STEM Integrated Lesson Plan – Shaylee Rademacher

TOPIC:
Renewable Energy, Nonrenewable Energy, Energy Efficiency and Climate Change

TITLE:
Save Money, Save the Planet: The Effect of Energy Efficiency and Conservation on Climate Change

GRADE LEVEL:
7th Grade

TIME/PACING:
I estimate that this lesson will require approximately 2 weeks. The "Heat Loss Project" part (TeachingChannel, 2012) of this lesson will require 5 days (~47 minute periods) for construction, "thermal imaging," and the re-makes.

Essential Questions:

1. What is meant by the statement, "The cheapest and cleanest kilowatt is the one that is never used."
2. What can Americans do right now to reduce the effects of climate change?

NGSS:
MS-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the last century.
MS-ESS3.B.1 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

ELA/Literacy:
RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
(MS-PS3-1) WHST.6-8.1 Write arguments focused on discipline content.
(MS-PS3-5) WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
(MS-PS3-3),(MS-PS3-4) SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
CCSS.ELA-Literacy.RST.6-8.8 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Mathematics:
CCSS.Math.Content.7.RP.A.3 Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.

Learning Objectives:

- Students will analyze data and draw conclusions based on evidence.
- Students will predict the percentages of types of energy sources and compare to actual data.
- Students will work in groups of four to build a model home to measure the transfer of heat out of the home and re-evaluate the build to minimize the transfer of energy.
- Students will measure materials for their model house to the nearest centimeter.
- Students will construct an argument to explain which type of renewable energy makes the most sense in Missouri compared to another state.
- Students will identify the scientific factors that contribute to climate change, i.e. greenhouse effect, burning of fossil fuels for energy, etc.
- Students will recognize the possible effects of climate change.
- Students will research the five main types of renewable energy sources to gain an understanding of the benefits and problems with each type of energy.
- Students will explain why fossil fuels contribute the highest percentage of the total energy sources currently and infer what is the trend in the near future for our state.

Driving Questions:

Where does our energy come from?
What is energy efficiency?
What is climate change?
What are energy costs for a typical American household per year?
Why are some forms of renewable energy better suited for different geographical regions?

Justification:

In this lesson series students will build a model home, identify where heat is being transferred out of the house using “thermal imaging” and digital thermometers, use cotton ball insulation to improve their model and minimize the transfer of heat out into the atmosphere. By taking measurements and using their own data, students will be gaining an understanding of heat loss from their model home which can be applied to their own homes, and the average American home. This knowledge base can be used to help students make the argument that Americans should reduce their use of energy, decreasing the need for fossil fuels, which in turn could reduce the effects of climate change; reduction in sea ice, increased average global temperatures, rises in ocean levels and an increase in severe weather such as tornadoes, hurricanes, and drought. **Students will be taught the science behind climate change due to the utilization of nonrenewable energy, or fossil fuels, such as how emissions from; coal burning power plants, transportation, methane production from animals, produce greenhouse gases that act to warm the planet like an actual greenhouse. This will be done using direct instruction, reading assignments, and a jigsaw activity. The use of nonrenewable energy for energy production will be compared to our states commitment to using renewable energy sources, also known as clean or green energy. Students will use a thermal imaging app, and their Chromebooks to integrate technology into this lesson. The app shows light intensity that can be extrapolated as heat loss in their model homes. Students will design the roof of a model home, and make improvements to it based on their own collected data. Using the iterative process of engineering design these improvements will then be tested and new data collected. This will help students make a connection between things that they, and their families, do and how small changes can help reduce the effects of climate change. Students will practice calculating percentages using data given to them by their instructor. These calculations will provide students with a deeper understanding of how much of our energy comes from nonrenewable energy compared to renewable energy. This will be done using a large group activity showing what percentage of the students in the room equate to the percentage of energy that comes from nonrenewable energy sources and how many students equal**

the percentage of energy that we get from renewable energy sources. The integration of these subjects is logical in sequence and has been shown effective in previous years of instruction.

Prior Knowledge:
I do this lesson half way through the Energy Unit, where students have learned the basic forms of energy, potential and kinetic and the Law of Conservation of Energy. They will have an understanding of how energy can change forms. One example would be chemical energy in fossil fuels → thermal energy → mechanical energy → electrical energy. Students have used Snap Circuits to build circuits that convert chemical energy in batteries to electrical energy into mechanical energy. They also had the chance to use the Green Snap Circuits with hand cranks that convert mechanical energy into chemical potential energy (charging a battery) into electrical energy to run a fan or light a light bulb. This concept will help with scaffolding for the generation of electricity using fossil fuels versus clean/green/renewable energy. The concept of thermal energy and the transfer of heat can be reinforced using the Heat Loss Project. (The Teaching Channel, 2012) This can be applied to the understanding of the greenhouse effect and climate change. Students will have worked in cooperative groups for several projects using the basic iterative process of engineering design. Depending on the order of teaching an understanding of Climate is necessary, and should be prior knowledge from earlier grades.

Vocabulary:

Efficiency
Renewable Energy sources “aka” green energy or clean energy
Nonrenewable Energy sources “aka” fossil fuels
Hydroelectric Energy
Solar Energy
Geothermal Energy
Biomass Energy
Greenhouse Effect

ENGAGE:

Day 1 (and maybe 2) - In the previous lesson series students created Piktochart Infographics about these five types of Energy (this is after lessons about potential, kinetic and mechanical Energy) Electrical, Nuclear, Chemical, Thermal, and Electromagnetic Energy. We have determined that nearly all of the energy on Earth comes from the Sun, but we can’t use the Sun’s energy on a large scale...yet. I will take the students outside with photovoltaic cells attached to a small electric motor. This solar cell starts to spin as soon as it is held in the sunlight. This was an inexpensive device purchased from either Nasco or Carolina. Using the solar cells from the Snap Circuits mentioned above, students will set these in the sun to charge batteries. There are numerous videos available about different forms of renewable energy sources, and some may make more sense based on your location.

