

UNIT 05

Section 3 Resources and Economic Development of Pakistan

Mineral, Power Resources & Telecommunication

In this unit the students will be able to:

- Describe the types and locations of mineral resources in Pakistan, outlining their importance in the national industry and economy.
- Investigate Pakistan's mining industry's potential for economic growth by providing a list of essential minerals, their uses and challenges faced by the mining industry, environmental impacts, and protective measures to recommend sustainable economic development.
- Assess the various energy resources available in Pakistan, which include both renewable and non-renewable sources such as hydroelectricity, wind, solar power, and bio-fuel, and examine their advantages and disadvantages.
- Evaluate the importance and role of telecommunications, including radio, television, phones, fax machines, emails, and the internet, in education/e-learning, industry, services, and trade/e-commerce in the development of Pakistan.
- Evaluate the overall impact of telecommunications on a country, considering its role in driving social and economic progress, the benefits it offers for business and industry, as well as its potential negative effects on the social and political aspects of society.
- Analyze the challenges of providing telecommunications in some parts of Pakistan and describe recent improvements in the telecommunications sector, particularly in relation to the education sector, and their potential for future growth.

Mineral Resources

A mineral resource refers to a concentrated deposit of naturally occurring solid, liquid, or gaseous material that is located on or within the Earth's surface. This material is present in a sufficient amount and form that it may be cheaply extracted and converted into valuable materials.

Minerals are essential for various biological and industrial processes. For instance, calcium and phosphorus are crucial for bone formation in living organisms, while minerals like quartz, feldspar, and mica are vital components in manufacturing materials such as glass, ceramics, and electronics. Similarly minerals like iron and coal are important in different ways.

Importance of Minerals

Mineral resources are of immense importance to modern society due to their widespread use in various industries and everyday life. They serve as essential raw materials for manufacturing, construction, energy production, and technological advancements.

For example, minerals like iron, copper, and

Expand Your Horizon

Minerals are essential for modern life, powering everything from smartphones to skyscrapers. Understanding minerals helps us appreciate their crucial role in our daily lives and inspires sustainable innovation for the future. Explore how minerals shape our world!

aluminum are crucial for producing vehicles, machinery, and infrastructure. Precious metals such as gold and silver are not only used in jewelry but also have significant applications in electronics and finance. Energy minerals like coal, uranium, and lithium are vital for electricity generation and powering batteries.

Furthermore, minerals contribute to economic development by creating jobs, driving innovation, and supporting trade. Their sustainable management and extraction are critical to ensuring a continuous supply for future generations, highlighting the need for responsible mining practices and environmental stewardship.

Mineral Resources in Pakistan

Pakistan possesses a wide range of mineral resources that are distributed throughout different parts of the country. The following are the basic types of minerals found in Pakistan:

- i) Metallic Minerals
- ii) Non-metallic Minerals
- iii) Energy Minerals
- iv) Gemstones

Metallic Minerals

Minerals that have a metallic appearance or properties are called metallic minerals. Significant reserves of iron ore are located in Chiniot and Kalabagh in Punjab, as well as in the Nokundi region in Balochistan. Iron ore is mainly used for steel production.



Saindak Copper and Gold Mine

The Saindak and Reko Diq regions in Balochistan are renowned for their significant deposits of **copper**. In Khyber Pakhtunkhwa, copper reserves are found in Chitral, Dir, and Hazara. Copper is mainly used for electrical wiring, electronics, construction, and industrial machinery.

Gold is discovered in conjunction with copper resources in Balochistan and Waziristan regions of Pakistan. The Saindak and Reko Diq copper deposits are noteworthy for their inclusion of minor quantities of gold, silver, and other valuable minerals. In addition to its use in jewelry and decorative items, gold also has various industrial applications in sectors such as computers, electronics, mobile phones, radiation shielding, aircraft, wiring, dentistry, medicine, and cosmetics.

Chromite deposits are predominantly found in the Muslim Bagh, Khanozai, and Wadh regions of Balochistan. Some reserves are also found in Malakand and Mohmand Agency in Khyber Pakhtunkhwa. The main uses of chromite include producing stainless steel, refractory materials, and pigments.

Khuzdar, Lasbela, and Quetta districts of Baluchistan contain lead deposits. It is located in the regions of Chitral, Swat, and Mardan within the province of Khyber Pakhtunkhwa. Lead deposits are also present in the Sargodha area of Punjab. It is commonly used in car batteries, paints, pigments, and ammunition such as bullets.

Non Metallic Minerals

Minerals that do not contain metal elements are called non-metallic minerals. **Gypsum** is abundant in Khewra, Dera Ghazi Khan, Mianwali, and Kohat. Gypsum serves as a primary ingredient in the production of phosphate fertilizers. Additionally, it holds significance in the

cement, plaster of paris, Sulphuric acid, paper, paints, and rubber industries. Gypsum has been used as a construction material for an extended period.

Limestone is plentiful in the Salt Range in Punjab, as well as in the Balochistan and Khyber Pakhtunkhwa provinces. The uses of limestone include cement production, construction aggregate, and steel manufacturing.

Rock salt is mostly obtained from the renowned Khewra Salt Mines in Punjab. Rock Salt is a mineral component that holds significant value for the health of both humans and animals. It is utilised in both cooking and the chemical sector, specifically for the production of Soda Ash, bicarbonate of Soda, caustic soda, and other soda products used in laundries, textiles, and tanneries.

Pakistan possesses a substantial reservoir of **marble**. The deposits are found in the Khyber Agency Swabi, Swat, and Chaghi regions. It is frequently used for sculptures, as a construction material, monuments, interior embellishments, and various other applications.

Pakistan is also home to **granite** deposits present in Gilgit, Dir, Chitral, Swabi, Kohistan, Nagarparkar, Chaghi, Mansehra, Malakand, and Swat. This material is used for manufacturing countertops, floor tiles, paving stones, curbing, stair treads, building veneer, and cemetery monuments.



Energy Minerals

Minerals that are used as a source of energy are called energy minerals.

Coal

Pakistan possesses substantial coal reserves in Tharparkar and Lakhra (Sindh), and Salt Range (Punjab). Moreover, Quetta coalfields also contain a significant amount of coal. Coal is an important mineral for energy production, cement manufacturing, and steel production.

