ENGINEERS WITHOUT BORDERS USA

ALTERNATIVE FUEL CURRICULUM

ASME SETTING THE STANDARD

ASCE American Society of Civil Engineers

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JETS

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Teacher's Background

Lesson Plans

Science

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Social Studies/History

ALTERNATIVE FUEL CURRICULUM

Project Overview

This curriculum is built around **Project #1: *Alternative Fuel***. The project challenged students at Clarkson University and the St. Regis Mohawk Tribe of upstate New York to develop a creative way to recycle used vegetable oil to fuel the reservation's tribal vehicles.

The project team included Professor Amy Zander of Clarkson University; Laura Weber, Manager of Solid Waste, St. Regis Mohawk Tribe; and engineering students from Clarkson University.

Members of the St. Regis Mohawk Tribe approached the Clarkson University EWB-USA Chapter with the idea of creating a system for recycling used vegetable oil (also called UVO) from the Akwesasne Mohawk Casino. The original project concept would have involved a complex and expensive biodiesel conversion system, but the final plan involved the development of a system for filtering and blending together UVO and ordinary diesel. Clarkson students assessed the situation, developed a plan for designing and building a unique trailer-based filtration and mixing system, and built the entire system with the support of University and tribal staff. The result: UVO will be reused, saving money and reducing air pollution.

Sustainability is an important aspect of all EWB-USA projects. By designing low-cost, easy-to-maintain solutions to local problems, engineers empower communities for the long haul. In the case of this project, Clarkson students worked with the St. Regis Mohawk Tribe to design an appropriate, mobile, low-cost, low-tech solution to reusing UVO.

Curriculum Connections

SCIENCE:

- States of matter (what happens when vegetable oil gets too cold)
- Energy (converting fuel to energy)
- Environmental Science (alternative energy/air pollution)
- Engineering (mechanical, chemical, environmental)

MATH:

- Estimation (how much UVO is actually produced)
- Measurement (space required, space available, scale modeling, etc.)
- Percentages (blending UVO with diesel fuel, scale modeling)
- Costs/budgeting (estimating cost of trailer, blending container, hoses, etc. based on a chart provided in the specific lessons)
- Measurement and charting of temperature rise (testing energy in various oils)
- Measurement of volume & weight (UVO, material to be burned and water to be heated)

SOCIAL STUDIES/HISTORY:

- Focus on Native American and Mohawk cultures, history, and economy
- Geography of Mohawk lands in US and Canada
- Economics (cost benefit analysis of project)
- Working in groups (cooperation among and between very different groups, cultures)
- Civics (volunteerism and its place in society, local governance)

Note to teachers:

Many of the activities in this curriculum assume that your school cafeteria uses vegetable oil to fry foods. This isn't always the case, and as a result some of these activities will need to be adapted to suit your particular situation.

Alternative 1

For younger children or for schools that don't use oil to fry foods, assign children the task of measuring the amount of vegetable oil used in their own homes in the course of a week. Have children add up their individual answers for a class total, then multiply by four for a monthly total. If desired, multiply the class total by the number of classes in the school and/or district to come up with a larger amount suitable for actual use in blended fuel.

Alternative 2

Assign older students the task of researching how much vegetable oil is used on a monthly basis by a selected local restaurant or restaurant chain. Students may call and/or visit the selected restaurant, interview the cook or owner, and even tour the kitchen (much of the EWB-USA students toured the restaurant on the St. Regis Mohawk land). Students may then make calculations as above. If the restaurant is part of a chain, they may choose to multiply based on the number of local franchises.

SCIENCE

Introduction

Where is all the petroleum? Most of the readily accessible petroleum is gone, and it is very expensive to recover fuel from the bottom of the sea, under the ice, and other hard-to-get-to places. What's more, digging for petroleum damages the Earth. Running engines on petroleum creates air pollution that impacts the life and health of humans, animals and plants—and creates global climate change.

Most of today's engines and transportation systems still run on petroleum. Petroleum is called a "fossil fuel," because it is made of fossilized plants and animals that, over millions of years, have turned into a mixture of hydrogen and carbon (hydrocarbon). Coal, diesel and gasoline are petroleum-based fuels used around the world to power everything from automobiles to video games.