Solar Energy Video - Australia

Give students this link **NASA videos about Climate Change Earth Minute** - the video I chose is titled *Usual Suspects.*

There are two ways to watch these videos. One would be to watch together on projector and then ask specific questions to the whole group. The other would be to insert the video into Edpuzzle. This way would give me a way to embed questions into the video and then talk about them as a group. I like this

way because students can come to their own conclusions, but then can see and hear other points of view from their fellow classmates.

Possible Questions about the video:

1. Review - What is the difference between climate and weather? Venn Diagram on the board
2. According to the video the Earth is experiencing "climate change." What evidence does the video give that the Earth's climate is changing? Give at least 3
3. What does it mean by the "usual suspects?"
4. What is different today that a century and a half ago, and how does that relate to climate change?
5. What are fossil fuels? If you don't know, write down I don't know...yet.
6. What are greenhouse gases and where do they come from? If you don't know, write down I don't know...yet.

Save this question for later. Refer back to the video. It said, "It's a lot easier to change our behavior than any of the usual suspects." What behaviors can we change that could reduce the effects of climate change?

I would have them Stand up, Hand up, Pair up (Kagan) with a partner. I would ask them to think about their summer in Missouri. We were classified as being in a severe drought in Northern Missouri. Ask the question, "How did the drought affect you, your family or someone you know?" Give the groups 30 seconds to think about their response, 20 seconds for person 1 to answer and 20 seconds for person 2 to answer the same question. Have students sit down together and ask this follow up question. What do you think caused this summer's drought? Could the drought be due to climate change? Give the students one minute to talk it out, then ask for volunteers to respond to the question for the whole group. I would leave this discussion open ended. It just gets students thinking about actual things taking place due to climate change, such as wildfires, Hurricane Harvey, things that are close to home. Have the students read the article together, and figure out the article's main idea. I would provide the following link to students via Google Classroom. I will lead the students toward an understanding of drought being one of the known effects of climate change with a class discussion and direct instruction.

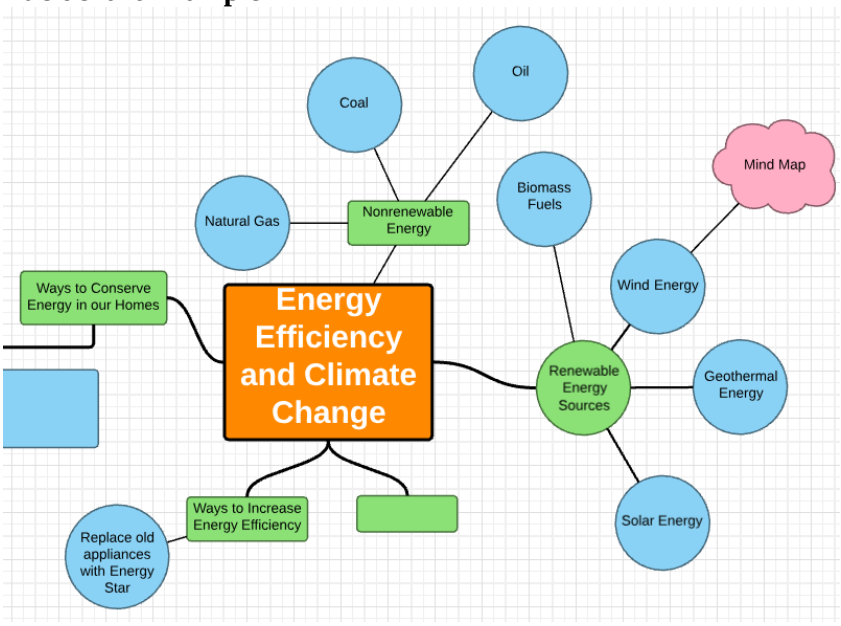
http://aceee.org/press/2014/03/new-report-finds-energy-efficiency-a

http://www.ase.org/resources/top-5-reasons-be-energy-efficient

Tell the group that if they finish up before everyone is done to go back to the NASA link. They can watch another video with earbuds, or look at the photo gallery. When all have read the article, tie the article and video together by reminding them that the video said, "It's a lot easier to change our behavior than any of the usual suspects."

Can we change ocean currents? Can we stop the eruption of a volcano? No, but what are some behaviors that we can change that could help reduce the effect of climate change? You can have partners pair up with another group and do a rally robin (Kagan) where each person gives an idea just out loud or write down ideas, whichever time permits, or you prefer. Talk about the ideas, list them on the board as a whole group. **In these groups have students create a Mind Map using Lucidchart to begin making connections to the essential question based on what the video and their article said about the cleanest and cheapest kilowatt being the one that is never used.**

Lucidchart Example



Homework:
Find out how much your parents pay in utilities per month (electricity bill, propane/gas, etc)

This amount will be discussed at the beginning of the next day in the Science Starter. The average American home pays $110 per month in electricity bills. Homes that use natural gas for heating have additional costs, and use additional fossil fuels. I will show them my propane costs 10 years ago and my yearly propane costs now. I will ask them what they think changed. Over time we have replaced our windows, an old inefficient furnace, and added insulation in the ceiling. Our records show that we used to use over 1000 gallons of propane/natural gas, now we use around 300 gallons.

