Yale-New Haven Teachers Institute®

Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
2013 Volume III: Sustainability: Means or Ends?

Green Construction

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Introduction

I teach fourth grade at Nathan Hale Elementary School in New Haven, Connecticut. My classroom is in an urban district and is composed of a diverse, multicultural community of learners that encompass a wide spectrum of achievements, interests, learning and social needs. At Nathan Hale, students are provided with the means to explore their multiple intelligences and utilize different learning styles to strive to reach their goals. Students are given opportunities to choose how they respond and how they are assessed on various integrated curricular tasks throughout the year. Assessment is done via project driven rubrics and students are not limited as to how much they can achieve. This unit is designed to teach students the fundamentals of our responsibility and the effect our daily decisions have on the community of people, and the environment which surrounds us.

This interdisciplinary unit will combine science curricula on energy sources and the environment, with social studies curricula outlining communities and their societal place. It is intended to show students the need to sustain natural resources in an effort to build a community that not only shrinks its footprint, but preserves the environment to fit the needs of the future. Students will therefore be better prepared to take more responsibility in their decisions, in their learning and in their job as a thoughtful member of a community, where each person has an impact on the reaction of their decision. Students will be able to evaluate the environmental issues involved in community planning and make changes to existing communities as they design their own sustainable community.

This unit will better instruct students through interdisciplinary connections, about the effect of their own ecological footprint and best practices to reduce it. They will understand how human activity and industrialization add to environmental pollution which then affects the enclosed habitats. They will recognize and understand the need for sustainability in a world of consumption. Students will know what it means to be 'green' as they learn about energy sources and their place in the powering of a community. Additionally, students will have a clearer understanding about urbanization, the three different types of communities and the members that govern and maintain it.

Background Knowledge in Science

The Environment

All living things need energy to stay alive. The difference lies in the source of energy used. Plants get energy from the sun when their leaves soak in the sunlight and then use the energy to convert carbon dioxide and water into food. Herbivores then feed on the plants to obtain the energy from the plants they eat while carnivores get their energy from the plant eaters. This food chain powers the earth and can be also known as an energy chain.

Humans also need energy, not only for our lives, but in order to power our homes, cook our food, provide transportation and power our industries. For most of history, energy has come cheap, but there is a price to pay. Energy comes at a high cost, not only in dollars, but to the environment. Dangers include radioactive waste, acid rain, deforestation, and even flooding. The change to our global climate however is the biggest hazard. Striking the right balance between our energy needs and ensuring future supplies without damaging the environment is the goal.

Energy Types

Issues that may lead to environmental changes cannot be mentioned without paying attention to the controversial topic about energy, its uses and its effects on human health and the environment. Energy is evident in our daily lives in a variety of ways. It is essential for existence. The supply of energy as it transmits throughout the world varies in production, supply and use depending on the community. Aside from the energy received through food, fueling the living population, it is also necessary for the functioning of a technologically driven community.

Energy is the ability to do work. Divided into two types, potential and kinetic, it makes everything happen. Stored energy is called potential energy, while moving energy is known as kinetic energy. Within its two types, it is found in many different forms. It can be chemical energy, electrical energy, thermal energy, radiant energy, mechanical energy and nuclear energy. Alternative energy sources are neither based on splitting atoms or fossil fuels because these forms have damaging effects on the environment. Examples of such forms include solar energy, wind energy, hydropower, thermal energy, biomass and biofuels.

Energy is often categorized as either renewable or non-renewable. This, however, can be misleading, since all sources of energy are renewable, but they are renewable on widely different time scales. Fossil Fuels, for example, renew over millions of years in comparison to wind or biomass which renew on a daily to yearly scale. Another way to sort these is by income and fund. Fund resources can be withdrawn from at any rate and therefore are often drawn from much faster than they can be replenished like fossil fuels and nuclear isotopes. Income resources are in a relatively continuous supply and routinely replenish, however, we are limited at how fast we can use them. Due to the differing time scales, we commonly use the term non-renewable for fossil fuels and fissionable isotopes since they do not replenish at a useful rate for man in comparison to the term renewable in which we use to describe such sources as the sun and wind which replenish on a daily basis. Most importantly, whether you categorize energy in terms of renewable and non renewable or income and fund, all forms of energy, at some point in time, produces some environmental consequence. All choices have consequences and in order to make informed decisions, careful consideration to these consequences must be weighed. For the nature of discussing energy in the classroom to young

minds, the background knowledge below classifies energy sources as either non renewable or renewable. It is vital to remind the students that energy is often classified as such based on the scale of time it takes for the energy source to renew.

Nuclear Energy

Energy from nuclear power produces less air pollution than the burning of fossil fuels, however are considered more dangerous in the case of an accident. Nuclear energy is formed when a plutonium or uranium atom is split, gets bombarded by neutrons and then spilts again. Energy is released in the form of heat and the heat is then used to produce steam or generate electricity. When things go wrong however, in the case of an explosion at a nuclear plant, radioactive material is released into the environment causing widespread damage, unfavorable living conditions, health problems and even death. Although the immediate impact of nuclear fission has the least impact on the environment, it is perhaps the most potentially catastrophic in the event something goes wrong. (McLeish, "Energy Resources: Our impact on the Planet," 12-30.)

Chemical Energy

Chemical energy is the energy that is stored in atoms and molecules and released in a chemical reaction, most often heat, known as an exothermic reaction. Examples of stored energy include batteries, coal, natural gas, petroleum and biomass. This stored energy undergoes a chemical reaction then converts into thermal, light or sound energy. For example, the wood in a fireplace is stored chemical energy, but when it is ignited the energy released is transformed into heat or light energy. Fossil fuels, biomass and biodiesel are subsets of this energy source.

Fossil fuels, which are formed by preserved remains of trees, plants and microscopic remains of animals, provide the world with about seventy-five percent of its energy. When fossil fuels burn, the carbon combines with oxygen to become carbon dioxide. This is where issues of environmental hazards occur. First, the fossil fuels are used more quickly than it took for them to be formed and the carbon dioxide levels in the atmosphere then rise. Additionally, the transportations of fossil fuels raise concerns with water pollution and neighboring ecosystems in the event of a spill. Fossil fuels however will eventually become depleted and it's hard to tell exactly how much oil, coal and gas will remain available for use and how long we will have access to them. It therefore becomes necessary to start looking into alternative renewable resources to "power" our planet.

Biomass is a renewable source of energy formed from wood, plants and animal material. The issues with this type of energy is that it requires a vast amount of land space taking over the land usually used for food, as well as the wood for heat and cooking. Biomass also emits an extensive amount of greenhouse gases similar to that of coal and oil. This is because when biomass is burned the carbon dioxide released is eventually absorbed into the atmosphere, oceans and soil.

Biodiesel is a renewable energy source that is made from vegetable oils and animal fats. Most biodiesel is made from soybean oil. The biodiesel is then blended with low amounts of petroleum. It is non toxic and biodegradable producing fewer air pollutants like carbon monoxide, sulfur dioxide and hydrocarbons. On the other hand, there is an increase in the emissions of nitrogen oxides. Comparatively with petroleum diesel, biodiesel is a cleaner choice. (McLeish, "Energy Resources: Our impact on the Planet," 12-30.)