Advantages and Disadvantages

The primary advantage of coal is its abundance and the potential to generate a substantial amount of electricity, which can help reduce Pakistan's reliance on expensive imported energy. The development of coal power projects also stimulates economic growth and job creation in mining and power generation sectors.

However, coal mining and combustion have considerable disadvantages, including severe environmental pollution from greenhouse gas emissions, air pollutants, and water contamination. Additionally, coal mining can lead to land degradation and displacement of local communities, posing social and ecological challenges.

The Thar coalfield of Pakistan is one of the largest coal reserves in the world, with an estimated 175 billion tons of lignite coal. This reserve is so vast that it has the potential to generate electricity for Pakistan for centuries, significantly reducing the country's reliance on imported energy and transforming its energy landscape.

Natural Gas

Natural gas is an important source of energy in Pakistan. The Sui gas field in Balochistan, which contains 89 operational wells, is the largest gas field in the country and accounts for 6% of the total gas production. Further reserves are discovered in the Khairpur, Mazrani, Sari, Kandhlot, and Sarang regions of Sindh, as well as in Punjab's Dhodhak, Pirkoh, Dhallian, and Mail.

Natural gas is used for power generation, heating, cooking, and as a fuel for specific vehicles. It plays a crucial role in the production of polymers and is indispensable for other chemical goods, such as fertilizers and dyes.

Advantages and Disadvantages

Advantages include being a relatively cleaner fossil fuel compared to coal and oil, emitting lower levels of carbon dioxide and other pollutants when burned. Natural gas infrastructure, such as pipelines and processing facilities, supports the energy supply chain and enhances energy security.

Natural gas extraction and transportation have disadvantages too, such as methane leaks, which are potent greenhouse gases. The finite nature of natural gas reserves also poses a long-term sustainability issue, necessitating the exploration of alternative energy sources.

Oil

In Pakistan, oil is found in the Pothohar Plateau that includes areas like Attock, Chakwal, and Jhelum. Moreover, the Khaur, Dhulian, and Meyal oil fields are also notable discoveries in Punjab. Oil fields have also been discovered in areas like Badin and Hyderabad in Sindh. In Khyber Pakhtunkhwa notable oil fields include those in Kohat, Karak, and Hangu districts. The Nashpa and Makori oil fields are key discoveries in this region.

It is primarily used for energy production, fueling power plants, and meeting the transportation needs of the nation by refining it into gasoline, diesel, and aviation fuel. Additionally, oil derivatives are vital in the petrochemical industry, producing a wide range of products such as plastics, fertilizers, and pharmaceuticals.

Advantages and Disadvantages

The advantages of oil include its high energy density providing more energy per unit than many other sources, making it an efficient source of energy for various applications. Local oil production helps reduce the burden of oil imports on the national economy and supports energy independence. Additionally, oil is a raw material for numerous products, including plastics, fertilizers, and medicines, making it essential beyond just energy production. Its availability and ease of transport further contribute to its importance in supporting economies and daily life worldwide.

Oil has significant disadvantages, including the environmental impact of oil spills, air pollution from combustion, and greenhouse gas emissions contributing to climate change. The volatility of global oil prices can also affect economic stability and energy security.

Gemstones

The Swat Valley in Khyber Pakhtunkhwa is

famous for its exceptional emeralds.

Rubies are extracted from mines located in the Hunza Valley in Gilgit-Baltistan.

Topaz and Aquamarine gemstones are located in the Shigar Valley and Skardu regions of Gilgit-Baltistan.

The wide range of mineral resources in Pakistan plays a vital part in the country's economy by making significant contributions to numerous industries such as construction, manufacturing, and energy generation. Their systematic extraction and effective management are crucial for the country's enduring development and economic expansion.

Pakistan's Mining Industry's Potential for Economic Growth

The mining sector in Pakistan has substantial potential to contribute to the economic progress of the country. If the nation efficiently manages and sustainably uses its diversified natural resources, it can stimulate industrial growth, generate employment opportunities, and enhance the national economy. The mining industry has the potential to create significant income by exporting valuable minerals like copper, gold, and chromite. Pakistan can enhance its foreign exchange revenues by harnessing these resources.

Mining operations have the potential to generate a significant number of job opportunities, both directly and indirectly, especially in rural and economically disadvantaged regions. This can aid in reducing poverty and enhancing living conditions. Moreover, the presence of crucial resources such as iron ore, limestone, and gypsum facilitates the expansion of vital sectors, including building, steel production, and cement making. The expansion of this industry can catalyse interconnected industries and make a significant contribution to the general advancement of the economy.

Implementing contemporary mining processes and technology can significantly improve productivity and efficiency within the mining industry, resulting in enhanced resource management and increased production.

Key Minerals

The substantial reserves of **copper and gold** found in Reko Diq and Saindak in Balochistan have the capacity to transform Pakistan into a prominent participant in the international copper and gold industries.

The **Thar coal** reserves rank among the world's largest. Exploiting these deposits can address the country's energy requirements and diminish reliance on imported energy.

The utilization of premium **marble and granite** resources in Khyber Pakhtunkhwa and Balochistan has the potential to increase exports and make a significant contribution to the building sector.



Challenges for the Mining Industry in Pakistan

Many challenges are being faced by the mining industry of Pakistan. The most significant challenges are as under:

- Insufficiently defined and consistent mining policies, bureaucratic delays, and weak regulatory frameworks impede investment and restrict development.
- Inadequate infrastructure, particularly in isolated mining regions, raises operational expenses and diminishes competitiveness.
- Obsolete mining methods and practices result in reduced production and environmental deterioration.
- The mining sector's growth and modernization are hindered by the lack of access to capital and investment.
- Mining operations have the potential to inflict harm on the environment and displace communities, necessitating the implementation of sustainable methods and active involvement of the local population to address these issues.
- Connectivity issues also affect the mining potential of the country. In the absence of reliable road or railways network the true potential of minerals cannot be exploited.