Ask students what is the percentage by which we reduced my homes carbon footprint (burning less fossil fuel)?
End result - Saved approximately $700 annually in energy cost, and had a 70% reduction in the amount of fossil fuel we burned to heat our home.

Whole group discussion: What would you buy with $700? If your parents saved $700 per year for 10 years that would be $7000. That's a decent chunk toward your college tuition, or buying a pre-owned vehicle for your college graduation. Over the course of 20 years, my house will use approximately 14,000 gallons less propane (natural gas) than it would have without the basic home improvements. We have reduced our carbon footprint and saved money, too. Can anyone tell me what I mean by "carbon footprint?" Talk to your shoulder partner about this phrase. What does it mean? Look it up if you need some help. Have groups share what they find, and discuss further if necessary. Lead the group toward the idea of where our energy comes from. We heat our homes with natural gas (fossil fuel), but where does the energy come from to switch on a lightbulb, make your toast, or play your Playstation?

So...where does all of that energy come from, what are the sources of energy? We'll figure that out tomorrow.

EXPLORE:
Day 2 or 3 - depending on discussion times

Open the hour with the video Gas Problems from the NASA Earth Minute Videos (link above) I will put the pie charts below on slides for the students to have access to via Google Slides/Peardeck. On Peardeck I will have a slide with a sliding dot, and will ask students to predict the percentage amounts of our energy that we get from renewable energy or green sources, and how much from non-renewable energy sources also known as fossil fuels. (Discuss the reason for why it's called fossil fuels if necessary) All of this could also be displayed on the board.

Calculating Percentages:
How to Calculate Percentages – I will have everyone stand up. I'll have a volunteer write that number on the board. Then I'll say, "Everyone who has blue or green eyes please sit down." Volunteer will write that number over the top of the total number of students. (I'll instruct them to do so.) Then I'll ask if anyone can explain how to calculate the percentage of students in the room that have brown eyes. We will get out calculators and I will explain how to divide the number of students with brown eyes by the total number of students. I will repeat using blue, green, and other. These percentages will be displayed on the board as each person calculates the percentages. Then I will present the data (Pie charts). The groups will calculate the Percentage of Energy that comes from Nonrenewable sources (coal, natural gas, and oil).
Students will get into heterogeneous groups developed by the instructor. Looking at the pie charts I'll ask the students to calculate the total percentage of energy that came from fossil fuels in 2005, 2010, and 2015. Then we'll look at the percentages from 2017.

Students will use provided links below, open internet research, and provided Energy Consumption Pie Charts to learn about 5 forms of renewable energy and nuclear energy. They will be provided with large paper and markers to write down things they learned in the research as they try to answer the following questions for each -

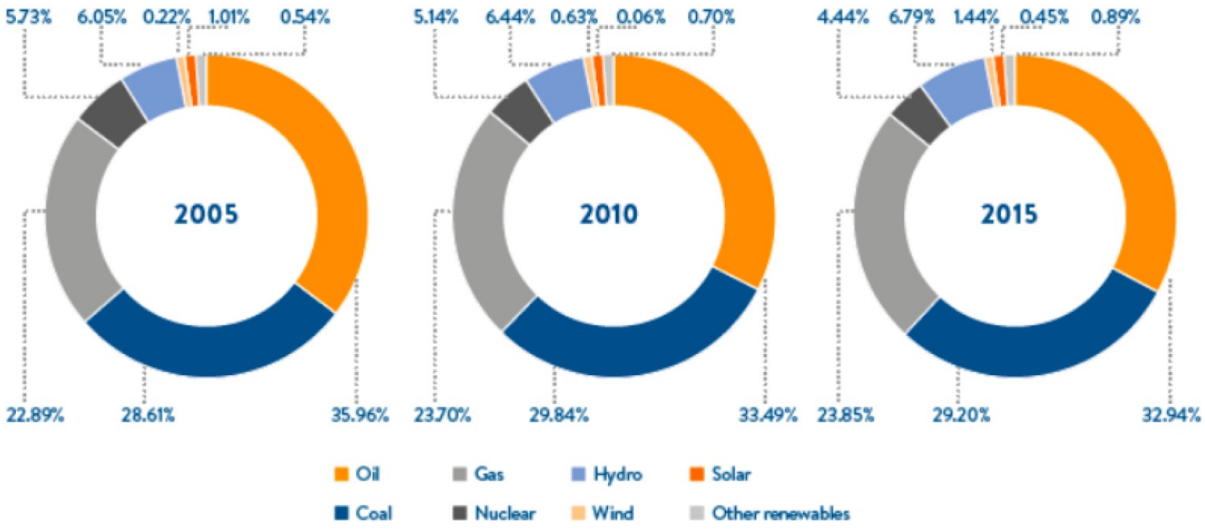
1. What is _____Energy?
2. What are benefits to generating electricity using this form of renewable energy?
3. What are some problems associated generating electricity using this form of renewable energy?
4. What percentage of the total energy in 2005 came from _____Energy?
5. What percentage of the total energy in 2015 came from _____Energy?
6. Where did the majority of the total energy used in the 10 year span from 2005 from 2015 come from?

