***The Impact of our Energy Choices***

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This curriculum unit is recommended for:
High School Science, and Technology curriculum and is specifically geared for CTE- Scientific and Technical Visualization.

**Keywords:** Energy, Science, Technology, Renewable energy, Non-Renewable energy, PowerPoint

**Teaching Standards:** See Appendix 1 for teaching standards addressed in this unit.

**Synopsis:**Children and adults are becoming more and more dependent on all forms of technology, such as tablets, smart phones, and gaming systems. Most individuals do not think about the electricity that charges the batteries on their devices, or the environmental impact that went into creating the electricity for the charge. This unit will support students understanding of *The Environmental Impact of our Energy Choices.* There is an increased pressure to incorporate technology and this unit is a great resource for teachers to bring technology to the classroom. To fulfill that demand students will create a research project that includes a PowerPoint presentation on an energy source. The purpose of this unit is to have students become informed about energy and to describe an energy source in great detail. My teaching philosophy is to enlighten students about the world around them and to help students become career and college ready. I believe that a lack of knowledge on energy is one of the main issues facing our society today. Since energy has an economic, political, and environmental effect on our society, it is important to educate students on energy. Understanding the concepts of energy and the impact our energy choices have on our everyday life will help students have a greater appreciation of the energy they use. This unit will focus on giving the students a better understanding of energy by looking at different energy sources.*I plan to teach this unit during the coming year in to 17 students in CTE- Scientific Visualization with students ranging from 9-12$^{th}$ grade.*

**The Nature of Energy: The Impact of Our Energy Choices**

***Christopher D. Herman***

## Introduction

West Mecklenburg High School was founded in 1951. Over 1900 students attend West Mecklenburg High School. It is located on the West side of Charlotte, NC, in a part urban part suburban setting. West Mecklenburg High School is considered a Title I School with71.4% of students qualifying for free or reduced lunch. Our school ethnic makeup is: 69.7% African American, 13.7% Caucasian, 8.3% Hispanic, 5.7% Asian, and 2.6% other. My school is unbelievably lucky to have an excellent staff of teachers and administrators who have increased the graduation percentage from 50 to 80 percent in just three years. I currently teach Scientific and Technical Visualization (also known as Sci-Vis). Sci-Vis is a Career and Technical Education curriculum. Sci-Vis is taking complex information and concepts and explaining them in a visual way through the use of technology. I teach students in all grade levels from 9-12. My diverse groups of students have multiple backgrounds in both Science and Technology.

My Curriculum is based off the North Carolina Department of Public Instruction (NCDPI). I follow the pacing guide given to me by the director or Sci-Vis for the state. Projects are created with the state standards for Scientific Visualization. Most lessons start off with a basic PowerPoint produced by the teacher. The purpose of the PowerPoint is to give students a basic understanding of the topic. I will often enhance my teaching instruction by showing YouTube clips and other visual representations. Students then are required to research and gather more information about the topic. After students have researched the topic, they will create a visualization using computer software such as: Adobe Illustrator and Autodesk 3D Studio Max. The final part of the unit is to explain to their peers what they have learned though presentations and visualizations. To help engage my students, computers are used on a daily basis. I also give my students options on their topic to try to make the projects interesting to them. All lessons are centered on students with little input from the teacher. Having a classroom that is student centered helps students become educationally independent which leads to college ready students and real world professionals.

## Rationale

This Unit is intended to be used in a High School Science and Scientific and Technical Visualization 2 (CTE-Technology) curriculum. Sci-Vis is taking complex information and concepts and explaining those concepts in a visual way through the use

of technology. The purpose of this Unit is to have students become informed about Energy. My philosophy behind teaching is to help enlighten the students about the world around them and to help students become career and college ready. I believe Energy is one of the main issues facing our society today. Energy has many impacts on our society, not only economically, but also environmentally and politically as well. Understanding the concepts of Energy and the impact our energy choices have on our everyday life will help students have a greater appreciation of the energy they use. This Unit called *Nature of Energy: The Impact of Our Energy Choices* will focus on giving the students a better understanding of energy by looking at different energy sources. Students need to be aware of their own energy consumption and the environmental impact energy sources have on the environment.

**Objectives/Standards**

The objective of this unit implements several Common Core Standards. In addition, this unit can be used to foster collaboration between Science and Technology curriculums and teachers. Further, this unit encourages the use of technology in the classroom.

