to a biodigester in Sacramento that will use anaerobic digestion to break down the food into a usable energy source – methane, to power CNG (Clean Natural Gas) vehicles that collect more food and recyclable construction waste.

## Description of Activities:

### Activity Day One:

Students will be introduced to Renewable Resources by taking notes from a power point in their notebook. Then in teams of two they will research one of the 5 Renewable Resources on the computer or I – Pad, taking notes. We will share out our findings on the benefits and costs of renewable resources with the class before the class is over.

### Activity Day Two:

The students will listen, take notes, engage in discussion with Laura Halbasch about the ReFuel Program at Atlas Disposal and how it is part of our goal for 33% renewable energy by 2020, by using biogas to refuel the CNG vehicles.

### Activity Day Three - Five:

The students will understand the scope and complexity of the project on biodigestion to be presented to the school and community/ school board. Research and production of the deliverable will happen, with edits and oversight by the teacher.

## Grading Rubric

Student Deliverables	4 = A Exceeds Expectations	3 = B Meets Expectations	2 = C Approaches Expectations	1 = D Fails to meet Expectations	0 = F No Project
Academic/ Content Literacy	<p><b>Student</b> demonstrated thorough understanding of the content</p> <p><b>Explanation</b> of content was in-depth, detail oriented, and well supported</p> <p><b>Use of drawings/ pictures/ examples</b> were relevant and useful</p> <p><b>Content</b> was accurate, complete, well presented</p> <p><b>Well thought out,</b> very creative, analysis of content Engaging</p>	<p><b>Student</b> demonstrated solid understanding of the content</p> <p><b>Explained</b> most of the content correctly in depth and in detail</p> <p><b>Use of some</b> drawing, pictures and examples</p> <p><b>Content</b> mostly accurate, complete and well presented</p> <p><b>Thought out, &amp;</b> creative, attention to detail</p>	<p><b>Student</b> Somewhat demonstrated an understanding of the content</p> <p><b>Explained</b> some of the content correctly</p> <p><b>Some content</b> accurate, not complete</p> <p><b>Attention</b> to detail was lacking</p>	<p>Student ineffectively, demonstrated knowledge of content</p> <p><b>Little</b> or no correct examples of content</p> <p><b>Little or no</b> correct drawings to support content</p> <p><b>Limited</b> explanation No analysis or creativity</p> <p>Could be off topic</p>	No Project
Oral/Presen	Student	Student organized	Student could	Student	No

<p>tation Proficiency</p>	<p>presentation flowed well, seamless Fellow students were engaged Rhetorical strategies were thorough and creative All questions answered in detail</p>	<p>ideas logically Presentation was adequately delivered Appropriate tone used for setting and audience Used rhetorical strategies Answered fellow student's questions</p>	<p>not be heard/ mumbled. Poorly organized Awkward, pauses, fillers Inappropriate tone/ words No use of rhetorical strategies</p>	<p>could not be heard/ mumbled Not organized. Off topic</p>	<p>Presen tation</p>
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