

# **GENGP501 APPLY GENERAL PHYSICS**

## **LEVEL 5**

### **SECTOR: ICT**

### **TRADE: SOFTWARE DEVELOPMENT**

## **LU.1: SOURCES OF ENERGY IN THE WORLD**

### **1.1: DEFINITION AND TYPES OF ENERGY**

#### **1.1.1: DEFINITION OF ENERGY**

Energy is the power we use for transportation, for heat and light in our homes and for the manufacture of all kinds of products. There are two sources of energy: renewable and nonrenewable energy.

#### **1.1.2: TYPES OF ENERGY**

##### ➤ Nonrenewable Sources of Energy

Most of the energy we use comes from fossil fuels, such as coal, natural gas and petroleum. Uranium is another nonrenewable source, but it is not a fossil fuel. Uranium is converted to a fuel and used in nuclear power plants. Once these natural resources are used up, they are gone forever.

The process of gathering these fuels can be harmful to the biomes from which they come. Fossil fuels are put through a process called combustion in order to produce energy. Combustion releases pollution, such as carbon monoxide and sulfur dioxide, which may contribute to acid rain and global warming.

##### ➤ Renewable Sources of Energy

Renewable sources of energy can be used over and over again. Renewable resources include solar energy, wind, geothermal energy, biomass and hydropower. They generate much less pollution, both in gathering and production, than nonrenewable sources.

- Solar energy comes from the sun. Some people use solar panels on their homes to convert sunlight into electricity.
- Wind turbines, which look like giant windmills, generate electricity.
- Geothermal energy comes from the Earth's crust. Engineers extract steam or very hot water from the Earth's crust and use the steam to generate electricity.

- Biomass includes natural products such as wood, manure and corn. These materials are burned and used for heat.
- Dams and rivers generate hydropower. When water flows through a dam it activates a turbine, which runs an electric generator.
- Advantages and disadvantages of renewable energy

Wind, geothermal, solar, hydro, and other renewable technologies are a widely popular source of energy throughout the world today. Countries, corporations, and individuals are adopting renewable for a number of great benefits. In this article, we'll dive into some of the advantages and disadvantages of renewable energy.

Advantages of renewable energy

Using renewable energy over fossil fuels has a number of advantages.

**Here are some of the top benefits of going green:**

1. Renewable energy won't run out

Renewable energy technologies use resources straight from the environment to generate power. These energy sources include sunshine, wind, tides, and biomass, to name some of the more popular options. Renewable resources won't run out, which cannot be said for many types of fossil fuels as we use fossil fuel resources, they will be increasingly difficult to obtain, likely driving up both the cost and environmental impact of extraction.

2. Maintenance requirements are lower

In most cases, renewable energy technologies require less overall maintenance than generators that use traditional fuel sources. This is because generating technology like solar panels and wind turbines either have few or no moving parts and don't rely on flammable, combustible fuel sources to operate. Fewer maintenance requirements translate to more time and money saved.

3. Renewable save money

Using renewable energy can help you save money long term. Not only will you save on maintenance costs, but on operating costs as well. When you're using a technology that generates power from the sun, wind, steam, or natural processes, you don't have to pay to refuel. The amount of money you will save using renewable energy can vary depending on a number of factors, including the technology itself. In most cases, transitioning to renewable energy means anywhere from hundreds to thousands of dollars in savings.

#### 4. Renewable energy has numerous health and environmental benefits

Renewable energy generation sources emit little to no greenhouse gases or pollutants into the air. This means a smaller carbon footprint and an overall positive impact on the natural environment. During the combustion process, fossil fuels emit high amounts of greenhouse gases, which have been proven to exacerbate the rise of global temperatures and frequency of extreme weather events.

The use of fossil fuels not only emits greenhouse gases but other harmful pollutants as well that lead to respiratory and cardiac health issues. With renewable energy, you're helping decrease the prevalence of these pollutants and contributing to an overall healthier atmosphere.

#### 5. Renewable lower reliance on foreign energy sources

With renewable energy technologies, you can produce energy locally. The more renewable energy you're using for your power needs, the less you'll rely on imported energy, and the more you'll contribute to U.S. energy independence as a whole.

##### ➤ **Disadvantages of renewable energy**

Renewable energy has many benefits, but it's not always sunny when it comes to renewable energy. Here are some disadvantages to using renewable over traditional fuel sources.