During this Unit I plan to implement the following Common Core Standards:

CCSS.ELA-Literacy.RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. Students will research and explain the step by step process that goes into transferring energy from one source to the another.

CCSS.ELA-Literacy.RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms. Students will have to be able to describe relationships between the following: *force, friction, energy,*

CCSS.ELA-Literacy.RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. Students will have to use their knowledge of their energy topic to create a visual using Adobe Illustrator and 3d Studio Max. Students will also have to explain their energy visual aid using a PowerPoint presentation.

The Energy unit will cover Scientific Visualization units of: V201.01 Advanced Presentation Techniques, V203.04 Demonstrate Presentation Techniques, V204.01 Advanced Modeling, V204.02 Animation, V205.06 Simple Machine.

**Scientific Content: Overview for Teachers**

Vocabulary:

Coal- a black or dark-brown combustible mineral substance consisting of carbonized vegetable matter, used as a fuel. Compare anthracite, bituminous coal, lignite.

Biomass- plant materials and animal waste used especially as a source of fuel

Crude oil- petroleum as it comes from the ground, before refining.

Diesel- a combustible petroleum distillate used as fuel for diesel engines.

Energy- The ability to do work

Environment- the complex of physical, chemical, and biotic factors (as climate, soil, and living things) that act upon an organism or an ecological community and ultimately determine its form and survival

Ethanol- a colorless volatile flammable liquid $C_2H_5OH$ that is the intoxicating agent in liquors and is also used as a solvent and in fuel —called also *ethyl alcohol, grain alcohol*

Fracking- a process in which fractures in rocks below the earth's surface are opened and widened by injecting chemicals and liquids at high pressure: used especially to extract natural gas or oil.

Fossil Fuels- a fuel (such as coal, oil, or natural gas) that is formed in the earth from dead plants or animals

Gasoline- a volatile, flammable liquid mixture of hydrocarbons, obtained from petroleum, and used as fuel for internal-combustion engines, as a solvent, etc.

Generator- a machine that produces electricity

Hydropower- electricity produced from machines that are run by moving water

Kinetic Energy- energy associated with motion

Natural Gas- a combustible mixture of gaseous hydrocarbons that accumulates in porous sedimentary rocks, especially those yielding petroleum, consisting usually of over 80 percent methane together with minor amounts of ethane, propane, butane, nitrogen, and, sometimes, helium: used as a fuel and to make carbon black, acetylene, and synthesis gas.

Non-renewable- energy such as gasoline does not get replenished for a very long time.

Nuclear- energy released by reactions within atomic nuclei, as in nuclear fission or fusion

Photovoltaic- of, relating to, or utilizing the generation of a voltage when radiant energy falls on the boundary between dissimilar substances (as two different semiconductors)

Potential Energy- the energy that something has because of its position or the way its parts are arranged

Renewable- restored or replaced by natural processes: able to be replaced by nature

Solar- produced by or using the sun's light or heat

Turbine- an engine that has a part with blades that are caused to spin by pressure from water, steam, or air

Uranium- a white, lustrous, radioactive, metallic element, occurring in pitchblende, and having compounds that are used in photography and in coloring glass. The 235 isotope is used in atomic and hydrogen bombs and as a fuel in nuclear reactors. *Symbol:* U; *atomic weight:* 238.03; *atomic number:* 92; *specific gravity:* 19.07.

Wind- a natural movement of air of any velocity

**Science Background for Teachers**

Energy is the ability to do work. Energy is in everything that we do or use in our day to day life. There are two types of energy one is potential (which is energy being stored) and the other is kinetic (which is working energy). There are many different types of potential energy such as: gravitational, chemical, electric and nuclear. A real life example that is easy to grasp is gravitational energy. If a ball is on a table it has gravitational energy that is being held up by the table. If the ball falls off the table that potential energy turns into moving energy also known as kinetic energy. Kinetic energy as described in our example is movement or motion. Some other examples for kinetic energy are: thermal, sound and electrical.[1]

Everything on this earth has some sort of energy. So just how do we get the basic energy that we use in our day to day life. Take eating for an example: when you eat a piece of fried chicken, the fried chicken contains chemical energy. Our body then stores these chemicals as potential energy so that we can use it later for kinetic energy like when we ride a bike. Energy not only powers our body but it also powers all of our electronic devices. Just where does this energy come from you might ask?

Energy does not just magically appear. When you are playing a video game the electricity that you game system and TV you are using more than likely came from a power plant. The energy sources that energized the plant can be placed into two different categories: Renewable energy and Nonrenewable energy.

