

## UNIT - 1

### **1. Primary and Secondary Energy -**

Primary energy is the energy contained in raw fuels, such as coal, oil, natural gas, biomass, and nuclear fuel. Secondary energy is energy that has been produced from primary energy, such as electricity, gasoline, and heat.

The main difference between primary and secondary energy is that primary energy is extracted from nature, while secondary energy is produced from primary energy through a process of conversion. This conversion process can involve a variety of steps, such as refining, processing, or burning.

Primary energy sources are typically more abundant than secondary energy sources. However, primary energy sources can also be more polluting and less efficient than secondary energy sources.

Secondary energy sources are typically cleaner and more efficient than primary energy sources. However, secondary energy sources can also be more expensive than primary energy sources.

The choice of whether to use primary or secondary energy depends on a variety of factors, including cost, availability, environmental impact, and efficiency.

Here is a table that summarizes the key differences between primary and secondary energy:

Feature	Primary Energy	Secondary Energy
Origin	Extracted from nature	Produced from primary energy
Abundance	Typically more abundant	Typically less abundant

Pollution	Typically more polluting	Typically cleaner
Efficiency	Typically less efficient	Typically more efficient
Cost	Typically less expensive	Typically more expensive

Here are some examples of primary and secondary energy sources:

#### Primary energy sources

- Coal
- Oil
- Natural gas
- Biomass
- Nuclear fuel

#### Secondary energy sources

- Electricity
- Gasoline
- Heat
- Diesel fuel
- Jet fuel
- Kerosene
- Natural gas liquids (NGLs)
- Propane
- Butane
- Hydrogen
- Synthetic fuels

## 2. Commercial and Non Commercial Energy -

**Commercial energy** is energy that is available to users at a price. Non-commercial energy is energy that is available free of cost to users.

Commercial energy sources include electricity, coal, petroleum, natural gas, and refined petroleum products. Non-commercial energy sources include firewood, agricultural waste, and animal dung.

Commercial energy is typically used in industry, transportation, and commercial buildings. Non-commercial energy is typically used in rural areas and by low-income households.

Commercial energy is more expensive than non-commercial energy. However, commercial energy is also more reliable and efficient. Non-commercial energy is often less reliable and less efficient, but it is also less expensive.

The use of commercial energy is increasing in developing countries as these countries become more industrialized. The use of non-commercial energy is decreasing in developed countries as these countries switch to more efficient and reliable energy sources.

Here is a table that summarizes the key differences between commercial and non-commercial energy:

Feature	Commercial Energy	Non-Commercial Energy
Availability	Available at a price	Available free of cost
Reliability	More reliable	Less reliable
Efficiency	More efficient	Less efficient
Cost	More expensive	Less expensive

Use

Industry, transportation, commercial  
buildings

Rural areas, low-income  
households

### 3. Renewable and Non RenewableEnergy -

**Renewable and non-renewable** resources are two types of natural resources.

Renewable resources are those that can be replenished in a relatively short period of time, while non-renewable resources are those that cannot be replenished in a human lifetime.

Some examples of renewable resources include:

- Solar energy
- Wind energy
- Hydropower
- Geothermal energy
- Biomass energy
- Ocean energy

Some examples of non-renewable resources include:

- Fossil fuels (coal, oil, natural gas)
- Nuclear fuel

Renewable resources are becoming increasingly important as the world's population grows and demand for energy increases. Renewable resources are also seen as a way to reduce greenhouse gas emissions and combat climate change.

Non-renewable resources are becoming increasingly scarce and expensive. They also have a number of environmental impacts, such as air pollution and water pollution.

The use of renewable resources is growing rapidly around the world. In 2019, renewable energy accounted for 26% of global electricity generation. This is up from just 18% in 2009.

The growth of renewable energy is being driven by a number of factors, including government policies, falling costs, and increasing public awareness of the environmental benefits of renewable energy.

The future of energy is likely to be a mix of renewable and non-renewable resources. However, the use of renewable resources is expected to continue to grow in the coming years.

