Title	Robots and Alternative Fuels
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Primary Subject	STEM (CTE)
Secondary Subject	Science
Grade Level	7th

Description
This lesson will introduce the student to electrical engineering and robotics. Students will build 2 power stations utilizing Lego NXT robotics. They will also conduct labs using the robots and complete online simulations.

Materials:

LEGO NXT LEGO Alternative Fuels kit Activity Sheets Activity Sheet 2 Building Instructions. NASA Design Process

Automated systems require minimal human intervention.
An open-loop system has no feedback path and requires human intervention, while a closed loop system uses feedback.
Automated systems can be powered by alternative energy sources like solar and fuel cells. (FT Version)

Standard 4.0 Students will use, manage and assess the engineering design process as they apply STEM to create solutions to a problem.
Standard 6.0 Students will understand the effects technology and inventions and innovations have on the environment.

Next Generation Science Standards (NGSS)

Physical Science:

MS-PS1-1	Develop models to describe the atomic composition of simple molecules and extended structures.

MS-PS1-4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
MS-PS3-1	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
MS-PS3-5	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
MS-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
MS-PS4-2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
MS-PS4-3	Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

Engineering Design:

MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

First Principles of Engineering

x	1.0	The Meaning of Engineering

x	2.0	Problem Solving
	3.0	Creative Thinking
	4.0	Engineering Design Process
	5.0	Teaming
x	6.0	Applied Mathematics and Science Knowledge
	7.0	Computer Tools
x	8.0	Modeling
x	9.0	Technical and Engineering Communications
	10	Graphics
	11	Ethics
	12	Time Management
	13	Project Management
x	14	Role of Engineers and Engineering in Society

ITEEA:

	1.0	Students will develop an understanding of the characteristics and scope of technology.
	2.0	Students will develop an understanding of the core concepts of technology.
	3.0	Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.
	4.0	Students will develop an understanding of the cultural, social, economic, and political effects of technology.
	5.0	Students will develop an understanding of the effects of technology on the environment.

	6.0	Students will develop an understanding of the role of society in the development and use of technology.
	7.0	Students will develop an understanding of the influence of technology on history.
	8.0	Students will develop an understanding of the attributes of design.
	9.0	Students will develop an understanding of engineering design.
x	10.0	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
x	11.0	Students will develop the abilities to apply the design process.
	12.0	Students will develop the abilities to use and maintain technological products and systems.
	13.0	Students will develop the abilities to assess the impact of products and systems.
	14.0	Students will develop an understanding of and be able to select and use medical technologies.
	15.0	Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.
x	16.0	Students will develop an understanding of and be able to select and use energy and power technologies.
	17.0	Students will develop an understanding of and be able to select and use information and communication technologies.
	18.0	Students will develop an understanding of and be able to select and use transportation technologies.
	19.0	Students will develop an understanding

		of and be able to select and use manufacturing technologies
	20.0	Students will develop an understanding of and be able to select and use construction technologies.

Plan: Pick one promising idea and then develop a plan.

Create: Emphasize teamwork and follow the plan.

Experiment: Do the experiments, measure, record and ask how to improve their design.

Improve: Changes are made to the original model to come up with the best solution.

Procedures:

Activities:

1. Design and build a wind turbine. Then measure the energy production.
2. Design and build rotating solar panel

Day 1:
The teacher will introduce the topic and the students will complete the activity in their interactive notebook on the simulation found at http://tcipg.mste.illinois.edu/applet/pg.

Day 2:
The students will begin building the base for the solar activity.

Day 3

The students should finish with building and begin the programming phase for the solar activity.

Day 4
The students will complete lab activity using the solar robots.

Day 5
The students will begin building the wind turbine.

Day 6
The students will finish building and program the wind turbine.

Day 7
The students will complete lab activity using the wind turbine.

Day 8-10
Students will work on Solar Simulation and put their results in their interactive notebook.