Years ago we turned to petroleum because it was an inexpensive source of what seemed to be an endless fuel for factories, homes, and transportation. Though it created pollution when it burned, people didn't worry much about it. That's no longer the case.

One good way to slow or even stop pollution caused by digging for and using petroleum is to find other, cleaner fuels. The EWB-USA chapter at Clarkson University is looking for a project that allows students to work with a community to produce alternative fuel. The St. Regis Mohawk Tribe in New York is hoping to find a better, cleaner, less expensive way to power its tribal vehicles. One idea is to create biodiesel from used vegetable oil (UVO) (oil that had already been used to cook fried foods at restaurants). Another is to use a blend of UVO and ordinary diesel. Follow the Clarkson EWB team as they face the challenges of assessing, designing, and implementing a solution that will provide the Mohawk Tribe with an alternative way to power their tribal vehicles.

For more information about alternative fuels, teachers and students may wish to explore the Department of Energy's Alternative Fuels website www.eere.energy.gov/afdc/fuels/index.html. The site includes overviews of many different types of alternative fuels, along with links to documents comparing relative pollution, mileage, and costs.

Online Resources:

- State of California Energy Commission site for kids:
  - www.energyquest.ca.gov/transportation/index.html

- US Department of Energy pages on alternative fuels and vehicles:
  - www.eere.energy.gov/afdc/fuels/blends.html
  - www.eere.energy.gov/afdc/fuels/index.html
  - www.eere.energy.gov/afdc/
  - www1.eere.energy.gov/vehiclesandfuels

Assessment

Middle School

In this activity, students will conduct tests on various types of oil to determine the best fuel to power a tribal vehicle. Safety and environmental precautions: Use caution when working with fire. If desired, this activity may be presented as a teacher demonstration rather than a lab project.

Oil Options

Materials:

- 3–5 various types of oil (UVO, pressed olive, motor oil, etc. – some new/some used)
- Pure cotton balls
- Fireproof dishes or bowls
- Ring stand (with clamps if necessary)
- Fireproof test tube or flask (sized to fit in ring stand) or if not available, a soda can may be used for the same purpose
- Charcoal lighter
- Water
- Lab thermometer
- Timer or watch

Procedure:

1. Put a teaspoonful of the first oil into a fireproof dish or container. Drop a cotton ball into the container and turn it until it is soaked in oil.
2. Add about 10 ml of water to a fireproof test tube or container. Attach to the ring stand. Take the temperature of the water and make a note of it. Leave the thermometer in the water.
3. Light the first cotton ball and move it under the container of water.
4. Start the timer.
5. When the cotton ball stops burning, note the time and temperature of the water. Students may also graph the differences in burning time and water temperature.
6. Repeat with other oils.

Questions:

- Which oil burned longest?
- Which oil burned at the highest temperature?
- Did any of the oils emit a bad smell or dark smoke?
- How did used oil work compared to new oil?
- Which oil or oils would be a good fuel to use for heating?

High School

Expand the middle school assessment by including diesel and biodiesel fuels to those fuels tested. High school students may also be ready to research and report on what biodiesel is and how it's made. If a safe and appropriate lab and materials are available, high school students can actually make biodiesel. Depending upon resources, a possible extension or group project may involve students in experiments with various used and unused vegetable oils in small engines to see whether and how well the engines will run.

Elementary School

Simplify the middle school assessment by discussing that fuel is an energy source. The energy in every fuel starts with energy from the sun. Elementary students may want to build a "Solar Hot Dog Cooker" based on a design available on California's "Energy Quest" website (www.energyquest.ca.gov/projects/solardogs.html). Discuss how energy from the sun is stored in coal, oil, and other fossil fuels. Create a poster to show the sequence: sun, trees, leaves, coal and shale, oil, gasoline.

Design

Middle School

After assessing the availability of UVO, EWB-USA participants decided that it wouldn't be cost-effective to make biodiesel. Instead, they decided to blend UVO with gasoline. The blend varies with the time of year: 20% UVO in winter; up to 60% UVO in summer. Why?