Here is a table that summarizes the key differences between renewable and non-renewable resources:

Feature	Renewable Resources	Non-Renewable Resources
Replenishability	Can be replenished in a relatively short period of time	Cannot be replenished in a human lifetime
Environmental impact	Typically have a lower environmental impact	Typically have a higher environmental impact
Cost	Typically more expensive	Typically less expensive
Availability	More abundant	Less abundant
Use	Growing in popularity	Becoming increasingly scarce

#### 4. Energy Needs of Growing Economy-

As an economy grows, its energy needs also grow. This is because economic growth is typically accompanied by increased industrialization, urbanization, and transportation. All of these activities require energy.

The energy needs of a growing economy can be met through a variety of sources, including fossil fuels, renewable energy, and nuclear energy. Fossil fuels, such as coal, oil, and natural gas, are the most commonly used energy sources in the world. However, fossil fuels are also a major source of greenhouse gas emissions, which contribute to climate change.

Renewable energy sources, such as solar, wind, and hydro power, are becoming increasingly important as a way to meet the energy needs of growing economies. Renewable energy sources are clean and sustainable, and they do not produce greenhouse gas emissions.

Nuclear energy is another option for meeting the energy needs of growing economies. Nuclear energy is a clean and efficient source of energy, but it also has the potential for serious accidents.

The choice of which energy sources to use to meet the needs of a growing economy is a complex one. There are a number of factors to consider, including cost, availability, environmental impact, and safety.

Here are some of the key challenges in meeting the energy needs of a growing economy:

- Increasing demand: As economies grow, so does the demand for energy. This puts a strain on existing energy resources and can lead to higher prices.
- Depleting resources: Fossil fuels are a finite resource and are being depleted at an alarming rate. This means that we need to find alternative sources of energy to meet our future needs.
- Environmental impact: The production and use of energy have a significant impact on the environment. This includes air pollution, water pollution, and climate change.

- Safety concerns: Some energy sources, such as nuclear energy, pose a risk of accidents that can have devastating consequences.

Despite these challenges, there are a number of ways to meet the energy needs of a growing economy in a sustainable and environmentally friendly way. These include:

- Increasing energy efficiency: By using energy more efficiently, we can reduce our demand for energy and save money.
- Investing in renewable energy: Renewable energy sources are clean and sustainable, and they can help to reduce our reliance on fossil fuels.
- Developing new technologies: New technologies, such as carbon capture and storage, can help to mitigate the environmental impact of energy production and use.

By addressing these challenges and investing in new technologies, we can meet the energy needs of a growing economy in a sustainable and environmentally friendly way.

## **5. Energy Pricing in India -**

Energy pricing in India is a complex issue that is influenced by a number of factors, including the cost of production, government policies, and the availability of resources.

The cost of production of energy in India is relatively high due to the use of outdated technologies and the high cost of fuel. The government has implemented a number of policies to reduce the cost of energy, such as subsidizing the production of electricity and providing tax breaks to renewable energy companies. However, these policies have had limited success in reducing the cost of energy.

The availability of resources is another important factor that influences energy pricing in India. India is a resource-rich country, but it is also a developing country with a

large population. This means that the demand for energy is high, and the supply is limited. This can lead to higher prices for energy.

Government policies also play a role in energy pricing in India. The government sets the prices for electricity and other energy products. These prices are often below the cost of production, which means that the government subsidizes the energy sector. This can lead to higher taxes and debt for the government.

The future of energy pricing in India is uncertain. The country is facing a number of challenges, including rising demand, limited resources, and government debt. These challenges could lead to higher energy prices in the future.

However, there are also a number of opportunities for India to reduce its energy costs. The country is investing in renewable energy, which is a clean and affordable source of energy. The government is also implementing policies to improve energy efficiency, which can help to reduce the demand for energy.

By addressing these challenges and investing in new technologies, India can reduce its energy costs and build a more sustainable future.

Here are some of the key challenges and opportunities for energy pricing in India:

### Challenges

- **Rising demand:** The demand for energy in India is growing rapidly due to economic growth and population growth. This puts a strain on existing resources and can lead to higher prices.
- **Limited resources:** India is a resource-rich country, but it is also a developing country with a large population. This means that the demand for energy is high, and the supply is limited. This can lead to higher prices for energy.
- **Government debt:** The government of India subsidizes the energy sector, which means that it spends more money on energy than it receives in revenue. This can lead to higher taxes and debt for the government.

