YALE NATIONAL INITIATIVE
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Curriculum Units by Fellows of the National Initiative
2009 Volume VII: Energy, Climate, Environment

EFP&W: Energy Food-Production & Waste

Curriculum Unit 09.07.03, published September 2009
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Introduction

When we go to the store, any store, to buy food, how is it that we decide what we want and need to buy? Are our food purchases made because we are hungry while shopping? Are our food purchases part of our subconscious memories of television advertisements that told us what foods taste best? Are our food purchases based on some radio advertisement or on billboard displays we may have driven pass on our way to the store? Are our food purchases based on what friends and family have told us they have enjoyed, so we feel we must honor their suggestions and try the foods out for ourselves; because the next time we speak with this friend or family member we do not want to have not tried the food? Any one of the mentioned scenarios are often part of the food decision process, food decisions are often made based on convenience and emotion. Few if any of us are able to divorce ourselves from the power of pervasive persuasion. It is a rare occasion that food decisions are based solely on what we know is best for our own health and the health of the Earth planet.

The majority of Americans make food decisions based on our trust in what we are told by food advertisements, health professionals, friends, and tradition. Food decisions seem relatively easy on the surface, but if we probe just below the surface we will find ourselves with truckloads (literally) of food facts that are overwhelming and rather startling. We will find that the foods we eat are not the foods are grandparents ate or our parents in many cases.

Food is business, gigantic business, and the food business is not for the faint of heart, or those seeking good nutrition, or those particularly concerned with our Earthly environment.

Food like air and water is essential to all living things; we eat to live, food is the energy of living, food determines health, the better we eat the better we live. We cannot equate life with car size or make, home size or location, college degrees obtained or not; we can equate life with good nutrition, which comes directly from our food. Yes, we should and must exercise, but exercise and any movement for that matter requires food energy; living without exercise is not intelligent, but it can be done; living without food is not possible.

Food comes directly from the Earth's soil, be it plant or animal. Everything we put into our soil or remove from it determines how much food and the quality of food we will be able to put into our bodies. Growing food, plant and animal, requires energy, and it is in the food energy production that it seems we have grown into a

culture where convenience determines our decisions.

Food energy usage is where our decisions are not solely our own, because it is here that our information about what we are eating fades into a vast hole of ambiguity. Most of the food purchased at grocery stores will be labeled with a host of nutritional facts, but what do all those facts really mean to the average consumer? If the consumer is counting calories, is interested in sodium content, or concerned with how many grams of sugar per serving, then the nutritional facts may be useful. Keep in mind, the foods that are best for us are not labeled with nutritional facts; go figure that one out.

This energy-food-production and waste unit will introduce you to basic facts about how a few foods make it from small seeds to landfills, and the energy usage along the seed to landfill journey.

This energy-food-production and waste unit is intended to give you enough information so that you may teach your students about how food and the environment are intertwined; and how energy begins, transfers, and ends our ability to eat food.

This unit is comprised of three lessons, and a project. Each lesson is crafted with the intention of informing, inspiring, and initiating a change in the way students and educators think about food production and waste. The lessons are welded in such a way where the students will take their gained three areas of knowledge and create a virtual world where they have the opportunity to make decisions about food and waste as food and waste relate to community.

When all members of the classroom community are engaged, learning, having fun, and examining ways to improve the way we all live, I will feel satisfied with what I have written.

Unit Rationale and Background

We all know there are some basics about food, first we know we must either cook, shelve, refrigerate, or freeze the foods we eat; all of these choices are usually not difficult to make, because we make them dependent on the types of foods they are. Ice cream along with any meats not being cooked within a day of purchase are usually put into the freezer. Grains (rice, beans, cereal), and canned foods are usually stored in the cupboard. Fruits and vegetables, milk and foods that spoil, are usually put into the refrigerator until we plan to eat or cook them.

Some foods seem to be on our radar to purchase as soon as we think of food shopping or we are actually in the process of food shopping, why? When we food shop are we asking ourselves about the nutritional contents of each item we place in our shopping carts or are we making our decisions based on food gratification, based on our emotional connections to the food. We may put the food into the cart based on what someone told us it will taste like, what we remember tasting, or how we felt (emotionally and physically) while eating the food; remembering how the food felt after we digested it may help us to make different food decisions. For the most part food purchases are our responses to emotional stimulants and connections.

Food gratification is so powerful that many of our decisions about food would not be made beyond the produce, dairy, and meat sections, if food gratification were not powerful we could basically go into the grocery store and do all of our shopping along the periphery (produce and meat on the outer aisles, dairy

along the back aisle). There would be almost no need to go to the aisles in the nucleus of the store…..well there are the spices.

Those aisles in the middle of the store have all the foods with the nutritional facts posted along the spines of their boxes and packages. These are the foods that sparkle on the tongue without needing to add spices, the tastes are sweet and salty all in one, and they smell divine when taken from the microwave or oven, they look really tasty in their packaging, they also do not usually require much effort beyond freezing, refrigerating, and putting onto the stove or into the oven. Interestingly, these are the same foods where a "Tums" calcium carbonate tablets come in handy for helping us to get over the queasy acidic stomach feelings. The food may have tasted wonderful while on the tongue, but upon entrance into the stomach everything changed. This example may seem exaggerated in the moment, but if you really consider food gratification the truth reveals itself. If food gratification were none existent, there would probably be fewer heart related diseases, fewer children with diabetes, and more people with the energy to keep themselves healthier through exercise. There would also be fewer people working at huge grocery store food companies ….what could be a viable alternative for employment? If employment at local farmer's markets would allow these same hard working people to earn livable wages, while providing a needed service to the community, and creating a space where the worker felt valued, could we make a change?

Farmer's markets are a great place to buy our foods for so many reasons, they create a sense of community and are usually held in neighborhoods, the food sellers are usually well informed about the nutritional facts of the foods they are selling, the packaging of the foods are considerably less environmentally damaging. It is rare if ever that a well-packaged box of cereal with a cartooned looking tiger is on display at a farmer's market; bulk granola….this is the usual cereal sold.

Creating community in food selling could make it so that people talked while shopping, in-turn making it so that people have the opportunity to know each other more intimately. Because farmer's markets are usually held in neighborhoods more people could consider walking to buy their foods, which translates into more exercise, the exercise of non-strenuous walking.