Environmental Impacts of Mining

Pakistan's mining industry has substantial environmental implications, which can be effectively mitigated by implementing sustainable practices and enforcing strict regulatory requirements. Some of the significant impacts are as under:

- Deforestation, soil erosion, and landscape alteration due to mining activities.
- Contamination of water sources from mining effluents and improper waste disposal.
- Dust and emissions from mining operations affecting air quality.
- Destruction of habitats and ecosystems due to mining activities.



Deforestation due to Mining



Note For Teachers: Encourage students to learn more about the minerals potential of Pakistan and find the reasons why this potential could not be used.

Protective Measures

Environmental impacts can be mitigated by the implementation of protective measures. One effective approach is regulatory enforcement, which involves enforcing laws and regulations to ensure compliance with environmental standards. This helps to prevent and reduce negative impacts on the environment. Enactment and upholding rigorous environmental legislation and standards to guarantee the adoption of responsible mining operations.

Routine environmental audits and impact assessments to oversee adherence to regulations and pinpoint opportunities for enhancement may also help solve the issues related to the environment.

There is a need of use contemporary mining technologies and methodologies that mitigate environmental consequences, including the reduction of waste production and the conservation of water resources.

Enactment of laws related to land reclamation and restoration initiatives to reinstate mined sites to their original condition or repurpose them for alternative functions may also bring better results.

Employing dust mitigation methods, such as the application of water sprays and the use of vegetation barriers, to reduce the release of dust particles may help reduce pollution. For the preservation of biodiversity, it is important to establish protected areas and buffer zones surrounding mining sites. Moreover, adopting effective waste disposal and management techniques may result in avoiding soil and water pollution.

Energy Resources of Pakistan

Pakistan, characterised by its varied topography and weather patterns, possesses a vast range of energy resources. Comprehending these resources is vital to recognise and value the nation's energy capacity and difficulties.

We have already discussed non-renewable energy resources such as coal, oil, and gas. Another form of non renewable energy source is Nuclear energy.

Nuclear Energy

Nuclear energy, produced through nuclear fission in reactors, is a powerful method for generating electricity. While it provides a significant amount of energy without releasing greenhouse gases during operation, nuclear energy is classified as a non-renewable source of energy. This is because it relies on uranium, a finite material that cannot be regenerated in a human timeframe. Once uranium is used up, it cannot be replenished, unlike renewable resources such as sunlight or wind.

In Pakistan, nuclear energy is an essential part of the country's energy resources. Pakistan's first nuclear power plant, the Karachi Nuclear Power Plant (KANUPP), was established in 1971 near Karachi. Since then, Pakistan has expanded its nuclear power capabilities with additional plants located at key sites, which include Karachi Nuclear Power Complex, and Chashma Nuclear Power Complex situated near Chashma, Punjab. Both these plants comprise multiple reactors that supply a significant amount of power to the national grid. These power plants are operated by the Pakistan Atomic Energy Commission (PAEC), and they play a key role in meeting the country's growing electricity demands.

Advantages

Nuclear energy produces a large amount of electricity from a small amount of fuel, making it highly efficient compared to fossil fuels. Moreover, unlike coal or natural gas, nuclear plants do not emit carbon dioxide during operation, which helps in reducing the country's carbon footprint.

Nuclear power plants can operate continuously for long periods, providing a stable and reliable source of electricity, unlike some renewable sources that depend on weather conditions.

Disadvantages

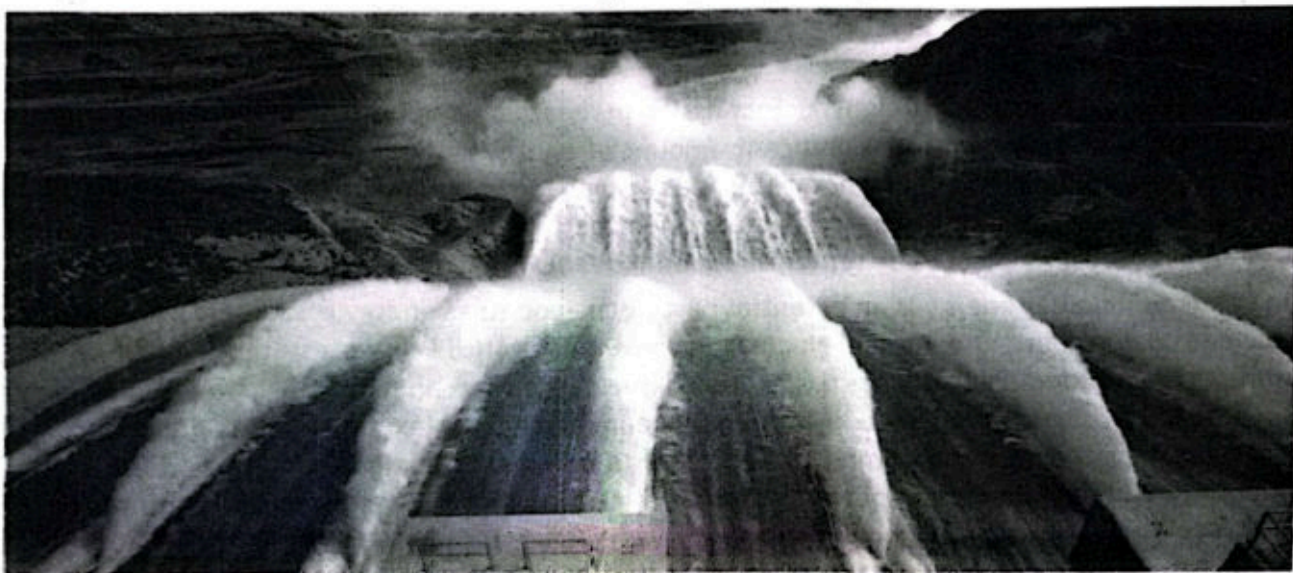
Nuclear energy depends on uranium, which is a finite and non-renewable resource. Extracting and processing uranium also has environmental impacts. In addition, nuclear reactors produce radioactive waste, which remains hazardous for thousands of years. Safe disposal and management of this waste are significant challenges. Building and maintaining nuclear plants are costly and time-intensive. Initial construction and future decommissioning expenses are substantial. Another significant disadvantage is the risk of accidents which can have devastating environmental and health impacts.