Materials:

- Four types of oils (fresh vegetable oil, used vegetable oil, motor oil, mineral oil)
- Freezer
- Refrigerator
- Sun lamp
- Thermometer for each group of students
- Four paper cups for each group
- Markers for each group

Procedure:

1. Break class up into groups.
2. Have each group label cups and fill each cup about 1/2 full with a different oil or shortening.
3. For each oil, have students predict in writing what will happen in various settings (temperatures):
   - Room temperature
   - Warm (sun lamp)
   - Chilly (refrigerator)
   - Freezing (freezer)
4. Have each group test its oils in each different setting by observing and taking the temperature of the oil, noting the results, waiting for one day, and then repeating observations. Note all results.

Questions:

- What happened to the various oils in different temperatures?
- What happened to the vegetable oils in cooler temperatures?
- Why would trucks need to burn less vegetable oil during the winter?
- Would the same issues apply in warm temperatures?
- Why or why not?

High School

Expand the middle school design activity by considering the addition of blended oils and/or the addition of diesel and biodiesel in appropriate proportions. Pollution created by diesel and biodiesel may also be tested by placing a very small amount of each fuel on a watch glass (glass disk) and heating the disk with a Bunsen burner. Students will observe that both create some smoke, but pure diesel smells worse and appears smokier. Filter paper may be used to collect and compare residue from the burning fuel.

Elementary School

Simplify the middle school design activity by using only two or three types of oil and only room temperature and refrigerator. Discuss the implications of the environment for other types of renewable energy; for example, where can you use water energy? Where would it not be a good choice? Is solar energy more plentiful in a desert or in a forest?

Implementation

Middle School

Once the EWB-USA participants decided they would blend diesel with UVO, they had to figure out where and how the blending would take place. They solved this design puzzle by building a mobile system on a trailer, based on a design by a school in New York State. This process—thinking of, designing and building a better system to do an important job – is at the heart of engineering. One of the trickiest elements of this project, though, was the price tag: students only had about $4,000 available to make their system work. Sometimes, parameters such as a low budget can help inspire creativity.

Energy on a Budget

In this activity, students will work in groups to develop an idea for decreasing fuel needed for heating, powering, or transporting things in their own community. They'll need to figure out how to build or draw a prototype (if they plan to build a system), price the elements, and show a budget of under $100. This activity includes elements of assessment and design. After completing the activity as it is described, some classes may have the resources to actually construct one of the ideas developed by class members.

Materials:

- Paper and pencils
- Materials to work with (large pieces of cardboard, duct tape, strings, pipe cleaners, wire, springs, heavy-duty scissors, glue, markers, etc.)
- Space to build (push desks against the wall)

Procedure:

1. Describe this situation to your students: Tell the class that they are now engineers and they have been given a problem to work on. The town (school or community) is interested in saving energy and money, and they want ideas for decreasing the amount of fuel used by individual families or by the town itself. Fuel is used for heating, electric power, and transportation, so ideas for reducing fuel consumption in any of those areas would be welcomed. There is, as always, a limited budget: the town wants each idea to cost no more than $100 to put into action. It's also important for students to consider the issue of sustainability, so if the idea they develop is hard to implement or maintain, it won't be a useful long-term solution to a problem.

Idea

If desired, the teachers may choose to select a particular fuel issue of concern to the local community and provide specific information about that issue to the class. The teacher may also choose to "become" the client and "meet" with student groups to discuss needs, constraints, sustainability, and other issues.

2. Divide the class into teams and explain that each team is to come up with at least one practical, inexpensive way to save fuel used for heating, power, or transportation. They should describe their idea in a paragraph. If the idea involves building something, they should draw a "blueprint" of their machine or system.

   ▸ **Explain:** To help them think creatively, remind students that the heat of the sun is free and that greenhouses collect and hold the sun's warmth. In the past, sun and wind power dried clothes, ground corn into flour, transported water, and did other important jobs that trucks and electric machines do today. Mention that reusable power sources such as wind, muscle power and water power are very low-cost.

