Driving Question:
What do I want others to know about my engineering design for sustainable communities?

Overview
In this lesson, youth will create engineering cards, and videos if time allows to share how their engineering design works, and how the design makes their community more sustainable.

This lesson culminates with an opportunity for the youth to share their engineering design work with the larger community.

Lesson Standards

| MS-ETS1-2 Engineering Design Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem | Addresses the engineering practice of obtaining, evaluating and communicating information |

Objective
Students will explain to their community how their engineering designs works and how it supports sustainability.

I Can Statement
I will explain to my community how their engineering designs works and how it supports sustainability.

Materials
- Community engineering cards

Equipment
- Computers or iPads
Background for Teachers

Sharing the engineering designs with the community is a great way to end this unit for multiple reasons. It connects directly to engineering for sustainable communities because the designs are for people in students' lives.

Also, multiple community members perspectives mattered in students' designs. Finally, it is a great opportunity for students to be recognized for their accomplishments.

To celebrate students' work, host a showcase. Have students try out each others’ designs. Students should have the opportunity to explain their design to their classmates. This positions them as experts.

Have students share their engineer designs with other members of the community. It can also be powerful if people who provided feedback during earlier stages of the design to see how the youth adjusted their work.
Lesson Sequence

I. Creating youth engineering cards

A. Re-visit the community engineering cards that your class has utilized earlier in this unit: the light-up umbrella, the Woot Wall and the light-up football.

- Say: “Now that you have engineered for sustainable communities, it is time for you to create your own community engineering card.”
- Have students create their own youth engineering cards using the provided templates on the slide show. This can happen in groups or as individuals. As the students are creating these cards, walk around and prompt them to include as much information as possible. Ideally, the whole class is doing this at the same time. Before the students submit their information, they should have a classmate read it, and have them provide feedback about what else could be included on their card. This provides an opportunity for the students to both be positioned as experts and will help the students provide a thorough explanation of what they did and why.

B. Print extra cards for students to exchange and share with community members that matter to them. Ideally, you should print these cards before the showcase so they can share them with others.

II. Making Videos

A. If there is extra time or you have early finishers, invite students to create videos about their prototype. The movies should include:

- The technical and social aspects of the design
- Why they made it
- How it works

TIP

- Recognition for your talents, skills, potential, and abilities in an area is key to developing STEM identities.
III. Community showcase

A. Make a plan for sharing your students’ engineering design. Here are some ideas you can utilize:

- Invite school staff members, other classes and family members to see their work. Ask visitors to ask students: why they made it, how it works and what changes they made to their design over time
- Email/text loved ones, videos of project
- Display in prominent place in school
- Have students host show and tells for younger students’ classes

It can be useful to ask students how they want to share their work. This can allow for them to connect the showcase more to engineering for sustainable communities.

TIP

- Additionally, through offering multiple ways for students to share their work, they are able to draw upon other expertise that they hold. This success may lead to future identity work for the student in STEM.

B. Have the students write a script to explain: (see the optional script template)

- Who they are
- What they made
- Why they made it
- How it works
Script for showcase

Hello! We are: _________________________________________________________

We made the: ____________________________________________________________________

We made it to solve this problem: __________________________________________________________

We know this is a problem because: _______________________________________________________

This is how it works: _________________________________________________________________

Do you want to try it? (write out any other information that you want to share) ________________________

______________________________________________________________

______________________________________________________________
<table>
<thead>
<tr>
<th>I-Engineering Big Ideas</th>
<th>Criteria – Postcard Text and/or Photo</th>
<th>Is this present in text or photos?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engineering for Sustainable Community (EfSC) Principles</strong></td>
<td>Uses community members’ ideas in engineering</td>
<td>Describes how design was based on community survey data (Ex: Community survey data showed we wanted to make learning more fun) and how the sketch up design incorporated community and expert feedback in iterative changes (Ex: We used a parallel circuit instead of a series circuit because of expert feedback)</td>
</tr>
<tr>
<td></td>
<td>Includes both social and technical aspects of design</td>
<td>Describes seeking a balance of technical and social aspects of the project, and trade-offs, which are a part of the EfSC engineering design process (Ex: We wanted 5 color lights in a circle to make it pleasing to look at, but we only had room for a small parallel circuit for 4 lights)</td>
</tr>
<tr>
<td></td>
<td>Sustainable over time</td>
<td>Describes how the engineering process and product will benefit the community now and in the future (Ex: Knowing students want to have more fun in class from the survey encourages the teacher to use the light-up Happy Box; The Happy Box will stay lit up as long as there is light from the window with solar panels)</td>
</tr>
<tr>
<td></td>
<td>Reduces negative environmental impacts</td>
<td>Describes how the project minimizes the negative environmental impacts (Ex: Our project, made with solar panels to produce renewable electricity, is not emitting CO2 because we do not use electricity from the wall socket which is often made from burning coal)</td>
</tr>
<tr>
<td><strong>Engineering Practices</strong></td>
<td>Engineering Solutions</td>
<td>Describes the process of engineering a solution to the problem (Ex: We built a series circuit but it did not work, so we tried a parallel circuit and then it worked)</td>
</tr>
<tr>
<td></td>
<td>Types of Energy</td>
<td>Describes the process of deciding which source of energy to be used (Ex: This will sit in the window sill where the sun shines in, so we decided to use renewable energy from solar panels)</td>
</tr>
<tr>
<td></td>
<td>Energy Flow</td>
<td>Describes the process to design a working circuit (Ex: We drew a series circuit, but it did not work when we tested it, so we changed to a parallel circuit and then it worked)</td>
</tr>
<tr>
<td></td>
<td>Energy Transformation</td>
<td>Explains how energy was transferred in the circuit (Ex: When we used the hand crank at one end of the circuit it made the handle of the hand crank we connected at the other end of the circuit move around—Kinetic energy became electric energy and then became kinetic energy)</td>
</tr>
<tr>
<td><strong>Identity</strong></td>
<td>Introductions</td>
<td>Describes group members, their interests and experiences, as well as their general location.</td>
</tr>
</tbody>
</table>
Guion para la exhibición

