MODULE 1 -PP

1) Explain the world Energy Scenario with respect to production and consumption with statistic.

Ans)

- Interest in energy everywhere throughout the world is expanding progressively.
- Coal, Oil and gas are the three noteworthy essential primary sources of energy.

Production:

- The global energy production at the end of 2014 was equivalent to 14000 Million Tonnes of Oil Equivalent (MToE).
- Coal accounted for 29%, Oil 31%, Natural gas for 21% and other at 18%.

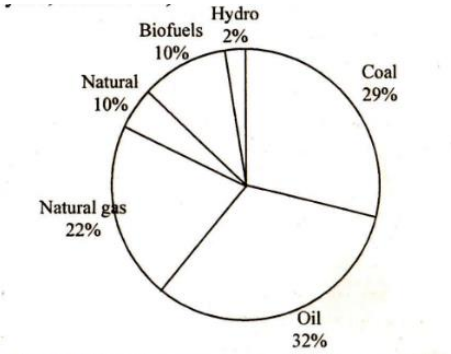


Fig 1.1 Global energy production (as on 2014)

Coal:

- Global coal production stood at 7700 MToE as on 2015.
- Global coal production fell by 4% when compared to historical data.
- China accounted for a larger share with about 46%, other Asian countries about 17%.

Oil:

- Global oil production stood at 4300 MToE as on 2015.
- Global oil production increased rapidly by 3.2%.
- Middle East accounted for about 32%, Europe and Asia about 16%, America about 9% compared to historical data.

Natural gas:

- Global natural gas production stood at 4000 billion cubic metre (bcm) as on 2015.
- OECD countries accounted for 37% share, Europe and Eurasia by 24% and Asia by 9%.

Consumption:

- The developed countries attributed to high energy consumption as compared to developing countries.
- 80% of the world's population lies in developing countries.
- Their energy consumption amount is only 40% of the world's total energy consumption.

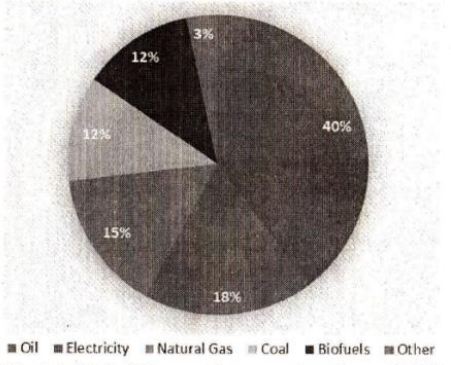


Fig 1.5 Global Energy Consumption (as on 2014)

Coal:

- Global coal consumption fell by 1.8% as compared to historical data.
- US saw a decline of 12.7%, China of 1.5%.
- India recorded an increase in coal dependence by about 5%.

Oil:

- Global oil consumption grew by 1.9% as compared to historical data.
- US accounted for increase in 1.6%, China about 6.5%, India about 8.1%.
- Japan saw a decline of about 4%.

Natural gas:

- Global natural gas consumption grew by 1.7% as compared to historical data.
- Iran accounted for increase in 6.2%, China about 4.7%, US about 3%.
- Russia saw a decline of 5% and Ukraine saw a decline of 21%.

Conclusion:

- Developed countries are consuming more and more energy.
- Energy demand is growing strongly.
- Renewable sources will gain importance and energy system will become more complex rapidly.
- Investments should be huge with focus on requirements of solid ecological arrangements.

2) Define Energy and Power. Differentiate the same.

Ans)

Energy is the ability or capacity to do work.

Power is the rate at which the work is done.

Energy	Power
1) Energy is defined as the ability or capacity to do work.	1) Power is defined as the rate at which the work is done.
2) Unit is Joule.	2) Unit is Watt.
3) Commonly used symbol is W.	3) Commonly used symbol is P.
4) Energy can be transformed from one form to another.	4) Power is generated/transmitted.
5) Energy can be stored.	5) Power cannot be stored.
6) Different kinds of energy are kinetic, thermal, potential, gravitational, sound, electromagnetic, light, elastic, etc.	6) Different kinds of power are electric power, optical power, human power, etc.

3) Explain the various key energy trends in India.