3. When time is up (students will need at least 15 minutes to work on this portion of the project), have each team present their ideas. Other groups may ask questions or suggest ideas.
4. Have each team follow their own blueprint to build a model of the system or machine they have in mind. When they're finished, have each team come up with a list of parts needed for their project. The list should be specific (4-2x4x8 lengths of wood rather than "wood," for example).
5. Provide students with the opportunity to research the costs of the items they'll need to build their system or machine (the web is usually an excellent resource, but students may need adult help in finding specific prices).
6. Based on the prices, have students make any necessary changes to their design. For example, if a design calls for a chain, but a rope is cheaper, they may need to change their materials.

Idea

If desired, consider presenting student designs and price lists in a mini-environmental fair. Invite parents and community members to attend, ask questions, and learn about student ideas.

Questions:

- What made this a real-life engineering project?
- What ideas did you think of and then decide against?
- What problems did you encounter as you started to draw your design?
- What problems did you encounter as you built your model?
- Did you make any changes to your design or to the materials you used based on price?

High School

Expand the middle school activity to allow students to actually research community needs, build scale models of design solutions, and write up proposals for funding their ideas.

Elementary School

Simplify the middle school activity to exclude the budget research portion of the project. Instead of asking students to research prices, provide a price list for items included in student designs (based on your own knowledge or research).

Idea

If appropriate, present one or more concepts to the proper town governance committee.

MATH

Introduction

When they began their project, the EWB-USA students at Clarkson hoped to build a system that would convert used vegetable oil (UVO) to biodiesel. Converting UVO to biodiesel requires a chemical reaction between UVO, alcohol, and a catalyst. Biodiesel produced in this way is an alternative fuel that has already been approved for use on public roads by the Environmental Protection Agency.

After assessing the amount of UVO available, the Clarkson team realized it wasn't enough to justify the cost of biodiesel conversion. Instead, after consulting with St. Regis Mohawk Tribe members, they decided to create a fuel that blends straight UVO with ordinary diesel.

Once the decision was made to create a blended fuel with UVO and traditional diesel, Clarkson students were able to move forward. Based on the information they'd gathered about the amount of oil available, the space available, and their budget, they could then figure out how big a blending tank they needed, how much fuel they could create, how many trucks they could fill with blended fuel, and how much money (and pollution) they could save.

Assessment

Middle School

Every organization that fries food is left with used vegetable oil in the kitchen. That used oil is often thrown out, but it can be reused as fuel (depending upon the laws of your community). To process UVO, you need a holding tank and a filtering system. A tank costs about $400, and a filtering system costs about $250. How much used vegetable oil does your school produce each day? Is there enough to make a UVO fuel program worthwhile?

Materials:

- Pint measuring cup
- Large container
- Paper and pencil
- Access to the school kitchen

Procedure:

1. Let your school's kitchen staff know that students would like to measure a day's worth of used vegetable oil after lunch is served.
2. When lunch is over (and after the oil has cooled), visit the lunchroom. Invite students to use a pint measuring cup to measure out UVO into a large container.
3. Have students stop measuring at approximately the 1/4 point, and ask them to estimate the quantity of oil remaining. Based on their estimate, come up with a total amount of oil used for today's lunch.
4. Have students interview the cafeteria staff about their cooking routine. Do they use the same amount of oil each day? If not, how much more or less do they use on other days? How is used vegetable oil removed from the cafeteria? Does the school spend extra money to have it removed?

5. Return to the classroom with your information, and put your findings on the board. Together, calculate:
   - How much UVO is produced in your school cafeteria each week?
   - How much UVO is produced in your school cafeteria each month?
   - If you blended UVO with diesel at an average of 40% UVO/60% diesel, and each school bus needs 50 gallons of fuel per week, how many busses could you fuel per month? Per year?
   - How much money is spent on UVO removal from the school right now?
   - Based on your findings, and knowing the costs of processing UVO, how long would it take to start saving money by using UVO?

Ask students to work together in groups to write a proposal to the school's administrative staff. Students should present their findings and figures, and make their recommendations as persuasively as possible.