Electrical Energy

Electricity is a secondary energy source as we get it from the conversion of other sources such as coal, gas, oil, nuclear power or other natural sources of energy such as biomass. Electricity's applications are nearly limitless, as it is used in heating, lighting, communication and transportation to name a few.

Geothermal Energy

Geothermal energy is heat that is generated from within the Earth's core. This heat can then be captured as steam or water and used to heat buildings or generate electricity.

These geothermal reservoirs occur naturally, but can gradually find its way to the Earth's surface in the forms of volcanoes, hot springs or geysers. The most geothermal activity occurs in an area that encircles the Pacific Ocean known as the Ring of Fire. Most of the geothermal power plants in the United States are located western states such as California, Nevada, Utah, Oregon and Hawaii. Geothermal plants' emission levels are very low, so they release less than one percent of the carbon dioxide emissions of a fossil fuel plant. The geothermal systems that get energy from lakes and rivers can be considered renewable, in comparison to the systems that get energy from traps. This type of system could only be renewable on a time scale of thousands of years. Geothermal systems can also upset the geological strata and lead to earthquakes.

Solar Energy

Solar energy is energy that has been produced by the sun and can then be converted directly and indirectly into another form of energy such as heat and electricity. Solar energy is used for heat, agriculture and generating electrical energy. Although renewable, solar energy does have its drawbacks, such as its intermittent timing in reaching the Earth's surface and the large area required to collect it at a useful rate. Solar energy is also expensive in its conversion via photovoltaic cells. Any solar radiation that we use for energy does contribute to global warming because it is unable to reflect back to space, although not nearly as much as the combustion of fossil fuels.

Wind Energy

Wind power is simply energy generated from moving air. Since the Earth's surface is heated irregularly it absorbs the sun's heat at different rates. The type of land and location determine the rate at which it heats. Wind energy is used to generate electricity but although renewable is not fully reliable, because it can be used only as long as the sun shines. Wind Turbines use blades to collect the wind's kinetic energy to create electricity. The wind travels over the blade which creates "lift." The blades connected to a drive shaft then turn an electric generator. This renewable resource requires careful planning in its location where high altitude is necessary like the tops of a rounded hill, open plains, shorelines and mountain gaps. Although wind speed varies depending on location, this energy source has fewer environmental issues. Wind turbines do not release emissions, and can reduce the amount of electricity produced from fossil fuel power plants. On the other hand, their size is very large and can disrupt the physical landscape of an area. Some even complain about the noise caused by the wind turbine blades. It can also be detrimental to wildlife. Wind is also contingent on global circulation which is dependent on ocean currents.

Hydropower

Hydropower is a renewable energy source that relies on the water cycle; where solar energy heats surface water causing evaporation, this water vapor condenses into clouds and then falls back to the surface in a form

of precipitation which eventually flows through rivers and back to the oceans where it evaporates and begins the cycle again. The amount of energy derived from water is dependent on its flow. Water that moves fast from a high peak or forcefully through the water will produce more energy as it eventually is captured to turn blades in a turbine which spins a generator to produce electricity. The hydropower is produced in large facilities built by the federal government located mostly in Washington, Oregon and California. Although this electricity is considered clean energy it does present some environmental problems. Hydropower dams may obstruct fish migration and changes the natural temperature, flow and chemical properties of the water which negatively impacts its native plants and animals. Greenhouse gases like carbon dioxide and methane are also released from hydropower reservoirs and generators in amounts that can measure nearly equal to the amount generated by fossil fuels. Drought and land use change, can severely affect weather patterns. Hydropower also destroys large land areas and alters the natural flow of water (Energy Kids, http://www.eia.gov).

Enormous amounts of energy found in the sources mentioned above are used to power transportation, provide heat, generate electricity and manufacture goods in order to keep a community in flux. With this overconsumption come challenges. Part of this challenge lies in the choices made in the development and powering of the community that will not only match the energy needs of the population but is also environmentally sustainable.

What Does it Mean to be Green?

"Green" means making environmentally friendly choices that use our natural resources for present needs without depleting them for the generations to come. A healthy community depends on clean air, fresh water, fertile land and access to a transportation system. Our daily needs are met by these resources that come from the environment, so if we are to survive, nature must as well.

Terms like "going green" and "eco-friendly" have become buzz words and have many definitions and are used for different products and practices. Eco-friendly means earth-friendly. This term most commonly refers to products that contribute to green living or practices that help conserve resources like water and energy. Eco-friendly products prevent contributions to air, water and land pollution. An eco-friendly product must have human safety and the environment in mind. The product must be non-toxic and created from sustainably grown ingredients such that the ecosystem does not get depleted. Products should be made from recycled materials and biodegradable.

Developing eco-friendly habits will help you use less and make the most of what you have. Some examples include, turning off lights in empty rooms and useing a programmable thermostat so you're only heating or cooling your home when it's occupied. Businesses can also institute such practices, by using a company-wide recycling program that conserves natural resources or by initiating a telecommuting advantage for employees, to decreases air pollution and fuel consumption by eliminating daily travel to work.With a deeper understanding of the flow of energy throughout our lives we can look at exactly what it means to be green as well as what our responsibilities are to ourselves and our community. (Holtzer, "What Does Eco-friendly Mean?" http://greenliving.nationalgeographic.com)

What is Sustainability?

Sustainability's goal is to balance the needs of human development with the impact on the environment. Although, used interchangeable with being green, sustainability focuses more on the material and design rather than the recognition of and acceptance to the responsibility of individual and communal impact on the natural world. It is more than just being environmentally friendly; it considers the economic and social impact of the development. According to the Environmental Protection Agency (EPA), "Sustainability is based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony that permits fulfilling the social, economic and other requirements of present and future generations." (EPA Home, What is Sustainability? http://www.epa.gov/sustainability/basicinfo.htm) It is hoped that because of this principle, renewable, natural resources can be conserved in an effort to protect not only the environment, but human health as well.

