

Unit - I

Syllabus — Commercial and non-commercial energy, primary and secondary energy resources, energy needs of growing economy, energy pricing, Energy Conservation Act-2001, BEE

Q. What is Energy?

→ It is a key component for most of the consumption activities and production activities and hence plays a vital role in a country's economic growth and development.

There are two sources of energy —

1) Commercial Energy — It is traded in market (domestic and international)

The sources of energy which command a price and their users have to pay the price for them are known as Commercial Energy. It is consumed by commercial entities and industries rather than by individuals or families. It is a non-renewable source of energy. eg- coal, petroleum & electricity

It indicates how well the economy of a country is doing. By it is an excellent indicator

2) Non commercial Energy —

The sources of energy which in general do not command a price are known as non-commercial energy. It is used for domestic use. It is a renewable source of energy.

Eg- cow dung, firewood, agricultural waste. The country's living standards can be determined by the usage of these resources. Villagers use it as free goods. It is traded in local market.

Q. Define Primary and Secondary Energy resources with example  
→

Primary Energy Resources — They are natural sources of energy that have not undergone any transformation. They <sup>are</sup> directly obtained from nature.

- Fossil fuels — coal, crude oil & natural gas.

- Nuclear Energy — Uranium & Thorium

- Renewable Sources — Solar energy, wind energy, hydro energy

Secondary Energy Resources — They are derived from the conversion of primary energy. They are more convenient for usage, storage and transportation.

- Electricity — Generated from coal, natural gas, nuclear reaction.

- Refined fuels — Gasoline, diesel, Kerosene (seize from crude oil)

- Hydrogen — Produced from water electrolysis or natural gas

Q. Discuss the challenges faced by growing economies in meeting energy demands.

→ Growing economies experience rapid industrialization, urbanization and increasing energy demands. Challenges —

fossil fuel imports

1. Energy Security — limited domestic resources increase dependency on Many countries rely ~~on~~ heavily on imported energy, leading to vulnerability in global price fluctuation.

2. Infrastructure Development — Aging power grids and inadequate infrastructure increase transmission losses. Large investments are needed for modernizing and expanding energy networks.

3. Technological Constraints — Limited funding for R&D restricts innovations in the energy sector. Lack of access to advanced renewable energy technologies slows down energy efficiency improvements.

4. Environmental Impact — • Rapid industrialization leads to high carbon emission, pollution, deforestation. • Sustainable practices and policies are needed to balance economic and environmental growth.

5. Energy Pricing and Affordability — • Subsidies on fossil fuels can burden government finances but can be affordable for lower income population. • Implementing tiered and time of use pricing can help optimize energy use.

6. Access and Equity — • Rural areas still face energy poverty with limited access to reliable electricity. • Government needs to expand electrification programs to reach all communities.

Q: What are different types of energy pricing models?

→ Energy pricing models determine how consumers pay for energy.

1. Cost-Based Pricing — (Fixed Pricing)

- Prices are based on production, operation and maintenance cost
- Ensure stability but not efficiency.

2. Market-Based Pricing — (Variable Pricing)

- Prices fluctuate based on supply and demand.
- Encourages competition but can lead to volatility.

3. Time-of-use Pricing <sup>(TOU)</sup>

- Different rates apply during peak and off peak hours
- Encourages energy use during low demand period.

4. Tiered Pricing —

- Users pay more as consumption increases.
- Promotes energy conservation but may burden large users.

## Importance of energy for economic growth

### 1. Industrial Production —

- without a reliable energy supply, industrial activities would slow down or halt, affecting the production of goods and services.

### 2. Transportation —

- Moving goods and people, rely heavily on energy sources like petroleum, electricity and natural gas.

### 3. Infrastructure Development —

- A growing economy needs continuous infrastructure development to support its expansion.

### 4. Technological Advancements —

- Innovation and technical progress often depend on energy availability.
- High-tech industries, R&D services all need energy to operate & thrive.

### 5. Urbanization & Modernization —

- As economy grows, urbanization increases leading to higher energy consumption.
- Modern amenities and improved living standards are tied to energy availability.

### 6. Agricultural Development —

- Modern Agriculture relies on energy for irrigation, transportation.
- Energy-intensive farming techniques can lead to increased agricultural productivity and food security.

## Factors influencing energy pricing —

1. Production costs.
2. Supply and Demand.
3. Government Policies and Regulations
4. Geopolitical factors.

## 1. Energy Conservation Act, 2001

→ It was introduced in India to promote energy efficiency and conservation across various sectors.

### 1. Establishment of Bureau of Energy Efficiency (BEE) —

- BEE was set up under Ministry of Power to formulate policies, set energy efficiency standards, and promote energy saving practices.

### 2. Energy Consumption Standards —

- The Act mandates energy efficiency norms for industrial equipment, appliances and vehicles.

### 3. Energy Audits and Monitoring —

- The Act enforces compliance through penalties for violations.
- Large Industries are required to conduct energy audits to assess their energy usage.

### 4. Energy Conservation Building Code — (ECBC)

- New commercial buildings must adhere to ECBC, ensuring optimized energy consumption in lighting, heating & cooling systems.

### 5. Energy Savings Certificates (ES Certs) —

- Organizations that achieve energy savings beyond targets are issued certificates, which can be traded in market.
- This encourages industries to adopt energy efficient technologies.

### 6. Carbon Credit Training —

- It includes provisions for companies to earn and trade carbon credit certificates for reducing greenhouse gas emissions.

### 7. Promotion of Renewable Energy —

- Encourages investment in solar, wind, & bio-energy to reduce dependence on fossil fuels.

- Q. Explain the role of Bureau of Energy Efficiency (BEE).
- It was established in 2002 under Energy Conservation Act, 2001 to promote energy efficiency in India.
1. Policy Formulation — Develops energy conservation policies & programs
  2. Energy Performance Standards — Implements Star Labeling system for appliances (e.g. ACs, refrigerators).
  3. Energy Auditing & Certification — Conducts mandatory audits for industries and promotes Energy Saving Certificates (EScert).
  4. Building Codes — Enforces the Energy Conservation Building Code (ECBC) for commercial buildings.
  5. Awareness and Training — Conducts campaign, workshops and collaborations with industries.

- Q. What is Energy Auditing? Explain its types and methodology.
- Energy auditing is the systematic process of analyzing energy consumption and identifying areas for energy savings.

### Types of Energy Audit—

1. Preliminary Audit — Quick assessment using existing data and estimates.
2. Detailed Audit — In-depth analysis involving measurements, cost benefit analysis and recommendation.

### Energy Audit Methodology.

1. Phase 1 - Pre Audit —
  - Gather Energy bills, equipment details and previous audit reports
  - Identify areas of high energy consumption.
2. Phase 2 - Audit Process —
  - Conduct on site inspections and measure energy use.
  - Identify inefficiencies and suggest improvements.
3. Phase 3 - Post Audit —
  - Implement recommended changes.
  - Monitor savings and ensure compliance with standards.