Food Sellers knowing some of the nutritional facts about foods they sell is a huge factor in food purchasing. People knowing where their food is grown, who grew it, how it grows, and what nutrients it provides to the body is unquantifiable knowledge. Of course not every buyer would want to know all of these things, but imagine how much better a choice a person could make if given the opportunity to know. As it stands, knowing about the foods we eat is not readily if at all available without extensive research.

Food packaging in such excess could be reduced considerably if farmer's markets were places where the masses bought their groceries. Our foods come into our homes so heavily wrapped, often plastic coverings in plastic coverings, inside of cardboard shiny colored boxes. These same heavily boxed and wrapped foods are put onto grocery store shelves after being removed from other boxes that were wrapped in cellophane plastic wrappers. Just how much protection (from all sorts of critters) do we need? Have we considered the protection we did not require from the pesticides, water poisoning, and plastic chemicals? If we want protection on the back end, we should want it on the front start, but it is the front start were we have little or no knowledge; farmer's markets are a way of changing this food experience.

The reason it's so convenient to create waste by, say, using disposable plastic bags, is because of decisions made at corporate and governmental levels. And those decisions made are largely determined by the larger system—industrial civilization—that corporations and governments are embedded in. Specific programs and laws that reduce waste can—and generally should—be put into effect. But these tend to have small impact in

the scheme of things, partly because they focus on consumer-level issues. (1)

Where and how we buy our food is incredibly important and the factors influencing food is more than eating and the nutrition gained through eating. Food has to be analyzed as a cost, a cost beyond paper money, a cost steeped in energy, Earth's energy. Our Earth fixes energy into soil and rocks, and we have to eat the soil through the plants that grow form it or eat the animals that ate the plants that grew from it; either way, we must eat the soil to live off the energy the Earth provides. We have grown into a culture completely dependent on extracting every bit of energy from the rocks the Earth took millions of years to make. We have come to depend on so much of this energy that we are now worried about what we will do when we have depleted our sources.

We live in great abundance and the Earth has enough energy to supply us with all of our learned abundant needs and wants, for now that is. But we should consider the way we live with a tad more mindfulness, and a tad more conscious thought about what our want habits are or are not creating for our descendants. If it is in our collective consciousness to live more harmoniously with Earth, then we have to make wiser decisions about what we buy (food and more) and how it affects our food source, Earth. There must be some form of accountability that makes us take note that those that inhabit this Earth after us just may want to live the easy life too, and what challenges and opportunities will we pass on to them?

Mental voyage: Think about just a few very basic reasons we may want to make better, smarter decisions about the foods we eat? Cash register cost:

Food	**Cost**
Gallon of Whole Milk	$1.99
Frozen box of Hot Pockets (12 per box)	$7.98
Loaf of bread	$2.79

(2,3,4)

These listed prices are not paper money cheap nor are they reflective of the real paper money cost, because they do not reflect what it costs to produce a gallon of milk, a frozen box of Hot Pockets or a loaf of bread, these prices do not include the gas needed to transport them from where ever they come or the price to store them so they do not melt or spoil in route to the store where they will be stored until purchased. Yes, it is true; our government subsidizes food prices so that we have enough food to put into our garbage cans once a week. But the biggest and most concerning part of the cost that is not included is the taxing cost to the environment that cannot be measured monetarily. The Earth and the Earth's sun rotate and revolve as they do, and with each revolution and rotation energy is captured, baked, and stored for the time (millions of years) it takes to ready itself for our use.

Michael Morris is lead agriculture economist at the World Bank. The price of food in American supermarkets does not reflect the true cost of production of rice, wheat, corn, or livestock that fatten on it. "The low prices are there partly because of the first—world efficiencies, but mostly thanks to subsidies," he said. "And subsidies have a depressing effect on producers in developing countries. They sharply reduce incentives." (5)

On its face, cheap food is a godsend, especially for urbanites and the rural landless. But frequently this benefit is short-lived. Over the long term, over reliance on cheap food contributes to food dependency, complacency, and—when prices rise as they have in recent years—social unrest and devastation. (6)

When food prices are cheap people can't compete to make a living in growing food, so they don't. Even local growers who usually sell their products at farmer's markets can't compete with the low prices and sale prices offered by big corporate grocery stores like Safeway and Wal-Mart.

The New York Times reported: "During a year when the sock market lost a third of its value—its worst performance since the Great Depression—shares of McDonald's gained nearly 6 percent, making the company one of the only tow in the Dow Jones Industrial Average whose share prices rose in 2008. (7)

Energy is unlimited; this is one way many of us have learned to think about energy, and this way of thinking is one of the contributing factors for our concerns about environmental issues, global warming, greenhouse gasses, weather changes, nature's fury. It seems we want different results with horizontal changes versus creating different results because we made vertical changes. In the most simplistic way we think energy comes in the form of electricity from the electrical sockets built into our walls; energy comes in the form of fire from our stovetops; energy comes in the form of octane molecules, pumped from the hoses at our gas stations; in a nutshell we have learned to think that all we have to do is plug it in, push it in, or turn the knob, and the energy will flow…..Well this is true for most Americans, unless you are poor. Issues of poverty creates another whole set of rules and regulations.

Marketing

Energy-food-production and waste are so incredibly important and these ideas and concepts are up against very smart and well-trained artists of advertisements. McDonald's spent over $ 1.3 billion on advertising in 2002 in the United States alone. Kraft Foods (owned by Phillip Morris, also known as Altria Group) marker of Kraft Macaroni and Cheese, Oreos, and Kool-Aid, spent about $ 465 million in 2001. Quaker Oats spent $ 15 million pitching Cap'n Crunch. Food ads account for most of the marketing that targets kids. There are links between media and food manufacturers. Food advertising effectiveness is quite powerful and effective, and we usually want what we were told to want.

Children

What do children see when they enter a store? They see what everyone sees, but with a little more excitement; the colors, fantasy characters, and promises of fun tempt children in beautiful ways, as they should. The problem with tempting children with food is the nutritional implications and environmental energy results. Most of the foods targeted for children to eat are not good for them, and the waste associated with the packaging of the food is ridiculous; it is like from the box to the trash in less than 5 minutes. Children do not come from the womb wanting sugar coated wheat flakes, just as they don't come from the womb wanting grapes and spinach; they do come from the womb needing the nutrients stored in the cells of grapes and spinach.

