Driving Question:
What are the steps I need to take to engineer for sustainable communities?

Overview
The purpose of this lesson is to apply the engineering for sustainable community principles to the engineering design cycle. In order to do this, students will:

- Watch a video about other youths’ sustainable engineering designs
- Analyze the youths’ application of the engineering design cycle and engineering for sustainable community principles

Lesson Standards

**MS-ETS1-2:** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

Objective
Students will be able to explain how they can engineer for sustainable community using the engineering design cycle.

I Can Statement
I can apply engineering for sustainable communities principles to the engineering design cycle.

Materials
- Occupied video
- Occupied postcard
**Background for Teachers**

In this lesson, students will recognize the EfSC principles as the guiding design principles for the engineering challenge of this unit. In preparation for this lesson, you can read the article “Teaching Engineering for Sustainable Communities: An Equity-Oriented Approach” from the teacher materials before starting this lesson. This article will be helpful as a reference for the rest of the unit as well.

Below we highlight core design principles for Engineering for Sustainable Communities (EfSC) that are integrated across the unit, and are intended to support teachers in teaching engineering practices from this perspective.

1. Uses community members’ ideas in engineering
2. Helps the community solve their problems through engineering
3. Cares about the environment
4. Designs solutions for now and in the future

Make sure to keep these principles in mind as you support students in systematically refining design constraints and evaluating possible solutions towards optimization in the unit.

**Key Terms**

**Sustainability** → caring about making positive environmental impacts while creating long term solutions for the community.

**The Occupied Bathroom Alert System**
Lesson Sequence

I. The Occupied Bathroom Alert video and analysis

II. Adjusting the engineering design cycle based on the design principles of engineering for sustainable communities

I. The Occupied Bathroom Alert video and Analysis

A. Introduce the Occupied Bathroom Alert video and postcard.

- This video & postcards were made by Mateo, Tryn and Meg, all 6th graders, who engineered a The Occupied Bathroom Alert for their community using a sustainable energy source.

- As you watch the video, think about the following questions (which are on the back of the postcard):
  1. How did this video inspire you?
  2. What problem did The Occupied Group members identify?
  3. What was their solution?
  4. What data did The Occupied Group members use when they created their innovation?

B. In groups of about 4 students, discuss the questions on the back of the postcard.

C. After small discussion, discuss each question as a whole class. You can write this information on the white board as it will help your varying perspectives about competing design solutions, criteria, and constraints for design

D. Hand out the engineering design cycle to each of the students. Additionally, project the map on the white board. Use the map to discuss The Occupied Group members' bathroom alert project. Have students write key ideas for each of the questions below on their design cycle map.

Questions to facilitate discussion include:

- What was the problem that The Occupied Group members tried to solve?
- What community perspectives did Stephan consider? How did he find out those perspectives?
- What are some design features of their bathroom alert system?
  - Lighting → number, brightness
  - Energy source
  - Background color and words on light sign
  - Other

TIP

- The video and what inspires youth is a good place to highlight identity work. Not all youth will be inspired by the same things, and valuing all of the different entry points to engineering and what inspires young people to engineer is important.
III. After they built their bathroom alert system, what tests did they do to determine how well their bathroom alert system addressed their problem?
- Why did he do some of these tests?
- What technical data did he get?
- What social data did he get?

IV. Based on this data, what kinds of things did The Occupied Group members do to improve their bathroom alert system and why?

TIP

- When you discuss the community perspectives, pay attention to the different stakeholder groups that the students identify. It is important for them to see how engineering sustainable communities incorporates many different perspectives from different community members.

II. Linking EfSC with the Engineering Cycle

A. How is The Occupied Group members’ bathroom alert system an example of engineering for sustainable communities (see 4 principles)? Have students add their ideas to the bottom box on the map.

B. How do you think this engineering cycle helped The Occupied Group members make their project for sustainable communities?

TIP

- It is important to emphasize what kids can do. For example, in one implementation one of the 6th grade girls said “wow, if other kids can do this, then I can too!”
What was the problem that The Occupied Group members tried to solve?

What community members’ viewpoints did the group members consider? How did he find out their ideas?

After The Occupied Group members built their bathroom alert system, what tests did they do to determine how well their design addressed their problem? Why did they do some of these tests?

What kinds of things did The Occupied Group members do to improve their design and why?

What are some design features of The Occupied Group members’ bathroom alert system?
¿Cuál fue el problema que intentaron solucionar los miembros de The Occupied Group?

¿Qué tipos de cosas hicieron los miembros de The Occupied Group para mejorar su diseño y por qué?

¿Cuáles son algunas características del diseño del sistema de alerta de baño de los miembros de The Occupied Group?

Luego de que los miembros de The Occupied Group construyeran su sistema de alerta de baño, ¿qué pruebas llevaron a cabo para determinar cuán bien su diseño atendía el problema? ¿Por qué llevaron a cabo algunas de esas pruebas?

¿Cuáles puntos de vista de los miembros de la comunidad tomaron en consideración los miembros del grupo? ¿Cómo se enteraron de sus ideas?