### Opportunities



- Renewable energy: India is investing in renewable energy, which is a clean and affordable source of energy. Renewable energy can help to reduce India's reliance on fossil fuels and lower energy costs.
- Energy efficiency: The government of India is implementing policies to improve energy efficiency, which can help to reduce the demand for energy and lower energy costs.
- Technology: New technologies, such as smart grids and energy storage, can help to improve the efficiency of the energy system and lower energy costs.

By addressing these challenges and investing in new technologies, India can reduce its energy costs and build a more sustainable future.

## **6. Energy and Environment -**

The relationship between energy and the environment is complex and multifaceted. Energy production and use can have a significant impact on the environment, both positive and negative.

On the one hand, energy production and use can lead to a number of environmental problems, including air pollution, water pollution, and climate change. For example, the burning of fossil fuels, such as coal, oil, and natural gas, releases greenhouse gases into the atmosphere, which contribute to climate change.

On the other hand, energy production and use can also be used to address environmental problems. For example, renewable energy sources, such as solar and wind power, do not produce greenhouse gases and can help to reduce our reliance on fossil fuels. Additionally, energy efficiency measures, such as insulation and smart thermostats, can help to reduce our energy consumption and save money.

The relationship between energy and the environment is a critical issue that we need to address in order to build a sustainable future. By investing in renewable energy

and energy efficiency, we can reduce our reliance on fossil fuels and protect the environment.

Here are some of the key environmental impacts of energy production and use:

- Air pollution: The burning of fossil fuels, such as coal, oil, and natural gas, releases pollutants into the air, including particulate matter, sulfur dioxide, and nitrogen oxides. These pollutants can cause a number of health problems, including respiratory problems, heart disease, and cancer.
- Water pollution: The mining of fossil fuels can contaminate water supplies with heavy metals and other pollutants. Additionally, the use of water for cooling at power plants can lead to water shortages and the degradation of aquatic ecosystems.
- Climate change: The burning of fossil fuels releases greenhouse gases into the atmosphere, which trap heat and cause the Earth's temperature to rise. This is leading to a number of changes to the Earth's climate, including more extreme weather events, rising sea levels, and changes in plant and animal life.

Here are some of the ways that we can reduce the environmental impacts of energy production and use:

- Invest in renewable energy: Renewable energy sources, such as solar and wind power, do not produce greenhouse gases and can help to reduce our reliance on fossil fuels.
- Improve energy efficiency: Energy efficiency measures, such as insulation and smart thermostats, can help to reduce our energy consumption and save money.
- Support policies that promote clean energy: We can support policies that promote clean energy, such as tax breaks for renewable energy companies and regulations that reduce greenhouse gas emissions.

By taking these steps, we can reduce the environmental impacts of energy production and use and build a more sustainable future.

## **7. Energy Audit -**

An energy audit is a process of inspecting and analyzing energy flows in a building or other facility to identify opportunities for energy efficiency improvements. The goal of an energy audit is to reduce energy costs and improve the environmental impact of a building or facility.

An energy audit typically includes the following steps:

1. Gathering data on energy use. This may include reviewing utility bills, conducting on-site measurements, and using computer modeling software.
2. Analyzing the data to identify areas where energy is being wasted. This may include looking at things like lighting, heating and cooling, and appliances.
3. Developing recommendations for energy efficiency improvements. This may include things like installing energy-efficient appliances, upgrading lighting, and weatherizing the building.
4. Implementing the recommendations and monitoring the results. This is important to ensure that the improvements are actually resulting in energy savings.

Energy audits can be conducted by a variety of professionals, including engineers, architects, and energy consultants. The cost of an energy audit will vary depending on the size and complexity of the building or facility.

There are a number of benefits to conducting an energy audit. These include:

- Reduced energy costs: Energy efficiency improvements can save businesses and homeowners money on their energy bills.
- Improved comfort: Energy efficiency improvements can make buildings more comfortable to live and work in.
- Reduced environmental impact: Energy efficiency improvements can help to reduce greenhouse gas emissions and improve air quality.