##### **1. Higher upfront cost**

While you can save money by using renewable energy, the technologies are typically more expensive upfront than traditional energy generators. To combat this, there are often financial incentives, such as tax credits and rebates, available to help alleviate your initial costs of renewable technology.

##### **2. Intermittency**

Though renewable energy resources are available around the world, many of these resources aren't available 24/7, year-round. Some days may be windier than others, the sun doesn't shine at night, and droughts may occur for periods of time. There can be unpredictable weather events that disrupt these technologies. Fossil fuels are not intermittent and can be turned on or off at any given time.

##### **3. Storage capabilities**

Because of the intermittency of some renewable energy sources, there's a high need for energy storage. While there are storage technologies available today, they can be expensive, especially

for large-scale renewable energy plants. It's worth noting that energy storage capacity is growing as the technology progresses, and batteries are becoming more affordable as time goes on.

#### **4. Geographic limitations**

The United States has a diverse geography with varying climates, topographies, vegetation, and more. This creates a beautiful melting pot of landscapes but also means that there are some geographies that are more suitable for renewable technologies than others. For example, a large farm with open space may be a great place for a residential wind turbine or a solar energy system, while a townhome in a city covered in shade from taller buildings wouldn't be able to reap the benefits of either technology on their property. If your property isn't suitable for a personal renewable energy technology, there are other options. If you're interested in solar but don't have a sunny property, you can often still benefit from renewable energy by purchasing green power or enrolling in a community solar option.

#### **5. Renewable energy has more benefits than drawbacks**

When it comes to renewable energy, the positives outweigh the negatives. Transitioning to renewable on a personal, corporate, or governmental level will not only help you save money but also promote a cleaner, healthier environment for the future.

Installing solar panels is one of the easiest ways to go green. By signing up on the Energy Stage Solar Market place, you can compare multiple quotes from local, pre-screened installers to see what solar costs and savings for your property. The quotes will also include estimates of the amount of carbon dioxide emissions you will offset over 20 years, and what this equates to in both trees planted and gallons of gasoline burned.

Non-Renewable Energy | Sources, Advantages, Disadvantages

Non-renewable energy is a type of energy whose sources cannot be replenished in our lifetime (or in many lifetimes).

All fossil fuels are non-renewable, but not all non-renewable energy sources are fossil fuels

Coal, crude oil, and natural gas are all considered fossil fuels because they were formed from the buried remains of plants and animals that lived millions of years ago.

Uranium ore, a solid, is mined and converted to a fuel used at nuclear power plants. Uranium is not a fossil fuel, but it is classified as a non-renewable fuel.

➤ **Non-renewable energy sources**

- Biomass Energy
- Nuclear Energy
- Natural Gas
- Petroleum
- Coal

**Advantages of non-renewable energy**

- It is easy to store
- It is easily accessible
- It is more compatible
- It is affordable
- It is present in fair quantity
- It can be efficiently converted to the type of energy required
- It is easy to transport
- A power plant which runs on non-renewable source of energy can be located anywhere as long as fuel is available
- They are available throughout the year unlike solar energy or water energy
- They have high energy density

➤ **Disadvantages of non-renewable energy**

- It produces greenhouse gases
- Its products cause damage to the environment
- Once exhausted they are not easily replenished
- Rising cost
- Its residual products are generally non-biodegradable
- Its products pose potential threat to human health

- Responsible for acid rain

### **Harmful Effects of Non-Renewable energy on the Environment**

- Green-house gas emissions
- Air pollution
- Acid rain
- Water pollution
- Soil pollution
- Non-biodegradable waste generation
- Oil spills
- Depletion of ozone layer

Is nuclear energy renewable?

It is a matter of debate due to unavailability of exact definition of renewable energy. Some consider it as renewable energy while other consider it as non-renewable energy.

### **Different Sources of Energy Of Energy In The World**

There are 10 main different sources of energy that are used in the world to generate power. While there are other sources being discovered all the time, none of them has reached the stage where they can be used to provide the power to help modern life go.

All of these different sources of energy are used primarily to produce electricity. The world runs on a series of electrical reactions – whether you are talking about the car you are driving or the light you are turning on. All of these different sources of energy add to the store of electrical power that is then sent out to different locations via high powered lines.