What are some of the lessons we can teach children our students about food production, food energy costs, and food waste? We can start with the following three lessons and project.

Lesson 1"Food, From Seed to Stink-Place"

Objective 1:

To create an atmosphere where students learn about how the foods they consume involves energy; and how energy impacts the environment in a repeating cycle.

Objective 2:

- Students use math to calculate distances and about how much gas it takes to get from one place to another, home to store, store to home, school to home
1. Using either Yahoo Maps or Google to map the school location to a grocery store within 5 to 10 miles, and estimate how much gas would be used in traveling that distance.
2. Have students choose three foods from Food Chart and chart how much energy is involved in getting the food to the point from which they buy the food to the place where it is disposed of.

- Note: The teacher needs to find the landfill that is closet to the school and tell the students where it is, and how far (in miles) it is from the school location.
  - Students use language arts to define the meaning of each word within Food Energy Cycle
  1. Each word within the Food Energy Cycle must be defined, and used in complete grade level sentences that can be directly applied to the energy cycle.
  2. Students will study each of the diagramed words, noticing how they are interrelated, and use energy in one form or another. This part of the lesson is intended to give students an opportunity to be able to think independently, then share in small groups, then share their thoughts with the class.
- Note: This part of the lesson will be somewhat time consuming because of the sharing, but in order for the students to gain an understanding this part of lesson should not be skipped.

The diagrams of the Food Energy Cycle and Food Comparison Chart should be given to each student, as well as posted on a wall for the entire class to review together. The diagram and charts give students an opportunity to use expanded visual learning, and creates a learning place where learning can happen in a variety of ways attacking all of the learning modalities.

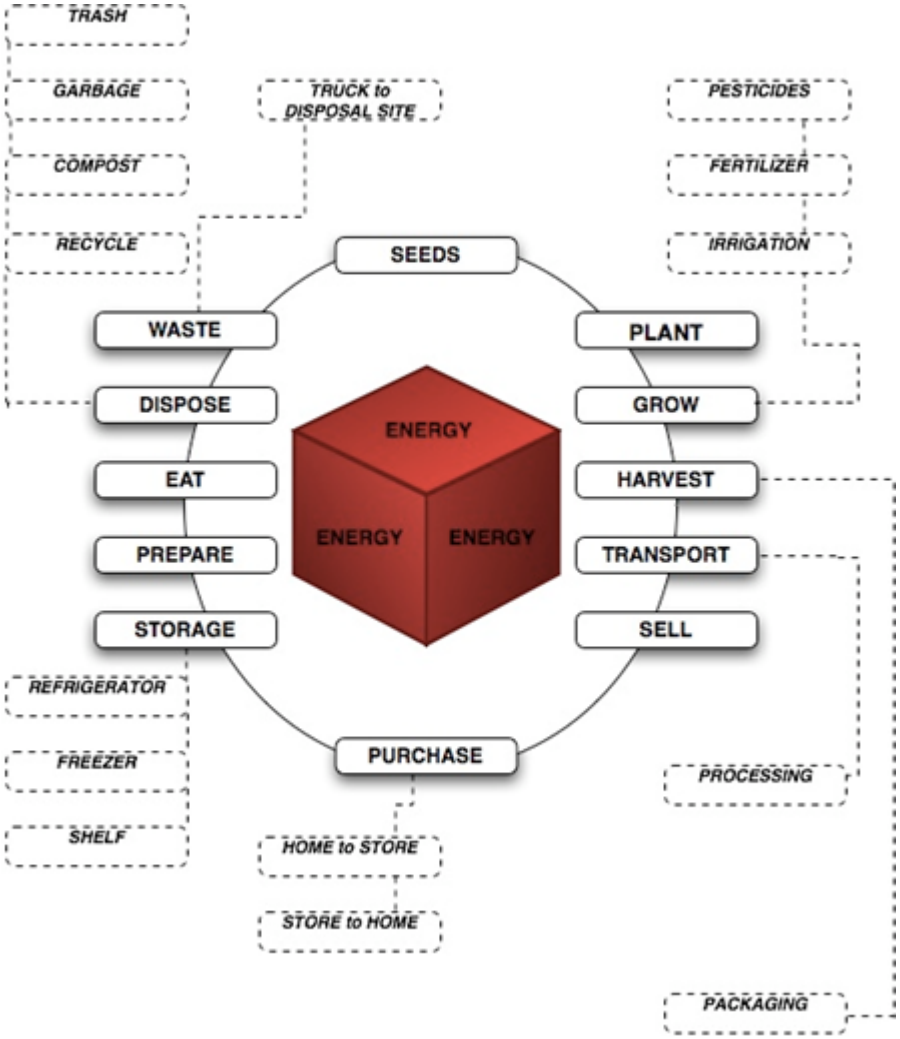

Diagram created by Kelly Clark

This diagram of the Food Energy Cycle should be given to each student, as well as posted on a wall for the entire class to review together.

Food Comparison Chart

Food: Apple

- Content: [Apple]
- Packaging (farm to store): [cardboard boxes]
- Packaging (store to home): [clear plastic bag from produce section] + [grocery bag (plastic) or (paper bag)]
- Grown: California
- Storage: No refrigeration required
- Energy needed: [gasoline x (truck)+(car)+(farm tractor)], [human labor]
- Chemicals:

Food: Apple Juice

- Content: [Apples] + [water] + [sugar]

- Packaging (farm to store): [bottles (plastic) or (bottle)] + [cardboard boxes inside truck]
- Packaging (store to home): [original container] + [grocery bag (plastic) or (paper bag)]
- Grown: California
- Storage: requires refrigeration after initial opening
- Energy needed: [gasoline x (truck) + (tractor) + (car)], [human labor] + [machines for packaging], [oil to make plastic]
- Chemicals:
- Unknowns because of too many variables: [Water source] + [sugar source]

Food: Milk

- Content: [water] + [proteins] + [lactose:makes it sweet] + [fat] + [vitamins]
- Packaging (farm to store): [bottles (plastic) or (bottle)] + [cardboard boxes inside truck]
- Packaging (store to home): [original container] + [grocery bag (plastic) or (paper bag)]
- Grown: [majority of commercial milk comes from cows]
- Storage: refrigeration
- Energy needed: [gasoline x (truck) + (tractor) + (car)], [human labor] + [machines for packaging], [oil to make plastic] + [cows] [
- Chemicals:
- Unknowns because of too many variables: what exact chemicals cows are feed to get them to produce large quantities of milk seems to vary from farm to farm.