Renewable energy is energy that can be re created or is replenished. Renewable energy sources are identified as a clean source of energy (minor impact on our environment.) The sun is the Earth’s main energy source. The energy source from the sun is extremely plentiful. The sun creates thermal (heat) as well as radiant (light) energy.

The thermal and radiant energy is then dispersed in our environment in a multitude of ways. We can collect the light energy of the sun directly, solar energy, or we can use related renewable energy sources such as wind, biomass and hydropower. [1]

Solar energy can be used in a few different ways. The most direct way for solar energy to be used is from the direct light and heat from the Sun. Your home uses windows to draw in direct sunlight into your home. However it is also possible for you to run all the electricity in your home by using the Sun's energy. One way of creating electricity from the energy of the sun is by concentrating solar power. A large curved shaped mirror focuses sunlight on a pipe. The pipe is typically constructed of materials (metal alloys usually) and are filled with a circulating high heat-capacity liquid (like oil) that heats up. This hot oil circulates through a heat exchanger and warms water to create steam. The steam then turns a turbine which results in the production of electricity.[3]

The more common use of converting solar energy into electricity is using photovoltaic's. Photovoltaic (PV) cells (also known as solar cells) are the working force behind converting sun light into electricity. The word photovoltaic derives from the word photo which means light and volt which stands for electricity. PV cells are made of silicon when the light hits the solar cell it can either be absorbed, get reflected or pass right through the cell. Sunlight that is absorbed by the semiconductor, frees electrons from the atoms in the solar cell. Some of these electrons travel through a conducing wire on the solar cell. These electrons passing through the conducting wire are the electricity produced by the solar cell. These electrons can flow in a circuit and that is the electricity output of the solar cell.[3]

There are countless different applications for solar energy. One way of using solar energy is by taking the heat from the sun and heating your house or swimming pool. Using PV solar energy is ideal for remote locations because it can be produced on site. Many countries in Africa use solar energy power remote villages. There are also varieties of scale, both big and small, that are great for solar panels. You can use a solar cell to power everything from a calculator all the way up to powering a whole town. Another benefit of solar energy is the fact that the sun's energy is plentiful and with new technologies the cost of solar panels are becoming reasonable. Solar panels produce no air or water pollutants thus being a clean means of electricity. However there are some down falls in solar energy. To create a solar cell there are several toxic materials and chemicals that makes up the solar cell. Weather and cloud coverage is also a major down fall of solar panels. To overcome the issue of cloudy weather you need expensive batteries to store the energy or a secondary power source.[3]

The Suns energy also changes the temperature of the earth. When you have two different temperatures close together this can create pressure differences and wind. You might be asking yourself, why would there be two different temperatures close together? When you have land close to water such as a coastline, the land heats up faster than the water. The kinetic energy of the wind can be used to turn a wind turbine. A wind turbine

works like an old windmill. There are several blades that are propelled by wind. The movement of the blades is then transformed using gears and a drive shaft to turn an electric generator thus producing electricity.[4]

The electricity created by wind turbines is considered extremely clean, because it does not harm the atmosphere or the environment with pollutants. Wind turbines are used throughout United States and are a good supplement to other energy producing sources. However, one major drawback of a wind turbine is that there is not enough wind to power the turbines on a day to day basis. Wind Turbines need substantial amount of wind to move. Wind turbines are also extremely large and are considered to be a visual eye sore. However most wind turbines are found ether off the coast of a lake or ocean, or on farm lands. Wind turbines can be a flight hazard to birds. For example the bald eagle are one of the most iconic symbols of America are killed each year from wind turbines.

One issue facing renewable energy is how to store the energy during non peak hours. The most common way to store this energy is using batteries. However to create a battery can be harmful to the environment as well as costly. There is one company called "Light Sail" that is trying to change the way we store energy. Light Sail stores energy by using compressed air. The way the system works is by a piston that compresses the air. They then use a fine mist of water to absorb the heat that is being released. The compressed air is stored in a low-cost tank. They use the heat that is absorbed from the compressed air to immediately heat other buildings. As the air expands again the heat is absorbed from the water and converts it into mechanical energy when the power is needed during peak time. [14]

