

CAREER CLUSTER: Science, Technology, Engineering, & Mathematics	DURATION: 17 Sessions – can be modified to fit schedule (Session = 45 to 50 minutes)	TEACHER:	UN SUSTAINABLE DEVELOPMENT GOAL: #7 — Affordable & Clean Energy
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GLOBAL ISSUE OVERVIEW

Global access to affordable, reliable, modern energy is a goal the United Nations has identified in order to stay on track to meeting sustainable, affordable energy targets for 2030. In the least developed countries, the number of people with access to electricity more than doubled between 2000 and 2016 (U.N., 2015). However, as of 2015, three billion people (almost half of the world’s population) were still not able to harness this electricity for cooking — and were using harmful cooking stoves. Exposure to household air pollution from burning wood, charcoal, coal, or kerosene is still a leading risk factor for a variety of diseases such as childhood pneumonia, ischemic heart disease, stroke, and lung cancer. Pregnant women exposed to this pollution increase the risk for stillbirth, low birthweight, or decreased lung function for their infants. (Clean Cooking Alliance, 2019).

Replacing open fires and stoves with clean cookstoves and fuels reduces emissions and lowers the exposure of diseases associated with household air pollution (HAP) and helps to meet the United Nations goal of ensuring access to affordable, reliable, sustainable, and modern energy for all.

The [United Nations Sustainable Development Goal #7 — Ensure access to affordable, reliable, sustainable, and modern energy for all](#), has laid out the following [target](#):

- 7.1: By 2030, ensure universal access to affordable, reliable, and modern energy services.

Global Competencies Addressed:

Investigate the World: Initiate investigations of the world by framing questions, analyzing and synthesizing relevant evidence, and drawing reasonable conclusions about global issues.

Recognize Perspectives: Recognize, articulate, and apply an understanding of different perspectives.

Communicate Ideas: Select and apply appropriate tools and strategies to communicate and collaborate effectively — meeting the needs and expectations of diverse individuals and groups.

Take Action: Translate ideas, concerns, and findings into appropriate and responsible individual or collaborative actions to improve conditions.

STANDARDS ADDRESSED		
Career/Technical Knowledge and Skills	Academic Knowledge and Skills	21 st Century Skills
<p>Common Career Technical Core Career Ready Practices 1. Act as a responsible and contributing citizen and employee. 4. Communicate clearly and effectively and with reason. 5. Consider the environmental, social and economic impacts of decisions. 6. Demonstrate creativity and innovation. 7. Employ valid and reliable research strategies. 8. Utilize critical thinking to make sense of problems and persevere in solving them. 9. Model integrity, ethical leadership and effective management. 12. Work productively in teams while using cultural global competence.</p> <p>Science, Technology, Engineering, & Mathematics Career Cluster</p> <ul style="list-style-type: none"> • SCC02.01.02 Effectively communicate STEM information to a select audience. • SCC03.01 Effectively develop and apply the skills inherent in systems 	<p>National Council for the Social Studies Theme 3: People, Places, Environment Theme 6: Power, Authority, and Governance Theme 9: Global Connections Theme 10: Civic Ideals and Practices</p> <p>Next Generation Science Standards HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.</p> <p>Common Core Academic Standards ELA/Literacy:</p> <ul style="list-style-type: none"> • RST. 11-12. 1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text. • RST.11-12.7. Integrate and evaluate multiple sources of information 	<p>Learning & Innovation Skills:</p> <ul style="list-style-type: none"> • Creativity & Innovation • Critical Thinking & Problem Solving • Communication • Collaboration

engineering where requirements, configuration, integration, project management, quality assurance, and process applications are necessary.

- **SCC06.01.01** Apply appropriate safety and health practices when developing plans, projects, processes, or solving complex problems.

presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

- **RST.11-12.8.** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
- **RST.11-12.9.** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

PROJECT DEFINITION & GOALS/OBJECTIVES

The [Clean Cooking Alliance](#) works to reduce the negative impacts of cooking on health, climate, air quality, women, and girls. They have linked 3.8 million premature deaths annually to household air pollution (HAP). The goal of this project is to identify an alternative to fire or wood burning stoves after investigating the impact on human health and the environment.