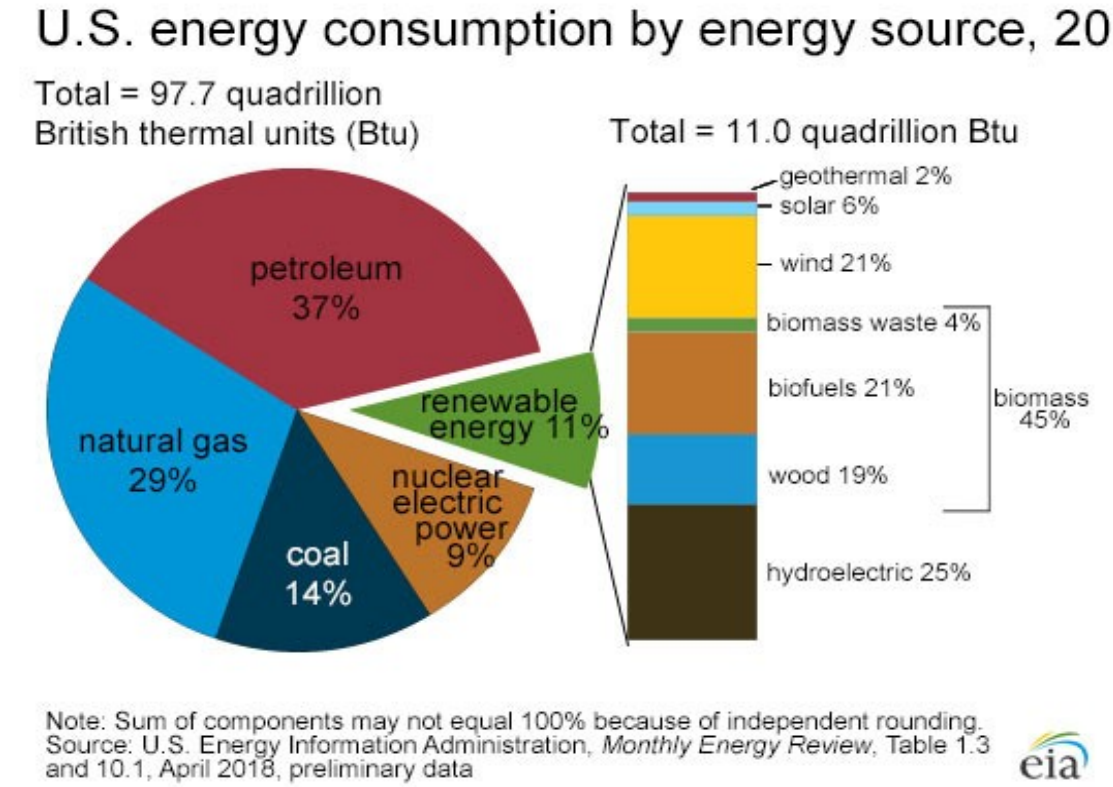
They can also put "fun facts" or "something interesting" on their large paper. These papers will be hung up around the room and each group will present their topic in 60 seconds or less. Then the groups will rotate around to each paper as a gallery walk.

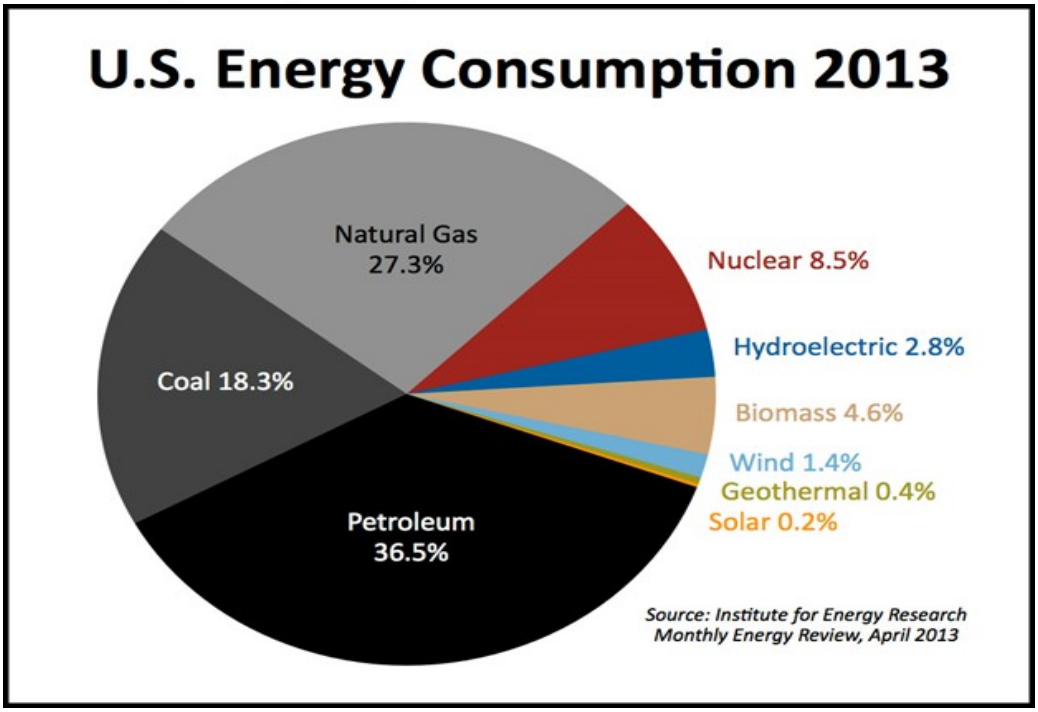
Exit ticket: (I'm planning to do this on a Peardeck interactive slideshow. I'm in the process of making it but found out it can only be used with Google Slides.)

Question - How has the amount of fossil fuels (non-renewable) energy changed over the last 10 years? Which form of renewable (green/clean) energy makes the most sense to you in Missouri? Why?