- Increased property value: Energy efficiency improvements can increase the value of a building or property.

## **8. Explain in detail about - Preliminary and Detailed Audit**

A preliminary audit is a quick and easy way to identify areas where energy may be wasted in a building or facility. It typically involves a visual inspection of the building or facility and a review of utility bills.

A detailed audit is a more comprehensive way to identify areas where energy can be saved in a building or facility. It typically involves a thorough inspection of the building or facility, the use of computer modeling software, and the collection of data on energy use.

Here are the details of preliminary audit and detailed audit:

### **Preliminary Audit-**

A preliminary audit is a quick and easy way to identify areas where energy may be wasted in a building or facility. It typically involves the following steps:

1. Visual inspection: The auditor will walk through the building or facility and look for areas where energy may be wasted, such as:
  - Lights that are left on when no one is in the room
  - Doors and windows that are open when they should be closed
  - Appliances that are left on when they are not in use
2. Review of utility bills: The auditor will review utility bills to get an idea of how much energy the building or facility is using. They will look for trends in energy use, such as spikes in usage during certain times of the year or on certain days of the week.

The results of a preliminary audit can be used to develop a plan for a more detailed audit or to implement energy efficiency improvements immediately.

## Detailed Audit-

A detailed audit is a more comprehensive way to identify areas where energy can be saved in a building or facility. It typically involves the following steps:

1. Visual inspection: The auditor will walk through the building or facility and look for areas where energy may be wasted, as in a preliminary audit. They will also look for more hidden areas of energy waste, such as:
  - Poorly insulated walls and ceilings
  - Inefficient lighting
  - Faulty appliances
2. Data collection: The auditor will collect data on energy use, such as:
  - Temperature and humidity levels
  - Lighting levels
  - Appliance usage
3. Computer modeling: The auditor will use computer modeling software to simulate the energy performance of the building or facility. This will help them to identify areas where energy can be saved.

The results of a detailed audit can be used to develop a plan for energy efficiency improvements that are specific to the building or facility.

Here are some of the benefits of conducting a preliminary audit:

- It is a quick and easy way to identify areas where energy may be wasted.
- It can help you to develop a plan for a more detailed audit.
- It can help you to implement energy efficiency improvements immediately.

Here are some of the benefits of conducting a detailed audit:

- It is a more comprehensive way to identify areas where energy can be saved.
- It can help you to develop a plan for energy efficiency improvements that are specific to your building or facility.
- It can help you to save money on your energy bills.

- It can help you to improve the comfort of your building or facility.
- It can help you to reduce your environmental impact.

## **9. Need for Energy Audit -**

There are many reasons why an energy audit is important. Here are some of the most common reasons:

- To save money on energy bills: Energy audits can help you identify areas where you are wasting energy and make recommendations for improvements that can save you money on your energy bills.
- To improve the comfort of your home or business: Energy audits can help you identify areas where your home or business is uncomfortable and make recommendations for improvements that can make it more comfortable.
- To reduce your environmental impact: Energy audits can help you identify areas where you are using energy inefficiently and make recommendations for improvements that can reduce your environmental impact.
- To comply with regulations: In some cases, energy audits may be required by law or regulation. For example, many states require businesses to conduct energy audits on a regular basis.
- To qualify for incentives: In some cases, you may be eligible for incentives or rebates for making energy efficiency improvements. An energy audit can help you identify which improvements qualify for incentives and help you apply for the incentives.

## **10. Need and Role of Energy Managers -**

An energy manager is a professional who is responsible for developing and implementing energy management programs. They work with businesses and organizations to help them reduce their energy consumption and costs. Energy managers typically have a background in engineering, business, or a related field.

They must have a strong understanding of energy efficiency and be able to develop and implement energy management strategies.

The need for energy managers is growing as businesses and organizations become more aware of the need to reduce their energy consumption. Energy managers can help businesses and organizations save money on their energy bills, improve their environmental impact, and comply with regulations.