Food: Ground Beef

- Content: beef lean
- Packaging (farm to store): [Styrofoam bottom] + [plastic covering] + [cardboard boxes]
- Packaging (store to home): [original container] + [grocery bag (plastic) or (paper bag)]
- Grown: [cows]
- Storage: [intense lighting] + [freezer] + [refrigeration]
- Energy needed: [gasoline x (truck) + (tractor) + (car)], [human labor] + [machines for packaging], [oil to make plastic] + [cows]
- Chemicals: so many, too many, contamination is a huge factor
- Unknowns because of too many variables:

Food: Frozen Pizza (pepperoni)

- Content: water + salt + yeast + flour + vegetable oil + fat + beef + sugar + pepper + garlic + ascorbic acid + paprika + tomatoes + oregano
- Packaging (farm to store): cardboard box + plastic
- Packaging (store to home): original container + grocery bag (plastic or paper)
- Grown: there are so many ingredients they are grown in multiple places and multiple regions
- Storage: freezer
- Energy needed: [gasoline x (truck) + (tractor) + (car)], [human labor] + [machines for packaging], [oil to make plastic] + [cows: beef]
- Chemicals: an array considering all the ingredients…..lots of pesticides
- Unknowns because of too many variables: the contents of a frozen pizza are vast

Lesson Background

How far from our homes (home to store) do we travel to buy the foods we eat regularly? Do we buy our foods from a grocery store, a farmers market, or do we grow some of it ourselves? Are we examining the true cost of foods when we buy them or do we make the assumption that we are paying the true costs?

How do we get to our food?

When we venture out to make our food purchases are we within walking distance, is riding a bicycle a viable option, is using public transportation an option? Or is where we buy our food only accessible by car? If the public transportation system is near our homes, is it in a condition (clean and safe) that makes it so that we are willing and wanting to use it? The public transportation also needs to be located within a walking distance from our homes so that we can carry our purchases. All of these matters should be considered if our goal is to transform neighborhoods into defined communities; should be considered if our desires are to change the way we use energy, save energy, and limit our misuse of energy.

Perhaps there we can align our thoughts about food production with systems already in place; something as simple as transportation can change the way we affect energy output, while simultaneously bring employment opportunities to cities. The filmmaker Michael Moore, and native of Michigan has suggested to President Obama that instead of closing all of the autoplants that they be used as factories where alternative energy vehicles be made. (8) This sort of forward thinking has the potential to provide tens of thousands of jobs all while transforming our energy use to a variety of sources versus straining just a few.

What makes sense?

We cannot forever be willing and able to hire people in foreign lands to produce our goods (food, electronics, otherwise). The cost of labor seems only small in the short-run, but in the long run the cost is incredibly expensive. We are living in a time where we refer to most of what we have according to the price we pay at the cash register. The price at the cash register is not the real cost, it is a portion of cost, it is the subsidized cost. If we factor in the cost of energy from steps seed to landfill, we can see our costs are subsidized. All work, labor in this case, requires energy, human physical labor requires more energy than it does to sit and type this unit, but labor being labor we should be mindful of how we use it. How much cheaper is it to have a person in Vietnam can tuna than it would be to can the tuna near where the tuna is caught? The price is not just the labor; there is the energy cost of machinery, and transportation. Employing people at wages were their earnings allow them to afford the very products they make is fair and makes way for everyone to live healthier happier lives. Employing people in Maine to catch, package, and sell shrimp and lobster makes much better sense to energy usage and economically than shipping frozen shrimp form Thailand.

Growing Food

Modern crop farming varies widely in its scope, ranging from intensively managed small plots to commercial farms covering thousands of acres. Successful crop farmers must be expert at selecting the kinds and varieties of plants that are adapted to their soils and climate. They must be skilled in preparing soil and in planting, growing, harvesting, and storing crops. They must be able to control weeds, insects, and diseases, and they need good marketing skills to gain reasonable returns from their crops.

Food Crop Chart

CROP	REGION GROWN&FOOD	NOTES
Fruit	**Temperate**: *apples, pears, peaches, plums, nectarines, cherries, grapes, strawberries, blackberries, raspberries, blueberries, and cranberries* ———————— **Subtropical**: oranges, lemons, limes, tangerines, olives, figs ———————— **Tropical**: bananas, avocados, mangoes, dates, pineapples, papayas.	Most commercial fruit, the fruit we buy from our local grocery stores are grown without seeds….. great to know, huh. It is also true that these same seedless fruit have to sprayed with some form (biological or pesticide) to control pest and insect damage
GRAIN	**Temperate:** wheat, barley,oats, rye, corn ————————- **Tropical:** rice ———————— **Subtropical**: rice, (corn used to be a subtropical grown grain)	The most important food-energy source for three-fourths of the world population is grains. Most grains are members of the grass (edible seeds) family. The grains eaten most (humans and animals) are wheat, rice, corn (maize), barley, oats, rye, sorghum, and millet.
NUTS	**Tropical:** coconuts ———————— **Temperate:** Walnuts, pecans, almonds, chestnuts, peanuts	
VEGETABLES	**Leafy** lettuce, spinach, endive, celery, Chinese cabbage ———————— **Roots:** beets, carrots, potatoes, sweet potatoes, radishes, turnips, rutabagas ————————- **Cole:** cabbage, broccoli, cauliflower	

Gardens

Community gardens exist in many nations and in both urban and rural areas. They vary in what they offer according to local needs. Some provide open space and greenery. Sometimes they provide cheap vegetables for a local community. With the spread of cities and consequent land scarcity, the demand for communal gardens seems to be increasing. Community gardens are now recognized to be an international phenomenon, and urban gardening is widely seen to be a way of improving local food supplies as well as leisure and recreational activity. (9)

The concept of community gardens should be very broadly conceived to include many kinds of civic intervention with local governments and other public agencies acting in partnership with citizen groups of various kinds. (10)

Some of the mentioned questions and thoughts about food are widely known, yet there is an apathetic attitude that interferes with our willingness to make the choices that are so vital to a healthier and cleaner environment.