Goals:

- Students will gain an understanding of the United Nations Sustainable Development Goals (SDGs) and develop empathy for other cultures.
- Students will acquire the skills necessary to research factors impacting global health.
- Students will develop solutions to a complex real-world problem.

Objectives:

- Research the impact of household air pollution on people and the environment.
- Research alternative fuel solutions.
- Identify solutions to remove open fire or gas stoves.
- Brainstorm prototypes.
- Model a prototype (visually or physically).
- Communicate and demonstrate the solution in a creative way.

SCENARIO OR PROBLEM: What scenario or problem will you use to engage students in this project?

You are on a creative technology team tasked with developing an alternative oven or stovetop to replace open fire and insufficient stoves. Exposure to household air pollution (HAP) from burning wood, charcoal, coal, and kerosene is causing much more harm than good but is the only solution to cooking and preparing food in many regions of the world. Your task is to research and gain an understanding of the impact of HAP on the environment and human population. Once you complete your initial investigation, you'll begin researching alternative fuels and cooking options. Then, as a team (or individually), think through and create a method to cook and prepare food without causing harm to people or the environment. Your team must also be conscious of providing a solution that is affordable. Be as creative and innovative as you can, and be prepared to demonstrate or build a prototype to present your solution.

Essential Questions

- To what extent does household air pollution impact quality of life?
- To what extent does household air pollution impact the environment?
- What's the value of an alternative cooking system?
- What changes could be done to minimize the impact of household air pollution?
- What solutions will reduce environmental impact and be affordable in low income areas?
- How important is addressing household air pollution?

Grade Level Adaptations

- Allow younger students to work in teams to create a sample solar powered oven.
- Advanced students can individually create their designs. Then, require advanced learners to reason and identify solutions to the oven design they create.

ASSESSMENT: How will you determine what students have learned? (Check all that apply.)

FORMATIVE		SUMMATIVE	
Quizzes/Tests		Multiple Choice/Short Answer Test	
Notes/Graphic Representations	X	Essay Test	
Rough Draft		Written Product with Rubric	
Practice Presentation	X	Oral Presentation with Rubric	X
Preliminary Plans/Goals/Checklists of Progress		Other Product or Performance with Rubric	
Journal/Learning Log	X	Self-Evaluation or Reflection	X
Other:		Evaluation by Authentic Audience	X
		3D Model	X
		Other:	

MATERIALS, RESOURCES, or CONSTRAINTS: What materials and resources will be needed? Are there any perceived challenges?

Materials:

- Computers with internet access
- Cardboard, scissors, paper, and other materials to build a prototype oven
- Student journals
- Project rubric

Internet Resources:

- [Sustainable Development Knowledge Platform, Clean Affordable Energy](#)
- [Clean Cooking Alliance](#)
- [Can Alternative Energy Effectively Replace Fossil Fuels](#)
- [Alternative Energy](#)
- [Sustainable Development Goal on Energy and the World Bank Group](#)
- Video resources:
 - United Nations Foundation’s video, “[A Look at the Sustainable Development Goals](#)” (1:00). An introduction to the 17 Sustainable Development Goals from the United Nations Foundation.

SUPPORT, MODIFICATIONS, AND EXTENSIONS: What is needed to provide support for students who have difficulty learning the content, modify for students with special learning needs, or to provide enrichment for advanced students?

Support & Modifications:

- Provide rotating small group sessions or team meetings on a regular basis with a focus on teaching research skills and strategies for students that will need support.
- Design journal templates for students that might struggle to keep their own journal organized.

Extensions:

- Require advanced learners to research the impacts outside of human health and the environment.
- Require advanced learners to reason and identify various alternative fuels.
- Require advanced learners to develop a teachable unit for younger students and have them deliver the lessons to classrooms.
- Develop an awareness campaign for their cause.

CALENDAR OF MAJOR LEARNING ACTIVITIES: What are the learning activities or tasks for each day? Are there any project milestones? When will formal assessment activities occur?