High School

Expand the middle school assessment to include your entire school district. How much UVO does the district produce each month? Each year? Given a 20/80 mix in summer (6 months) and a 40/60 mix in winter (6 months), how much fuel could you produce? Check the cost of diesel today. Given that cost and an estimated cost for UVO, how much money could your district save per year on bus fuel?

Elementary School

Simplify the middle school assessment by drawing a blending tank. Show the amount of diesel fuel (60%) and the amount of UVO (40%). If a bus holds 50 gallons, how many gallons less of diesel will each truck need? If diesel costs $4/gallon and UVO costs nothing, how much money per bus is saved?

Design

Middle School

It's great to come up with an idea for reusing used vegetable oil, but it's even better to figure out a plan of just how it can be done. To begin, students will need to think through the logistics of storing UVO.

Materials:

- Measuring tools (measuring tapes)
- Access to the Internet
- Information gathered for the Assessment activity in this curriculum

Online Resources:

www.eere.energy.gov/afdc/pdfs/afv_info.pdf

Procedure:

1. Tell students they will be using their math skills to create a plan to reuse UVO.
   - Ask cafeteria staff how UVO is presently stored and what kind of storage space is presently available.
   - Ask school administration staff whether it is practical (hypothetically) to place a large-scale UVO storage tank in or near the cafeteria. Find out where such a tank could be placed, and what (if any) modifications to the space would be needed to make the space safe for UVO, which is a flammable liquid.
   - On the Internet, research options for purchasing an oil tank and filtering system. Use data gathered in the Assessment activity to determine how large a tank will be needed (based on the amount of UVO produced each week).
2. Break students into three groups and have each group conduct research as described above.
3. Reconvene and have each group report on its findings.

4. As a class, visit the space where a tank could be stored. Based on the size of the tank you've selected, is there enough room? Where in the room could the tank be placed?
5. Using graph paper, draw a scale diagram showing the room and the location of the storage container.
6. Create a budget for purchase of the UVO tank, filtering system, and any other materials you might need (for example, a dolly for moving UVO from the kitchen to the storage location; new safety equipment such as a fire extinguisher; etc.). You may need to research these additional costs on the Internet, or ask school officials for estimated costs.
7. Now that you know what it would really take to reuse your school's UVO, how long would it really take to make up the cost of the materials you'll need to purchase? Do you feel it's worth the work and cost?

High School

Expand the middle school design activity by expanding the project and calculations for your entire district. Now, research your options for storage tanks, using the Internet. How many storage tanks would you need and what would they cost? Would you be better off collecting UVO from around your district and then storing it in one tank? What would such a storage tank really cost? What are the additional safety measures you'd need to take (based on research) and what would those additional measures cost? Approximately how much energy is in each tank? How efficiently is UVO likely to be burned? How does that compare with gasoline and diesel?

Elementary School

Simplify the middle school design activity by assuming that a blending tank will be kept in your school, and it will have a "footprint" of 5x5 feet. Choose a space in which to "store" your "tank." Measure the space. Map and draw the surrounding area including doors, furniture, shelves, etc. Will your tank fit?

Implementation

Background Information

The St. Regis Mohawk Tribe is implementing a project to blend straight UVO and diesel for its municipal vehicles. It is likely that a project involving your school would need to actually convert UVO to true biodiesel, using a chemical process. The investment in equipment for biodiesel conversion may be a bit higher than that for filtering straight UVO. Once the investment is made, though, biodiesel may be a big money saver. It is certainly a great way to reduce waste while also reducing pollution.

In addition, you and your class should know that:

1. the EWB-USA students involved with this project priced out a UVO transportation and filtration system, and found that it could be made for a budget of $4,000. While a biodiesel conversion system includes different costs, which may vary depending upon a variety of circumstances, it is reasonable to use the same number for purposes of the exercise below.
2. biodiesel produces no sulfur dioxide (a major pollutant), while ordinary diesel produces at least 15 parts per million.
3. biodiesel costs about $3/gallon to produce.