Hydropower is a clean renewable energy source that provides the most electricity out of all the renewable energy in the United States. In order to create hydropower you need to have a basic understanding of the water cycle. The Sun's energy (solar) heats up water and causes water to evaporate. The evaporated water condenses to forms clouds. Eventually the clouds become too full and release the water back to the surface (also known as precipitation). Water is constantly moving due to the influence of gravity from higher elevations to lower elevations, creating streams and rivers. Most streams and rivers ultimately drain into the ocean. The force of the water (kinetic energy) can be used to create electricity. The movement of the water moves through a pipe and turns a turbine. The turbine spins a generator, which produces electricity. A dam holds water in a reservoir (potential energy). This reservoir acts as a holding pitcher until you need electricity. Once there is a need of electricity the dam allows some of the water to pass through pipes and turn the turbines. [5]

Hydropower is a constant source of energy that can be used very affectively. Hydropower generator does not directly emit air pollutants. Dams may directly affect the migration patterns of fish. However there are some dams that have created ladder system to protect the fish and to help fish spawn (reproduce). Hydropower may also change the

waters temperature, flow or chemistry. The result from affecting the water chemistry can be harmful to the wildlife that inhabits the water and for the animals that drink the water.[5]

The sun energy is also absorbed by plants in a process known as photosynthesis. Animals and people then eat the plants and consume the chemical energy. Biomass is an organic material that is created by plants and animal waste. There are many different types of biomass such as wood, crops, manure, and garbage. Some biomass is used as a chemical energy when it is burned. For example when you cut down a tree and you use it for heating a home with a wood burning stove. Not only is biomass used by burning to create heat it can also be used to convert different forms of energy. The reason Biomass is a renewable energy is because you can always plant another tree or crop. Ethanol and biodiesel for instance can be used as transportation fuels. Ethanol is produced from crops such as sugar and corn. The sugar and corn are fermented to produce ethanol. Biodiesel is produced from left-over food such as vegetable oil.[6]

Biomass is a great renewable resource. To use waste like vegetable oil and animal fat as fuel for your vehicle is pure genius. Not only are you creating a renewable energy but you're getting rid of waste. Since America is such a wasteful society the thought of using our waste to power other means is a great solution. Creating biomass from corn and sugar to create ethanol may drive the cost of food up. Food cost can be a negative effect on our society. Burning biomass like wood will causes $CO_2$ emissions. Burning other waste may correspondingly affect the air quality in the air but it can be consider a trade-off to placing it in a landfill. [6]

Not all energy sources can be replenished or abundant. Non-renewable energy such as gasoline does not get replenished for a very long time. Most non-renewable energy sources appear from the ground in liquid, gas or solids. Although non-renewable energy sources can't be replenished and are also harmful to the environment, however non-renewable energy makes up 90% (2011)[13] of our energy. There are many different forms of non-renewable energy such as: Oil and petroleum products, Natural gas, Coal, and Uranium.[1]

Crude oil is formed from the breakdown of fossils. Back millions of years ago Earth had many marine animals. Like all living creates theses marine animals eventually died. After time these dead animals will eventually fossilized and become covered in layers of sand and silt. From the extreme pressure and heat from theses layers of sand and silt will starts a process of breaking down the fossils. The breaking down of these fossils will result in the making of crude oil. Once the oil is removed from the ground it is sent to refineries. There are different types of transportation fuels that are in oil such as gasoline and diesel. However other by-products of oil such as propane and kerosene can be use by burning for an energy source of heat. These fuels are then calculated to be in one barrel of oil. [7]

Gasoline accounts for nearly 66% of all transportation needs in United States. There are 19 gallons out of a 42 gallon barrel of oil. The way a gasoline engine works is by creating a small explosion contained in the engine. In order to have this explosion you need three essentials a spark (spark plug), a fuel (gasoline) and oxygen. The spark from the spark plug ignites the fuel which pushes your piston up and down. The piston is the mechanical movement needed to turn the drive shaft. The drive shaft then turns the tires and off you go. [8]

Diesel is used in many large forms of transportation like tractor trailers and tractors. Diesel fuel works in the same principles as gasoline engines. The way a diesel engine works is by creating a small explosion contained in the engine. In order to have fire you need three essentials a spark (spark plug), a fuel (diesel) and oxygen. The difference between diesel and gasoline is that diesel does not burn as hot however it burns slower. Therefore you do not get a high RPM or (rotates per minutes) with your piston. The benefit of an engine that has lower RPMs is that your engine will have less wear and tear and ultimately will last longer. Diesel not only last longer but produces an abundant amount of torque from the slower burning fuel. The torque provides a substantial amount of pulling power. [9]