Travel, Food, Affordability

In order for citizens to effectively participate in efforts to improve the environment, they must certainly be informed about the nature of the problems and the effect of environmental contamination on them. But it is also necessary to change popular habits of mind and action, ones that have led to the previous acceptance of

the unfortunate environmental practices and the disempowered of citizenry. (11)

The proliferation of private cars contributed to the decline of use and the availability of public transit. Most municipalities are that the system needs to be economically self-sustaining, something that is hard to achieve. Public transit is arguably a tool that helps achieve housing affordability, as it prevents the need to own and maintain a car. Buses, therefore, need to be an integral part of the region and the neighborhood planning process.

Maybe how we determine if housing is affordable has to include our ability to get to places where we can buy healthy foods without having to power a car. Maybe we have to begin to build and design communities where people can work collectively in food gardens (these types of communities probably would be a lesson in socializing and getting along with one another better too).

In building of communities and in-turn changing how food is purchased we can lessen our carbon footprints. The food industry accounts for 10% of all fossil fuel use in the United States. Of all the energy consumed by the food system, only about 20% goes towards production; the remaining 80% is associated with processing, transport, home refrigeration and preparation. (12) This energy usage could change considerably by simply changing how we build our communities; where food to buy is located in relationship to home.

How far we travel for food to home is relatively easy to calculate, but there are more distances to be considered in food travel calculation. Calculating the distance a food item has traveled varies in complexity depending on whether the item is made up of a single ingredient or multiple ingredients and the mode of transportation used to carry the item. (13) Still we could lower the traveling distance and therefore the energy usage by having our food purchasing places closer to home.

How about decreasing the impact of food energy by selling food directly to schools, hospitals, prisons and other institutions is becoming an increasingly popular option. Selling food to institutions creates a reliable market for the farmer and provides great health and economic benefits to the consumer. Farm-to-institution programs also reduce food miles. (14). A better and smarter way to decrease our usage of energy as it relates to food.

What about our waste

There are some things we know for sure in reference to how food is wasted and poor energy usage, like the farther food travels, the more fossil fuels are required for transport. The burning of fossil fuels leads to the emission of greenhouse gases, which contribute to global warming.

There is also the energy use in waste, how we dispose of our food after we no longer want what is leftover. There is the throwing of things away that has become a toxin to our environment; are we considering where the trash-man takes our unwanted leftovers? Where do our scraps of food and trash go?

Our scraps and food and trash usually go straight to a landfill and or incinerator. Landfills and dumping are related and overlapping strategies that differ in intent and approach. A "sanitary landfill," currently the most popular approach to waste disposal in the industrialized nations, is a site (usually lined with plastics) where garbage is spread, buried in layers, and capped to minimize the leaching of toxins from water flowing through (15) (this does not usually work as well in practice as in theory)

The toxins that have been created are extremely hard to deal with at landfills because of the amount of

plastics we use. We wrap all of our foods in plastic over and over again. Americans use about 100 billion polythene bags per year (16). If you stopped sleeping and did nothing but watch plastic bags be produced at a rate of one per second, it would take nearly two thousand lifetimes to observe only one year's worth of plastic bag production. (17) Disposable and paper bags use more energy and produce more waste than plastic bags. (18) There are those people who believe in recycling, but recycling is a huge energy sucking process, and most of the recycling we think we are doing is not even recycling. Most plastics aren't so much recycled as they are downcycled, Carol Misseldine, sustainability coordinator for Oakland, California, notes; We're not recycling plastic bags into plastic bags. They're being downcycled, meaning that they're being put into another product that itself can never be recycled. (19)

There was a time when Americans could and did care for the garbage they created in useful and recycle ways. In times of old before the invent of modern day trash collecting (which I appreciate and would not want to go without) when garbage collection was rare in most American cities and people did not want to give up their waste. The garbage that was collected was often collected informally, by people liked the so called "swill children" who once went from house to house in American cities to gather food refuse to sell as fertilizer or for hog food (20)

If a community can't sort and deal with its waste intelligently—then their waste truly becomes waste, because they can't close the loop back to a useable substance. (21)

Lesson 2 "Energy types, Different and Environmentally Better"

Objective 1

To teach the students about the differences between using fossil fuels as energy sources, and alternative energy sources.

Objective 2

Using science and language arts as the backdrop students will engage in the exploration of researching varying energy sources over the course of a few weeks.

1. In sheltered science lessons students will learn about how the sun is able to store energy in rocks, soil, and plants.
2. Students will study the periodic table, the periodic table supports understanding of where elements are found, and how they are used; various rock types, studying rock types will give students a better understanding of how coal is a rock filled with energy; photosynthesis, understanding photosynthesis is a good way to help students understand cycles and energy, and it may inspire them to think of creating authentic forms of recycling. In studying these subjects students will be better equipped to learn about how energy is related to the sun.
3. Once students gain some recognizable insight into the energy sources they will independently research the different ways each of the above six energy sources are used commonly.
4. Finally students will write a 5 paragraph expository essay describing why they think using an alternative energy source is or is not a good idea..
5. Students will be given the opportunity to read their papers aloud. (Having an audience tends to work as

a motivator of better writing)