Renewable Energy Resources

Pakistan possesses a wealth of renewable energy resources, which present substantial opportunities to fulfill the nation's escalating energy requirements in an environmentally sustainable manner. Renewable energy resources offer both clean and sustainable energy, decrease the country's dependence on imported fuels, improve energy security, and aid in environmental conservation by reducing greenhouse gas emissions. These renewable resources include hydroelectric energy, wind energy, solar energy, and bio-fuels.

Hydroelectric Energy

Hydroelectric power is an important and renewable energy source in Pakistan that utilises the energy from rivers to produce electricity. Significant dams such as Tarbela, Mangla, and Ghazi Barotha make a considerable contribution to the national power system.



Tarbela Dam

Advantages

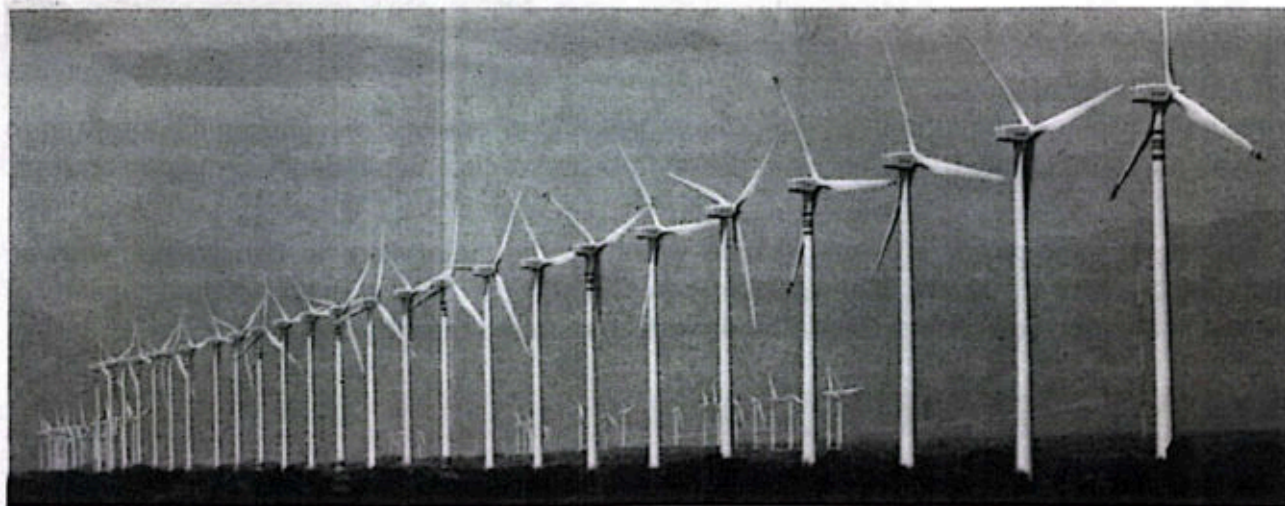
The advantages of hydroelectric energy include their being renewable and sustainable. This energy has low operational costs once established and provides a reliable and stable source of electricity. On the environmental side, they reduce greenhouse gas emissions.

Disadvantages

The disadvantages of hydroelectric energy include their high initial construction costs. Due to such huge plans, a considerable number of people are displaced, and their resettlement requires huge funds. In addition, while dams and barrages help reduce greenhouse gas emissions, they have an environmental impact on aquatic ecosystems. Another disadvantage of over-dependence on hydroelectric energy is the seasonal variability in water flow which can affect energy production.

Wind Energy

Pakistan possesses substantial wind energy potential, particularly along the coastal areas of Sindh and Balochistan. Most of the wind power plants are in Jhampir Sindh. The Gharo-Keti Bandar wind corridor in Sindh is one of the most promising sites, with consistent wind speeds favorable for energy generation. This region alone has the potential to generate thousands of megawatts of electricity, making it a cornerstone of Pakistan's renewable energy strategy.



Wind Power Project Jhampir

Advantages

Wind energy in Pakistan offers several significant advantages. As a renewable and sustainable energy source, it ensures an inexhaustible supply of power. Once wind turbines are installed, they incur low operational and maintenance costs, making them economically viable in the long run. Wind energy production emits no greenhouse gases or pollutants, contributing to environmental conservation and combating climate change. Moreover, developing wind energy reduces Pakistan's reliance on imported fossil fuels, enhancing national energy security and reducing exposure to global energy price fluctuations. The establishment of wind farms can also create

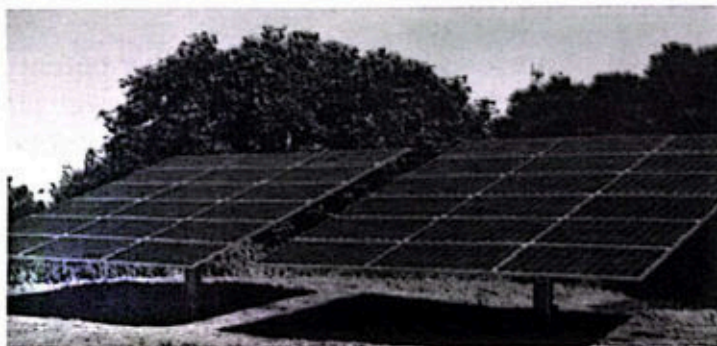
local jobs and stimulate economic growth in rural and remote areas.

Disadvantages

Wind energy also presents some disadvantages. Its intermittent and variable nature means that energy production can fluctuate daily and seasonally, posing challenges for ensuring a consistent power supply. The initial installation and infrastructure costs for wind turbines are high, requiring substantial capital investment. Wind farms require large land areas, which can lead to land use conflicts, especially in densely populated or agriculturally important regions. Additionally, wind turbines can be visually unappealing and produce noise, which may be a concern for nearby residents. There are also potential risks to wildlife, particularly birds and bats, which can experience habitat disruption and mortality due to turbine operations.