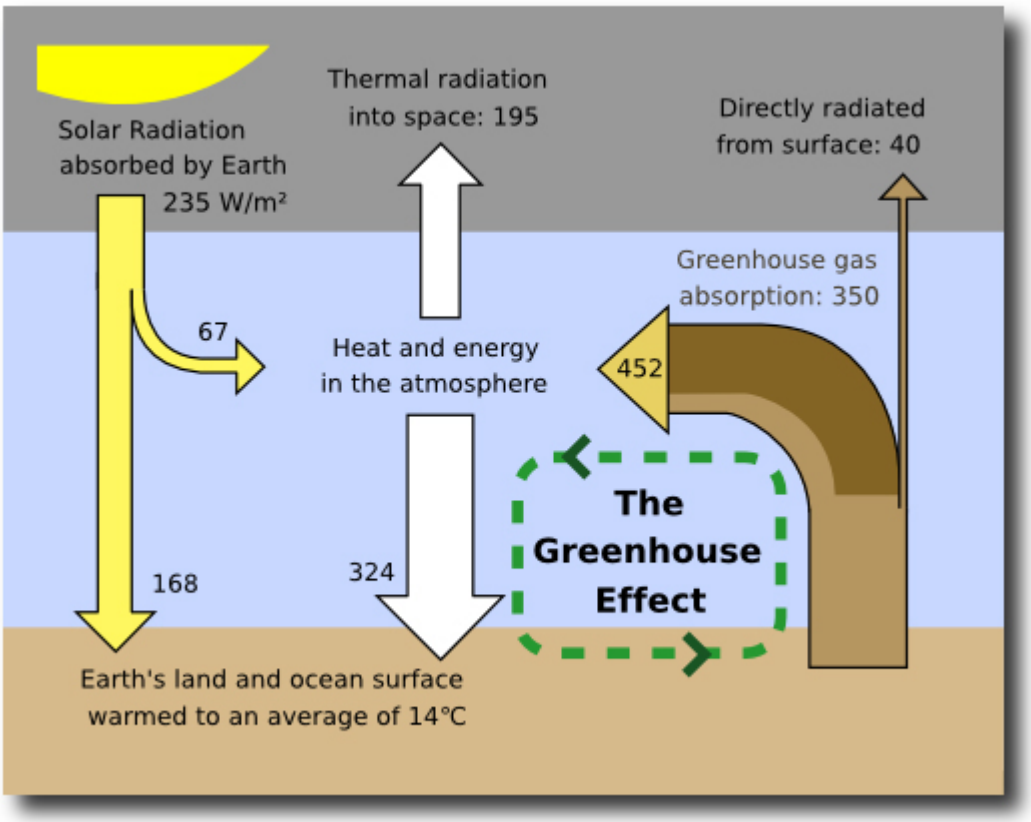
The necessity for sustainability arose due to a rise in population growth that stimulated an overconsumption of natural resources. The primary goal of the EPA was to first and foremost control pollution, but due to community changes, they now proactively work to prevent it through extensive science and technology research. They promote human and environmental health not only through individual practices, but through the promotion of green business practices. This is supported through governmental regulations which set federal policies to "conduct environmental, transportation, and energy-related activities in support of their respective missions in an environmentally, economically and fiscally sound, integrated, continuously improving, efficient, and sustainable manner." Additionally their goals also are intended "to establish an integrated strategy towards sustainability in the Federal Government and to make reduction of greenhouse gas emissions (GHG) a priority for Federal agencies." (EPA Home, What is Sustainability? http://www.epa.gov/sustainability/basicinfo.htm.) The EPA also implements programs to inform citizens, including business owners about how to reduce the environmental impact of impending facilities as well as building newer, environmentally sustainable infrastructures that enforce energy efficient regulations for greener living. "The concept of sustainability centers on a balance of society, economy and environment for current and future health. Sustainability is the intersection of people, planet and profit, commonly referred to as the "three-legged stool." (NC State University, What is Sustainability? http://sustainability.ncsu.edu/about/what-is-sustainability)

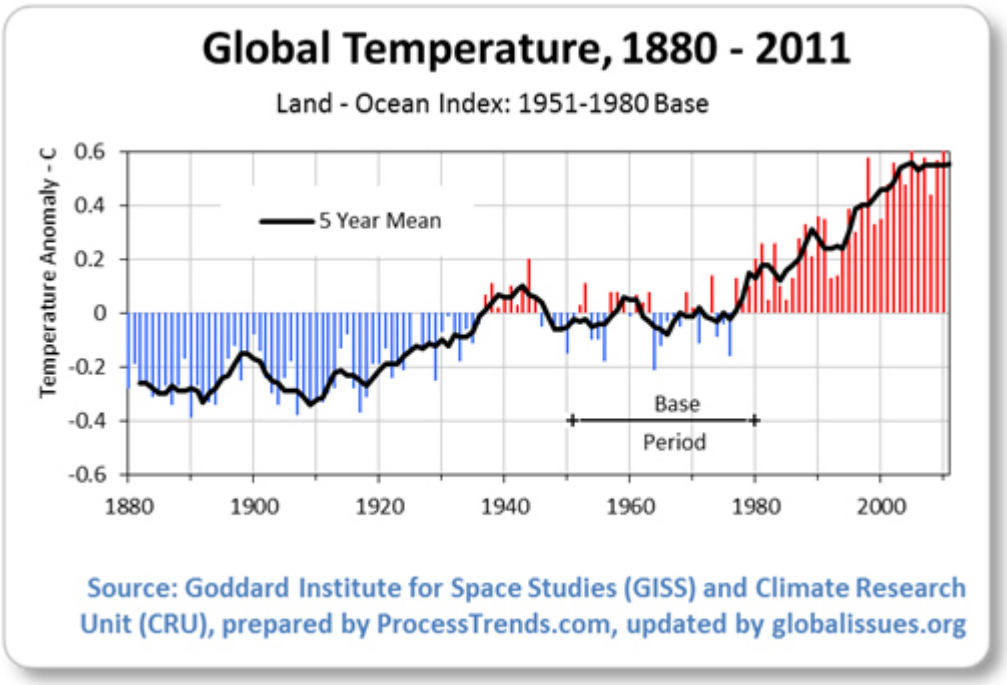
Climate Change and Greenhouse Gases

Our demand for energy affects the globe. Some of the recent changes in global climate such as higher temperatures and extreme weather frequency (tornadoes, hurricanes and blizzards,) are the result of an increased level of greenhouse gases in the environment. Greenhouse gases are produced when fossil fuels are burned. A fog of exhaust fumes and harmful gases produced by industrial processes often veil cities. The six main greenhouse gases are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorcarbons and sulphur hexafluoride. Water vapor is also considered a greenhouse gas.

Many greenhouse gases are life-enabling, but, if the greenhouse effect becomes stronger, then more heat

gets trapped than needed, and the Earth may become less habitable for humans, plants and animals. Carbon dioxide, though not the most potent,is the most significant one. Human activity has caused an imbalance in the natural cycle of the greenhouse effect. NASA's Earth Observatory is quoted below on the effect human activity is having on the natural carbon cycle. (Shah, Anup. Climate Change and Global Warming. http://www.globalissues.org/article/233.) In addition to the natural fluxes of carbon through the Earth system, anthropogenic (human) activities, particularly fossil fuel burning and deforestation, are also releasing carbon dioxide into the atmosphere. When we mine coal and extract oil from the Earth's crust, and then burn these fossil fuels for transportation, heating, cooking, electricity, and manufacturing, we are effectively moving carbon more rapidly into the atmosphere than it is being removed naturally through the sedimentation of carbon, ultimately causing atmospheric carbon dioxide concentrations to increase. Also, by clearing forests to support agriculture, we are transferring carbon from living biomass into the atmosphere (dry wood is about 50 percent carbon).The result is that humans are adding ever-increasing amounts of extra carbon dioxide into the atmosphere. Because of this, atmospheric carbon dioxide concentrations are higher today than they have been over the last half-million years or longer. Confusion about the difference between climate change and weather patterns arise when weather patterns and climate changes are mixed. "Weather patterns describe short term events, while climate change is a longer process that affects the weather. A warming planet is actually consistent with increasing cold, increasing rain and other extremes. The following charts explain the Greenhouse Effect and the trends in the rising of global temperature (Shah, Anup. Climate Change and Global Warming. http://www.globalissues.org/article/233.)





Background Knowledge in Social Studies

The History of Urbanization

Predominantly, the early United States was rural. In accordance with the 1790 census, 95% of the population lived in the countryside, leaving 5% of Americans living in urban areas (small villages.) Boston, New York and Philadelphia remained the only early areas with more than 15,000 inhabitants. The South at that time was nearly completely rural. Following 1830, urban areas grew more quickly than rural areas. The 1890's brought with it industrialization and a substantial growth in the cities. Now, 35 % of Americans lived in urban areas, primarily in the North, while the South, with exception to New Orleans and a few other cities remained rural. In fact, the number of Americans living in cities did not surpass the numbering rural areas until 1920. About half of the United States population lived in cities and approximately one quarter lived in densely populated suburbs by the year 2000 (The United States Active Center, www.theusaonline.com.)