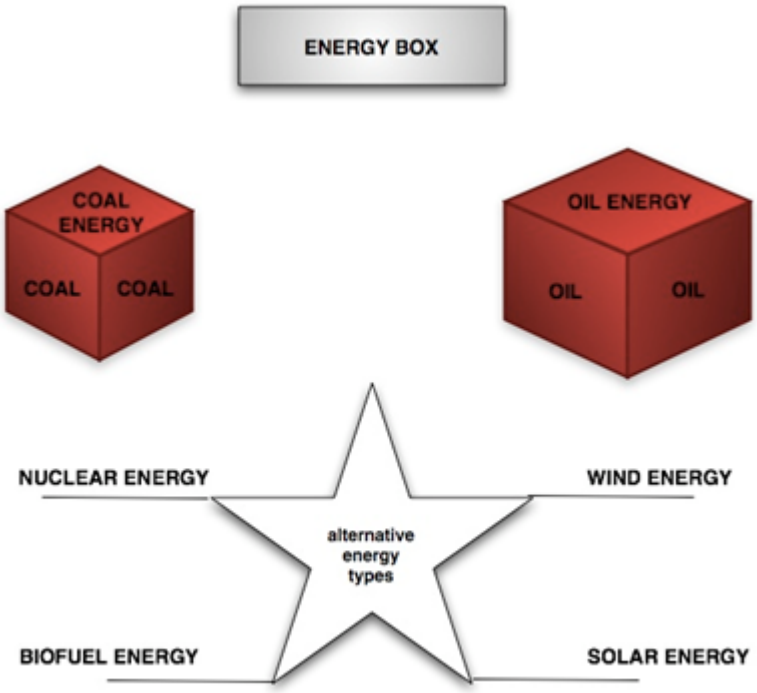

Diagram created by Kelly Clark

Lesson Background Oil and Coal

Why do we want use coal and oil as our primary energy sources? For very practical reasons our willingness to use these very useful energy source are that we are knowledgeable about the process of extracting them from the earth, we have taught ourselves enough about each that we know how to find them in places where they are most abundant, they creates jobs for our citizens, they make some folks extremely wealthyand they are more economically advantageous to use than other energy sources.

Oil and coal have not always been the familiar energy sources.

Why oil?

The modern era of oil production began on August 27, 1859, when Edwin L. Drake drilled the first successful oil well 69 feet deep near Titusville in northwestern Pennsylvania. Just five years earlier, the invention of the kerosene lamp had ignited intense demand for oil. By drilling an oil well, Drake had hoped to meet the growing demand for oil for lighting and industrial lubrication.

Drake's success inspired hundreds of small companies to explore for oil. In 1860, world oil production reached 500,000 barrels; by the 1870s production soared to 20 million barrels annually. In 1879, the first oil well was drilled in California; and in 1887, in Texas. But as production boomed, prices fell and oil industry profits declined.

During the early twentieth century, oil production continued to climb. By 1920, oil production reached 450 million barrels - prompting fear that the nation was about to run out of oil. Government officials predicted that the nation's oil reserves would last just ten years.

During the 1950s, a combination of cheap fuel and a burgeoning consumer culture led to an orgy of consumption. With only six percent of the world's population, the United States accounted for one-third of global oil consumption. Foreign oil was so cheap that coal-burning utilities made the expensive shift to oil and natural gas. World oil prices

were so low that Iran, Venezuela, and Arab oil producers banded together in 1960 to form OPEC, the Organization of Petroleum Producing States, a producers' cartel, to negotiate for higher oil prices (22)

Why Coal?

Coal is a combustible black or brownish-black sedimentary rock composed mostly of carbon and hydrocarbons. It is the most abundant fossil fuel produced in the United States. (23) Coal is a nonrenewable energy source because it takes millions of years to create. The energy in coal comes from the energy stored by plants that lived hundreds of millions of years ago, when the earth was partly covered with swampy forests. (24) When coal is burned as fuel, it gives off carbon dioxide, the main greenhouse gas that is linked with global warming. Burning coal also produces emissions, such as sulfur, nitrogen oxide (NOx), and mercury that can pollute the air and water. Sulfur mixes with oxygen to form sulfur dioxide (SO2), a chemical that can affect trees and water when it combines with moisture to produce acid rain. Emissions of nitrogen oxide help create smog, and also contribute to acid rain. Mercury that is released into the air eventually settles in water. The mercury in the water can build up in fish and shellfish, and can be harmful to animals and people who eat them. The Clean Air Act and the Clean Water Act require industries to reduce pollutants released into the air and the water. (24) Not only is coal a supreme source of energy, but it comes in multiple forms all of which generate different amounts of energy that can be used for different things. There is lignite, sub bituminous, bituminous, anthracite; it is bituminous coal that is found most abundantly in the United States.

As all useful and profoundly wonderful as coal is, coal damages our environment when used as much as it is being used currently. Also, the more of the resource we use the more depleted it becomes, and the more we damage our environment. So then, we must lessen our needs and consider the wide possibilities other energy forms can offer us.

Not oil or coal; instead alternative energies

In the 1970s, oil shortages pushed the development of alternative energy sources. In the 1990s, the push came from a renewed concern for the environment in response to scientific studies indicating potential changes to the global climate if the use of fossil fuels continues to increase. Which has lead a variety of alternative energy sources that can be very useful, while still offering some concerns and hazards.

Nuclear energy is energy in the nucleus (core) of an atom. Atoms are tiny particles that make up every object in the universe. There is enormous energy in the bonds that hold atoms together. Nuclear energy can be used to make electricity. But first the energy must be released. It can be released from atoms in two ways: nuclear fusion and nuclear fission. (25)

Nuclear energy has both a host benefits: they do not directly release pollutants (sulfur dioxide, nitrogen oxides, carbon dioxides, carbon monoxide, particulates or toxics like mercury); they are capable of adding significant power from a single centralized location; they can be competitive with fossil fuel plants, they operate around the clock, there are many innovative artists of science studying the possibilities of nuclear usage as energy. Some of the biggest drawbacks to nuclear energy is that it uses Uranium which is not limitlessly available in nature; it requires lots of water to cool the systems; releases harmful radioactive gases

(not good at all), hazards for mine workers since it is mined similarly to coal. (26)

Wind energy is simple air in motion. The uneven heating of the earth's surface by the sun causes it. Since the earth's surface is made of very different types of land and water, it absorbs the sun's heat at different rates. Wind energy too has both benefits; it has the lowest-cost of all the renewable energies; it has zero fuel cost (with the exception of building the wind turbines); there is no air pollution and climate change associated with it; construction is easy comparatively, so then making new energy sources available quickly. Then there are the drawbacks; there is no prediction of how much energy will be output; high upfront costs, manufactures of the turbines are not in the United States (an opportunity to create American jobs); interference with radars. (27)

Solar energy is free, and its supplies are unlimited. Some of the benefits to solar energy usage are; solar energy panels are easy to install; there are no moving parts; there are no operating costs; there are no fuel delivery costs; design is growing; there are little environmental footprints. The biggest drawback for solar energy is it has the highest cost of all electricity generation sources, even with government subsidies. In addition, large solar thermal farms can also harm desert ecosystems if not properly managed. (28)

Biofuel energy are biomass resources that are converted into liquid fuel needed for transportation, ethanol and biodiesel. Biodiesel can be made from vegetable oils, animal fats, or greases. Most biodiesel today is made from soybean oil. About half of biodiesel producers are able to make biodiesel from used oils or fats, including recycled restaurant grease. (29). Some of the benefits of biofuel energy are thermochemical conversions systems can be generate electricity at any time; when biomass fuels are taken from forestry and agriculture wastes the overall environment impact is minimal; biomass fuels can be derived from supplies of clean uncontaminated wood wastes. Some of the drawbacks include, but are not limited to, emissions of nitrogen oxides, emissions of carbon monoxide, emissions of carbon dioxide (greenhouse gas….not good at all).

