Energy Consulting 101

Table of Contents

Becoming an Energy Consultant

Through a series of readers and assignments, the Energy Consultant 101 packet is designed to train you to be an effective energy consultant. Readers contain all the information you need to complete each assignment. Energy consulting, through efficiency and conservation recommendations, is an important job that helps protect the climate. As an energy consultant you will learn how to do the following.

- Define sustainability
- Explain the impacts of greenhouse gases on the atmosphere
- Demonstrate a scientific understanding of the causes & consequences of climate change
- Explain the difference between electrical power and electrical energy
- Determine the energy consumption of a device if knowing its power requirement and its hours in operation
- Calculate monetary cost and CO2 emissions resulting from operating an electrical device
- Define and list renewable and nonrenewable energy sources
- Identify the services that require electricity in buildings
- Describe how energy conservation can help reduce greenhouse gas emissions
- Identify what you can do to reduce energy use

Vocabulary

Fossil Fuels: coal, natural gas, and petroleum were produced over millions of years through tremendous heat and pressure on decomposing plants and animals under the surface of the Earth

Non-Renewable Energy Source: sources that are not replenished within a human time scale

Renewable Energy Source: sources are replenished in a relatively short period of time

Greenhouse Effect: the warming effect caused by greenhouse gases (GHGs) trapping infrared radiation in the atmosphere. The Greenhouse Effect is vital to maintaining a hospitable climate for life on Earth, but swelling concentrations of GHGs in the atmosphere are increasing the Greenhouse Effect leading to rising global temperature and climate change

Carbon Cycle: the combined processes, including photosynthesis, decomposition, respiration, and combustion, by which carbon cycles between its major reservoirs - the atmosphere, oceans, underground, and living organisms

Energy Efficiency: The use of technology, like an appliance, that requires less energy to perform the same function

Conservation: careful use and protection of natural resources; using less resources

Plug Load: any appliance or electronic device that takes power from a wall outlet

Operating Load: The amount of power a device uses when it is on and in use

Phantom Load: energy used by electrical devices when they are plugged in but not being used

Energy: The ability to do work. It can exist in many forms (including kinetic energy, thermal energy, and electrical energy). The standard unit to measure energy is Joules.

Electricity: A form of energy that is produced when electrical charge moves (or flows) across a conductor material.

Power: The rate at which energy is transferred, or how much work can be done in a given amount of time, measured in Watts (Joules/second). Electrical devices 'demand' a certain amount of power at any moment to work

READER: INTRODUCTION TO SUSTAINABILITY & CLIMATE CHANGE

Sustainability

The root of the word sustainability is the ability to sustain or continue. Practices that are sustainable can be continued indefinitely at their present level. When we talk about sustainability in an environmental context, we mean protecting the Earth's ecological balance by not depleting natural resources at a rate that is faster than the rate at which natural resources can regenerate.

- For example, if we managed a forest which had 1,000 standing trees and 20 of those trees became mature for logging each year, the sustainable harvest rate would be 20 trees or less per year.

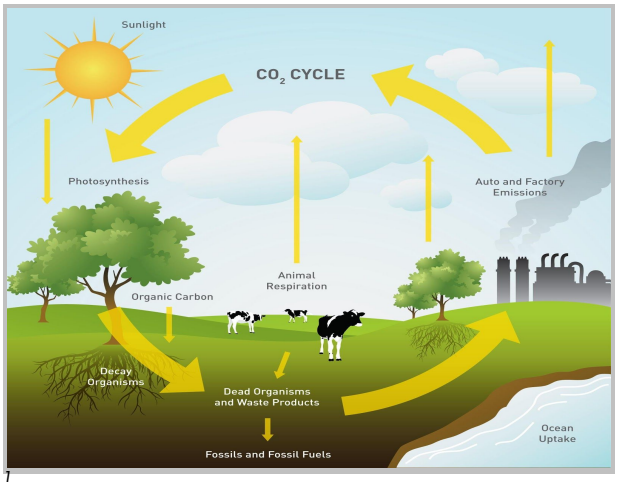
We must also consider the total effects of our logging practices on the ecosystem, but with wise planning and choices the forest can continue to generate wood products indefinitely at this sustainable harvest rate. Achieving sustainability for our planet is much more complex than simply preserving economic yields; it involves balance within a complex system of interdependent relationships in the global network of life.