These changes however did not happen overnight, nor did they evolve without problems. Although the movement climaxed in 1920, by 1860 cities had already become to dominate. Industrialization was the key to this explosion. The replacement of hand labor by machines, new inventions, expanding technology and advances in the transportation system via canals and railroads added to the rise of cities. Although the number of people working on farms increased until about 1916, the rise of city dwellers increased at a much faster pace (Collier, "The Rise of Cities," 9-34.)

With such a sweeping change, problems began to arise. The streets were littered with garbage; water became impure, inadequate organized police and firefighters, over crowding, crime, poverty and disease rose. As industry thrived, cities like Boston, New York City and Philadelphia soon became over crowded and dirty in comparison to the open farm land cities where cities originated (Collier, "The Rise of Cities," 35-64.) Living

here was more compact, based on convenience so homes, work areas and stores where close together. Rivers and waterways began to get utilized for transportation and the shipping of supplies between communities. People were moving from the farms to cities in order to find factory jobs, which increased the city population. Factories began to pollute the air with smoke and the concern for environmental hazards of air pollution, and sewage treatment began to arise. Apartment complexes became crowded and often unsanitary due to poor fresh air circulation and lack of indoor plumbing. The unhealthy environment caused illness to spread among residents. Planners then needed to look for a solution by proposing new plans for the suburbs. The newer planned communities were linked to the cities by trains so that residents can commute to work, but live in a more 'country like atmosphere away from the pollution and disease.' In order to protect the residents of the lower income housing with the cities, planners recommended park systems to offer open green space. Planners could not do this alone. Government, albeit small, needed to step in. Through the 1890's into the 1900's, American city housing became more tightly regulated in an effort to supply running water, heat, toilets and fire protection. Conditions began to improve for the lower income families and local government began to see reform as a result of the City Beautiful Movement. With the help of Frederick Law Olmstead, this movement utilized the political and economic structure to create a city that is not only beautiful, but spacious and orderly. City planning was used to shape the physical appearance of the community and to direct urban growth.

Zoning laws were also established so that property owners would know what could be built upon in a way that the health and the safety of the residents were first priority. This was designed so that residential areas were kept away from polluting industries like landfills and factories. Zoning typically segregated land into three categories- residential, commercial and industrial. If a zone is considered residential, no commercial uses would be allowed in the area. Although zoning served to protect property value, and enhance the use of automobiles, it created less appealing cities. Planned use development later came into effect allowing cities to zone a new section of development with mixed uses to allow single family homes near apartments, offices and grocery stores so people can work and shop close to home (About.com, http://geography.about.com.)

In 1916, New York City adopted the first zoning regulations and by 1920, much of the nation upheld zoning ordinances New York is noted as the first because it was considered more of a city, but smaller villages had also begun to set up ordinances at the same time. As with anything else, zoning regulations also posed problems. The town of Euclid, Ohio passed a zoning ordinance that resulted in the devastation of 68 acres of land. The Amber Realty Company, who owned the land, sued the town for violation of the Fifth Amendment to The United States Constitution. By 1926, the Supreme Court ruled that zoning is constitutional providing that it is designed to protect public health, welfare and safety. The city of Houston, Texas is notable for its lack of zoning ordinances. (About.com, http://geography.about.com.)

In order to protect public health, welfare and safety, planners also needed to balance the natural environment with the needs of the residents. A greater increase in federal acts, new highways and the idea of owning your own home became more accessible for people in the 1940s. The construction of highways through the cities, along with urban renewal via the demolition of targeted neighborhoods, opened up a vast amount of land for development. This caused suburbs to prosper and cities to decline in the 1960s and 1970s due to the loss of businesses and the middle class tax base. Some concerns about sprawl emerged. Traffic, air pollution and loss of open space raised further concerns with an increase on the dependence of cars. A series of laws were then written to protect wilderness land areas and the government became more fully involved in the environmental planning movement. The federal government stepped in to address the environmental concerns by creating national agencies intended to develop standards that would to address environmental concerns therefore limiting pollution. Because the economy was affected, federal agencies began offering financial incentives to

encourage companies and builders to implement environmentally friendly practices. During the 1980s – 2000, organizations against governmental regulations began complaining about the burdens of inflexibility, cost, social impact and loss of job growth. Smart Growth then arrived, which encouraged the economic and population growth while still protecting the environment. This approach was taken to offset the effects of sprawl by fostering growth in areas that had existing infrastructures and transforming them into walkable communities. The federal government's role however was then cut back leaving the agencies responsible for proving the environmental acts to be cost effective. Land trusts began to rise as well as many non-profit organizations formed in an effort to acquire land and preserve it for natural areas farms or forests. New Urbanism, established in the 1980s, mirrored the Smart Growth model with an emphasis on interconnected narrow streets walkable neighborhoods, public transportation and mixed use green space in order to promote cleaner air and healthier people. By 1997 the Kyoto Protocol was established to foster international agreement on targets for greenhouse gases. The 21 st century then showed another shift with more people living in cities than in rural areas. This lead to urban ecological planning which looked at the city as a part of an ecosystem in an effort to diminish environmental decline. Today, sustainable planning is more of a holistic view of city and region, where leaders promote environmental, economic and social factors in their planning (Cruickshank, "Green Community," 33-38.)

What is a Community?

A community can be defined as a social group of any size whose members reside in a specific loyalty, share government and often have a common cultural or historical heritage. It can also be referred to as interacting living organisms sharing an environment.

It is a place where people live, work and play. In this, all communities must have physical features like water and landforms (flatland, hills, and mountains.)

According to the 2013 United States Census there are over 300 million people occupying urban, suburban or rural areas. Urban areas or cities are defined as land occupied by buildings and other structures used for residential, institutional or industrial means. Urban areas often have some form of public transportation such as busses, subways or trains. Buildings are often closer together and built higher than those in suburban or rural areas. Suburban areas are on the outskirts of cities. Residents here often commute to the city to work. Some suburban areas have commuter trains and buses that shuttle people to and from cities and the population is generally smaller than in the cities. Suburbs offer the same services such as schools, health care facilities and public works.

Rural areas have significantly lower populations with large amounts of land. Infrastructures are often spread further apart than what you will find in an urban or suburban community. Some rural communities share hospitals and schools.

(Rural, Urban and Suburban, http://www.brainpopjr.com)

Although communities may fit into various categories, there are many basic needs that a community must have in order for it to be successful. Needs like proper governance and an efficient supply of energy, food and

water must exist for the community to survive. To meet these needs many considerations must be looked at; economic, environmental and social conditions, zonings, government and safety/crime prevention. There are many environmental issues associated with infrastructures and our use of them. These issues not only affect the community, but the world as a whole and are larger than any one type of energy saving design could solve. Regardless of where the homes or buildings are located how they are built, what they are used for and what is done in them can contribute to environmental problems like water pollution, energy consumption, ozone depletion, soil contamination, destruction of natural areas, solid waste and resource consumption. As noted earlier in the unit, the environmental impact and energy resources and their uses are outlined. Below, the social studies curricula are more formally outlined. (Government, http://www.brainpopjr.com)

Governance and Economics in a Community

The United States actually began as a group of small communities and throughout its rich history; Americans have maintained the need for both a local and federal government. A government is a group that sets laws and runs a community. The local government is the body that leads a specific community like a town or city and consists of counties, municipalities, special districts and school districts. The local government needs the support of its community members as well as the support from the federal government when dealing with issues of transportation or pollution. The local governments serve three main functions, health and safety, welfare and housekeeping. The function of health and safety is to provide police and fire protection, immunizations for contagious diseases, hospital services, local roads, garbage collection and fresh water to drink. Education is the largest expense in the welfare role other responsibilities also include, libraries, museums, recreational facilities and mass transit. The functions of the housekeeping role includes record keeping for births, deaths, marriages and property transfers as well as collecting taxes and administering elections.

