POWER

Coal:

• It is an old fossil fuel.
• The best type of coal takes several hundred million-year to form.
• It is a non-renewable energy.
• It can be classified into four types based on quality:

- Anthracite – It is the top-quality coal and contains high carbon. The heating value is also high. It is not available in Pakistan.
- Bituminous – It has good quality, high carbon content and high heating value.
- Lignite - It has low carbon content and low heating value. It contains moisture and ash.
- Peat – It is the initial stage of a coal formation with very low carbon content. It is highly vegetative.

Transportation:

• Trollies/donkeys are used for the transportation of coal from the mine to the surface.
• It is sold to the middleman who then transports it to cement factories and brick kilns by truck.
• In these factories, coal is used as fuel.

Future of Coal as a Power Source:

• It provides the cheapest fuel.
• New reserves are found in the Thar desert and Salt ranges.
• These reserves have 7508 million tons of coal.
• Therefore, it is anticipated that it will be used as a cheap fuel source for many years to come.

Uses of Coal:

• Coal is used in the process of smelting in iron and steel industries. Smelting is a process that separates iron from iron ore.
• It is used as a fuel in thermal power stations to generate steam for electricity.
• It is also used as a raw material in fertilizers, ceramic and brick kiln industry.
• It is also widely used in domestic activities such as cooking and heating.
• It is also used in Bitumen i.e. used for roofing, surfacing, roads, etc.

Coal Fields in Pakistan

Quetta Coal Fields:

• There are coal fields at Harnai, Degari, Sharig, and Mach.
• Bituminous is found in these fields.
• This type of coal is used in steel and brick kiln industries.

Lower Sindh Coal Fields:

• Coal fields are found in Sonda, Lakhra and Jhimper.
• Lignite is found in these fields.
• It is used for thermal power stations.

Salt Range:
• Coal can be found in Pidh and Dandot.
• Lignite and Bituminous are found there.

Makarwal:
• Coal is found in Marwal.
• Sub-bituminous is found there.
• It is used in the ceramic industry.

Coal Extraction:
• There are three methods by which coal can be extracted.

Shaft Mining:
• This method is used when coal is underground.
• In this method, a vertical shaft is dug.
• Along the coal seams, several other shafts are dug.
• To break coal seams, dynamite is used.
• Miners pick coal using a shovel.
• Once it is picked, trollies are used to transport the coal to the surface.

Adit Mining:
• It used to extract coal that is on the hillside.
• For hillside coal extraction, horizontal shafts are dug.
• Multiple shafts can be dug at different levels.
• Dynamite is used to break the seams; shovels are used to pick up coal and trollies are used to transport the coal outside.

Open Cast Mining:
• It is used when coal is visible on the surface.
• Dynamite is used to break these seams and shovels to pick them up.
• The coal is then supplied to industries using vehicles.

Why Pakistan Imports Coal?
• Pakistan is rich in coal, but the coal found here is mostly of low quality.
• Moreover, Pakistan lacks the proper infrastructure and machinery to mine coal reserves.
• Therefore, to mix proper quality coal, Pakistan imports coal.

Thar Power Generation Project:

Advantages:
• Thar coal fields are rich in coal with 175 billion tons of coal (lignite).
• It is anticipated that this can produce almost 100,00 MW of power for the next 200 years.
• This coal can also be exported to other countries like India.
• Electricity will become cheaper.
• There will remain no need to import oil and billions of dollars will be saved.

Disadvantages:
• Coal power sources can be damaging to the environment and will pollute rivers with waste and air with mercury.

- Mercury will contaminate the air and seafood and their continuous consumption can damage brain cells.
- The fly ash particles in the air can cause respiratory disorders in humans and animals.
- The fly ash particles in the air can also reduce crop yields.

Mineral Oil (Petroleum)

Mineral Oil:

- It is one of the most important fossil fuels.
- It is also known as black gold.
- It can be found underground (many meters) or under the seabed.
- It can be found mainly in anticline i.e. dome-shaped between dual layers of non-porous rocks.
- It is trapped in these anticlines with gas and water, above and below respectively.
- It is non-renewable energy.

Uses of Mineral Oil:

- It is used as a fuel to vehicles, trains, and aircraft.
- It is used to reduce friction in machines.
- It is also a power source i.e. used to generate electricity.
- Its by-products can be used for many industrial and domestic uses including plastics, wax, pharmaceuticals, chemicals, etc.