The role of an energy manager typically includes the following:

- Conducting energy audits to identify areas where energy can be saved
- Developing and implementing energy management programs
- Overseeing the implementation of energy efficiency measures
- Monitoring energy consumption and costs
- Reporting on energy performance
- Educating employees about energy efficiency
- Working with vendors to identify and purchase energy efficient products and services
- Complying with energy regulations

1. Prepare an annual activity plan and present to management concerning financially attractive investments to reduce energy costs.

2. Establish an energy conservation cell within the firm with management's consent about the mandate and task of the cell.

3. Initiate activities to improve monitoring and process control to reduce energy costs.

4. Analyze equipment performance with respect to energy efficiency.

5. Ensure proper functioning and calibration of instrumentation required to assess level of energconsumption directly or indirectly.

6. Prepare information material and conduct internal workshops about the topic for other staff.
7. Improve disaggregating of energy consumption data down to shop level or profit center of a firm.
8. Establish a methodology how to accurately calculate the specific energy consumption of various products/services or activity of the firm.
9. Develop and manage training programme for energy efficiency at operating levels.
10. Co-ordinate nomination of management personnel to external programs.
11. Create knowledge bank on sectoral, national and international development on energy efficiency technology and management system and information denomination.
12. Develop integrated system of energy efficiency and environmental upgradation, Wide internal & external networking.
13. Co-ordinate implementation of energy audit/efficiency improvement projects through external agencies.
14. Establish and/or participate in information exchange with other energy managers of the same sector through association.

Energy managers play an important role in helping businesses and organizations reduce their energy consumption and costs. They can help businesses and organizations save money, improve their environmental impact, and comply with regulations.

Here are some of the benefits of having an energy manager:



- Reduced energy costs: Energy managers can help businesses and organizations save money on their energy bills by identifying and implementing energy efficiency measures.
- Improved environmental impact: Energy managers can help businesses and organizations reduce their environmental impact by reducing their energy consumption.
- Increased employee productivity: Energy managers can help businesses and organizations improve employee productivity by creating a more comfortable and productive work environment.
- Enhanced safety: Energy managers can help businesses and organizations improve safety by reducing the risk of accidents and injuries caused by energy-related hazards.
- Compliance with regulations: Energy managers can help businesses and organizations comply with energy regulations by ensuring that they are meeting all applicable requirements.

If you are interested in hiring an energy manager, there are a few things you should keep in mind. First, you need to make sure that the energy manager has the right qualifications and experience. You should also ask for references from previous clients. Finally, you need to make sure that the energy manager is willing to work with you to develop a customized energy management program that meets your specific needs.

## **11. What is Energy Conservation?**

Energy conservation is the practice of using less energy. It can be done by using energy more efficiently or by using less energy overall. Energy conservation is important because it can help to reduce our reliance on fossil fuels, save money on energy bills, and protect the environment.

There are many ways to conserve energy. Some simple tips include:

- Turning off lights when you leave a room
- Unplugging appliances when they are not in use
- Weatherizing your home or business to make it more energy-efficient
- Using energy-efficient appliances and light bulbs
- Driving less and walking, biking, or taking public transportation more often
- Recycling and composting to reduce the amount of energy used to produce and dispose of waste

Energy conservation is a simple way to make a difference. By making small changes in our everyday lives, we can all help to conserve energy and protect the environment.

Here are some of the benefits of energy conservation:

- Reduced energy consumption: Energy conservation can help to reduce our reliance on fossil fuels, which are a major source of pollution and greenhouse gas emissions.
- Save money on energy bills: Energy conservation can help us save money on our energy bills, which can free up money for other things.
- Protect the environment: Energy conservation can help to protect the environment by reducing pollution and greenhouse gas emissions.

There are many ways to get involved in energy conservation. Some of the things you can do include:

- Adopt energy-efficient habits: Turn off lights when you leave a room, unplug appliances when they're not in use, and weatherize your home or business.
- Support energy-efficient products: Buy energy-efficient appliances, light bulbs, and other products.
- Get involved in your community: Volunteer for an energy conservation organization or attend an energy conservation event.
- Contact your elected officials: Let your elected officials know that you support energy conservation policies.

Energy conservation is a simple way to make a difference. By making small changes in our everyday lives, we can all help to conserve energy and protect the environment.