Middle School

Materials:

- Information you've already gathered about the amount of UVO available at your school
- Graph paper and pencils
- Poster board
- Access to the Internet

The US Department of Energy Website on Alternative Fuels:
www.eere.energy.gov/afdc/fuels/biodiesel.html
(Contains pages and downloads that will allow your class to compare the financial and environmental costs of traditional diesel with those of biodiesel.)

Procedure:

1. Given the amount of UVO available (you've already figured this out from prior activities), does it make sense to set up a $4,000 biodiesel conversion system for your school? Using the information above, figure and graph money savings over time, based on increase in costs of diesel fuel. At what point would your school pay off the cost of a conversion system? When would they start actually saving money? How much might they save in a year? In ten years?
2. If your whole school district got involved with this project, how much money could you save (estimate the amount of UVO available in other schools in the district based on the number of students in each school)? Figure and graph savings over time based on number of school districts in the state.
3. Discuss the pollution implications of traditional diesel fuel. What does "15 parts per million" mean? Why would such a tiny amount of sulfur dioxide make a difference to the atmosphere?
4. Break your class up into three teams and create an exhibit explaining the costs and benefits of biodiesel.
   Give each group one of the following tasks:
   - Show cost differences between traditional diesel and biodiesel (based on today's costs).
   - Show the costs and benefits of a district wide UVO/biodiesel program.
   - Show how 15 parts per million of sulfur dioxide could become an issue when multiplied by thousands and millions of vehicles.
5. Combine presentations together into a single exhibit.

Idea:

Present the exhibit to other classes or to administrators.

High School

Expand the middle school implementation activity by including the following: according to the EWB-USA students, the initial capital investment ($4,000) of an alternative fuel system that produces straight UVO is offset by the fuel savings. "Currently, Akwesasne (the St. Regis Mohawk Tribe) produces 250 gallons of UVO per month. This system converts the entire resource to fuel. Two hundred fifty gallons of diesel are saved. Assuming diesel at $3/gal, $750 is saved per month. Therefore, the system is paid for in 6 months. Furthermore, at one year after implementation, $9,000 of diesel is conserved."

For the purpose of this exercise, a biodiesel conversion system would cost the same amount as a straight UVO/diesel blend system, but it would require ongoing investment in the form of materials (catalyst, filters, etc). The price of diesel has continued to increase – while the cost of UVO remains close to zero. Assuming that the same 250 gallons of UVO per month is available, what would it cost to convert that amount of oil to biodiesel? What is the present cost of traditional diesel? Is it worth the investment?

Use http://journeytoforever.org/biodiesel_processor.html
and similar sites to help you investigate the costs involved in creating a biodiesel conversion system.

Apply your findings to your local school and school district. Would a biodiesel conversion system be worth the investment? If the answer is yes, put together your findings into a report and recommend to the district.

Elementary School

Simplify the middle school implementation activity by discussing that if biodiesel costs $3 per gallon and regular diesel costs $4 per gallon, how much money could be saved if thirty gallons of biodiesel were produced in one week? How much could be saved by making 360 gallons of biodiesel in three months? Calculate and graph money savings over the course of a year. How could the money saved be spent to help improve the environment? Create a budget to implement your plan.

SOCIAL STUDIES/HISTORY

Assessment

Middle School

This lesson focuses on the history, geography and culture of EWB-USA's "client" organization for the alternative fuels project: the St. Regis Mohawk Tribe of New York.

Materials:

- Handout: About the Mohawk Tribe
- Map: www.srmtenv.org/index.php?spec=map
- Access to the Internet and library
- Tri-fold displays
- Scissors, printers, tape, glue

Procedure:

1. Explain to your class that students from Clarkson University in New York State worked with the St. Regis Mohawk Tribe to develop an alternative fuel program that would reduce costs while also reducing pollution.
2. Ask students what they know about the Mohawk Tribe and why they think the tribe was especially interested in this project. Write answers on the board.
3. Ask students what they're interested in learning about the Mohawk Tribe and its relationship to environmental responsibility. Write answers on the board.
4. Distribute handouts to each student.
5. Read "About the Mohawk Tribe" aloud with the class. Were they surprised by anything they learned?
6. Draw students' attention to the statement, on the handout: "The efforts of the Environment Division are directed toward preventing disease and injury, while at the same time, promoting lifestyles that respect, protect and enhance the environment for the next seven generations at Akwesasne." Explain that this is an important Iroquois concept. What do students think this really means? How long is a generation? What would it mean to "Respect, protect and enhance the environment for the next seven generations?" Have your students ever considered the long-term implications of their actions?
7. Break students into groups, and ask each group to work together to ask a question about what they have seen and read that can be answered through research. Alternatively, ask each group to select one of the following questions:
   - What is the history of the Iroquois Confederacy?
   - How do the Mohawk people put the "Seven Generations" concept into action?
   - Where did the Mohawk Tribe originally live and where do they reside now?
   - What is the history of the Mohawk Tribe from the time of the American colonies to the present day?
   - What is life like for Mohawk people today?
   - What issues are they facing?
   - How do the tribe members make their living?
   - What kinds of activities do Mohawk children enjoy?
   - How is their life different than yours? How is it the same?

8. Assign each group to conduct research on the topic they've selected, and have each group create a tri-fold presentation about its findings. Included on the tri-fold may be maps, timelines, photos, biographies, and other elements.
9. Have each group present their findings to the class. Discuss the significance of the class's findings to the EWB-USA project: how would working with the Mohawk Tribe make the project more or less significant? Rewarding?

High School

Expand the middle school assessment activity by helping students to focus on the idea of sustainability. Have students investigate and report on local and/or regional sustainability efforts relative to fuels, agriculture, land development, ocean use, etc.

Elementary School

Simplify the middle school assessment activity by explaining to students that the Mohawk Tribe is a part of the Iroquois Nation. The Iroquois have a great law: "In every deliberation we must consider the impact on the seventh generation…even if it requires having skin as thick as the bark of a pine." Discuss what this law might mean (defining terms as necessary). How does it relate to decisions we make about how we use resources? How could decisions about transportation and fuel relate to the Seventh Generation law? How do decisions we make have an impact on the future? Ask children to interview their parents and/or grandparents and ask them how decisions they made in the past have affected the next generations.

Idea:

Develop a specific idea for a local sustainability project and present it to local government.
(Example: sustainable gardening practices which allow homeowners some options while also maintaining healthy waterways).

Handout

About the Mohawk Tribe

(From the St. Regis Mohawk Tribe Website)

The Mohawk are traditionally the keepers of the Eastern Door of the Iroquois Confederacy, also known as the Six Nations Confederacy or the Haudenosaunee Confederacy. Our original homeland is the northeastern region of New York State extending into southern Canada and Vermont. Prior to contact with Europeans, the Mohawk settlements populated the Mohawk Valley of New York State. Through the centuries, Mohawk influence extended far beyond their territory and was felt by the Dutch that settled on the Hudson River and in Manhattan. The Mohawks' location as the Iroquois nation closest to Albany and Montreal, and the fur traders there gave them considerable influence among the other Tribes. This location has also contributed directly to a long and beautifully complicated history.

The Mohawk Territory, which started out as a tiny village, is a truly international community which is home to approximately 10,000 people *(See Map)*. Located in northern New York State and literally bi-sected by the United States-Canada Border, the present territory called Akwesasne, a Mohawk word for Land Where the Partridge Drums, is divided into two separate federally recognized jurisdictions; The St. Regis Mohawk Tribe and the Mohawk Council of Akwesasne, and one traditional governing body encompassing all of Akwesasne, the Mohawk Nation Council of Chiefs.

The efforts of the Environment Division are directed toward preventing disease and injury, while at the same time, promoting lifestyles that respect, protect, and enhance the environment for the next seven generations at Akwesasne.

Largely due to the fact that the St. Regis Mohawk Reservation is situated next to a Superfund site highly contaminated with toxic chemicals, this Tribe has one of the most advanced environmental divisions of any Tribe in the country.

