UN Climate Council: Understanding Climate Change

This lesson uses C-Learn, a climate simulation tool from Climate Interactive's World Climate Exercise. To learn more, head over to climateinteractive.org. To learn more about Black Rock Solar and our student and educator resources, go to blackrocksolar.org.

Next Generation Science Standards:

H.S. & M.S. Weather and Climate ESS3-5 *Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.*

H.S. & M.S. Energy PS3-3 *Crosscutting Concepts: Energy and Matter & Influence of Science, Engineering, and Technology, on Society and the Natural World*

H.S. Human Sustainability ESS3-2 *Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.* **ESS3-4** *Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.* **M.S. Human Impact ESS3-3** *Apply scientific principles to design a method for monitoring and minimizing human impact on the environment.* **ESS3-4** *Construct an argument supported by evidence for how increases in human population and per-capital consumption of natural resources impact Earth's systems.*

International Society for Technology in Education: National Educational Technology Standards (ISTE/NETS)

Grade Level:

Research and Information Fluency

· Locate, organize, analyze, evaluate, and ethically use information from a variety of sources.

Essential Questions:

· What is causing climate change?
· What do greenhouse gases (GHG) do? What produces GHG emissions? · What gases are considered GHGs?
· Which countries (or group of countries) produce the most GHGs? · Which countries have the highest GHG emissions?

6-12

Subjects:

Environmental Science Physical Science

Pre-requisites:

Students learn about the factors that have caused the rise in global temperature. This lesson builds upon energy concepts relating to the production of electricity and renewable vs. non renewable sources of energy. It builds on Weather & Climate science and Human Impact & Sustainability concepts related to atmospheric processes and climate change. **Teacher Prep Time:** 20 minutes

Lesson Duration:

Two 50-60 minute classes

· Do lifestyles that use more resources (consumption of goods, electricity usage, transportation, etc.) contribute more GHG emissions than those that use less?
· How does deforestation affect climate change?
· What can be done to reduce GHG emissions? What has been done?
· When should solutions be implemented? When should emissions stop increasing and start reducing

to prevent climate change and the associated environmental impacts?

Instructional Objectives:

At the end of the lesson, students will be able to:
· Describe the effects of climate change on our environment.
· List the primary factors that are leading to climate change.
· Compare and contrast "business as usual" scenarios with their own solutions to climate change. · Explain the advantages and disadvantages of climate change solutions.

Lesson Overview: In Nevada and the southwest region, climate change poses threats to communities, infrastructure, agriculture, and recreational activities. Increasing temperatures and more frequent and severe droughts will likely worsen existing competition for water resources. Global impacts include habitat destruction, species extinctions, coral reef die-offs, more frequent and more extreme storms and droughts, food and water shortages and coastal flooding from a rise in sea levels.

To minimize the negative effects of global climate change, scientists have advocated for action to limit global warming to no more than 2° C (3.6 degrees F) relative to the preindustrial level (prior to 1750, before the Industrial Revolution). Achieving the temperature goal of no more than 2° C will require that greenhouse gas (GHG) concentrations be stabilized at a level well below 450 ppm (parts per million). Earth has already experienced almost 1/2 of the 2.0 °C. In the last 100 years, Earth's average surface temperature increased by about 0.8 °C (1.4 °F) with about two thirds of the increase occurring over just the last three decades.

Students will be acting as members of the UN Climate Council and will be working within teams to identify and address the major factors behind climate change.

This lesson is based on the 5E model. The 5Es represent five stages of a sequence for teaching and learning: Engage, Explore, Explain, Extend (or Elaborate), and Evaluate. The lesson is broken into 6 steps and two main parts and includes a PowerPoint presentation, class discussion, reading passages, student worksheets, and a vocabulary list.

Background: Scientists now believe it's "extremely likely" that human activity is the dominant cause of global warming. The United Nations' Intergovernmental Panel on Climate Change (IPCC) used its strongest language yet in a 2013 report on the causes of climate change, prompting calls for global action to control emissions of CO_2 and other greenhouse gases. Scientists have moved from being 90 percent sure to 95 percent — about the same degree of certainty they have that smoking kills.

The IPCC said the evidence of climate change has grown thanks to more and better observations, a clearer understanding of the climate system and improved models to analyze the impact of rising temperatures. Assessment of the science finds that the atmosphere and ocean have warmed, the amount of snow and ice has diminished, the global mean sea level has risen and the concentrations of

greenhouse gases have increased.

The IPCC assessments are important because they form the scientific basis of U.N. negotiations on a new climate deal. Governments are supposed to finish that agreement in 2015, but it's unclear whether they will commit to the emissions cuts that scientists say will be necessary to keep the temperature below a limit at which the worst effects of climate change can be avoided.