Solar Energy

Pakistan is endowed with significant solar energy potential, notably in its arid and semi-arid regions. With an average of over 300 sunny days per year, places like Sindh, Balochistan, and parts of Punjab are excellent for generating solar electricity. Large-scale solar farms are being created in these locations, alongside smaller, decentralized solar projects for rural and off-grid people. The government has been



encouraging solar energy through various measures and incentives, recognizing its potential to contribute considerably to the national energy mix and reduce dependence on imported fossil fuels.

Examples of solar power projects include Quaid-e-Azam Solar Park in Bahawalpur with an installed capacity of 100 MW, Bhalwal Solar Power Plant in Sargodha with an installed capacity of 90 MW, and Matiari Solar Power Plant in Sindh with an installed capacity of 60 MW.

Do You Know?

Pakistan has immense potential for solar energy, with the ability to generate over 2.9 million megawatts annually. The country receives sunlight for about 300 days a year, averaging around 5.5 kilowatt-hours per square meter per day, making it one of the most solar-rich regions in the world. Government of Pakistan has taken significant steps of converting its government buildings on solar energy and provision of solar energy for domestic users on subsidized rates.

Advantages

The advantages of solar energy in Pakistan are enormous. Solar power is a clean and renewable energy source, meaning it creates electricity without generating greenhouse gases or pollutants, therefore helping to combat climate change and improve air quality. The quantity of sunlight in Pakistan makes solar energy a reliable and continuous power source, particularly in places with limited access to traditional energy infrastructure. Solar installations, ranging from big solar

farms to tiny residential systems, may be rapidly erected and expanded, providing adaptable solutions to suit various energy needs. Additionally, solar energy installations generate local employment possibilities in installation, maintenance, and manufacture, promoting economic growth and development.

Disadvantages

Solar energy also has some disadvantages. The initial expenses of solar panel installation and accompanying infrastructure are relatively costly, which can be a barrier for wider adoption. Although the operational expenses are cheap, the intermittency of solar power—due to daily and seasonal variations in sunlight—requires effective storage solutions or backup systems to maintain a consistent power supply. Large-scale solar farms require considerable land tracts, which might lead to land use conflicts, particularly in agriculturally fertile regions. Furthermore, the effectiveness of solar panels can be impacted by dust and pollution, demanding constant cleaning and maintenance. Despite these limitations, continuous technology breakthroughs and supportive legislation can help alleviate these disadvantages and expand the role of solar energy in Pakistan's sustainable energy future.

Biofuel

Biofuel resources are mostly obtained from agricultural waste, animal manure, and other organic elements. The country's enormous agricultural industry produces large quantities of biomass, including crop wastes from wheat, rice, sugarcane, and maize, which can be transformed into biofuels. Biofuel projects are backed by both government programmes and private sector investments aimed at promoting renewable energy sources and reducing dependency on imported fossil fuels.

Pakistan has implemented several notable biogas projects including the Punjab Biogas Pilot Project, the University of Agriculture, Faisalabad (UAF) biogas initiative, the Rural Support Programs Network (RSPN), the Pakistan Domestic Biogas Program (PDBP), and the Pakistan Dairy Development Company (PDDC). These projects collectively demonstrate the potential of biogas technology to promote sustainable energy practices and improve rural livelihoods in Pakistan.

Advantages

The advantages of biofuels in Pakistan are noteworthy. As a renewable energy source, biofuels help reduce greenhouse gas emissions and mitigate climate change by recycling carbon dioxide that plants absorb during their growth. Utilizing agricultural waste for biofuel production provides an effective way to manage waste, reducing environmental pollution and enhancing sustainability in the agricultural sector. Biofuels can also promote rural development by creating local job opportunities in the collection, processing, and distribution of biomass. Furthermore, biofuels can enhance energy security by diversifying the country's energy mix and reducing dependence on imported oil and gas.

Disadvantages

The development of biofuels in Pakistan faces several disadvantages. The production of biofuels can compete with food production for land and resources, potentially leading to higher food prices and food security concerns. The variability in the quality and energy content of biomass feedstock can affect the efficiency and consistency of biofuel production. Additionally, the initial

investment costs for biofuel infrastructure and technology are high, which can be a barrier for widespread adoption. The environmental impact of large-scale biomass cultivation, such as deforestation and soil degradation, must also be carefully managed to avoid negative ecological consequences. Despite these challenges, with appropriate policies and sustainable practices, biofuels can play a significant role in Pakistan's renewable energy landscape.

Telecommunication

Telecommunication refers to the transmission of information over vast distances via electronic methods, permitting communication between people and devices. It comprises a wide range of technologies, including telephones, fax machines, radios, televisions, and the internet. Telecommunication systems use wired or wireless networks to transport voice, data, text, pictures, and video, enabling real-time communication and data sharing.



Importance of Telecommunication

The value of telecommunication rests in its ability to connect people and businesses across great distances, revolutionizing how we communicate and interact in today's globalized society. It provides real-time communication through voice conversations, video conferencing, and instant messaging, promoting seamless collaboration and information exchange.

Telecommunication is crucial for economic growth, as it promotes the digital economy, increases company processes, and fosters innovation. It plays a significant role in emergency response and



Note For Teachers:

Remind students that it is important to consider installation, operational and maintenance cost carefully while choosing the best form of energy source to be used. It depends on initial resources available, location where energy plant is to be installed and availability of maintenance or operational cost.

catastrophe management by providing rapid communication channels. Additionally, communications span geographical and social divisions, enhancing access to education, healthcare, industry, commerce, and government services, so supporting inclusive growth and societal advancement.

Due to advancement in telecommunication the world has turned into a global village. This asks for understanding the requirements of global citizenship that are based on mutual respect and understanding.

Role of Telecommunication in the Development of Pakistan

Communication technologies such as radio, television, phones, fax machines, emails, and the internet play pivotal roles in Pakistan's development across multiple sectors. These technologies facilitate education and e-learning, drive industrial efficiency, enhance service delivery, and expand trade and e-commerce opportunities. By connecting people, businesses, and institutions, they contribute significantly to the country's economic growth and societal progress, transforming how information is shared and business is conducted in an increasingly digital world.

Let's discuss them one by one.

Radio

Radio has been a crucial tool in Pakistan's educational and industrial development. In education, radio broadcasts have historically supplied instructional information, especially in remote places where access to schools is limited. It acts as a venue for educational programs, news, and public service announcements, helping to promote awareness on many problems.