Once the crude oil is extracted from the ground it has to be transported to a refinery. The refinery process is done in three steps. Step one is to separate the different types of oil. Like a bottle of Italian dressing heavy particles such as motor oil settle to the bottom. The medium fuels like diesel and kerosene will then float on top of the heavier oil. Gasoline and liquid petroleum is the lightest fuels in a barrel of fuel hence it being on top. Oil can also go into a conversion process (step 2). Conversion is the process in which you are taking non demand oil and convert it into gasoline which is in heavy demand. The conversion process that is most apparent is cracking. Cracking is adding heat and pressure to crack heavy hydrocarbon molecules into lighter hydrocarbon molecules. The last step in the process of refinery is the final treatment. In order to make gasoline technicians combine streams from the processing unit. [7]

Oil has been the major transportation fuel for a number of years. The great thing about oil is that we have the entire infrastructure in place to continue using it. For example are vehicles are mainly powered by gasoline and diesel fuels. You would be hard press to travel 5 miles without seeing at least one fuel station. The other advantage of using oil in transpiration is that the basic gasoline and diesel engines have been around for such a long time. However the disadvantages of oil are tremendous. The emissions that are the result of burning oil are carbon dioxide, carbon monoxide, sulfur dioxide and nitrogen oxide. All of these emissions are indeed harmful for our environment. Carbon dioxide is known for green house gasses and global warming. Acid rain which, is harmful for plants and animals is a result of sulfur dioxide. [7]

Natural gas is an odorless gas that is used for heating and light purposes. Many people believe natural gas is on the brink of a break out in the automotive industry,

because of the liquefying process of natural gas. Natural gas is cooled down to -260 degrees F. With the liquid faction process the natural gas can be stored 600 times smaller than when it is a gas. The fossilization of plants and animals also produces this odorless gas. The extracting process of natural gas is by locating gas and oil deposits from different types of rock. Once rock samples have been tested, and gas and oil deposits are found. Scientist and engineers began the drilling process of natural gas.[10]

Natural gas has become more abundant in the United States thanks to newer efficient drilling techniques in shale. However we still consume more natural gas then we produce currently in the United States We import about 9% of our natural gas from Canada. Just more than half of the homes in America use natural gas. Natural gas is not just a good source of heat or light it can also be use to create steel, glass, brick and even electricity. Natural gas can be considered a cleaner energy source then gasoline or diesel since it emits less carbon dioxide. However natural gas can still have a negative environmental impact. Some of the environmental impacts can be associated by drilling and transporting natural gas in rural areas where wildlife would call home. A highly controversial impact on the environment is during the drilling process. During the drilling process water may become contaminated from the fracking fluid. This is the stuff the drillers send down the well to break or fracture the rock to release the gas. Not only do you have to worry about water becoming polluted but you also have to be concerned about unprocessed gas. This unprocessed gas like hydrogen sulfide can be exceedingly toxic. In the transpiration of natural gas through pipelines can also affects the environment from the heavy engines and equipment. [10]

Coal is the most abundant fossil fuel in the United States. Coal is a brownish black sedimentary rock. This sedimentary rock is consisted of carbon and hydrocarbon material. Coal is considered a non-renewable energy source because it takes so long to create. Like other fossil fuels coal is also created by plants that lived millions of years ago. These plants are covered by layers of dirt, sand and water. The pressure of the dirt and water creates the coal. Coal is mined in two different ways. The first way coal is mined is by shallow mining or surface mining. Surface mining is less expensive then underground mining. Underground mining is when coal is extracted deep down in the ground. Once the coal is extracted it then goes though processing. Here in the processing process coal is then striped from unwanted material such as dirt, rocks and ash. The reason processing coal is important is because when the coal is pure the coal burns longer. Coal is burned to create steam in a power plant that then moves a turbine. The turbine then moves a generator that produces electricity. [11]

The main use for coal is to produce electricity. Approximately 37% of the electricity we use is produced by coal. Coal like all fossil fuels has a negative impact on our environment. One coal producing techniques is actually extracted by blowing up mountains. Water that may be contaminated from the blast may travel downstream and into our water source. Underground coal mining has less impact on our environment

however it is still known to release methane gas. Underground mining is known to be extremely dangerous occupation with approximately 20 or more deaths per year since 2000. The burning of coal is also extremely harmful to the environment. Coal accounts for 74% of carbon emissions in our atmosphere. [11]