Ans) The various key energy trends in India include:

1) Demand

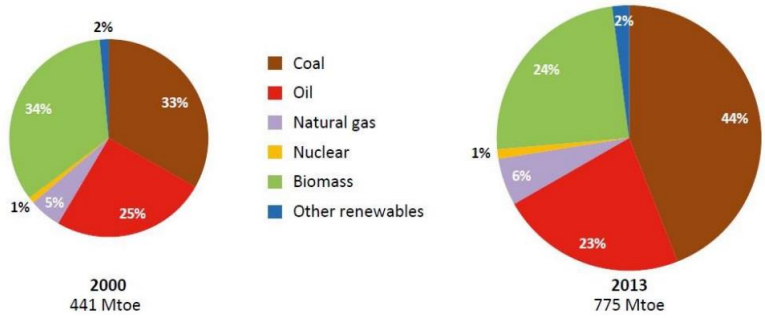
2) Electricity

3) Access to Modern Energy

4) Energy Production and Trade

Demand:

- India has been responsible for almost 10% of the increase in global energy demand since 2000.
- Energy demand has almost doubled since 2000, but this is slower than the rate of economic growth over the same period.
- Almost three-quarters of Indian energy demand is met by fossil fuels because of a rapid rise in coal consumption and a decreasing role for bioenergy.
- This is because the households move away from the traditional use of solid biomass for cooking.
- The availability and affordability of coal relative to other fossil fuels has contributed to its rise, especially in the power sector.



- Energy demand had traditionally been dominated by the buildings sector.
- In the buildings sector, a key driver of consumption in both rural and urban areas has been rising.
- This is because of the rising levels, especially of fans and televisions and an increase in refrigerators and air conditioners in urban areas over the latter part of the 2000s.

Electricty:

- The provision of electricity is critical to India's energy and is a major area of uncertainty for the future.
- The country's electricity demand in 2000 was 376 tera watt hours (TWh), in 2013 was 897 TWh.
- The demand for electricity is increasing at the annual rate of 6.9%.
- As with all other demand sectors, further rapid growth is to be expected.
- The situation varies from state to state.
- Higher taxes paid by commercial and industrial consumers are typically not enough to offset the losses arising from subsidies to residential and agricultural consumers.
- The consequent financial problems faced by local distribution companies is a key structural weakness for the energy sector as a whole.
- But, despite the increase in generation, India faces a structural shortage of power.
- Industrial consumers are also affected by unreliable and unpredictable power supply.
- The increased use of captive generators, both at household and industrial levels, often worsens local air pollution.

Access to Modern Energy:

- India has made great efforts in improving access to modern energy in recent years.
- Since 2000, India has more than 50% of the people without access to electricity and doubled rural electrification rates.
- Nonetheless, 20% of the population remain without access to electricity
- Relatively small number of states is having less access to all these.
- In July 2015, RGGVY was subsumed within a new scheme, the Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY).
- The main components of this scheme are the separation of distribution networks between agricultural and non-agricultural consumers to reduce load shedding, strengthening local transmission and distribution infrastructure and metering.
- Aside from electricity, India also has the largest population in the world relying on the traditional use of solid biomass for cooking.

Energy Production and Trade:

- Fossil fuels supply around three-quarters of India's primary energy demand.
- Fossil fuels serve as alternate fuels.
- This share will tend to increase over time as households move away from the traditional use of biomass.
- This high and potentially growing reliance on fossil fuels comes with two major drawbacks.
- India's domestic production of fossil fuels is by far the lowest among the major emerging economies.
- Combustion of coal and oil products contributes to pressing air quality problems in many areas, as well as to global greenhouse gas (GHG) emissions.

4) With relevant statistics, enumerate the primary energy production trend for our country India.

Ans)

Coal:

- India has the third largest hard coal reserves in the world, as well as significant deposits of lignite.
- Yet the deposits are generally of low quality and India faces major obstacles to the development of its coal resources.
- In 2013, India produced almost 340 million tones of coal equivalent (Mtce), but it also imported some 140 Mtce.
- Around 7% of national production comes from captive mining.
- At present, more than 90% of coal in India is produced by open cast mining (mining from surface not dug deep into ground).

Oil and Oil Products:

- India is one of the few countries in the world that rely in imports of crude oil while also being significant net exporters of refined products.
- India has relatively modest oil resources.
- Most of the reserves are located in Rajasthan and in offshore areas near Gujarat and Maharashtra.
- Most of the remaining production comes from the blocks awarded under successive licensing.
- India has already doubled its refining capacity in the last ten years.
- Presently, India is a net exporter of all refined products except LPG.