Municipalities include the cities, villages and boroughs that provide services such as police and fire protection, parks and recreation and streets and sewers to name a few. Special districts are organized to provide services such as water and sanitation, mosquito control, transportation, parks and recreation and flood control. The special districts can change taxes and spend public money. The local government that is responsible for collecting taxes, making contracts, providing services and making the laws and ordinances for health, safety and well being of its citizens. Its leaders are elected into office such as the mayor or city council members. The mayor and city council members are responsible for making policy decisions about the way the community/city is run. This government must also have a city attorney to handle legal issues, a municipal judge to preside over court and a clerk to handle records and documents. The local government depends largely on sales tax revenue as well as the revenue from water service fees, fuel tax, vehicle registration fees, the lottery and police and fire pension funds.

The laws within the local governments may vary from those set by the state government or federal government. Each state has its own constitution that can not conflict with the national constitution. The state government runs the entire state. The governor is the elected leader. Each state also elects a senator and representatives to represent their state in Congress. Some positions in the state government are elected, while others are appointed. The appointed members help to manage the state's education and health systems, protect the state's environment and build and maintain roads to connect the communities across the state. The elected, are elected by community members voting for the candidate that they feel best represent their own views and will address the concerns of the community.

The national constitution sets the basis for the federal government. The writers of the constitution wanted to

make sure that the nation and its citizens were free and independent and ensure that citizens' rights were respected and protected without becoming too powerful. After the Constitution was written, some delegates did not sign it until the Bill of Rights was added. This bill listed the individual rights of every citizen. The powers of the individual state's government were also left intact, allowing the individual states to control certain things within their borders as long as it did not interfere with the rights of the other states or nation. The power within the federal government was also limited to ensure that all 'rule' was not up to one person alone leading toward a dictatorship. The government was therefore divided into three branches; the executive, legislative and judicial branch.

The executive branch is headed by the president who carries out federal laws, recommends new ones and directs national defense and foreign policy. Powers include directing the government, commanding the armed forces, dealing with international powers, acting as chief law enforcement officer and vetoing laws. The legislative branch is headed by Congress which includes the House of Representative and Senate. Together they make laws, originate spending bills, impeach officials and approve treaties. The judicial branch is headed by the Supreme Court whose powers include interpreting the Constitution, reviewing laws, and deciding cases that involve states' rights. By creating these three branches, a check and balance system was worked into the Constitution so that no branch could become too powerful. The writers also understood that few things last without change, so the addition of amendments was added, allowing approved changes to the original document (Congress For Kids, www.congressforkids.net.)

City governments provide much of the services such as police protection, schools, hospitals and transportation to citizens. They do not always have the money that they need. The cost of running a large city is high and often repairs and maintenance fees for water pipes, sewers, roads and bridges are needed. Although most of the money comes from taxes, as people move from cities to suburbs, the cities have fewer people to tax. Businesses pay much of the taxes in cities as well, but as the businesses moves outside of the city, jobs as well as taxes are lost Unemployment then becomes a problem and with it making a living for people without jobs becomes difficult. Communities should be planned to help take care of this problem.

When planning the design of a community, many monetary factors must be taken into place. Economics is the study of goods and services and how they are produced, distributed, consumed and exchanged. Students will understand the roles of a producer, consumer, goods and services. A producer is someone who will grow goods, make goods or offer services. A consumer is the person who buys the goods or services. Although goods are grown or made, some are manufactured, such as clothes, computers and cars. Some goods are made from natural resources like pencils, paper and furniture, while others are created from non renewable resources that cannot be replaced on a reasonable time scale, like fossil fuels and oil. A service is work that someone does for someone else. Dentists, bus drivers, clerks and postal workers are all people who provide services. In addition to goods and services the idea of supply and demand must be introduced. A supply is the amount of something available to consumers, while the demand is how much consumers want. If the demand is high, but the supply is low, producers may raise their prices to maximize prices. At the same time, if demand is low and the supply is high, the price that producers charge consumers will lesson.

The idea for supply and demand is often rooted in the relationship between needs and wants. A need is something that an organism must have in order to survive such as air, food, water and shelter. A want something that someone would like to have, but can survive without such as televisions, video games or bicycles. Within a community people need to have jobs in order to earn the money to first meet their needs and later their wants. This earned money through work can be used for the goods and services necessary in their life. (Economics, http://www.brainpopjr.com)

Unit Overview

This unit is divided into four sections. Students are expected to understand how their actions affect the surrounding community via the social studies and science components and realize that they can be the change that is needed. This should be evident in the content learned throughout the four weeks and represented through lessons and activities that allow students to understand the history behind community and environmental planning, identify the components of a built environment and its affect on the lives of residents in that community, hypothesize the challenges faced, and define the services and amenities needed by individuals in a community and the challenges incurred because of them like pollution, waste disposal transportation and housing.

Week 1: This first week will provide the students with an overview of what it means to be green. This will include what are the practical sources of energy and the pros and cons of renewable energy sources versus nonrenewable sources. Students will learn about sustainability and its necessity. Students will understand their own ecological footprint and access the footprint of the school. With this understanding students will begin to think about how every action causes a reaction in issues regarding air and water pollution.

Week 2: The second week will focus on experimental design where students will review the scientific process and collaboratively come to a consensus on what is the best form of green energy and what changes they can make in their own lives to reduce their carbon footprint. Students will understand what a community is made of and the issues every community faces from the air they breathe to the impact of their daily decisions upon the environment. Students will be able to identify the difference between individual and community needs as they strive to strike a balance. Experiments will be centered on biofuels and biomass as a source of energy. Students will also identify the individual and societal needs of a community. Students will combine the science and social studies background knowledge to discuss transportation issues evident within a community.

Week 3: Students will understand the three different types of communities including the importance of proper governance and collaboration. The students will discuss the history of urbanization and begin thinking about past ideas and their relationship to the future design of the community.

Week 4: This week the students will combine the background science and social studies concepts learned as they explore and problem solve issues involved with community planning and land use. Students will begin to work in groups in to make decisions on how to define the problems involved with building designs that currently exist and work together to investigate and generate ideas to design a community on the basis of quality of life and land use, i.e. residential, commercial, industrial, institutional and open/public space. The students will also understand how environmentally positive decisions also may have negative consequences.