Uranium energy is also known as nuclear energy. Uranium is another non-renewable resource. Atoms are tiny particles that make up the universe. The nucleus is the core of the atom and has a colossal amount of energy that bonds the nucleus together. Once this nucleus bond is broken apart, the energy is released. The bond is broken by eitherfusion or fission. If atoms are split to produce smaller atoms this process is called fission. This process of splitting the atoms is what produces the energy. Nuclear fusion is when the nuclei combine to produce larger atoms. Currentlystars are the only source of nuclear fusion. The element use to create a nuclear fission is uranium. The reason uranium is use is because the atoms can be easily split apart. During this process a neutron hits the uranium atom and causes the uranium to split. This process releases an abundant amount of energy in the form of heat and radiation. In this process even more neutrons become released. The releasing of the neutrons begins a chain reaction with other uranium atoms.[12]

Nuclear energy is the result of 20% of our electricity. Uranium is found in rocks around the world however once you have your hands on the uranium it still has to go through a process to work. Not all uranium is created equal. There is a small amount of uranium that can be use called U-235. The positive aspect of nuclear energy is that it does not produce any harmful carbon dioxide. The problem with nuclear energy is it produces radioactive waste. Radioactive waste can be harmful to humans for thousands of years. The good news is that radioactive waste breaks down over time. Therefore it is vital for nuclear power plants to contain the radioactive waste is a sealed container called a storage cask.[12]

**Teaching Strategies**

I have set up this unit for use in both a Science and Technology curriculums. Energy directly relates to both technology and science. New technologies are being created behind scientific philosophies to help our energy demands. Therefore it is critical for science concepts to be a part of technology curriculums and vice versa.

For Science teachers you have a couple of options of implementing this Unit into your classroom:

The first option is for you to use the information provided on the website (www.mrhermanenergy.weebly.com) to help you instruct your students to create a PowerPoint (PPT) presentation. This Unit will give students proper rules for PowerPoint's, along with different tools to help enhance the students PowerPoints. The rules and tools will help make the PPT successful in relaying information to the audience.

When I first started to teach I did not give the students' proper rules for their (PPT). The PowerPoint's that I saw were extremely ineffective.

Each PPT will be based on one particular energy source. Students will be required to complete research about their energy source topic. It is essential for students to learn how to research a topic and provide factual information about that topic. Students who plan to go off to college will have to do a lot of researching in their college classes. It is also mandatory that students cite all of their work to avoid plagiarism. Students should also be required to present their information to the class. Good presentations skills are also an important attribute for our students to be successful after high school.

One part of this unit is for students to make a 3d animation of their PowerPoint. Most science teachers do not have access to the software program Autodesk 3D Studio Max. Therefore I will provide student samples of 3ds Max in a video file (AVI). Therefore your students who do not have access to the software program (3ds Max), will still be able to put a visual animation (that was created by my students) of how each of the energy sources works. I would encourage you to continue with the PowerPoint as being described in this unit. One other option for you as a science teacher would be to have your students make a diagram model of their energy source.

The second way you can use this curriculum unit is to show the students the PPT that I have created along with the PPT my students have created to teach them the concepts of Energy.

For technology teachers and especially teachers who teach Scientific and Technical Visualization 2:

The Energy unit is meant to enhance student's academic growth in Sci-Vis as well as their core classes such as Language Arts and Science. The knowledge of energy will help your students recognize different simple machines, which is a part of the Sci-Vis curriculum. Not only is it important to comprehend Energy in the classroom. Students will be creating a PowerPoint presentation using the rules and guidelines from the Sci-Vis 1 unit Presentation techniques. Students will also have to create a 3d representation using Autodesk 3ds Max. Students should have a general guideline on how to use the program from Sci-Vis 1. Students 3d representation should also be animated and provide an accurate demonstration on how the energy source works.

**Classroom Strategies and Activities**

Activities in chronological order

The first classroom strategy that should be address day one of the Energy unit is a KWL (know, want to know, learned). The first step in KWL is students take out a paper and fold it in thirds ether landscape (horizontal or hamburger style) or portrait (vertical or hotdog style). Once the student has folded their paper to make three different sections the

students will label each part know, want to know and learned. On the first day of the unit have students write down everything they know about Energy along with all topics they want to learn. Students will then hand this in and can be given a participation grade for the class. As a reminder always keep your grading as simple as possible, how I would grade this activity is as long as a student did the work give them credit. I would also encourage teachers to go over what students know as a brainstorm class activity. What happens here is students will remember more information that they have forgotten from hearing what their peers have written down. What the students "know" is a good review from their previous knowledge about the subject. The best part for a teacher to have the class participate in a KWL is what students want to learn. Here is where you can "dig deeper" in what the students are interested as a whole. What I have found out as a teacher is if the students have an interest in what they are learning about, students will have a higher engagement in the classroom. Have the students hand in their papers and the teacher should keep them in a safe spot until the end of the unit. At the end of the unit, give the students back their KWL and have them reflect on what they have learned.