Here is an overview of each of the different sources of energy that are in use, and what's the potential issue for each of them:

#### **1. Solar Energy**

Solar power harvests the energy of the sun through using collector panels to create conditions that can then be turned into a kind of power. Large solar panel fields are often used in desert to

gather enough power to charge small substations, and many homes use solar systems to provide for hot water, cooling and supplement their electricity. The issue with solar is that while there is plentiful amounts of sun available, only certain geographical ranges of the world get enough of the direct power of the sun for long enough to generate usable power from this source.

## **2. Wind Energy**

Wind power is becoming more and more common. The new innovations that are allowing wind farms to appear are making them a more common sight. By using large turbines to take available wind as the power to turn, the turbine can then turn a generator to produce electricity. While this seemed like an ideal solution to many, the reality of the wind farms is starting to reveal an unforeseen ecological impact that may not make it an ideal choice.

## **3. Geothermal Energy**

Geothermal energy is the energy that is produced from beneath the earth. It is clean, sustainable and environment friendly. High temperatures are produced continuously inside the earth's crust by the slow decay of radioactive particles. Hot rocks present below the earth heats up the water that produces steam. The steam is then captured that helps to move turbines. The rotating turbines then power the generators.

Geothermal energy can be used by a residential unit or on a large scale by a industrial application. It was used during ancient times for bathing and space heating. The biggest disadvantage with geothermal energy is that it can only be produced at selected sites throughout the world. The largest group of geothermal power plants in the world is located at The Geysers, a geothermal field in California, United States.

## **4. Hydrogen Energy**

Hydrogen is available with water( $H_2O$ ) and is most common element available on earth. Water contains two-thirds of hydrogen and can be found in combination with other elements. Once it is separated, it can be used as a fuel for generating electricity. Hydrogen is a tremendous source of energy and can be used as a source of fuel to power ships, vehicles, homes, industries and rockets. It is completely renewable, can be produced on demand and does not leave any toxic emissions in the atmosphere.

## **5. Tidal Energy**

Tidal energy uses rise and fall of tides to convert kinetic energy of incoming and outgoing tides into electrical energy. The generation of energy through tidal power is mostly prevalent in coastal areas. Huge investment and limited availability of sites are few of the drawbacks of tidal energy. When there is increased height of water levels in the ocean, tides are produced which rush back and forth in the ocean. Tidal energy is one of the renewable source of energy and produce large energy even when the tides are at low speed.

## **6. Wave Energy**

Wave energy is produced from the waves that are produced in the oceans. Wave energy is renewable, environment friendly and causes no harm to atmosphere. It can be harnessed along coastal regions of many countries and can help a country to reduce its dependence on foreign countries for fuel. Producing wave energy can damage marine ecosystem and can also be a source of disturbance to private and commercial vessels. It is highly dependent on wavelength and can also be a source of visual and noise pollution.

## **7. Hydroelectric Energy**

What many people are not aware of is that most of the cities and towns in the world rely on hydropower, and have for the past century. Every time you see a major dam, it is providing hydropower to an electrical station somewhere. The power of the water is used to turn generators to produce the electricity that is then used. The problems faced with hydropower right now have to do with the aging of the dams. Many of them need major restoration work to remain functional and safe, and that costs enormous sums of money. The drain on the world's drinkable water supply is also causing issues as townships may wind up needing to consume the water that provides them power too.

## **8. Biomass Energy**

Biomass energy is produced from organic material and is commonly used throughout the world. Chlorophyll present in plants captures the sun's energy by converting carbon dioxide from the air and water from the ground into carbohydrates through the process of photosynthesis. When the plants are burned, the water and carbon dioxide is again released back into the atmosphere. Biomass generally include crops, plants, trees, yard clippings, wood chips and animal wastes.

Biomass energy is used for heating and cooking in homes and as a fuel in industrial production. This type of energy produces large amount of carbon dioxide into the atmosphere.

### **9. Nuclear Power**

While nuclear power remains a great subject of debate as to how safe it is to use, and whether or not it is really energy efficient when you take into account the waste it produces – the fact is it remains one of the major renewable sources of energy available to the world. The energy is created through a specific nuclear reaction, which is then collected and used to power generators. While almost every country has nuclear generators, there are moratoriums on their use or construction as scientists try to resolve safety and disposal issues for waste.