¡Hola! Somos: ________________________________

Creamos el: ____________________________________________

Lo hicimos para solucionar el problema de:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Sabemos que esto es un problema porque:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Funciona así:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

¿Lo quieres probar? (escribe cualquier información que quieras compartir)

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
### I-Rúbrica para postal de ingeniería

Nota: Los trabajos escritos de las hojas de trabajo de las lecciones 1-10 se pueden usar para el texto de las postales.

<table>
<thead>
<tr>
<th>I-Grandes ideas de ingeniería</th>
<th>Criterios - Texto o foto de la postal</th>
<th>¿Esto se encuentra en el texto o las fotos?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Principios de ingeniería para una comunidad sostenible</strong></td>
<td>Usa las ideas de ingeniería de los miembros de la comunidad</td>
<td>Describe cómo el diseño se basó en los datos del cuestionario a la comunidad (Ej. Los datos del cuestionario a la comunidad demostraron que queríamos hacer que el aprendizaje fuera más divertido) y cómo el diseño incorporó los comentarios y las sugerencias de la comunidad y los expertos en cambios iterativos (Ej. Usamos un circuito en paralelo en vez de un circuito en serie siguiendo las recomendaciones de los expertos).</td>
</tr>
<tr>
<td></td>
<td>Incluye tanto los aspectos sociales como técnicos del diseño</td>
<td>Describe la experiencia de buscar el balance entre los aspectos técnicos y sociales del proyecto y las limitaciones, que son parte del proceso de diseño de ingeniería para comunidades sostenibles (Ej. Queríamos 5 luces de colores en un círculo para que fuera más agradable para la vista, pero solo teníamos espacio para un circuito en paralelo pequeño para 4 luces).</td>
</tr>
<tr>
<td></td>
<td>Sostenibilidad con el tiempo</td>
<td>Describe cómo el proceso de ingeniería y el producto beneficiarán a la comunidad ahora y en el futuro (Ej. Sabiendo que los estudiantes quieren clases más divertidas según el cuestionario, se alienta al maestro a usar una Caja Feliz con luces; la Caja Feliz se mantendrá encendida siempre y llegue la luz que entra por la ventana a los paneles solares).</td>
</tr>
<tr>
<td></td>
<td>Reduce el impacto ambiental negativo</td>
<td>Describe cómo el proyecto minimiza los impactos ambientales negativos (Ej. Nuestro proyecto, creado con paneles solares para producir electricidad renovable, no emite CO2 porque no usamos la electricidad del enchufe de la pared, que suele producirse por la combustión de carbon).</td>
</tr>
<tr>
<td><strong>Prácticas de Ingeniería</strong></td>
<td>Soluciones de ingeniería</td>
<td>Describe el proceso de ingeniar una solución para el problema (Ej. Construimos un circuito en serie, pero no funcionó, así que intentamos hacer un circuito en paralelo que sí funcionó).</td>
</tr>
<tr>
<td><strong>Conocimiento de contenido energético</strong></td>
<td>Tipos de energía</td>
<td>Describe el proceso de decidir cual fuente de energía se utilizaría (Ej. Esto se colocará al borde de la ventana donde entra la luz solar, así que decidimos usar energía renovable de paneles solares).</td>
</tr>
<tr>
<td></td>
<td>Flujo de energía</td>
<td>Describe el proceso de diseñar un circuito de trabajo (Ej. Dibujamos un circuito en serie, pero no funcionó cuando lo probamos, así que lo cambiamos a un circuito paralelo y funcionó).</td>
</tr>
<tr>
<td></td>
<td>Transformación energética</td>
<td>Explica cómo la energía se transfirió al circuito (Ej. Cuando usamos la manivela al extremo del circuito, ocasionó que el mango de la manivela que conectamos al otro extremo del circuito se moviera. La energía cinética se convirtió en energía eléctrica y entonces se convirtió en energía cinética).</td>
</tr>
<tr>
<td><strong>Identidad</strong></td>
<td>Presentaciones</td>
<td>Describe a los miembros del grupo, sus intereses y experiencias, al igual que su ubicación general.</td>
</tr>
</tbody>
</table>