Materials List:
Copies of the Student Reading Passages and Student Worksheets
The UN Climate Council PowerPoint presentation

Part I: Climate Change Factors

Introduction and Student Engagement (Engage – 10 minutes) (Check for understanding)

Ask students to focus on the important role climate plays in their everyday lives. Ask them what choices they made last week that were influenced by weather. Ask them to consider how different their lives would be if the climate in Nevada were different. For example, how different would their lives be if it always rained in Nevada, or if it snowed heavily for 4 months out of the year? How would their lives change? These questions can help guide the discussion:

- Have you ever experienced a situation in which the climate influenced your activities? Discuss your experience.
- What are some other ways climate impacts you or your family economically or socially?
- How would your life/community change if there were severe droughts and greater competition for water?
- Have you noticed a change in the climate (record breaking heat or cold)? Locally, globally?

(Extension) As a class use a KHWL chart to organize students. These questions can help guide the discussion:

- What do you KNOW about climate change?
- Ask student to explain HOW they have learned the information stated.
- What do you WANT TO KNOW about climate change?

Identify Climate Change Factors (Explore - 20 minutes)

Explain to students that they have been chosen to be members of the United Nations Climate Council to identify and address the major factors behind climate change. As a group their goal is to develop a plan that identifies and addresses the major causes of climate change.

Show students only first 7 slides of the presentation.

Step 1: Give each student a copy of the UN Climate Council student packet. Organize students into groups of 3-5. Ask them to identify three of the greatest factors contributing to climate change today. Factors include methods of electricity generation (coal-fired or natural gas-powered power plants), certain lifestyles, transportation, deforestation, etc. Have students explain why they chose those factors

(ex. Coal-fired power plants are a major contributor to climate change due to carbon dioxide emissions). Each student should complete their own handout.

While students are working ask the following big picture questions:

- How does that lead to climate change?
- Does it make a significant impact on the environment?
- How prevalent is that factor globally?
- What would it take to change that factor?

Step 2: After students have completed the first section in their student packet, direct them to the UN Climate Council Brief (pg.2-4) and have students prepare a list of at least 5 questions to research.

Confirm Climate Change Factors (Explain – 25-30 minutes)

Step 3: After conducting further research, have students review their list of the top three factors and modify as necessary. Students should complete the second section on page 1. One student from each group will take 3 minutes to present their findings to the rest of the class. The rest of the class will have 3 minutes to ask questions following the presentation. If group members do not know the answer, they can research the question to answer during the next class period. Review the KWHL chart for unanswered questions that can be included here.

Teachers can ask students the following questions to help them connect their explanation to the concept of climate change. These are higher order thinking questions which teachers will use to solicit student explanations and help them to justify their explanations.

- What would happen if that factor continued to be in place without any change, in other words, business as usual? Would these factors become more significant?
- Do those factors contribute to other environmental impacts?
- Are these factors limited to a geographic location?
- Are these factors caused by a certain group of people or certain socio-economic background? · How easily can we change these factors? How engrained are they in our culture or infrastructure?

Revisit the KWHL chart to monitor whether students learned what they wanted to know and if they learned anything new. List questions still remaining that will be reviewed during the next class period.

Part 2: Choosing Solutions to Reduce Greenhouse Gas Emissions

Revisit unanswered questions from previous class period. Review the KWHL chart (5-10 minutes).

Identify Climate Change Solutions (Extend – 20-30 minutes)

Show slides 8-13 in the PowerPoint presentation to introduce students to the following activity and to present some ideas for solutions.

Discussion: Ask students to discuss solution.

- Are they easy or difficult to implement?
- Would they require expensive equipment? Would it be expensive overall?
- Would they require behavioral changes?
- Have they seen these solutions implemented already?
- How would people react to these solutions? Would they readily accept them or would you need to educate people, tax people, incentivize people to ensure changes are made? · Would the solutions require a great deal of land?

Step 4: Have students gather again in their groups to identify 2-3 solutions to address each of the top 3 factors listed by the different groups. Have students research solutions and outline possible pros and cons (pg. 5-7). *Make sure students keep in mind the economic, social and environmental impacts of solutions.*

Show slide 14-15. Students will guesstimate (see student sheets) how much impact their solutions will have on climate change. Show students how to use the C-Learn model to simulate the associated environmental changes. Students are encouraged to run various simulations and explore this educational tool.

Final Report: (Evaluate) Students can begin report in class if time allows. Step 5:

Students will prepare a 1-2 page final report on their findings. Have them list the top 3 factors contributing to climate change and the reasons why they chose those factors. Then have them outline how they will address those factors and why they chose those solutions.

Step 6: Visit C-Learn: Climate Simulation http://climateinteractive.org/simulations/c-learn/simulation

Have them enter in their data and run the program. Their data will be based on educated guesses. The most important part of this activity is for them to see the levels of emissions reduction required to prevent increasing climate change and sea levels.

Students will print their results from the main page and should attach with their final report.