### **10. Fossil Fuels (Coal, Oil and Natural Gas)**

When most people talk about the different sources of energy they list natural gas, coal and oil as the options – these are all considered to be just one source of energy from fossil fuels. Fossil fuels provide the power for most of the world, primarily using coal and oil. Oil is converted into many products, the most used of which is gasoline. Natural gas is starting to become more common, but is used mostly for heating applications although there are more and more natural gas powered vehicles appearing on the streets. The issue with fossil fuels is twofold. To get to the fossil fuel and convert it to use there has to be a heavy destruction and pollution of the environment. The fossil fuel reserves are also limited, expecting to last only another 100 years given are basic rate of consumption.

It isn't easy to determine which of these different sources of energy is best to use. All of them have their good and bad points. While advocates of each power type tout theirs as the best, the truth is that they are all flawed. What needs to happen is a concerted effort to change how we consume energy and to create a balance between which of these sources we draw from.

### **Conservation of energy law**

The law of conservation of energy is a law of science that states that energy cannot be created or destroyed, but only changed from one form into another or transferred from one object to another.

Law of Conservation of Energy Examples

## Everyday Examples: Law of Conservation of Energy

The law of conservation of energy can be seen in these everyday examples of energy transference:

- Water can produce electricity. Water falls from the sky, converting potential energy to kinetic energy. This energy is then used to rotate the turbine of a generator to produce electricity. In this process, the potential energy of water in a dam can be turned into kinetic energy which can then become electric energy.
- When playing pool, the cue ball is shot at a stationary 8 ball. The cue ball has energy. When the cue ball hits the 8 ball, the energy transfers from the cue ball to the 8 ball, sending the 8 ball into motion. The cue ball loses energy because the energy it had has been transferred to the 8 ball, so the cue ball slows down.
- Kelly ran across the room and bumped into her brother, pushing him to the floor. The kinetic energy she possessed because of her movement was transferred to her brother, causing him to move.
- When a moving car hits a parked car and causes the parked car to move, energy is transferred from the moving car to the parked car.
- When playing the lawn game bocce ball, a small ball is thrown with the intention of hitting larger balls and causing them to move. When a larger ball moves because it was hit by the small ball, energy is transferred from the small ball to the larger one.
- When you push a book across the table, the energy from your moving arm is transferred from your body to the book, causing the book to move.
- A cat sitting on the highest branch of a tree has what is known as potential energy. If he falls off the branch and falls to the ground, his potential energy is now being converted into kinetic energy.
- When kicking a football that is sitting on the ground, energy is transferred from the kicker's body to the ball, setting it in motion.
- Sam was rearranging furniture, and needed help to push the heavy sofa. His brother came over, and together they were able to lift the sofa onto sliders. This made it easy to push the

sofa across the room. When Sam and his brother pushed the sofa and it slid across the wood floor, energy was transferred from the men to the piece of furniture.

- A fly ball hits a window in a house, shattering the glass. The energy from the ball was transferred to the glass, making it shatter into pieces and fly in various directions.
- Two football players collided on the field, and both went flying backwards. Energy was transferred from each player to the other, sending them in the opposite direction from which they had been running.
- Claire threw the ball and it hit her mother's vase, knocking it over. Energy was transferred from the moving ball to the stationary vase, causing the vase to move.
- Fingers hitting piano keys transfer energy from the player's hand to the keys.
- Billy hit the punching bag, transferring energy from his arm to the stationary bag.
- The dog ran in into the Christmas tree and knocked it over. Energy was transferred from the moving dog to the stationary tree, causing the tree to move.
- When the car hit the road sign, the sign fell over. Energy was transferred from the moving car to the stationary sign, causing the sign to move. No energy was lost in the transfer.
- Potential energy of oil or gas is changed into energy to heat a building.
- When a bowling ball knocks over pins that had been standing still, energy is transferred from the ball to the pins. No energy is lost.
- Beth hit the wall so hard that she put a hole in it. Energy was transferred from Beth's body to the drywall, causing it to move.
- When the car hit the curb it broke apart. Energy from the moving car was transferred to the non-moving cement, causing it to move.

These law of conservation of energy examples show how commonplace this physics concept is in everyday life.

## **LU 2: MOTION IN ORBIT**

### **2.1: RECALLS ON THREE NEWTON'S LAWS OF MOTION**