

Teacher Guide

Dairy Digester Virtual Field Trip

Grades 8-12

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Because of COVID-19, tours to SMUD facilities weren't possible this year. And even when they are open to the public, there isn't enough time or money to organize tours for every school that might want one. That's why SMUD Community Education and Technology team did something unique, we are creating virtual, online field trips.

Why take students on a virtual field trip?

Almost everyone has had a memorable childhood field trip! I'm sure you remember your favorite school trips.

A field trip is a very mindfully planned activity in which to set students up for success. In learning, when students can see it, experience it, (even virtually), they break away from their daily routine. The experiences create synaptic connections which build cognitive, social, cultural and emotional structures.

Real world learning

Every student comes from a unique background. A field trip is a way to provide each student with real-world experience. Did you know that many urban students do not know that milk comes from cows?



Cultural growth



Providing students with a variety of enrichment experiences through field trips help students develop not only academically, but also socially and culturally. Real-life learning is occurring as students see things from outside of their bubble. Exposure to general knowledge about the world increases a student's tolerance and empathy, helping them to see themselves a part of a bigger world outside of the walls of their classroom. Learning that farmers start work at 3 a.m. and work 365 days a year may be an eye opener for them.

Academic growth



Field trips can also be an important component of a well-rounded instructional program. They bring balance to the curriculum as field-based learning increases test scores. The three parts of a successful field trip include the pre-trip instructions, time to explore and self pace and then a time to debrief and share experiences.

Why teach about renewable energy?



Energy surrounds us. It powers student homes and classrooms and provides heat, light and electricity. The value of renewable energy sources should also be at the forefront of students' minds also with the effects of energy which contributes to 60% of global greenhouse gas emissions. As students learn more about energy, they become the next the generation of energy leaders driving the change to make clean, affordable energy for everyone.

Why teach about a dairy digester?



Did you know that when you turn on your lights, some of the electricity you are using is made from cow poop? It's a bit icky to think about, but with almost 40 dairies and nearly 15,000 cows in Sacramento county, there's a lot of cow poop to go around. It makes great fertilizer and can be used to grow crops. But there is a downside – as it breaks down it emits methane, a greenhouse gas that is 20 times more powerful than carbon dioxide. In fact, about half of California's methane emissions come from the dairy industry. The good news is that we can capture and use that methane to make electricity, supporting local dairy farms and helping SMUD meet its commitment to our ambitious new 2030 zero carbon vision.

SMUD has created an engaging, self-paced field trip at the dairy digester at New Hope Dairy. Now your students can explore the dairy from the comforts of their own home or school and see for themselves how SMUD is turning cow waste into electricity. Using a combination of video and interactive web pages, the tour melds the history and culture of New Hope Dairy with the technical expertise of SMUD's own R&D team to help our community understand how SMUD is investing in the local economy, protecting the environment, and supporting small dairies and the families that operate them.

Let's go on a field trip!

Pre-tour preparation for students



Before you assign the Dairy Digester field trip to your students, ask them if they know where their electricity comes from. Some of them may know that their electricity comes from SMUD which is their electricity provider, but do they know the source of the electricity?

A short and excellent video, [Where does SMUD's electricity come from?](#)

Ask the students if they understand the difference between renewable and non-renewable energy sources. Ask if they know how non-renewable sources effect the environment.

Whiteboard their responses.

Ask if the students know the benefits of renewable energy. Any constraints?

Whiteboard the responses.

Tell the students that they will be visiting a renewable energy source – a Dairy Digester. Tell them why you think it's important to visit.

The students will be given a scavenger hunt worksheet to use to make observations and respond to prompts. Make sure they understand how to use the pause button and know how to navigate through the virtual tour.

This field trip assignment is best given as a weeklong task to allow students to self-pace their learning experience. Ensure that students have access to the glossary guide, reviewing terms related to the Dairy Digester.

Dairy digester virtual tour



To begin the Dairy Digester tour, go to smud.org/DairyDigester

Post dairy digester tour



Have the students arrange in small (6) break out groups. Have them debrief their tour and share their experiences. (10 minutes)

Ask the breakout groups to share their experience.

Ask each group to be the subject matter experts in the following: (10 minutes)

1. Interesting facts about dairy cows.
2. Interesting facts about operating a dairy farm.
3. Interesting facts about feeding and caring of cows.
4. Interesting facts about turning dairy waste into renewable energy.
5. Interesting facts about how methane is produced and why it is harmful to the environment.
6. What are some career paths related to and part of a dairy digester.

Have the breakout groups share out their findings to the class and have them available to answer any questions. (30 minutes)

Additional/Supplemental classroom experiences



Have the students draw a poster that shows the transformation of cow poop to energy. Use chemical formulas when possible.

Have the students draw out the anerobic chemical process.

Have students draw out the burning of methane.

Have the students draw out the chemical process of fermentation.

Have the students draw out the difference between aerobic and anaerobic composting.

Have the students design a method for capturing the other methane released from cows: cow burps. Can be made into a comic strip.

Have the students calculate how many cows will it take mathematically to run a car, power a blow-dryer or play video games.

Have student break out groups list all the possible jobs associated with a diary digest. The team with the most entries wins.

Digital resources



How to turn poop into power

<https://www.youtube.com/watch?v=iAZdg969mww>

How to make energy from cow poop – by kids

<https://www.calacademy.org/educators/renewable-energy-powered-by-poop>

How about other kinds of poo?

<https://www.youtube.com/watch?v=yh-67zu-kx4>

The chemistry and problems of Methane – BBC

<https://www.science.org.au/curious/earth-environment/methane>

Anerobic vs. aerobic and fermentation

https://www.youtube.com/watch?v=YbdkbCU20_M

What about pig poop?

<https://www.youtube.com/watch?v=iAZdg969mww>

Going beyond poop – how to turn trash into cash

<https://www.youtube.com/watch?v=8GQlrTTXyg4>

Biogas – Helping a village reduce waste, disease, and turn indoor pollution into electricity

<https://www.youtube.com/watch?v=Ey8nEPqhkE>

Digital resources *(continued from page 4)*

How to make your own microbiocidal fuel cell

<https://www.labroots.com/trending/earth-and-the-environment/6010/methane-electricity-bacteria>

MAAS Energy Works

<https://www.maasenergy.com/>

Using waste in a circular economy

<https://www.youtube.com/watch?v=hEFqcqOWSWw>

Methane – the Chemical

<https://energyeducation.ca/encyclopedia/Methane>

Explore Clean Energy Careers

<https://www.energy.gov/eere/education/explore-clean-energy-careers-0>

