Lesson Five - Solutions Project
Lesson Planning Tool for Climate Change

Title of Lesson: Solutions Project

Grade Level: 11th and 12th
Subject: Environmental Science

Source(s) of the lesson: Utilizing the information available on http://thesolutionsproject.org/

Essential Question(s): How can we move towards a 100% renewable energy economy by the year 2050?

Massachusetts Curriculum Frameworks Science Standards:
HS-LS2-7 Analyze direct and indirect effects of human activities on biodiversity and ecosystem health, specifically habitat fragmentation, introduction of non-native or invasive species, overharvesting, pollution, and climate change. Evaluate and refine a solution for reducing the impacts of human activities on biodiversity and ecosystem health.*

Content Objectives	Practice Objectives	Language Objectives
SWBAT - evaluate the local production of renewable energy and how to transition to a low carbon economy	4. Analyzing and interpreting data 5. Using mathematics and computational thinking 6. Constructing explanations (for science) and designing solutions (for engineering) 8. Obtaining, evaluating, and communicating information	SWBAT- summarize in writing how we can move towards a sustainable energy future.

Important Vocabulary: Climate change, albedo, acidification, feedback loops, atmosphere, precipitation, carbonic acid, carbon dioxide, methane, ozone, greenhouse effect, mitigation, anthropogenic, urban heat island, permafrost

Materials Needed: Computers, internet access, attached handout

Other Resources: (websites, videos, books, etc.)

Background Information for Teacher: Understand the basics of renewable energy, and how some areas of the world are more suited to a specific type of power versus others. (solar in Nevada vs. offshore wind in Massachusetts)

Background Information the Student Needs to Access the Lesson: What prerequisite knowledge should the students have?
How the planet receives energy? How have humans used fossil fuels as an energy source since the industrial revolution, and what that has done to the atmosphere? How can we act more sustainably by utilizing the sun as a direct, or indirect energy source?

Lesson Structure

Lesson Launch (Do Now)	Brainstorm on types of renewable energy, and what makes one type a better option than another and why? Then view the Ted Talk from Dr. Mark Z. Jacobson from Stanford University, the founder of The Solutions Project, and debrief. https://www.youtube.com/watch?v=NnrdvWz6BIQ
Background Instruction (pre-activity)	Review the different types of renewable energy, and how they work, their source of energy etc...
Activity	Complete the attached handout on the analysis of the solutions project.
Discussion/ Debrief	Discuss what it would take to transition to a low carbon economy and sustainable energy production by 2050.
Formative Assessment	Grade the attached handout.

Notes:

Solutions Project Analysis

Professor Mark Jacobson and his team have created 50 state plans to transition to 100% renewable energy. Each plan identifies a custom mix of wind, water and solar (WWS) to power our energy for all purposes (electricity, transportation, heating/cooling and industry).

Please visit the website – thesolutionsproject.org and complete the following questions

Choose any state from the interactive map and analyze the energy sources.

1. Explain how the following energy sources work, and provide a list of positive and negative attributes to each. Hint: use other resources if information is insufficient.

CSP Plant **Positives/Negatives**

Wave Devices **Positives/Negatives**

Geothermal **Positives/Negatives**

Tidal Turbines **Positives/Negatives**

2. How does the projected energy demand in the year 2050 compare to today? Why is this true? How did Prof. Jacobson calculate these numbers (what is this based off of)?

3. Compare two states with a significant geographical separation. Does the location of the state limit the potential WWS energy it can utilize? Why or why not?

State Comparison

Complete a state profile analysis for Massachusetts and a state of your choice. Compare the data from each state for each question below.

1. What is the breakdown for the projected 2050 energy mix for each state?

2. What is the comparison of 40-year jobs created, for both construction and operational?

3. How much less energy will each state have to produce by 2050 to meet the necessary energy demands?

4. Compare the avoided health care and mortality costs. How many lives will be saved due to a reduction in air pollution?

5. What percentage of land will be needed for the WWS energy plan?

6. How do the future WWS energy costs compare to the business as usual (BAU) plan?

7. What is the annual energy, health and climate costs savings per person in 2050?

8. The Solutions Project 2050 is an ambitious plan to move the US into a renewable energy future. What are the most significant benefits to this plan, and what are some potential drawbacks you see? Please be specific and elaborate and explain your answers.