As consumers, we make choices that affect global sustainability. In order to be sustainable when we design new products and processes, we must consider the impacts on the triple bottom line – people, the planet, and profits (the economics of a decision). Our current economic system is linear. Materials move quickly from extraction to manufacturing to consumption and then disposal. The Earth's systems, however, are cyclical. Waste becomes food for other organisms. For example, trees in the forest will shed leaves and branches that provide nutrients for both the tree and other organisms living on the forest floor. By moving materials quickly on this linear path from extraction to disposal, we are transforming our limited habitat (planet Earth) faster than we can adapt. Humans, and other species, have evolved over millions of years to the Earth's unique conditions. By changing those conditions faster than we can evolve to meet those changes, we are threatening the ability of current species, including our own, to continue to thrive within our rapidly changing environment.

Climate Change

The Carbon Cycle and Fossil Fuels

An example of how humans are changing the environment to which we have adapted is the effect we have had on global climate. Our reliance on unsustainable fuel sources has caused an imbalance in the carbon cycle and led to global climate change. This is known as anthropogenic (or human caused) climate change. Fossil fuels, such as coal, oil, and natural gas, were formed when decaying plant and animal matter buried deep underground were subjected to unique conditions, including intense heat and pressure for millions of years. When we dig up these fuel sources and burn them for energy, carbon dioxide is released into the atmosphere. Because we are burning fossil fuels at a much faster rate than they can be formed, we are not only running out of these fuel sources but we have created an overabundance of carbon dioxide in the atmosphere.



[1]

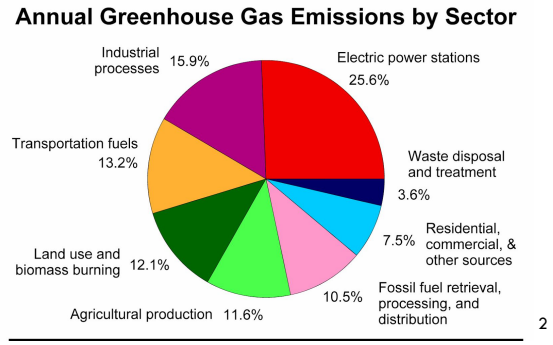
[1] Carbon cycle image courtesy of Dave Murro

The Greenhouse Effect

Carbon dioxide, along with methane and nitrous oxide, are prevalent greenhouse gases (GHGs) on Earth. When solar radiation passes through the atmosphere and warms Earth's surface, the warm Earth re-emits infrared radiation. Some of this radiation is naturally trapped in the atmosphere by GHGs. Therefore, the more GHGs we have in the atmosphere, the more infrared heat is trapped, raising the overall surface temperature of the Earth, like a blanket. If there were no greenhouse gases in the atmosphere, the Earth's surface would be too cold to survive, so having some greenhouse effect is crucial to life. Unfortunately, by releasing GHGs (carbon dioxide from burning fossil fuels) into the atmosphere at an unprecedented rate, we are creating many environmental problems.

Carbon Dioxide in the Atmosphere

The human contribution to the greenhouse effect is largely due to the burning of fossil fuels, but agricultural practices, deforestation, waste, and many other societal systems also add to the total human-sourced carbon dioxide that is accumulating in our atmosphere. The Intergovernmental Panel on Climate Change (IPCC) has measured levels of carbon dioxide on Earth over hundreds of thousands of years and discovered that over the last 200 years CO_2 levels have increased from an average of 275 parts per million (ppm) to over 400ppm in 2013.



[2]

Consequences of Climate Change

The large increase in atmospheric carbon dioxide and other greenhouse gases over the last 200 years has triggered an increase in average global temperatures that leads to many impacts. Scientists predict we will begin to see more: extreme events such as floods, droughts, storms, and fires; intense heat waves; shifting weather patterns that threaten food and water supplies; changing disease patterns such as malaria in expanded areas of the world; shrinking ice sheets; and rising sea levels, displacing coastal communities around the world.

Scientists at the IPCC have identified the highest safe level of carbon dioxide in the atmosphere to be 350ppm. If we do not reduce our carbon dioxide emissions, we risk reaching a tipping point in global temperature that could threaten the ability of current species on Earth, including humans, to adapt to rapidly changing conditions.