Once you have gathered all KWL's, students will need some background information to construct their PowerPoint presentation. Therefore there has to be some teacher directed learning. I have attached a PowerPoint (PPT) to this unit.

The first PowerPoint which is located on the website(http://mrhermanenergy.weebly.com/what-is-energy.html)will be based on the introduction to energy. What is Energy? (What is energy is answered in a YouTube clip and definition). Students will also gain an understanding of what kinetic and potential energy are. I had also placed a fun activity for students on the computer, which is *Sum of all Thrills* (hyperlinked). Non-renewable and renewable energy are also introduced in this PowerPoint as well.

"Different Types of Energy Sources" PPT was created to help students gain a better understanding of different Energy sources. The different sources will now become the topics for their research PPT. Provided on the webpage (http://mrhermanenergy.weebly.com/energy-sources.html ) will be a PowerPoint that briefly highlights and introduces the different types of Energy. Topicsin the PowerPoint are: Solar, Wind Energy, Nuclear, Coal, Natural Gas, Fossil Fuels, Diesel, Gas, Hybrids, Natural gas. This PowerPoint is supposed to encourage the groups to decide on what topic they would like to research. This PowerPoint will also help the students get a brief understanding of each Topic.

During each of these different PowerPoint's expect the students to be taking Cornell style notes. This Unit will have different examples of how to create Cornell notes and templates for your students. Cornell notes are a great way for your students to understand and better grasp the knowledge that you are trying to teach them. I would recommend you start Cornell notes on day one of your year and continue using them untilthe end of the year.

**Student Projects**

After reviewing the PowerPoints on What is Energy, and Energy Sources. Students will work with a partner to inspire teamwork and to save class time. Each pair will choose a topic based on "Different Types of Energy Sources" and research that topic in depth. I will provide the groups with some research however they will also be required to perform research as well.

Students will then see a PowerPointon the techniques and rules to successfully create a PowerPoint (http://mrhermanenergy.weebly.com/powerpoint-presentation-resource.html).Information that will be present in the PowerPoint will be rules such as the 6-6-6 rule, Presentation techniques, and tips for a successful PPT.

Part 1 of Students Project will be for students to prepare a presentation using PowerPoint (PPT) or a Prezi. Students will be required to research information based on one particular energy source. Also provide will be researched materials to help the students. A Storyboard (visual rough draft) should also be created and checked off by a teacher. Students will be mandated to have at least 10-20 slides (with workable Hyperlinks). PowerPoints should have a uniform background on all slides and one transitional animation though out the whole PPT. Positive or negative consequences of their researched energy source to our Earth's environment should also be a stated on the PowerPoint's.

Students will use www.easybib.comto cite all information so they do not plagiarize copyrighted material. Easybib.com is a great tool for students as well as teachers and is extremely easy to use. All you have to do is follow the directions and students should be able to come up with a bibliography page for their PPT pretty effortlessly.

Part 2 of Students Project will be having the Students Create a 2d Diagram of their energy source in the software program Adobe Illustrator. (If your lab does not have Adobe illustrators have your students' either draw an example in Microsoft Word or Microsoft Paint.). This diagram will help the audience comprehend the topic in a visual way, as well as the steps involved to transform their energy.

Part 3 of Students Presentation: Students will also be required to model and animate their research in 3ds Max (3d Modeling and Animation Software) All parts will be created using 3ds Max. All parts should be proportional to other parts. An animation will be created which should explain how the energy is used or transformed. Student's animation will be converted into an AVI (Audio Video Interleave) video based on their Rendering of a 3d Model as well as a 2D diagram (For you science teachers there will be my student's examples for your students to place in their own PowerPoint's).

Once students create their presentation they are expected to present their presentation in front of the class. Students are expected to follow the guidelines that are placed based on presenting from the Sci-Vis 1 and Sci-Vis 2 which is located on the website (http://mrhermanenergy.weebly.com/powerpoint-presentation-resource.html) under the file *Rules for PowerPoint and Presenting.*

**Resources: Annotated Bibliography**

"Energy Basics," EIA Energy Kids -, accessed October 5, 2013, http://www.eia.gov/kids/energy.cfm?page=about_home-basics. This website is a perfect place to get background information. It is easy to read for both students and teachers. This page represents the basic concept of energy and gives background information on non-renewable and renewable energy.