In the industrial sector, radio is utilised for conveying information on market trends, weather forecasts, and agricultural suggestions, directly affecting productivity and efficiency.

Television

Just like radio, television has a crucial role in education and public awareness in Pakistan. Educational channels and programs broadcast educational content, making learning accessible to students who may not have access to regular schools. During Covid 19 pandemic, television continued the education of millions of Pakistani students through recorded lectures and animated videos.



Phone

The proliferation of phones has transformed communication in Pakistan. In education, phones provide e-learning through applications and online resources, allowing students to access instructional materials anytime and anywhere.

In the industrial and service sectors, mobile phones offer real-time communication, boosting operational efficiency and customer service. For trade and e-commerce, phones provide a platform for mobile banking, online shopping, and digital transactions, boosting market reach

Expand Your Horizon

Pakistan has experienced a remarkable surge in internet usage, with over 124 million internet users as of 2024, representing nearly 55% of the population. This rapid digital expansion has positioned Pakistan as one of the fastest-growing internet markets in the world. Learn more about the trends.

and economic potential.

Though not very common these days, Fax machines also play an important role in communication of important documents, especially where internet services are either not available or not reliable.

Internet and Email

The Internet is a cornerstone of modern development in Pakistan, fuelling growth throughout education, industry, services, and trade. In education, the internet offers e-learning platforms, online courses, and access to a large array of educational resources, fostering digital literacy and lifelong learning.

In the industrial sector, the internet helps automation, supply chain management, and access to global markets, boosting efficiency and competitiveness. In the service sector, the internet provides online services, customer assistance, and digital marketing, enhancing service delivery and consumer satisfaction. In trade and e-commerce, the internet provides a platform for online shopping, digital payments, and worldwide trade, expanding market access and supporting economic growth.

Impact of Telecommunications on a Country

Telecommunications have a major impact on a country's development, promoting economic growth, social improvement, and political engagement. By facilitating real-time communication and information exchange, telecommunications promote productivity, efficiency, and innovation across diverse sectors such as education, healthcare, industry, and commerce. They transcend geographical and social divisions, giving rural and underprivileged populations with access to crucial services and opportunities. Telecommunications promote worldwide connectivity, allowing firms to extend their markets and compete internationally. They also play a significant role in disaster response and emergency management, ensuring fast dissemination of critical information.

Potential Negative Effects of Telecommunication

Telecommunications can also have detrimental consequences on social and political aspects of society. On a social level, the ubiquitous use of digital communication can lead to difficulties such as less face-to-face encounters, weakening of personal relationships, and increasing social isolation.

The dissemination of misinformation and fake news through digital channels can heighten social tensions and undermine trust in institutions. Additionally, excessive screen time and dependency on digital gadgets can damage mental health and well-being.

Politically, telecommunications can impact public opinion and political processes in both positive and negative ways. While they provide platforms for free expression and political activity, they

can also be utilised for monitoring, censorship, and manipulation. Different groups can leverage telecommunications to promote propaganda, launch cyber-attacks, and infringe on privacy rights.

The digital divide, when certain groups lack access to telecommunications, can lead to unequal political involvement and worsen existing social inequities. Thus, while telecommunications offer various benefits, it is vital to address these possible negative repercussions through effective regulation, digital literacy initiatives, and policies that encourage fair access and ethical use of technology.

Challenges of Providing Telecommunications

Pakistan is facing a variety of issues in constructing telecommunication effectively. Some of the issues are discussed here.

Economic Constraints

The high expense of developing telecommunications infrastructure in sparsely populated locations can be a considerable impediment. The return on investment in these places is generally low, preventing private enterprises from expanding services. Government subsidies and incentives are sometimes important, but limited public finances might constrain the extent and speed of development. This is the reason that some economically deprived areas of Pakistan face low connectivity issues.

Geographical Barriers

Pakistan's diversified geography, including harsh mountains, deserts, and distant rural areas, poses considerable challenges for the construction and maintenance of telecommunications equipment. Regions like the northern mountainous regions of Khyber Pakhtunkhwa and Gilgit-Baltistan and parts of Balochistan are extremely difficult to access, making it challenging to lay down cables, establish towers, and provide constant service.

Security Concerns

Certain regions of Pakistan, particularly in Balochistan and the erstwhile Federally Administered Tribal Areas (FATA), face security difficulties due to continuous conflicts and insurgencies. This volatility can limit the development of telecommunications infrastructure, since service providers may be unwilling to invest in locations with a high risk of damage or disruption. Similarly in regions close to international borders and line of control also face connectivity issues. It is pertinent to mention here that in certain areas of Gilgit Baltistan and Azad Jammu & Kashmir, Special Communication Organization (SCO) plays a crucial role in connecting these areas with Pakistan and rest of the world as many private cellular companies do not venture there.

Power Supply Issues

A reliable electricity supply is vital for telecommunications infrastructure. However, many rural



Note For Teachers:

Ask students to investigate the most crucial negative effects of the internet on the lives of people and suggest solution to the issues identified.

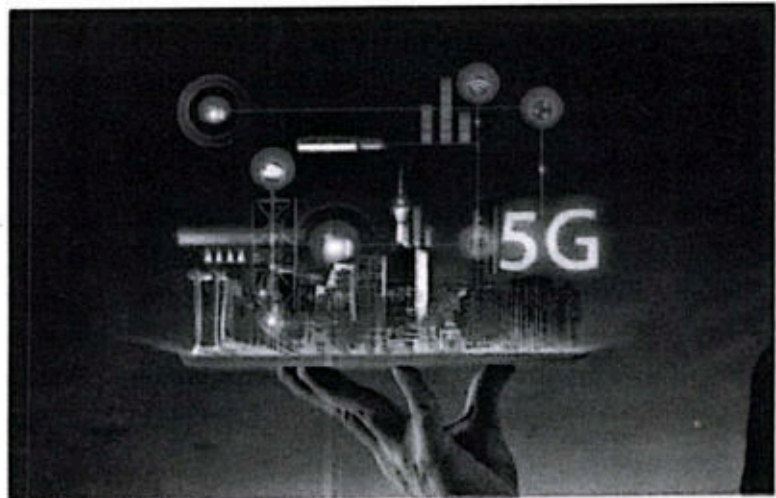
and remote locations in Pakistan suffer from regular power outages or lack access to energy completely, making it tough to operate and maintain telecom equipment.