What is Energy?

Energy is the ability to do work—everything needs energy to function. We use energy for power, electricity, and heat in many aspects of our daily lives: to cook food, drive cars, manufacture products, and construct buildings, just to name a few.

Energy comes from two different types of sources, non-renewable and renewable. A **renewable energy source** is one that can be replaced at the same pace or faster than it is used, while a **non-renewable energy source** can only be replaced over a *very* long period of time or cannot be replaced at all. Our reliance on non-renewable fuel sources has contributed to global climate change.

[2] Robert A. Rohde, Wikimedia Commons, "Greenhouse Gas by Sector"https://commons.wikimedia.org/wiki/File:Greenhouse_Gas_by_Sector.png

ASSIGNMENT: INTRODUCTION TO SUSTAINABILITY AND CLIMATE CHANGE

Name: _____ Date: _____

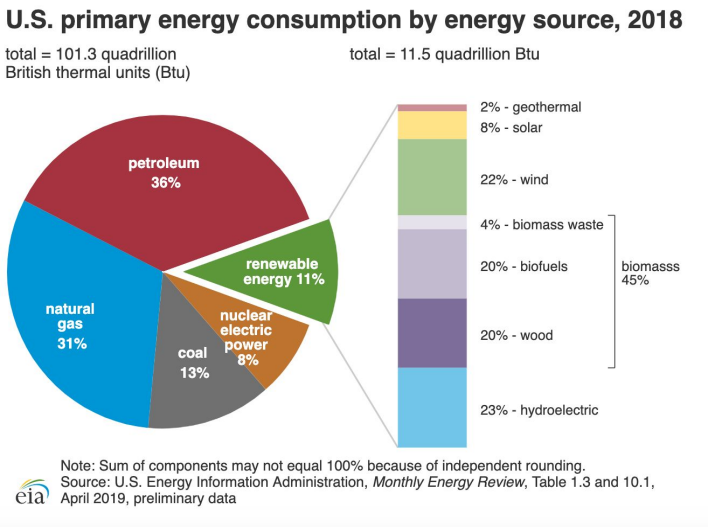
To complete this assignment read the Introduction to Sustainability and Climate Change and answer the following questions.

1. Define sustainability in your own words.

2. What is climate change? What causes it and what are the consequences (or impacts)?

3. What can we do to reduce the negative impacts of climate change and shift the balance of carbon in the cycle to return to below the safe limit of 350ppm?

4. Define renewable and non-renewable energy sources. Give an example of each.



5. Using the graph above, answer the following questions.
    a. Where does most energy in the US come from?

    b. Why do you think that most of the energy comes from non-renewable sources?

6. What are the key factors to consider when choosing an energy source?

7. Why is it important to save energy, aside from the fact that it helps our planet? (Think about how you could convince someone to save energy who might not be concerned about the environment)

8. List three ways you use energy in your daily life.

Personal Energy Pledge

Name: Date:

Reflect on the home energy saving opportunities you have identified from all the Personal Energy exercises and the Personal Energy Assessment. Below is a list of energy saving actions; check off the ones you pledge to perform in order to reduce costs and your carbon footprint. Add more actions to the bottom of the list. Sign this pledge and display it to remind you of your commitment to save energy!

No Cost Energy Conscious Behaviors:

___ Turn off lights when I leave a room
___ Use sunlight for light or heat whenever practical
___ Close the refrigerator door quickly after use
___ Walk, ride a bike, or take public transportation instead of using a car
___ Turn off the water while brushing teeth
___ Recycle glass, paper, and aluminum whenever possible
___ Unplug all appliances and chargers when not in use

Low Cost Energy Conscious Behaviors: Talk to building owners about…

___ Weather-striping windows and doors
___ Planting deciduous trees (that lose their leaves in the winter) on the Southwest side of the building to provide shade in the summer
___ Insulating attic, exterior walls, and crawl space
___ When an appliance no longer works, using Energy Star® labeled products/appliances when replacing standard, non-efficient appliances
___ Replace incandescent bulbs with compact fluorescent light bulbs (CFLs) or LEDs

I Pledge to undertake the additional Energy Conscious Behaviors:

***Student Signature*:** _____

Student Name _____Date _____