Lessons

The Solution to Pollution / Lesson 1: Mapping Your Ecological Footprint- Every human activity consumes resources from the planet and produces waste that the planet must then deal with. We can measure our individual impact as well as our collective impact to determine how close we are to a sustainable society. This is where theEcological Footprinthas a major role to play. In fact, we are all bound to our planet's environment

and natural resources through our Ecological Footprint. Objectives/ Activities: Students explore the concept of an ecological footprint by taking the ecological footprint quiz online at http://www.myfootprint.org. Students will be able to show how their ecological footprints are measured. Students will be able to explain how the size of their ecological footprint, impacts the environment. Students will be able to develop strategies to reduce one's ecological impact on the environment. Students collect and record the group's data in a chart. Materials Per student: 1 pre-assessment form, 1 blank ecological footprint quiz, 1 clip board, 1 post-assessment form. Materials for Teacher: Poster of healthy and unhealthy ecological environments, 1 computer, 1 data chart, Dry erase board to write down students' ideas.

Procedure: Pre-Assessment – Students answer questions about what they already know about ecological footprint, overshoot, and sustainability (pretest attached at the end of the lesson.) Teacher will engage the students by showing a poster that says "It's our choice." It has different pictures of healthy and unhealthy ecological environments. What do you notice about the poster? The unhealthy ecological environments have been caused by humans, but we have the power to clean and restore our environment. What are some ways you can help save the environment in your own community? A class discussion is held on what things adversely impact or help the environment. Teacher explains that doing things that hurt the environment makes your ecological footprint bigger and doing things that help the environment makes your ecological footprint smaller. The teacher will discuss ecological footprints, overshoot, sustainability, and different types of energy uses. Have students draw and color big and small footprints. Inside the footprints have them write different examples of practices that could make them that size. For instance, in the small footprint, students could write recycling. Following this, have the students explore the concept further by taking the ecological footprint quiz. An ecological footprint is the amount of space that is required to support the resource needs and waste of a person. Ecological footprints come in all different sizes. If we have a big ecological footprint this can be called overshoo **t** . Overshoot is when a person takes more than the earth can renew. If you take out and look at the graph titled, Humanity's Ecological Footprint, you can see that we have a big overshoot. If we have a small ecological footprint this can be called sustainability. Sustainability is when a person takes more than the Earth can renew. Our ecological footprints are calculated by finding out how much energy we use. We use energy for food, water, shelter, and mobility **.** There are different ways we use energy in our home. Students complete the ecological footprint quiz at http://www.myfootprint.org. Closure: after students complete the quiz, they discuss and chart their results. The students whose ecological footprint is small give advice on how they help to sustain natural resources to those whose footprints are larger. Students reflect and share on what they learn. The teacher charts the data. Students complete post test (attached at the end of this lesson.)

Pre-test

Name _____

Directions: Please answer the following questions.

1.) What measures the amount of space that is required to support the resource needs and waste of a given population or person?

2.) What is it called when a person takes more than the Earth can renew?

3.) What is it called when a person does **not** take more than the Earth can renew?

4.) List three things that would make your Ecological Footprint bigger.

1.

2.

3.

5.) List three things that would make your Ecological Footprint smaller.

1.

2.

3.

Post-test

Name _____

Directions: Please answer the following questions.

1.) What measures the amount of space that is required to support the resource

needs and waste of a given population or person?

2.) What is it called when a person takes more than the Earth can renew?

3.) What is it called when a person does not take more than the Earth can renew?

4.) List three things that would make your Ecological Footprint bigger.

1.

2.

3.

5.) List three things that would make your Ecological Footprint smaller.

1.

2.

3.

6.) In one or two sentences, explain why you think it is important to make your

ecological footprint smaller? (Creative Change Education Solutions, www.creativechange.net)

Lesson 2: Biomass and Biofuels: Introduction: The United States is faced with energy supply and demand

problems. One way in which we can help address these problems is through the proper use of biomass. Students will need to have a grasp on key vocabulary terms and their definitions: biodegradable, biodiesel, biomass, ethanol, methane, particulates, recycle, legislature, natural gas, nuclear energy, geothermal, solar energy, wind energy, hydropower, petroleum, global warming, ozone depletion, acid rain. The students will begin by making a flipbook to organize the students' definitions. The flipbook is created by folding a piece of 8 by 12 construction paper vertically in half. Then take the top sheet of the folded paper ad cut it from the outside to the fold to match the number of vocabulary words that will be defined. On the cover of the flap write the vocabulary word on the inside flap write the definition.

Discussion: The most common methods to obtain energy currently in use involve the combustion of fossil fuels. Not only are the fossil fuels limited and nonrenewable, but their oxidation contributes to environmental pollution, acid rain and global warming. The development of alternative energy sources and alternatively fueled vehicles reduces environmental damages and decreases dependence on nonrenewable resources. Objectives/ Activities: Students will be able to understand biomass concepts and related vocabulary. The students will be able to identify potential raw materials, discuss the necessary processing steps and explore biomass products and impacts. The students will compare the amount of biogas that is produced from different types of biomass.

The students will present their learning in the form of a poster, diorama or research paper.

Materials: Student and teacher student guides of Farmers Fueling the Future (available for free at http://www.soyohio.org/aws/OHSOY/pt/sp/osc_ed_guides), school menus, chart paper, science logs, materials needed in experiment listed below.

Procedure: The teacher will engage students with a read aloud of the guide Farmers Fueling the Future. The students will discuss the beginning and end process for converting soybeans into final biodiesel products. The students will then examine school menus and identify agricultural products that can be used in biomass. The students will keep a log of this as well as potential products from home and school that can also be used in biomass such as food items, cooking oil and plant and animal waste materials to name a few. After a acquiring a grasp on the concept, students will then conduct the experiment, From Trash to Cash. Hook to the experiment: the students will discuss the possibility of a world where you could take the scraps from last night's dinner and toss them into your car's fuel tank and make gas? In this experiment you'll discover that food scraps, dead plants, sawdust, and other decaying organic matter, calledbiomassare a rich source of energy. You can get energy out of biomass by burning it, turning it into a liquid, or by turning it into a gas calledbiogas *.You've probably burned biomass (like dead wood) before if you've ever built a campfire, and you've seen biogas being produced if you've ever watched cows happily munching on green grass. The cows eat a type of biomass (grass or hay) and turn it into the biogas, methane, in their digestive tracts. In this experiment, you'll compare the amounts of biogas produced by different types of biomass. The students will begin with a question: How much biogas will be produced by waste materials like manure and decomposing fruits and vegetables? The students will formulate a hypothesis about which type of biomass will create the greatest amount of biogas. Materials: 5 1 liter bottles, 5 balloons 750 ml of decomposed and blended fruits and vegetables, 600 ml of corn, 750 ml of cow manure, 750 ml of horse manure, 500 ml of soil, 2 sun lamps, disposable gloves, blender and duct tape. Method:* Collect organic cow and horse manure. Collect rotted fruits and vegetables as well as their peelings and keep in the refrigerator in a sealed container until ready for use. Measure 500 ml of blended, decomposing fruits and vegetables and pour into a one liter bottle, then add 250 ml of corn. Measure 500 ml of cow manure and add to a labeled one liter bottle, then add 250 ml of corn. Measure 500 ml of horse manure and add to a labeled a one liter bottle, then add 250 ml of corn. Measure 250

ml of soil and 250 ml of decomposing fruits and vegetables and add to a labeled 1 liter bottle, then add 250 ml of corn. Measure 150 ml each of the decomposing fruits and vegetables, cow manure, horse manure, corn and soil. Then add them to a one liter bottle. Secure a large balloon to the opening of the bottle. Place bottles under the sun lamps. Observe and record data. Graph and analyze results. The students will then discuss the results and measure the amount of methane collected by using a measuring tape to measure the diameter of the balloons. The students will then discuss how the methane can be converted into gas used to heat infrastructures or fuel cars. Closure/ Assessment: The students will research an environmental issue related to biomass utilization and alternative fuel sources or environmental problems as a result of fossil fuel use. The students will present his or her information to the class in the form of a poster, model or diorama. Two class periods are needed for research and one class period for presentation (Science Buddies, Sciencebuddies.org.)