FIGURE 1: COMPARATIVE PRIMARY ENERGY CONSUMPTION OVER THE PAST 15 YEARS







Hydroelectric Power

Solar Energy

Wind Energy

Geothermal Energy

Biomass Energy

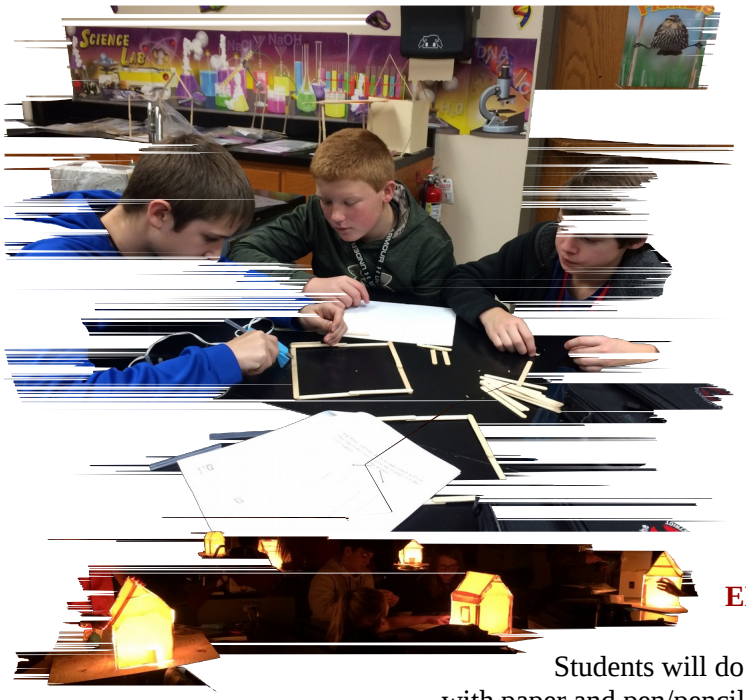
Nuclear Energy

Day 4 - The Heat Loss Project

Students will work in groups of 3 (I use three because it keeps everyone busy. The supplies are cheap, so more groups don't add much to the cost.) This is a project that requires some upfront work, but once you've done it, you can use it for years to come. I found this project on The Teaching Channel. https://www.teachingchannel.org/videos/stem-lesson-ideas-heat-loss-project There are files available for download on this link along with a video of the creating teacher's classroom in action. I have done this in class for 2 years now, and have made my own tweaks, rubrics, etc. (See appendix)

I give the students limited supplies, and a basic diagram of their model home and additional parameters. I let them be creative with the design of their roof. The rest of the house needs to be "built to specs." In order to continue on from Phase 1 to Phase 2, they have to show me their house with their data collected with the digital thermometers, and "thermal images." I explain to the student that the thermal images aren't real thermal images, they are just detecting light intensity, but can still be used to detect where heat is being lost out of the home. The images show red where light is escaping the house through cracks, open windows, etc. Students can use this as qualitative data, and improve upon the design in Phase 2. Finally, they will calculate the temperature difference before insulating the house, and after. (It is important for the students to time have the houses set on the light table for the same amount of time before taking the temperatures with the digital thermometers. I score them in the rubric based on the amount of red that is seen with the thermal imaging app. See appendix for supplies, directions, rubrics, and follow up assessment questions.

Here are pictures of students constructing their model homes, and one of our "glow" tables. This is done just for fun because it looks really cool in my room without any windows. I wish I had a better picture of the light table, and a thermal image. In the glow picture you can see the plywood table. There is a hole cut in the center that holds a heat lamp that I put a 60W incandescent light bulb (which I know is not energy efficient!) but this model won't work without an actual transfer of heat or thermal energy.



ELABORATE:

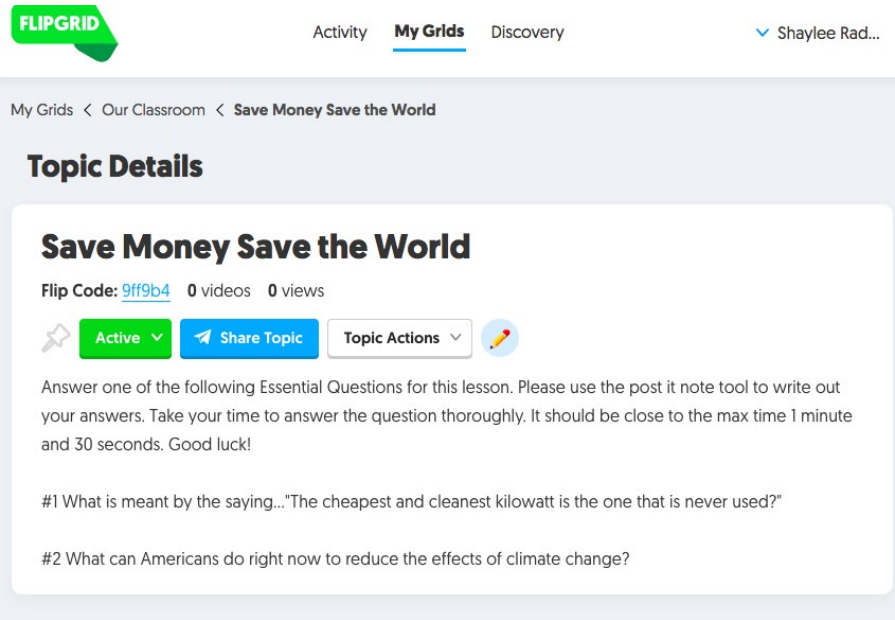
Students will do a Write Around. In groups of 4 students, each with paper and pen/pencil, a group of 2 facing a group of 2. I will give the students one of the Essential Questions as a topic to write about. What is meant by the statement, “The cheapest and cleanest kilowatt is the one that is never used.” I will remind them to use examples from videos we have watched, articles we have read, and their findings from the Heat Loss Project to support their argument. I will start out giving the group 2 minutes to write. I give the rule that they must keep writing, just let all of their thoughts flow out onto the paper. No talking, just writing. This is hard for some, but they do surprisingly well with this. I set a timer, and when it goes off we pass it to the left. They read what was written, then I give them 90 seconds to write. They can continue on with what their neighbor said, or switch gears. Just keep writing. If I notice a lull in writing I will ask the other essential question, “What can Americans do to reduce the effects of climate change, right now?” The cycle continues until the paper makes it all the way around the table. You can change the amount of time however you’d like or works in your class. If there is a group of 3 I will participate in the Write Around. When finished I ask for volunteers to read what is on their paper. **After the Write Around I will ask the students to get back into their groups to continue working on their Lucidchart Mind Map to continue to fill out the concept map, and make connections throughout.**