Online Resources:
http://www.srmtenv.org/index.php?spec=aboutUs
http://www.srmtenv.org/index.php?spec=map

Design

Middle School

This lesson focuses on the concept that, in every endeavor, there are stakeholders who have different perspectives and needs.

Materials:

- The DVD included in this package
- DVD player

Procedure:

1. Explain that you will be showing a video about the EWB-USA alternative fuels project conducted with and for the St. Regis Mohawk Tribe of New York. As they watch the video, students should pay special attention to the different people in this project. Who is part of the project? Why has each group chosen to (or been asked to) be part of the project? What do these groups have in common and how are they different?
2. After the video, introduce the term "stakeholder." Explain that everyone who cares about and will be affected by the project is a stakeholder. Ask your students to list the stakeholders they saw in the video. Are there stakeholders who were NOT shown in the video? (Possible additional stakeholders could be members of the St. Regis Mohawk Tribe who will save money and gain cleaner air; citizens of New York State, etc.
3. Ask students: What are the goals of the different stakeholders? What kinds of challenges were there in meeting those different goals?
4. Ask students to think about a project they've been involved with (science fair, play, sports team). Besides the students themselves, who else was a stakeholder? What were their different priorities?
5. Have students write an essay, play or short story that focuses on the idea of managing different stakeholders. They can write about something that really happened, or make something up. Each written assignment should include:
   - The project
   - The names and priorities of the stakeholders
   - At least one conflict caused by the fact that stakeholders have different priorities
   - A resolution that allowed stakeholders to each get what they needed

High School

Expand the middle school design activity by discussing that UVO-blended fuels and hydrogen cars are in the early stages of development. Ethanol and natural gas powered vehicles are becoming more common place. Who are the various stakeholders involved in decision-making about alternative fuels? Why would certain options move forward quickly while others may never develop?

Elementary School

Simplify the middle school design activity by focusing on the idea of stakeholders in a situation common to the class (playing on the playground or taking the school bus, for example). What are the rules surrounding that activity? Who set up the rules, and why? How do the rules represent a compromise for all stakeholders? A possible extension may involve students in a role-play exercise based on the situation discussed.

Implementation

Middle School

This lesson plan focuses on the concept of volunteerism and its significance to society.

Materials:

- The DVD included in this package

Procedure:

1. Explain that you will be showing a video about a volunteer project taken on by a group of students at Clarkson University in New York State. Ask students to pay special attention to the volunteers and their reasons for volunteering their time, energy, and expertise. If students have already seen the video, you may or may not choose to view it a second time.
2. After viewing the video, ask students why some of the volunteers chose to take part in an EWB-USA project. Write their answers on the board.
3. Ask students: What do you think about the volunteers' decisions? Would you work on a project like this for free? Why or why not?
4. Ask students to describe a situation in which they volunteered to do work for which they could have been paid (e.g., babysitting, helping at a fundraiser, etc.). What made them decide to volunteer? If desired, have students describe their experience in writing, either in class or as a homework assignment.
5. As a class, discuss some of the needs in your school or local community that could be met by volunteer students. Some examples might include playground or park cleanup, tutoring for younger students, etc. Put all ideas on the board, and then narrow them down (remove those that are unfeasible). Vote to select one idea that can be put into action.
6. Work with the class to make a plan for action. If possible, move forward with the class to put the plan into effect.

High School

Expand the middle school project by asking students to come up with ways in which they could volunteer outside the school in the larger community and set up the opportunity (e.g., volunteering in a nursing home, SPCA, homeless shelter, etc.). If preferred, select an agency for which to raise funds, and raise the funds through a school-based event or program. Involve students in awareness-raising for the selected project (e.g., making posters, PSAs for community TV, etc.). Involve students in financial planning for the event, managing fundraising income, and presenting fundraising income to the selected program.

Elementary School

Simplify the middle school project to a general discussion about volunteerism and reasons for volunteering. Together as a class, come up with a volunteer project that can be implemented in the school. For younger children this may be a short-term project that is easy and satisfying to implement. (Examples include a carwash or bake sale to raise funds for a selected charity or school program, planting flowers on the school grounds, making and sending cards to soldiers overseas, etc.)