Lesson 3: What is a Community? Students explore the concept of community. The students learn that communities take many forms: communities that form in response to a need or common interest, their school community, family community and the community in which they live. Communities come in different configurations, such as rural, suburban and urban. The students take a field trip to a local community business district/downtown and learn about the four sectors: business, government, nonprofit and family. They pay particular attention to the nonprofit sector. They come to recognize that people in communities help each other in many ways. Objectives: The students will define community and neighborhood, respond to an example of a community in literature, recognize that communities form when people work together for a common purpose, list places that help or give service in the community, state why trust is important in a community, illustrate urban, suburban and rural areas and define each of the sectors: business, government, nonprofit and family. Materials: City Mouse & Country Mouse: A Classic Fairy Taleby Isabelle Chantellard, Chart Paper, markers, crayons

Procedure: Discuss that there are many different types of communities. List the words: urban, suburb and rural on chart paper. Instruct the students that these are the three different types of communities where people live and work. Define and discuss each type. Then initiate a collaborative discussion about different ways in which to describe each area such as through the various types of buildings, businesses, people, animals and landscape. Introduce the book, City Mouse, Country Mouse and tell the students to listen for descriptions of each of the areas. After reading the book, discuss how the mice feel about their communities. Ask the students; Which place is better to live in? Why do the mice disagree? Why do people choose to live in different areas? Lead the students to understand that one type of community isn't better than another, they're just different. People choose where they live based on their interests, abilities, needs and resources.

Next, divide the class into three groups and assign them an area: urban, suburban and rural. Each group needs to work cooperatively to illustrate their assigned area by drawing an outline of the assigned community. Students must include a scale and label each part of the area clearly. The students then must present their community and discuss why their assigned area is rural, urban or suburban. After the presentation, connect the three communities and discuss how the three communities depend on each other and enjoy the resources of the other communities. Closure: Teacher will observe student participation in discussions. The final mural project should reflect understanding of the characteristics of the different areas (Learning to Give, learnngtogive.org.)

Lesson 4: Making a Community Map: Using the learning from lesson three, understanding the different types of communities, students are now going look through a magnifying glass at creating not only an outline of the urban, suburban and rural areas, but more closely at an individual part of the community by creating a map. Objectives: The students will understand the five land use categories. The students will explore sample maps

that outline a community, road maps and topographic maps and identify the land use categories. The students will discuss map features and the necessity of a legend. The students will design a community map. The students will create a legend to read the map. Materials: Collection of various maps, Overhead projector or Smart Board, Color coded photographs of the places that make up a community

Procedure/ Activities: The teacher will begin a whole class discussion on what maps are and how to read the legend using sample maps. The teacher will identify the five land use categories and discuss their importance to each community. 1) Residential: Places where people live (i.e., houses, apartments, university residences, townhouses, etc.)

2) Commercial: Places where people buy things (i.e., stores, restaurants, supermarkets,

hotels, malls, movie theatres, gas stations, etc.) 3) Industrial: Places where people work (i.e., factories, warehouses, electrical power plants, offices.) 4) Institutional: where community activities take place or community resources are stored (i.e., schools, libraries, parks, churches, temples, police stations, fire stations, sewage treatment plants, landfills, public works garage, bus stations, airports, etc.) 5) Open/ Public Space: Natural places like forests, trails, parks and recreation centers. The students will categorize, color coded photos of infrastructures involved in a community according to their land use. Discuss what a "community mix" is by comparing community planning with making cookies. Some questions to consider include: Is it better to have many land uses in an area, or just one? What kind of area would your students most like to live in — one with a mix of uses, or one that's less mixed? What are the benefits of community mix? What might be some of the drawbacks? Too much of any one ingredient makes cookies taste bad. Likewise, too much or too little of any one land use category makes a less attractive community mix. Split the class into groups of five or six and have them use the color coded infrastructures to design their community map with a legend. Closure: The students then present their map and discuss their reasons for creating it the way they did. The class then offers constructive comments (A Kids Guide to Building Great Communities, www.cip-icu.ca.)

Lesson 5: Community Clean Up: Based on the learning from lessons 1-4 students will apply what makes a community thrive by refurbishing one whose environmental impact is damaging. Objectives: Students will identify buildings, services and amenities people need and want in their towns and cities. Students will identify and define the five land use categories and the buildings that belong in each category. Students will identify challenges facing modern towns and cities such as pollution, waste disposal, transportation and housing. Students will compare and contrast utility choices and transportation. Students will develop a roughly scaled blue print/overview of zoning/placement of community resource centers/housing/retail. Students will produce a written summary analyzing their choices to clean up the community. Students will need to explain and defend their choices. Materials: Article on Grayville, Worksheet analyzing Grayville, Chart Paper and markers.

Procedure/Activities: Before a community can be designed, an assessment of the communal needs must be taken. Engage students in a discussion that involves the following teaching "Community assessment answers the basic questions: Who is in the community? Where do they live and work? Who will most directly be impacted by the revitalization project? What are the unique attributes of the community? What is the community's vision for revitalization? A community assessment is a study that requires data and can:define the community by gaining useful information on the current economic status, crime and census reports, educational systems, and existing stigmas. Identify stakeholders and local governmental leaders. Identify infrastructure and transportation issues. Identify community needs (e.g., open space, affordable housing, etc.)

Infrastructure Rubric

Creates pure air	Always 7pt	Usually 5pt	Sometimes 3pt	Never 1pt	Score
Creates pure water					
Stores rainwater					
Produces its own food					
Creates rich soil					
Uses solar energy					
Stores solar energy					
Creates silence					
Consumes waste unused					
Maintains itself					
Matches nature's cycle					
Provides wildlife habitat					
Provides human habitat					
Moderates local weather					
				Total Score	/ 100

(Derived to match: http://www.cip-icu.ca/_CMS/Files/kidsguide.pdf)

Divide students into groups of six and distribute the 'Rebuilding Grayville' worksheet and newspaper article. Read the article with the students. Ask the students to highlight what makes living in Grayville difficult. The student's need to examine the challenges and discuss how they can help solve the problems Grayville is experiencing. Gather the students together after having read the article and ask them; What do you think we should do to solve Grayville's problems? What do you think real city planners do when they are trying to figure out the answers to their problems? What information do you think you will need to plan a community? Now that students know about the challenges many communities face, the students work collaboratively to create solutions to the challenges and write an article persuading local government to notice the challenges and accept your solution to the problem as you create a refurbished version of Grayville. Closure: Using the checklist, the Grayville article and the letter to local government, explain what makes the community "green" from a societal and environmental point of view.