These alternative energy sources are becoming more and more obvious as alternatives that we will have to use as primary energy sources. We are in no position to continuously use oil and coal as we have been over the past 100 years. We are in wars around the world over energy, but should we be in fighting wars about the extraction of oil?

Clive Ponting describes one example in his book A Green History of the World: "In 1936 three corporations connected with the car industry (General Motors, Standard Oil of California and the tire company Firestone) formed a new company called National City Lines whose purpose was to buy up alternative transport systems and close them down. By 1956 over 100 electric surface rail systems in forty-five had been purchased and then closed. Their biggest operation was the acquisition, in 1940, of the Pacific Electric system, which carried 110 million passengers a year in fifty-six communities. Over 1100 miles of track were ripped up, and by 1961 the whole network was closed. (30) It is know time to reverse the tide of energy usage.

Let us make oil and coal our alternative energy sources.

Lesson 3 "Why it all matters?"

Objective 1

To teach students to develop a critical consciousness around the importance of a healthy environment as it relates to science, social justice and civil rights issues.

Students write a short three to five paragraph expository essay on how they interpret the link between "E-F-P& W" as an issue of social justice and science.

Objective 2

To have students answer the following questions, then create new questions after they have participated in calculating some of there own food waste:

These questions should be answered in a way where students have fun asking them and answering them. This part of the assignment should be shared and enjoyed by all classroom members. With the right engagement the students should be so inspired to want to ask other school community members and family these sorts of questions.

(before waste calculation question: bq)-

(after waste calculation question : aq)-

(new question developed from calculation information: nq)

Lesson Background

Caring about the environment is a natural thing to do, must of us are happy to go to the ocean, hike in the woods, and see the sunrise and sunset. If we were to go out to the beach and saw an ocean filled with plastics and other debris it would more than likely make us feel worried and sad; and we would probably want to do something about it. This is what is happening in our oceans only we can't see it because we spend our time on the shorelines.

Of the 200 billion pounds of plastic people use each year, about 10 percent ends up in the ocean. (31) Filling the ocean with plastic is hazardous to the environment, and therefore hazardous to humans, us.

How about a hike in the woods only to arrive at a forest that used to exist, a forest turned into a man-made tundra. If we continue to deforest so that we can have more gadgets, we will eventually create meadows, those that do not feature the color purple.

Children, our students, can only benefit by understanding the impact they make on the world around them, and explaining ocean pollution is mind boggling for adults as it is almost incomprehensible to understand what 200 billion plastic bottles must look like.

Though it is not easy to understand what 200 billion plastic bottles may or does look like, it is not farfetched to know what the foods we eat and throw away look like. It is not difficult to understand how the people growing the foods we eat, and disposing of the foods we eat may be impacted by the foods we eat. It is easy to

calculate our own impact on the environment by simply counting what we eat, throw away, where it comes from, where it goes, and how we can possibly make positive different choices.

The questions are tiered to build a sense of consciousness.

Recycle Questions (Tier 1)

bq: Do I recycle?

bq: Should I recycle?

aq: What have I learned about recycling that proves that recycling is useful?

nq: Student develops her/his own question

Social Justice Questions (Tier 2)

bq: Are there any real changes I can make to make the environment healthier?

bq: Why should I even care about making the environment healthier?

aq: Am I making the environment healthier, why or why not?

bq: How does the idea of making the environment better make me feel?

nq: Student develops his/her own question?

Food Choice Questions (Tier 3)

bq: What are my five most favorite foods to eat?

bq: How are my five most favorite foods packaged?

bq: What do I do with the container my five most favorite foods came in after I eat?

bq: What are my five most favorite foods made of?

bq: Where were my five most favorite foods purchased?

bq: How did my five most favorite foods get to the place where they were purchased?

aq: How much space did my five most favorite foods take up in my paper trash bag?

aq: How did I use and dispose of my five most favorite foods?

Project Development Questions (Tier 4)

(These questions are to be used when students are creating their virtual food stores.)

What do we eat?

Why and how do we make our food choices?

How is what we eat packaged?

Could we package what we eat differently?

Would what I eat be package differently if I bought it a grocery store versus a farmers market?

Can I grow (home or community garden) any of what I eat?

Should we package differently?

Who benefits from the way my food is packaged?

Who does not benefit from the way my food is packaged?

What forms of energy sources were used to package and dispose of the food I eat regularly?

Are there any real alternative energy ways to dispose of the food packaging I eat?

How do we see our recycled materials in our communities, how do the recycled materials show up (meaning are there green homes in my community or products I use in school that tell me I am using recycled materials)?

Are different communities impacted differently around food?

Project

Students will apply questions from tier 3 to our school lunch program. If the students eat the food prepared by the district they will calculate the food questions in the same way as they would if they were to bring food from home; the difference in food should not render a difference in the students ability to participate in the project.

Each student will chose one day per week over the course of five weeks to calculate how much food s/he has consumed and disposed of. After five days of food calculation has been recorded, the students will use classroom resources, science encyclopedias, and the Internet to research the details of the foods they have eaten.

The classroom as a complete community will take a fieldtrip to no less than two grocery stores where each student will be responsible for observing how each store does or does not display foods.

The classroom community will take at least one fieldtrip to a farmers market, where students again will make observations about what is sold, and how the foods are displayed.

The students will be expected to make comparisons between the differences they observed with grocery stores and farmers markets.