"Forms of Energy." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=about_forms_of_energy-basics. This webpage is a great introduction to both Kinetic and Potential energy. It also shows the different types of Kinetic and Potential Energy. As of all Energy kids pages it is easy to read for both students and teachers.

"Solar." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=solar_home-basics. This webpage gives the overall concept of Solar energy. It is also a great tool to look up Photovoltaic's as well as concentrated solar energy. This page will also give students different types of maps that show the potential of solar energy in the USA and where it is being utilized.

"Wind." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=wind_home-basics. This page will give students and teachers the basic concept of wind. This page also explains how a wind turbine works. And gives good images of maps on where wind energy is being used in America.

"Hydropower." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=hydropower_home-basics. This page will help students and teachers understand the water cycle. The page also describes the history of hydropower and how a hydropower plant and dams generate electricity.

"Biomass." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=biomass_home-basics. This page describes the many different types of Biomass, as well as basic concepts of photosynthesis, and where biomass is most abundant.

"Oil (petroleum)." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=oil_home-basics. On this page the breakdown of fossils to create fossil fuels is described. Different types of fuels from crude oil as well as where the refining process.

"Gasoline." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=gasoline_home-basics. Uses and the environment are highlighted about gasoline in this webpage.

"Diesel Fuel." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=diesel_home-basics. Uses and the environment are highlighted about diesel fuel in this webpage.

"Natural Gas." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=natural_gas_home-basics. This webpage will give students and teachers a good background on how natural gas is created, liquefying natural gas as well as environmental implications, and uses of natural gas.

"Coal." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=coal_home-basics. This webpage will give an explanation: to the formation of coal, environment of using coal, how it is mined and transporting of coal.

"Uranium (nuclear)." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=nuclear_home-basics. This webpage will inform the reader of how nuclear energy is created, used, getting the Uranium, and the environmental consequences of nuclear energy.

"U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." Energy Perspectives, Total Energy. Accessed October 27, 2013. http://www.eia.gov/totalenergy/data/annual/perspectives.cfm. Good graph on the different energy sources that are use.

**Appendix 1: Common Core Standards, State Standards**

CCSS.ELA-Literacy.RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. Students will research and explain the step by step process that goes into transferring energy from one source to the another.

CCSS.ELA-Literacy.RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms. Students will have to be able to describe relationships between the following: *force, friction, energy,*

CCSS.ELA-Literacy.RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. Students will have to use their knowledge of their energy topic to create a visual using Adobe Illustrator and 3d Studio Max. Students will also have to explain their energy visual aid using a PowerPoint presentation.

The Energy unit will cover Scientific Visualization units of: V201.01 Advanced Presentation Techniques, V203.04 Demonstrate Presentation Techniques, V204.01 Advanced Modeling, V204.02 Animation, and V205.06 Simple Machine.

**Appendix 2: Activates and Worksheets**

**Notes** _____

[1] "Energy Basics," EIA Energy Kids -, accessed October 5, 2013, http://www.eia.gov/kids/energy.cfm?page=about_home-basics.

[2] "Forms of Energy." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=about_forms_of_energy-basics.

[3] "Solar." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=solar_home-basics.

[4] "Wind." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=wind_home-basics.

[5] "Hydropower." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=hydropower_home-basics.

[6] "Biomass." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=biomass_home-basics.

[7] "Oil (petroleum)." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=oil_home-basics.

[8] "Gasoline." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=gasoline_home-basics.

[9] "Diesel Fuel." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=diesel_home-basics.

[10] "Natural Gas." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=natural_gas_home-basics.

[11] "Coal." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=coal_home-basics.

[12] "Uranium (nuclear)." EIA Energy Kids -. Accessed September 27, 2013. http://www.eia.gov/kids/energy.cfm?page=nuclear_home-basics.

[13] "U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." Energy Perspectives, Total Energy. Accessed October 27, 2013. http://www.eia.gov/totalenergy/data/annual/perspectives.cfm.

[14] Erik Sofge, "The Energy Fix: Reinventing The Solar Array," Popular Science, June 11, 2013, accessed November 24, 2013, http://www.popsci.com/science/article/2013-05/future-energy-solar.