EXPLAIN:

Option 1:

Students will explain their thinking on a Flipgrid video, answering the Essential Questions, or 3 of the five of the driving questions. Flipgrid

Flipgrid Example



Option 2:
Students will create a Meme to summarize what we've learned about Energy Efficiency, Renewable vs Nonrenewable Energy or Climate Change
How to Make a Meme (This was shared with me by our instructional coach. I'm not sure if you can view it as is. You can make a copy if necessary.)
Meme Maker

Here is an example of a student created Meme (for another unit). Right click and push play to view.

EVALUATE:

Two-part End of Unit Test
Part 1
Energy Post Assessment Part 1 Access is given to anyone with this link. Please make a copy before editing.
Energy Post Assessment Part 2 – In appendix

Alternative Assessment: (Assignment and rubric in appendix)

Students will create a Powtoon presentation that explains how they can personally reduce the effects of climate change. It should incorporate their understanding of percentages of energy sources, and give examples of both nonrenewable energy sources and renewable energy sources. They should also present the type of renewable energy they feel makes the most sense in the Midwest compared to energy sources in one other state. Students should make an argument to explain what might happen as the population continues to grow and resources continue to be used at the current rate. They should include ways that Americans can conserve energy and be more efficient with the energy we do use.

Appendix

The Heat Loss Project

Essential Questions - **How can we make our homes more energy efficient? Why should we make our homes more energy efficient?**

Task - You will be working in groups of 3 to build a model home. The materials are listed below, and you will be given building instructions. It is important for you to know that supplies are limited, as they are in a real life building project. Money is an issue. Cost is

to be considered. Once you have your house built to the specifications you will set your house on a light table (provided by your teacher...me). You will be taking thermal images using an iPad app, and also temperatures at various places on your house using a digital thermometer.

Cooperation is of utmost importance. Each person in the group will have a job title. These titles will switch daily so that no one feels over-burdened, or unchallenged. The job titles are:

General Contractor/Manager - This person is in charge of supplies, obtaining them, keeping track of usage, and helping with cleanup

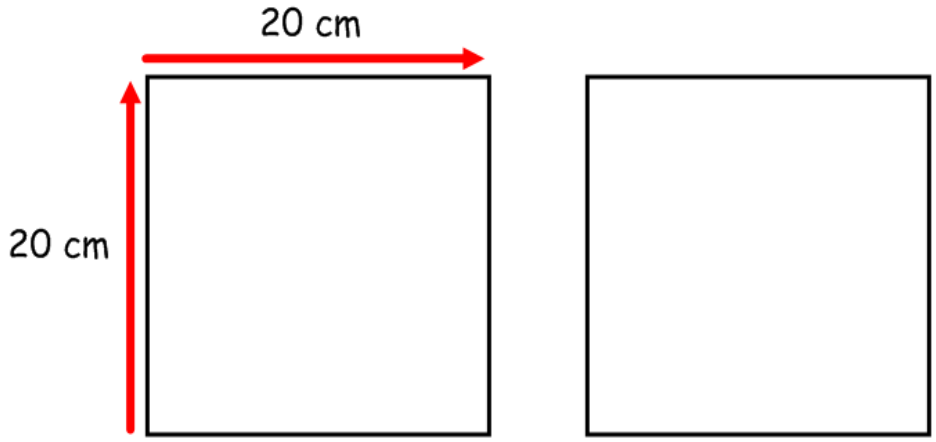
Construction foreman - This person is in charge of the designing for the day. This person will study the design plans and make sure it is being carried out, and will help with cleanup.

Construction worker - This person will be doing the construction work for the day (with help from other members), and will also help with cleanup.

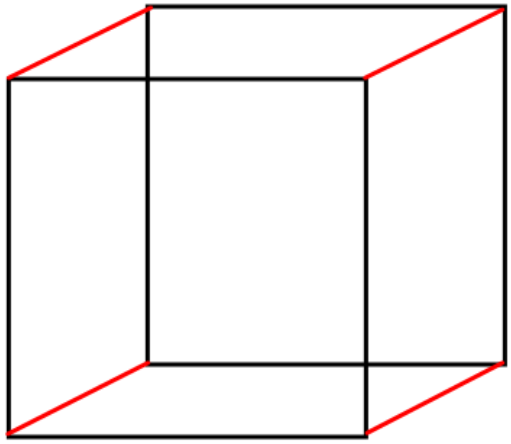
<u>Supplies</u>
3 file folders
1 or more - scissors
ruler
1 - glue gun
10 glue sticks
1 plastic baggie
40 craft sticks

How to Build Your Model Home

Step one: cut four (4) sticks 20 cm long and glue into a square. Repeat to build two equal squares