Recent Improvements in the Telecommunications Sector

In recent years, Pakistan's telecommunications industry has witnessed significant growth and transformation. This growth is driven by technological innovations, regulatory reforms, and increasing investments. Here are some key highlights:

Increased Investment

The telecommunications sector has drawn significant foreign investment, contributing to the development of infrastructure. International corporations perceive Pakistan as a viable market due to its big population and growing demand for data services. Moreover, collaborations between the government and private sector have led to the construction of essential infrastructure projects, including fiber optic networks and satellite communication systems.



Regulatory Reforms and Policies

The government's recent telecommunication policies focus on fostering innovation, enhancing competition, and ensuring affordable access to services. These policies include incentives for operators to improve their infrastructure and services.

Unprecedented Surge in Users

The number of telecom users in Pakistan has climbed by an amazing 25 percent in the last five years, reaching 192.3 million. Cellular mobile services are currently accessible to 90 percent of Pakistan's population, with 3G and 4G signals spreading to over 80 percent.

Affordability

Pakistan has some of the most affordable telecom data rates ranking Pakistan as one of the lowest data rates countries. This is the reason that internet connectivity is available in every corner of Pakistan.

Expansion of 4G Services

Over the past few years, Pakistan has significantly expanded its 4G network coverage. Major telecom operators have invested heavily in infrastructure, leading to broader and more reliable 4G and 5G services across urban and rural areas.

Growth in E-Commerce and Digital Services

Improved telecommunications infrastructure has helped Pakistan's e-commerce industry grow

rapidly. Online shopping and digital transactions have become more convenient because of reliable internet connectivity and mobile payment options. Moreover, the expansion of digital platforms for education, healthcare, and entertainment has been aided by reliable telecommunications services, which have improved quality of life and economic opportunities.

Improvements in the Telecommunications Sector Concerning Education

Pakistan's telecommunications sector has made great progress in recent years, affecting education. These advancements have improved access to educational resources, permitted distant learning, and increased digital literacy across the country.

Expansion of Internet Connectivity in Educational Institutions

The proliferation of broadband networks has connected several educational institutions across Pakistan, notably in urban and semi-urban areas. This connectivity enables students and teachers to access online educational resources, do research, and participate in digital learning platforms. In addition, efforts have been made to extend internet connectivity to rural and distant educational institutions. This effort strives to bridge the digital divide and ensure that students in less accessible places have same possibilities as their metropolitan peers.

Growth of E-Learning Platforms

The increased availability of high-speed internet has driven the creation of e-learning platforms, offering a wide selection of courses and instructional content. Platforms such as Coursera, Khan Academy, and local alternatives have grown more accessible, giving students with chances for self-paced study.

With the advancement of connectivity, many institutions in Pakistan have developed online degree programs, allowing students to pursue higher education remotely. These programs cater to both local and international students, enabling flexibility and widening access to great education.

Digital Classrooms

Telecommunications improvements have permitted the installation of smart classrooms equipped with interactive whiteboards, projectors, and high-speed internet. These classrooms enhance the teaching and learning experience by adding multimedia materials and enabling real-time collaboration. In addition, digital tools and high-speed internet have permitted the use of virtual labs and simulations, notably in scientific and engineering education. These tools allow students to conduct experiments and engage in practical learning experiences without the requirement for actual lab infrastructure.

Distance Learning

During the COVID-19 epidemic, the government introduced educational TV channels and radio programs to facilitate distance learning. These projects guaranteed continuity in education when traditional classroom teaching was disrupted. Moreover, video conferencing platforms have become crucial to distance learning. Enhanced telecommunications infrastructure has encouraged the widespread adoption of these tools, enabling live classes, webinars, and virtual office hours.

A spike in mobile learning applications has been noted, fueled by enhanced mobile internet

access. These applications offer a variety of educational materials, including interactive lessons, quizzes, and practice exercises, accessible from anywhere at any time.

Artificial Intelligence

Artificial Intelligence (AI) is revolutionizing the telecommunications sector, enhancing both service quality and customer experience. In Pakistan and globally, AI technologies are being used by telecom companies to improve network management, optimize services, and provide more personalized experiences to users. These advancements contribute to a faster, more reliable telecommunications infrastructure, benefiting millions of users in Pakistan by keeping them connected and improving their digital experiences.

Artificial Intelligence is also playing a transformative role in Pakistan's education sector by enhancing personalized learning, improving accessibility, and supporting teachers with automated grading and administrative tasks. AI-powered platforms provide students with customized learning experiences, while virtual tutors and chatbots offer 24/7 assistance, helping students overcome challenges outside of regular school hours. Additionally, AI tools enable educators to analyze student performance data to identify learning gaps and adjust teaching strategies. These advancements make education more efficient, accessible, and tailored to individual needs, ultimately raising the quality of education across Pakistan.

The telecommunications sector in Pakistan has played a major role in reshaping the educational landscape. The future expansion of the telecommunications sector in Pakistan contains great potential, driven by continued technology advancements and increased demand for connection. With the approaching implementation of 5G technology, Pakistan is ready to enjoy a huge increase in internet speeds and network stability, which will drive the development of smart cities, Internet of Things (IoT) applications, and advanced digital services.

Furthermore, continuing investments in fiber optic infrastructure and satellite communications are expected to boost rural connectivity, bridging the digital divide. The government's supportive policies and regulatory reforms, coupled with public-private partnerships, will further drive innovation and competitiveness within the sector. These advancements will not only increase communications services but also stimulate economic growth, expand access to education and healthcare, and foster a more digitally inclusive society.

What I have Learned

- Pakistan possesses significant mineral resources including coal, natural gas, copper, gold, and gemstones.
- Mineral resources play a crucial role in Pakistan's industrial sector, contributing to sectors like cement, steel, and fertilizer production.
- The mining industry supports employment and generates revenue crucial for the national economy.
- Essential minerals like limestone for cement, coal for energy, and copper for manufacturing are pivotal.
- Challenges include infrastructural limitations, legal frameworks, and environmental impacts.