Oil Drilling:

- A derrick (drilling rig) is set up.
- The well of oil is drilled to extract this liquid to the surface with the help of pipes.
- The drill is used to break rocks.
- To control the flow of oil valves are used.
- Once oil flow starts the derricks are removed.

Oil Refineries:

- This oil cannot be used in raw form.
- To make this oil suitable for use, it should be refined first.
- For this purpose, oil refineries in Pakistan are:

- Near the oil field in Potwar Plateau, Morga is the Attock Oil Refinery.
- In Karachi, at the port of import is the Pakistan Refinery and National Refinery.

Oil Fields in Pakistan:

- There are many oil fields in the Potwar Plateau including Dhullian, Tut, Balkasar, etc.
- The lower Sindh has oil fields too namely Mazari, Laghari, Tando Adam, etc.

Oil Transportation

Oil is Transported Through Pipes:

- It offers a continuous supply.
- It allows you to transport a large amount of oil quickly.
- It is cheap once the pipeline construction is complete.

• But the pipelines can also leak oil.
• It can transport oil to main centers only.
• It can transport only one product.
• Its construction is expensive.

Oil is Transported Through Rail Tankers:
• It can allow the oil to be transported to areas where there is no pipe construction.
• It can transport more than one product.
• It is best for small suppliers and users.
• It can transport only a small or limited amount of oil.
• It is a slow transport and can encounter accidents.
• It is expensive.

Oil is Transported Through Road Tankers:
• It can help the oil to transport to remote areas.
• It can transport more than one product.
• It is suitable for small users and suppliers.
• It can transport a limited amount of oil only.
• It is a slow transport, and can encounter accidents, theft or leakage.
• It is heavy on the roads.
• It is expensive.

Natural Gas

Natural Gas:
• It is an important fossil fuel.
• It can be found in rocks that are above the oil.
• The rocks act like a sponge and trap the gas.
• The rocks have several tiny holes.
• It is a non-renewable energy.

Areas of Natural Gas:
• It is in Sui, Balochistan.
• In Sindh, it is in Mari.
• It is in Mayal, Punjab.
• It can also be found in Khairpur, Uah, Pirkoh, and Dhullian.

Uses of Natural Gas:
• It has domestic uses as well as commercial uses.
• It can be used as a raw material in chemical, fertilizer and cement industries.
• It can be used as an alternative fuel for vehicles.
• It can be used in thermal power stations as a fuel.
• It is used domestically because it is easily available via pipeline, can be imported in the cylinder to remote areas, cheaper, convenient and cleaner.

Transportation of Gas

It Can Be Transported Using Pipeline:
• The pipeline provides a continuous and fast supply.

• It can transport a large amount of gas.
• It is cheap after the construction of the pipeline.
• The pipes can leak gas.
• It can supply gas to only main cities like Karachi.
• The pipelines are expensive to build.
• It can be transported using cylinders:

Cylinders Can Be Used to Transport Gas to Remote Areas:

• It is suitable for small users and can supply a small amount.
• It is portable.
• It is a slow transport.
• It provides a supply of gas that is interrupted when the cylinder is empty.
• It is expensive.

• There can be accidents.

Importance of Natural Gas:

• It can be used as an alternative fuel for vehicles.
• It can be used in thermal power stations as fuel.
• It is cheaper than coal and oil.
• It is cleaner than coal and oil.
• It can be transported easily.
• It reduces dependencies on imported fuels.

LPG:

• Natural gas is turned into a liquid when it is cooled at a very low temperature.
• This is known as the Liquified Petroleum Gas (LPG).

Energy Resources

Nuclear Energy:

• It is a powerful energy source.
• Energy is produced by the splitting of atoms.
• It is used for electricity generation.

Advantages:

• It is a reliable energy source.
• It can produce a large amount of energy with small raw material inputs.
• It is efficient.
• It is a long-lasting fuel in comparison with fossil fuels as they are running out.
• It is environmentally friendly as compared to fossil fuels.
• It can reduce load shedding.

Disadvantages:

• It is an expensive fuel to purchase and to build.
• It is difficult to maintain and there are not many skilled individuals available.
• It can be radioactive.
• Its disposal of waste can be a problem.

Nuclear Power Plants:
- Karachi Nuclear Power Plant.
- Chashma Nuclear Power Plant.

Thermal Electricity:
- If electricity is produced by utilizing non-renewable sources like nuclear, coal, gas and oil then it is known as thermal electricity.
- Fossil fuels are used to run turbines by producing steam in boilers.
- The turbine then rotates and turns the shaft into a generator within a magnetic field and electricity is produced.