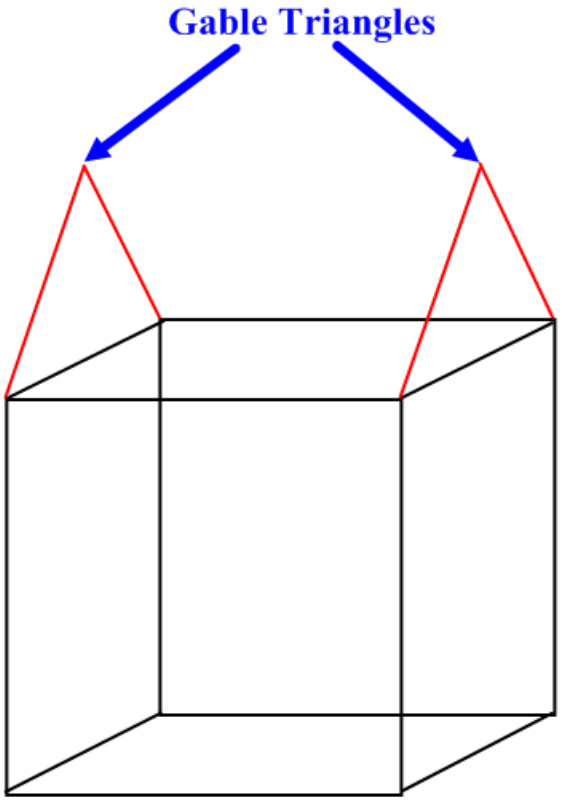


Step two: cut four (4) sticks 20 cm long and glue both squares together to form a 20 cm x 20 cm cube

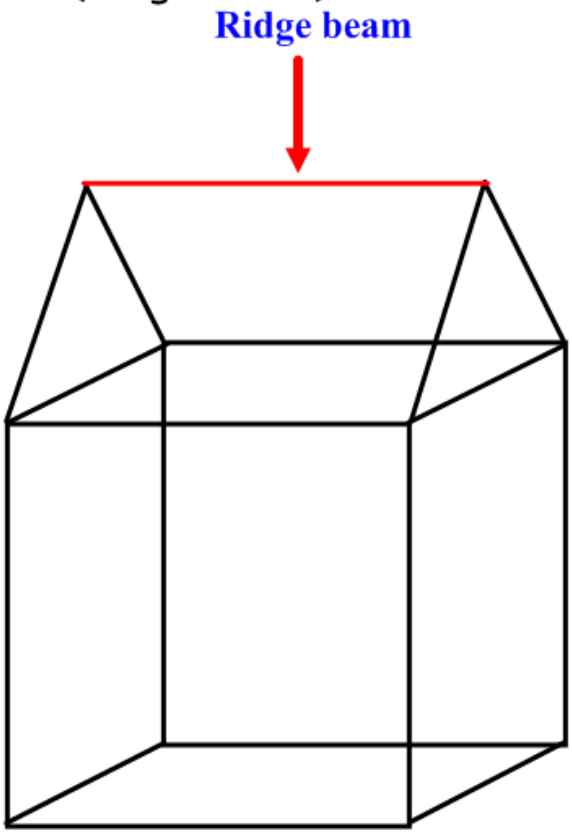


*****Your group can build your own design for the roof of your home. Remember that it must be done with the supplies provided. Below is an example that can be used.**

Step three: Cut four (4) sticks approximately 15 cm long. Glue to the cube to form two triangles for the roof. (gable)



Step four: cut a stick to connect the gables to form the roof-line (Ridge beam)



Group Names_____

Scoring Guide for Model House - Construction Phase #1

Criteria	**Low 5-6 pts**	**Med 7-8 pts**	**High 9-10 pts**
House completed on time			
House completed while using supplies sparingly			
House completed while working well with your team			
House built to specifications, neatly so that homeowner would be proud of it (and will pay for it!)			

Total _____

Group Names_____

Scoring Guide for Model House - Construction Phase #1

Criteria	**Low 5-6 pts**	**Med 7-8 pts**	**High 9-10 pts**
House completed on time			
House completed while using supplies sparingly			
House completed while working well with your team			
House built to specifications, neatly so that homeowner would be proud of it (and will pay for it!)			

Total _____

Group Names_____
Scoring Guide for Model House - Construction Phase #2

Criteria	**Low 5-6 pts**	**Med 7-8 pts**	**High 9-10 pts**
Amount of Red (heat loss) showing on House			
House completed while using supplies sparingly			
House completed while working well with your team			

Total _____

Group Names_____
Scoring Guide for Model House - Construction Phase #2

Criteria	**Low 5-6 pts**	**Med 7-8 pts**	**High 9-10 pts**
Amount of Red (heat loss) showing on house			
House completed while using supplies sparingly			
House completed while working well with your team			

Total _____

Name:_____ Hour_____Date_____

Thermal Imaging/Digital Thermometer Data

Directions: Put your house on the light table. Switch lamp on. Wait 5 minutes. Use the digital thermometer probe to measure and record temperature data at the locations listed in the chart below.
Leave the thermometer at each location for 10 seconds, then record. *Be sure to measure the temperatures in the same order as below, one after another. When finished switch light table off, let house cool for a few minutes, then remove house.*

Location	**First temp Reading in Celsius (After Construction Phase 1)**	**Second temp Reading in Celsius (After Construction Phase 2)**	**Temperature Change**
Solid Wall			
Window or door			
Corner			
Roof Line			

Thermal Imaging Analysis
-Open thermal imaging app on iPad. Aim camera at your house on the light table. Look at the house from all sides (make sure all people in group see it).

1. Describe the thermal images of your model home. (qualitative data) Where does the image show red/blue?

_____
_____
_____
_____
_____

2. What do the different colors in the thermal image mean? (research this on your own if you're not sure)

_____
_____
_____
_____
_____

3. What were the differences in temperature from Phase 1 to Phase 2 for two points in your house (quantitative data)? Example: window or door, roofline Explain your results.