- Environmental impacts include land degradation, water pollution, and habitat destruction.
- Protective measures involve sustainable mining practices, environmental impact assessments, and community engagement.
- Non-renewable sources include coal and natural gas, contributing significantly to the energy mix.
- Renewable sources such as hydroelectricity, wind, and solar power are increasingly utilized.
- Advantages include reduced greenhouse gas emissions and energy independence.
- Disadvantages include intermittency for renewables and environmental impacts like habitat disruption.
- Telecommunications revolutionized education through e-learning platforms and distance education.
- Industry benefits from improved communication networks boosting efficiency and connectivity.
- Services like banking and healthcare benefit from enhanced communication channels.
- Trade and e-commerce thrive due to improved internet penetration and digital connectivity.
- Socially, telecommunications promote connectivity, bridging urban-rural divides and fostering social cohesion.
- Economically, telecommunications stimulate business growth, facilitate access to markets, and enable entrepreneurship.
- Challenges include the digital divide and potential negative effects on privacy and data security.
- Challenges include inadequate infrastructure in rural and remote areas.
- Education sector improvements include online learning platforms and digital literacy programs.
- Future growth potential lies in expanding broadband access and enhancing digital infrastructure.

EXERCISE

Answer the following questions by choosing the best answer A, B, C or D.

- The Salt Range is famous for:**
 - granite and gypsum
 - rock salt and limestone
 - limestone and lead
 - rock salt and gypsum
- Copper and gold mines are located in:**
 - Khewra
 - Swat
 - Saindak
 - Lakhra
- Pakistan's largest coal reserves are in:**
 - Quetta
 - Malakand
 - Thar
 - Larkana
- Methane leak is one of the disadvantages of:**
 - rock salt
 - natural gas
 - copper
 - gypsum

5. Which of the following statements is true regarding the energy minerals found in Pakistan?
- Coal is only found in the Tharparkar region.
 - Sui gas field accounts for the majority of Pakistan's gas production
 - Coal mining does not lead to land degradation.
 - Natural gas extraction has no environmental disadvantages.
6. Which gemstone is famously extracted from the Swat Valley in Khyber Pakhtunkhwa?
- Ruby
 - Emerald
 - Topaz
 - Aquamarine
7. Which of the following is a significant environmental impact of Pakistan's mining industry?
- Urbanization
 - Deforestation
 - Desertification
 - Overfishing
8. Which of the following is an effective approach to mitigating the environmental impacts of mining in Pakistan?
- Increasing mining production
 - Regulatory enforcement
 - Expanding urban development
 - Raising mineral prices
9. Which of the following is a disadvantage of hydroelectric energy in Pakistan?
- Low operational costs
 - Renewable and sustainable
 - Seasonal variability in water flow
 - Reduction in greenhouse gas emissions
10. Which of the following is an advantage of solar energy in Pakistan?
- High operational expenses
 - Generates greenhouse gases
 - Creates local employment opportunities
 - Requires considerable land tracts

Answer the following questions briefly.

- Evaluate the impact of using coal as an energy source on both the environment and the economy.
- How can we improve the productivity and efficiency of the mining industry in Pakistan?
- Analyze the role of renewable energy resources in Pakistan's future energy needs.

4. What are the potential negative effects of modern means of telecommunication?
5. What is the role of telecommunication in e-learning?

Answer the following questions in detail.

1. Analyze the keyways Pakistan's mining industry can drive economic growth. What specific policies or practices could the government and industry leaders implement to maximize these benefits while minimizing environmental impacts?
2. Evaluate how Pakistan can strategically balance its diverse energy resources—such as fossil fuels, hydropower, and renewables—to promote long-term sustainable growth.
3. Examine the role of telecommunications in Pakistan's development. How does enhanced connectivity contribute to improvements in areas like education, healthcare, and economic opportunity?
4. Discuss how the telecommunications sector can drive both social and economic progress in Pakistan.
5. Assess the impact of recent telecommunications advancements on education in Pakistan, especially in remote regions. How have these improvements addressed access challenges, and what further steps could be taken to expand educational opportunities?

Relevance across Time

Energy Resources in Pakistan

Historical Context: Assess the evolution of energy resources in Pakistan, highlighting key milestones in the development of renewable (e.g., hydroelectricity, wind, solar power) and non-renewable (e.g., coal, oil, natural gas) energy sources.

Current State: Evaluate the current mix of energy resources in Pakistan, including their advantages and disadvantages. How have recent policies and technologies influenced this sector?

Project

Explore the environmental impact of mining activities. Address ecological consequences and measures to mitigate environmental damage. Based on your research, propose protective measures for sustainable economic development.

Compare and Contrast

Analyze the challenges of providing telecommunications in remote parts of Pakistan versus urban areas. Discuss recent improvements and advancements in the telecommunications sector.

Glossary

Mineral Resources: Naturally occurring substances found in the earth's crust that are extracted for economic and industrial purposes.

National Industry: The aggregate of manufacturing and production activities within a country, which contribute to its economy and employment.

Mining Industry: The sector of the economy involved in the extraction of minerals from the earth, which includes exploration, extraction, processing, and marketing of minerals.

Renewable Energy Resources: Energy sources that are naturally replenished, such as solar power, wind power, hydroelectricity, and bio-fuel.

Non-Renewable Energy Resources: Energy sources that cannot be replenished in a short period of time, such as coal, natural gas, oil, and nuclear energy.

Hydroelectricity: Electricity produced from the energy of moving water, typically from rivers or dams.

Solar Power: Energy harnessed from the sun using solar panels or other technologies.

Wind Power: Energy generated by wind turbines that convert kinetic energy from the wind into electrical power.

Bio-Fuel: Fuels derived from organic materials, such as plant and animal matter, used as an alternative to fossil fuels.

E-learning: Learning conducted via electronic media, typically on the internet.

GDP: Gross Domestic Product (GDP) is the total monetary value of all goods and services produced within a country's borders over a specific period

List more words and write their meaning that you find difficult in this unit.