Natural Gas:

- Natural gas has a relatively small share (6%) of the domestic energy mix.
- GAIL is the largest player in the midstream and downstream gas market.

5) Outline the factors affecting Indian energy development.

Ans) The various factors affecting India's energy development are:

1) Economy and demographics

2) Policy and institutional framework

3) Energy prices and affordability

4) Social and environmental aspects

5) Investment

Economy and demographics:

- The pace of economic and demographic change is a vitally important driver of India's energy sector.
- Measured on a PPP basis in 2008, India beyond Japan, became the third-largest economy in the world.
- In the period since the early 1990s, the poverty rate fell by more than half, from almost 50% to less than 25%.
- Although extreme poverty has been reduced, income inequality has increased in India.

- India is set to overtake China as the most populous country in the world before 2025.
- India's large and growing population is often regarded as one of its major assets.
- The large domestic market can also act as a natural driver for economic growth.
- The flip side of this demographic dividend is the likely strain on the country's infrastructure and resources.

Policy and institutional framework:

- The direction that national and state policies take will naturally play a critical role in India's energy outlook.
- Clarity of vision for the energy sector is difficult to achieve in India because of the country's federal system and complex institutional arrangements.
- A sharpened focus on achieving universal access to modern energy must be done, including the objective of supplying 24 X 7 electricity to all of India's population.
- A pledge to pursue a more climate-friendly and cleaner path must be done.
- The constitution divides power between the central and state governments.
- States have issues over water and land rights, natural gas infrastructure, and many specific areas of taxation.
- The institutional structure requires constant effort to achieve co-ordination and resolve disputes.

Energy prices and affordability:

- The relationship between income levels, energy prices and energy expenditure is fundamental to the evolution of India's energy system.
- As one would expect, energy consumption increases with income.
- But the level of consumption and the fuel choice are also affected by location.
- India has made significant moves towards market-based pricing for energy in recent years.
- India has also been one of the main beneficiaries of the fall in the oil price since 2014.
- Diesel is the most widely consumed petroleum product in India.

Social and environmental aspects:

- Rapid economic growth and urbanisation create a number of pressures on communities and the wider environment.
- India is burning more fossil fuels and biomass than it has at any other time in the past, releasing more pollutants.
- India has 13 of the world's 20 most-polluted cities.
- The government also launched a "Give it up" campaign to encourage the wealthiest consumers to abandon their LPG subsidy.
- On the other hand, India is the third-largest country in volume terms of CO_2 emissions in the world, behind only China and the United States.

Investment:

- Since 2000, we estimate that investment in energy supply in India has increased substantially.
- Meeting the country's investment needs will require the mobilisation of increasing amounts of private capital, including foreign direct investment (FDI).
- India's vast potential puts it high on the list of foreign investment, ranking third behind China and the United States.
- India's government aims to increase investment in infrastructure such as communications, road, rail and energy networks.
- India's government aims to increase investment in social areas such as schools and hospitals.
- Indian government has recognised not to take investment projects in the energy sector for granted.

6) List and explain two forms of energy.

Ans) The energy sources can be classified in 2 different ways:

1) Primary sources

2) Secondary sources

1) Primary sources:

- Can be used directly, as they appear in the natural environment.
- Ex: Coal, Oil, Natural gas

2) Secondary sources:

- Derived from the transformation of primary energy sources.
- Ex: Petrol, Electric energy

7) Write a short note on:

i) RGGVY

Ans)

- RGGVY - Rajiv Gandhi Grameen Vidyutikaran Yojana
- India's rural electrification programme was launched in 2005.
- It aimed to provide electricity to villages of 100 inhabitants or more and free electricity to people below the poverty line.
- The effective implementation of RGGVY has faced several challenges.
- There are strong variations in outcomes between states, as well as questions over the definition of access.

ii) DDUGY

Ans)

- DDUGY - Deen Dayal Upadhyaya Gram Jyoti Yojana
- The main components of this scheme are the separation of distribution networks between agricultural and non-agricultural consumers to reduce load shedding, strengthening local transmission and distribution infrastructure, and metering.
- They faced several issues during the progress with electrification.
- They also tried to find local solutions adapted to the specific circumstances of the remote settlements without access and a variety of problems in securing authorisation for the necessary projects.