Alternative Energy Resources:
- The energy that comes from sources that do not deplete natural resources as well as also does not harm the environment.
- Examples of these sources are sun, wind, geothermal, biomass, wave, tidal and water.

Importance of Renewable Energy:
- Fossil fuels are depleting and are becoming expensive with each passing day.
- Pakistan imports many fossil fuels such as oil.
- Nuclear energy's waste is difficult to dispose of.
- Nuclear energy can be radioactive.
- Renewable resources do not harm the environment.
- The renewable resources are cheap.

Hydro-Electric Power (HEP):

- It uses the force of flowing water to spin the hydro-turbines.
- There is a shaft that is going into the generator.
- The water force makes the hydro-turbine spin at a rapid speed.
- Then the hydro-turbine makes the shaft spin inside the magnetic field.
- The spinning of the shaft inside the magnetic field generates electricity.

Transmission:
- It is transmitted using underground or overhead transmission lines or grids.
- The local supplier sets the voltage and the electricity is supplied to commercial and domestic users.

Locations:
- Tarbela Dam
- Mangla Dam
- Warsak Dam

Conditions for Dam Construction:
- The climate should be wet and cool to prevent evaporation.
- There should be more rainfall for good water supply.
- There should be narrow and deep valleys.
- The steep sides also help in the easy construction of dams.
- There should be Impervious rocks to make sure there is less seepage.
- There should be hard rocks.
- Glaciers are also a great place as snow will melt in summer and more water will be stored.

Solar Energy:

- It is the energy of the sun.
- Pakistan has around 300 sunny days annually in several parts of Pakistan.
- Solar energy can be used in rural areas e.g. cooking, pumping water, water heating, etc.
- It is a renewable energy source.
- It is safe and clean.

Wind Power:

- The kinetic energy in wind is converted into electrical energy by windmills and pumps.
- This energy can be used for pumping water or grinding grain.
- The generator in wind turbines generates electricity.
- This electricity can be supplied to larger areas by connecting the grid to the generator.
- It is a renewable energy source.

Geothermal Power:

- It is derived from the heat of Earth's core.
- The Earth's heat is absorbed by hot springs (underground water).
- Drills are used to pump out this hot water.
- The hot water is used to run the turbines and electricity is generated.

Wave Power & Tidal Power:

- Wave motion is used to run the turbine and generate electricity. This is known as Wave Power.
- The Tidal water in the creeks of the Indus delta has high-velocity flow and can be used to generate electricity. This is known as the Tidal Power.
- Both power sources are renewable.
- They can provide continuous energy.
- However, they are expensive to construct.
- They can kill sea habitats.
- They can also affect the local shipping using the sea route.

Biogas & Biomass:

- Biogas refers to using vegetable and plant matter (decaying and living) to use as a fuel.
- The method of biomass is not new in Pakistan, women in rural areas use cow dung patties to use as a fuel for cooking.
- Biogas can be produced from the waste of animals and plants.
- Biogas can be generated by fermentation of cow dung, but it emits methane gas that can increase air pollution since it is a greenhouse gas.

National Grid:

- The National Grid transmits electricity to consumers and domestic users.
- It comprises transformers and long transmission lines in the network.

Shortcomings:

- It is expensive and difficult to maintain.
- The long transmission line is difficult to install.
- There is friction that makes the line lose electricity.

Electricity Shortage in Pakistan:

- The existing power station has become inefficient because of poor maintenance and old machinery.
- At HEP stations, reservoirs have a silt that has reduced their capacity to produce electricity.
- In winter, the water in HEP stations' reservoirs is less because of less rainfall.
- The demand for electricity has increased because of the increase in population, industrialization, rural electrification and improved standards of living.

Load Shedding:

- The planned power cuts are known as load shedding.

Rural Electrifications:

- The rural areas are also receiving electricity.
- It will help them in improving their standards of living.
- It is also helping them to use modern methods in agriculture.
- It will decrease the migration of rural people to urban areas.
- It will expand and improve small industries.
- It will connect rural areas with opportunities to access it.

Efforts for Rural Electrification:

- The national grid has been extended.
- More thermal power stations are established.
- More HEP schemes are planned.
- Many villages have access to electricity now because of solar energy and biogas.
- Foreign and private investments are in place for the development of rural electrification.
- WAPDA is also playing its role in rural electrification.
- The government has initiated various programs e.g. Village Aid Program.
- The government announced to provide electricity to villages that agree to bear 33% of installation cost.