Grayville Article: The town of Grayville was forced to use recreational canoes, fishing boats and other flotation devices in order to transport themselves to a safe area, while heavy rainfall continued to flood the nearby river over its banks. Most residents were relocated to a large city, named Grantsville, 50 miles from where most residents work. Long time residents are hopeful that the community can be rebuilt. Originally the community consisted mainly of a fishing community/industry. As years passed, coal burning power plants and other factories were built. A steady growth of strip malls, residential neighborhoods and large commercial centers developed in Grayville. This was less attractive to some, but others were happy that they didn't have to drive their kids to school without sidewalks and public transportation. Life that used to be spread out was now enclosed. Grayville was built in a low lying area, that was flooded in the past, but because of the new commercial developments in the adjacent wetlands, damaging floods were an increased risk. Residents are now faced with the task of rebuilding their beloved home.

Rebuilding Grayville Work Sheet: After reading the article about Grayville, discuss its challenges in the chart below. Challenges may include something that may not work well in Grayville, something that may be

missing, or a way that Grayville is not sustainable.

Grayville's Challenges	Possible Solutions to Challenges.

Closure: Gather the students together to discuss the challenges of living in Grayville and the components of the built environment that affect the everyday lives of the residents. Collaboratively decide which possible solutions would have the greatest overall impact (Cruickshank, Marilyn. Green Community. Pgs 44-45.)

Implementing District Standards

According to the CT Science Standards, fourth graders are expected to master matter and energy in an ecosystem. Students are assessed through the CMT on how all organisms, living and non-living are dependent upon the environment for survival. They will be expected to know and understand that when the environment changes, and ways in which they are responsible for the conservation of natural resources. Additionally, this unit is aligned with New Haven Pubic Schools' goals for students which say "What students learn in school must be relevant to the world in which they live. The learning that takes place in schools is not only academic, but also social and personal. It is profound and must be relevant to the world in which they live.

Looking ahead at what awaits us in education, lies the Common Core Standards. Common Core Standards explicitly state that selective non-fiction text will build a coherent knowledge across curriculums as well as give students essential opportunities to gather evidence, knowledge and insight in order to be able to own and demonstrate their learning. Standard 1: Science as Inquiry: The competent science teacher understands scientific inquiry and has the ability to conduct scientific inquiry. Standard 2: Technological Design: The competent science teacher understands the concepts, principles and processes of technological design. Standard 4: Organisms and Ecosystems:

The competent science teacher understands and can apply concepts that describe how living things interact with each other and with their environment. Standard 5: Matter and Energy: The competent science teacher understands the nature and properties of energy in its various forms, and the processes by which energy is exchanged and/or transformed. Standard 10: Science, Technology and Society: The competent science teacher understands the interaction among science, technology and society, including historical and contemporary development of major scientific ideas and technological innovations. These standards in conjunction with the current state standards that say all organisms depend on the living and nonliving features of the environment for survival, energy in the earth's systems and how external and internal sources of energy affect the earth's systems.

Reading List

Books:

Booth, Wayne C., Gregory G. Colomb, and Joseph M. Williams. *The Craft of Research* . Chicago: University of Chicago Press, 1995.The Craft of Research explains how to build an argument and to create solid introductions and conclusions.

Collier, Christopher. *The Rise of the Cities:1820-1920* : Christopher and James Lincoln Collier, 2001. This student and teacher friendly text acknowledges the pros and cons of the first American cities through its reform in the 1900s.

Condon, Patrick M.. *Seven rules for Sustainable Communities Design Strategies for the Post-carbon World* . Washington, DC: Island Press, 2010.This text for teachers reviews how the design of cities can challenge climate change due to the production of greenhouse gases. It provides insight on how to create greener, smarter infrastructure design and transportation.

Coyle, Stephen. *Sustainable and Resilient Communities: a Comprehensive Action Plan for Towns, Cities, and Regions* . Hoboken, NJ: John Wiley & Sons, 2011.An ultimate step by step guidebook in creating communities that are resilient, resourceful and healthy. This text provides sustainable plans for the environment in issues such as energy, transportation, waste and public health.

Cruickshank, Marilyn. *Green Community.* Washington D.C: The National Building Museum, 2012 A teacher's guide that provides extensive background information and lesson plans in green design.

Farr, Douglas. *Sustainable Urbanism: Urban Design With Nature* . Hoboken, N.J.: Wiley, 2008.This is a comprehensive guide to sustainable urban design as written by the United States Green Building Council (LEED) and provides teachers with a recipe for creating high performing infrastructure.

Leardi, Jeanette. *Making Cities Green* . New York: Bearport Pub., 2010.This student friendly resource discusses the environmental issues that cities face and the creative ways they are using to make the city more environmentally friendly. Issues with energy consumption and alternative energy resources are outlined as well has conservation techniques that cities across the United States are using.

McLeish, Ewan. *Energy Resources: our Impact on the Planet* . Austin: Raintree Steck-Vaughn, 2002.This book can be used for teacher and student research purposes and examines the decisions that governments and organizations are concerned with in terms of energy consumption and waste disposal.

Ristinen, Robert A., and Jack J. Kraushaar. *Energy and the Environment* . 2nd ed. Hoboken, N.J.: John Wiley, 2006.This teacher text deals with the basic concepts of energy, applications and current problems as well as the major concerns of energy usage as it applies to an industrial society.

Wengenmayr, Roland. *Renewable Energy: Sustainable Energy Concepts for the Future* . Weinheim: Wiley-VCH, 2008. This teacher resource provides extensive background knowledge about climate change and its effect on the environment as well as offers insight on how to make substantial progress toward sustainability through building design.

Websites:

Energy Kids, http://www.eia.gov This is a teacher and student friendly site that offers an abundance of information about energy and current environmental issues.

Holtzer, "What Does Eco-friendly Mean?" http://greenliving.nationalgeographic.com

National Geographic offers up to date information about earth friendly practices. This site is great at interdisciplinary connections with social studies and science.

NC State University, What is Sustainability? http://sustainability.ncsu.edu/about/what-is-sustainability Teacher centered site offering up to date information concerning sustainability and environmental concerns.

Shah, Anup. Climate Change and Global Warming, http://www.globalissues.org/article/233/climate-change-and-global-warming-introduction#WhatisGlobalWarmingandClimateChange This is an extremely informative site offering the latest trends in climate change.

Rural, Urban and Suburban, http://www.brainpopjr.com Student friendly website breaking down hard to understand topics across various curricular areas for easy understanding.

Congress For Kids, www.congressforkids.net This student friendly site examines government concepts in an easy to understand manner.

A Kids Guide to Building Great Communities, www.cip-icu.ca/_CMS/Files/kidsguide This student friendly site offers children an overview on community development and the necessity for collaboration within the community in its design and progress.

http://www.myfootprint.org This website is equally effective for students and teachers in understanding what an ecological footprint is and how to measure it as a way to understand how to reduce it.

Creative Change Education Solutions, www.creativechange.net. This website is perfect for teachers looking for innovative lesson plans to share and adjust to fit the needs of their science curricula.

Science Buddies, Sciencebuddies.org. Science Buddies offers a plethora of science fair experiments across from kindergarten through high school level. It lists the procedures as well as pictures and awards own.

Learning to Give.org This website is interdisciplinary, in that it allows teachers to browse and adjust developed lessons that teach students to give, character enrichment and civic engagement.

Active U.S.A. Center, http://www.theusaonline.com/people/urbanization.htm This website provides teachers through background information about the United States of America.

About.com, http://geography.about.com About .com provides extensive background knowledge for teachers on a variety of topics.