_____
_____
_____
_____
_____

4. What could be done to change the thermal image so that your model home would be more energy efficient (keep more heat inside the home instead of having heat move outside the home)?

_____
_____
_____
_____
_____

Answer the following questions after Phase 2.

5. Describe the thermal images of your model home after making it more energy efficient. Explain the differences of the before and after pictures.

_____
_____
_____
_____

6. Do the before and after temperatures agree or make sense according to your thermal images? Explain why or why not? If not, give a reason.

_____
_____
_____
_____

The Heat Loss Project

Today's directions:

1. Get iPad from cart and find your 4 thermal images.
2. Gather supplies - 24 cotton balls, 3 glue sticks, your leftover supplies
3. Locate each red area on the image and locate it on the model house.
4. Determine the best method to prevent the transfer of heat through that spot out of the house.
5. Make corrections and additions to your house using additional supplies.
6. Take four more thermal images of house.
7. Take temperature of house at the same places you did yesterday with digital thermometer.
8. Record on data table.
9. Show your teacher your before and after thermal images.

This is the final day for this work. If this work is not finished today, your grade on this project will reflect that. In a real world situation, days past the deadline cost money. Someone has to pay for it. In other words, there is no time for messing around today. All hands on deck!!

The Heat Loss Project

Today's directions:

1. Get iPad from cart and find your 4 thermal images.
2. Gather supplies - 24 cotton balls, 3 glue sticks, your leftover supplies
3. Locate each red area on the image and locate it on the model house.
4. Determine the best method to prevent the transfer of heat through that spot out of the house.
5. Make corrections and additions to your house using additional supplies.
6. Take four more thermal images of house.
7. Take temperature of house at the same places you did yesterday with digital thermometer.
8. Record on data table.
9. Show your teacher your before and after thermal images.

This is the final day for this work. If this work is not finished today, your grade on this project will reflect that. In a real world situation, days past the deadline cost money. Someone has to pay for it. In other words, there is no time for messing around today. All hands on deck!!

Name(s)_____Date_____Hour____

Final Analysis - The Heat Loss Project

Answer the following questions with your group. Each person should be the "expert" for one of these questions (working your way around the table) and then work together on the rest. You will need to refer to your data table where you recorded the digital thermometer temperatures.

Constructed Response

1. Define the term "heat" according to the scientific definition.

_____
_____
_____
_____
_____
_____

2. Why did we take the temperature readings outside of the model house?

_____
_____
_____
_____
_____
_____

3. Describe all the ways your team observed and collected thermal energy data during testing.

_____
_____
_____
_____
_____
_____
_____
_____

4. Is there any other way you could have detected the movement of heat out of your model home? Explain.

_____
_____

_____
_____

5. How can we make our homes more energy efficient (at least 2 ways)? Be sure to support your answer using things discussed in class or things you have learned from the Heat Loss Project.

_____
_____
_____
_____
_____
_____

6. Why should we make our homes more energy efficient? (At least 2 reasons)

_____
_____
_____
_____
_____
_____

Thermal Energy Test - Essay Questions

Name_____

The following are three essay questions. *You only have to answer 2 of them*. If you answer a third question, I will give you extra credit points (up to 4 points depending on your accuracy and detail). Don't forget that an essay question requires more than one sentence, proper capitalization, punctuation, etc. I will not count off for spelling, but you need to make an effort to make it understandable and legible.

1. How can we make our real homes more energy efficient? (Give at least 2 ways)

_____
_____
_____
_____
_____
_____

2. Why *should we* make our real homes more energy efficient? (Give at least 2 reasons)

_____
_____
_____
_____
_____
_____

3. Explain the saying…"The cleanest and cheapest kilowatt is the one that is never used."

_____
_____
_____
_____
_____
_____

Powtoon Energy Assignment – Your Final Assessment

You will be creating a Powtoon to demonstrate your understanding of the lesson we've been working on for the last two weeks, Save Money, Save the World. The Effect of Energy Efficiency and Conservation on Climate Change. We have been working on many activities and projects in order to answer the Essential Questions…What is meant by the saying, "The cheapest and cleanest kilowatt is the one that is never used," and What can Americans do right now to reduce the effects of climate change?

Your assignment:
Open Powtoon.

Your presentation should include answers to the following. You may include the questions in the presentation, but it is not required.

1. What can YOU do to reduce the effects of climate change?
2. Why should Americans conserve energy and be more energy efficient? (Be sure to include evidence from different sources that we have used in class to support your answer.)
3. Where does our energy come from? Why is this a problem?
4. What are your ideas for renewable energy in our state?

Your Powtoon should be 3-5 minutes in length. Read the paragraph below to help you fill out your presentation.

Students will create a Powtoon presentation that explains how they can personally reduce the effects of climate change. It should incorporate their understanding of percentages of energy sources, and give examples of both nonrenewable energy sources and renewable energy sources. They should also present the type of renewable energy they feel makes the most sense in the Midwest compared to energy sources in one other state. Students should make an argument to explain what might happen as the population continues to grow and resources continue to be used at the current rate. They should include ways that Americans can conserve energy and be more efficient with the energy we do use.

You will work on this assessment of your understanding (test) in class for two days and will be due at the end of the second day. You are welcome to work on it outside of class, too. Below is the scoring guide that will be used for grading. This assignment is worth 40 points.

Scoring Guide

Criteria	Excellent work	Good work	Almost there	Could be better

Presentation is eye-catching, easy to follow and creative.				
Presentation answers all required information and makes sense to the audience				
Presentation is the required length.				
Effort was put into the presentation.				