Students will create virtual grocery stores in teams of three to five students (class size dependent). Using food cutouts from newspapers, drawings, and photographs each student will work in a team creating a virtual grocery store. After the stores are made each team of students will use city maps to trace the route of a dump truck from the school dumpster to the landfill. A calculation of mileage and energy usage of the truck will be made.

After all students have completed their virtual stores and landfill routes, the students will work in teams to create virtual alternative ways to dispose of food.

After this leg of project has been completed, each student will chose a vegetable of choice and grow it somewhere on school grounds or at home.

After the vegetable is grown, we will prepare a classroom edible lunch. (maybe one of the students will prepare bread.

Maybe students are interested in creating an ethical diet……

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Appendix

CALIFORNIA STANDARDS

California Fifth Grade Math Standards

Number Sense

1.0 Students compute with very large and very small numbers, positive integers, decimals, and fractions and understand the relationship between decimals, fractions, and percents. They understand the relative magnitudes of numbers:

1.1 Estimate, round, and manipulate very large (e.g., millions) and very small (e.g., thousandths) numbers.

1.2 Interpret percents as a part of a hundred; find decimal and percent equivalents for common fractions and explain why they represent the same value; compute a given percent of a whole number.

2.0 Students perform calculations and solve problems involving addition, subtraction, and simple multiplication and division of fractions and decimals:

2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.

2.2 Demonstrate proficiency with division, including division with positive decimals and long division with multidigit divisors.

2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers

in the simplest form.

Algebra and Functions

1.0 Students use variables in simple expressions, compute the value of the expression for specific values of the variable, and plot and interpret the results:

1.1 Use information taken from a graph or equation to answer questions about a problem situation.

Mathematical Reasoning

1.0 Students make decisions about how to approach problems:

1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.

2.0 Students use strategies, skills, and concepts in finding solutions:

2.1 Use estimation to verify the reasonableness of calculated results.

2.2 Apply strategies and results from simpler problems to more complex problems.

2.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.

2.6 Make precise calculations and check the validity of the results from the context of the problem.

3.0 Students move beyond a particular problem by generalizing to other situations:

3.3 Develop generalizations of the results obtained and apply them in other circumstances.

California English Language Arts Standards

1.0 WORD ANALYSIS, FLUENCY, AND SYSTEMIC VOCABULARY DEVELOPMENT: Students use their knowledge of word origins and word relationships, as well as historical and literary context clues, to determine the meaning of specialized vocabulary and to understand the precise meaning of grade-level appropriate words.

Vocabulary and Concept Development:

1.2 Use word origins to determine the meaning of unknown words.

2.0 READING COMPREHENSION: Students read and understand grade-level-appropriate material. They describe and connect the essential ideas, arguments, and perspectives of the text by using their knowledge of text structure, organization, and purpose.

2.1 Understand how text features (e.g., format, graphics, sequence, diagrams, illustrations, charts, maps) make information accessible and useable.

2.2 Analyze text that is organized in sequential or chronological order.

1.0 WRITING STRATEGIES: Students write clear, coherent, and focused essays. The writing exhibits the students' awareness of the audience and purpose. Essays contain formal introductions, supporting evidence, and conclusions. Students progress through stages of the writing process as needed.

Organization and Focus

1.2 Create multiple-paragraph expository compositions:

a. Establish a topic, important ideas, or events in sequence or chronological order.

b. Provide details and transitional expressions that link one paragraph to another in a clear line of thought.

c. Offer a concluding paragraph that summarizes important ideas and details.

Research and Technology:

1.3 Use organizational features of printed text (e.g., citations, end notes, bibliographic references) to locate relevant information.

1.4 Create simple documents by using electronic media and employing organizational features (e.g., passwords, entry and pull-down menus, word searches, the thesaurus, spell checks).

1.5 Use a thesaurus to identify alternative word choices and meanings.

California Fifth Grade Science Standards

Physical Sciences

1. Elements and their combinations account for all the varied types of matter in the world. As a basis for understanding this concept:

a. Students know that during chemical reactions the atoms in the reactants rearrange to form products with different properties.

b. Students know all matter is made of atoms, which may combine to form molecules.

c. Students know metals have properties in common, such as high electrical and thermal conductivity. Some metals, such as aluminum (Al), iron (Fe), nickel (Ni), copper (Cu), silver (Ag), and gold (Au), are pure elements; others, such as steel and brass, are composed of a combination of elemental metals.

d. Students know that each element is made of one kind of atom and that the elements are organized in the periodic table by their chemical properties.

g. Students know properties of solid, liquid, and gaseous substances, such as sugar (C_6HO_6), water (H_2O), helium (He), oxygen (O_2), nitrogen (N_2), and carbon dioxide (CO_2).

h. Students know living organisms and most materials are composed of just a few elements.

Life Sciences

2. Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials. As a basis for understanding this concept:

e. Students know how sugar, water, and minerals are transported in a vascular plant.

f. Students know plants use carbon dioxide (CO_2) and energy from sunlight to build molecules of sugar and release oxygen.

g. Students know plant and animal cells break down sugar to obtain energy, a process resulting in carbon dioxide (CO) and water (respiration).

Earth Sciences

3. Water on Earth moves between the oceans and land through the processes of evaporation and condensation. As a basis for understanding this concept:

a. Students know most of Earth's water is present as salt water in the oceans, which cover most of Earth's surface.

d. Students know that the amount of fresh water located in rivers, lakes, underground sources, and glaciers is limited and that its availability can be extended by recycling and decreasing the use of water.

e. Students know the origin of the water used by their local communities.

4. Energy from the Sun heats Earth unevenly, causing air movements that result in changing weather patterns. As a basis for understanding this concept:

5. The solar system consists of planets and other bodies that orbit the Sun in predictable paths. As a basis for understanding this concept:

a. Students know the Sun, an average star, is the central and largest body in the solar system and is composed primarily of hydrogen and helium.

c. Students know the path of a planet around the Sun is due to the gravitational attraction between the Sun and the planet.

Investigation and Experimentation

6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

a. Classify objects (e.g., rocks, plants, leaves) in accordance with appropriate criteria.

b. Develop a testable question.

h. Draw conclusions from scientific evidence and indicate whether further information is needed to support a specific conclusion.

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