Week 1

Monday	Tuesday	Wednesday	Thursday	Friday
<p>Initiating: Teacher or guest leads lesson and discussion on building awareness for SDG #7. What prior knowledge do students have on the topic? Ask students what they know about the dangers of cooking. Then, ask what they know about dangers in cooking in global locations.</p>	<p>Initiating: Teacher leads a discussion on SDG #7. Discuss what household air pollution is and who it affects. Discuss the environmental impacts of HAP.</p>	<p>Initiating: Teacher leads a discussion and students generate questions and challenge assumptions. Teacher facilitates discussion and records questions for continued research.</p>	<p>Initiating: Teacher forms teams of students and shares the scenario with them. Students research HAP impacts on the environment and human population. To what extent is it causing damage? Who or what is it impacting the most? What is the awareness level of HAP? What barriers stand in the way to implementing meaningful change? Are other solutions affordable to low income areas?</p>	<p>Initiating: Students dig deeper into resources available as alternative options for fuels. How accessible are these options? How affordable are they? What would it take to implement other solutions? What are some out-of-the-box ideas to solve the problem?</p>

Week 2				
<p>Initiating: Students submit a brief overview of their perspective to the challenge of removing household air pollution. They could interview a local power/fuel specialist on the topic.</p> <p>Students continue to research their issue and gather data. They might research online, conduct interviews, etc.</p>	<p>Planning: Armed with research, data, and information, student teams brainstorm possible solutions. Teacher facilitates the brainstorming session(s) and encourages all ideas and multiple possibilities.</p>	<p>Planning: Students determine their best solution for the alternative cooking method — keeping cultural, economic, and legal realities in mind. Students generate a plan to address their solution and assign team roles and tasks.</p>	<p>Executing: Students begin creating their prototype.</p>	<p>Executing: Continued creation time. Teacher encourages testing and improving solutions throughout. Students share and seek feedback to improve their design.</p>
Week 3				
<p>Executing: Continued creation time. Teacher encourages sharing, revising, and improving prototypes throughout.</p>	<p>Executing: Continued creation time. Teacher encourages sharing, revising, and improving prototypes throughout.</p>	<p>Executing: Students complete the first iteration of their presentation and share it with the class, teacher, or other users. Class discusses positives and negatives of the presentation and offer ways to improve their message based on the information they have researched. Student teams make revisions based on their feedback.</p>	<p>Executing: Students complete the first iteration of their presentation and share it with the class, teacher, or other users. Class discusses positives and negatives of the presentation and offer ways to improve their message based on the information they have researched. Student teams make revisions based on their feedback.</p>	<p>Executing: Students complete the first iteration of their presentation and share it with the class, teacher, or other users. Class discusses positives and negatives of the presentation and offer ways to improve their message based on the information they have researched. Student teams make revisions based on their feedback.</p>
Week 4				
<p>Closing: Students present their solutions to an authentic audience like a</p>	<p>Closing: Students present their solutions to an authentic audience like</p>			

<p>local public power representative, politicians, students, public, etc.</p> <p>Students could also post solutions (e.g., pictures, brief summaries, etc.) to social media platforms such as Twitter, Instagram, or Facebook.</p>	<p>a local public power representative, politicians, students, public, etc.</p> <p>Students could also post solutions (e.g., pictures, brief summaries, etc.) to social media platforms such as Twitter, Instagram, or Facebook.</p>			
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STUDENT REFLECTION ACTIVITIES: How will students reflect on their work? Add reflection questions and/or activities here.

- Provide a prompt at the end of each session and have students write their reflections in their journals.
- Using a site like [Flipgrid](#), allow students to post video reflections of their work and development.
- Guide summary activities at the end of research days such as:
 - Quick Pick: Students pick the top three takeaways they had during the lesson.
 - Two Dollar Summary: Students write summaries of what they learned as if each word is worth ten cents. The summary should not be more than 20 words.
 - Gallery Walk: Students write or draw what they learned on large sheets of paper then walk through the gallery reading each other's charts.
- Allow students to create a blog that details the problem they are trying to solve and the process they are engaged in for solving it.

Adapted from: "Unit Planning Template" by the Southern Regional Education Board, n.d., Atlanta: Southern Regional Education Board.

Work Cited:

- Clean Cooking Alliance. (2019). *Air pollution, health, and clean cooking*. Washington, D.C.: U.N. Foundation. Retrieved from <http://cleancookstoves.org/resources/559.html>
- United Nations. (2015). *Sustainable development goals: Goal 7: Ensure access to affordable, reliable, sustainable, and modern energy for all*. New York: The United Nations. Retrieved from <https://sustainabledevelopment.un.org/sdg7>