

# Minerals

In this chapter you have

1. Types of minerals
2. Methods of mining or extraction
3. Effects of mining
4. Factors affecting mining
5. Distribution and import or export

# Types of minerals

1. Gypsum
2. Limestone
3. Rocksalt
4. Aluminium
5. Iron
6. Copper
7. Gold
8. Chromite
9. Coal
10. Oil
11. Gas

# Uses of minerals

## Gypsum

1. Gypsum board used as a finish for walls and ceilings
2. Plaster
3. Fertiliser or soil conditioning
4. Plaster or paris for casting moulds and surgical splints
5. Making models, modelling
6. Soil water potential monitoring
7. In foot creams, shampoos and hair products
8. Adding hardness to water used in construction



# How is gypsum used in measuring water potential

Gypsum blocks are often used as simple indicators of irrigation events. Gypsum blocks measure the electrical resistance of a block of gypsum as it responds to changes in the surrounding soil. The electrical resistance is proportional to water potential.

The readings are temperature-dependent and have very low accuracy. Also, gypsum dissolves over time, especially in saline soils, and loses its calibration properties. Gypsum blocks tell you wet or dry but not much more.



# Uses of minerals (2)

## Limestone

1. In manufacturing quicklime ( calcium oxide )
2. Cement and mortar
3. To neutralise acidic soil
4. Crushed to use as base for many roads
5. As a reagent in flue gas desulfurization
6. Glass making
7. Used in blast furnaces to extract iron from its ore
8. Medicine
9. Cosmetics



# Uses of minerals (3)

## Rocksalt

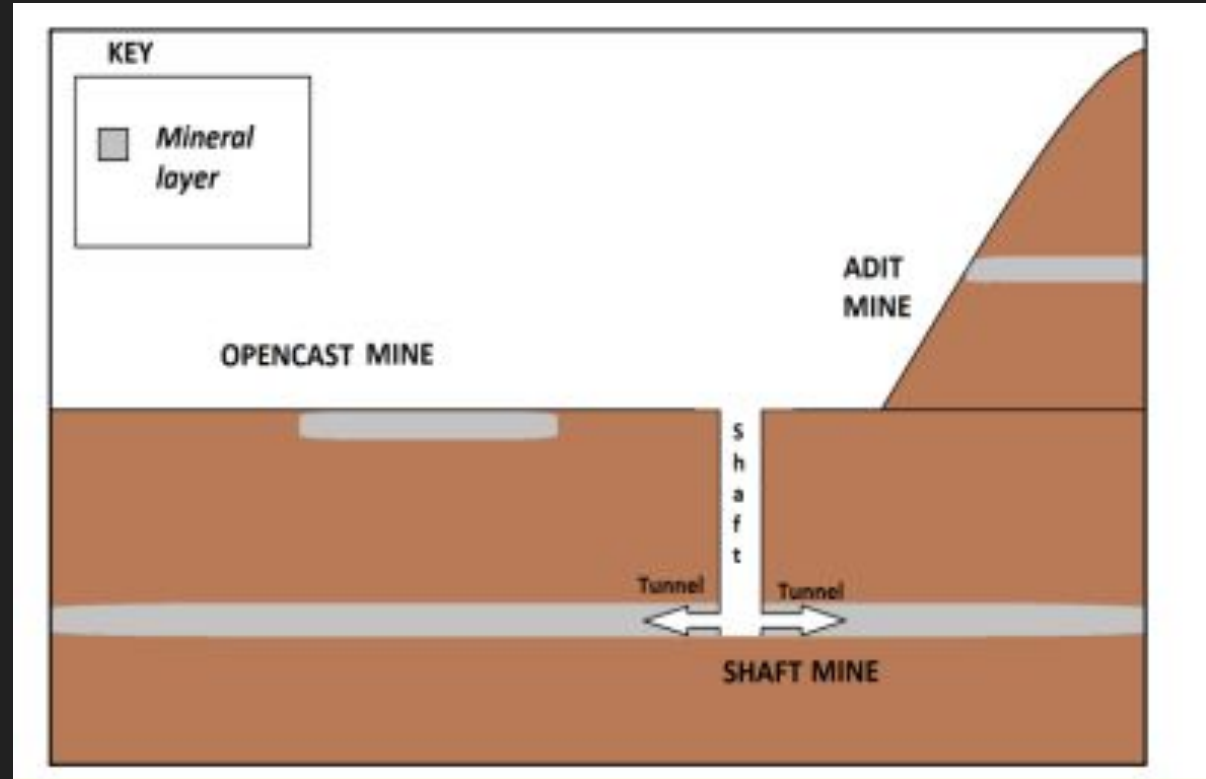
1. Manufacturing paper
2. Setting dyes in textile industry
3. Producing soap detergents and bath products
4. Source of industrial chlorine
5. Eating, cooking
6. Preserving (fish)
7. Melt ice

# Methods of mining

1. Adit mining
2. Shaft mining
3. Opencast mining

4. Derrick

(only for gas, oil)



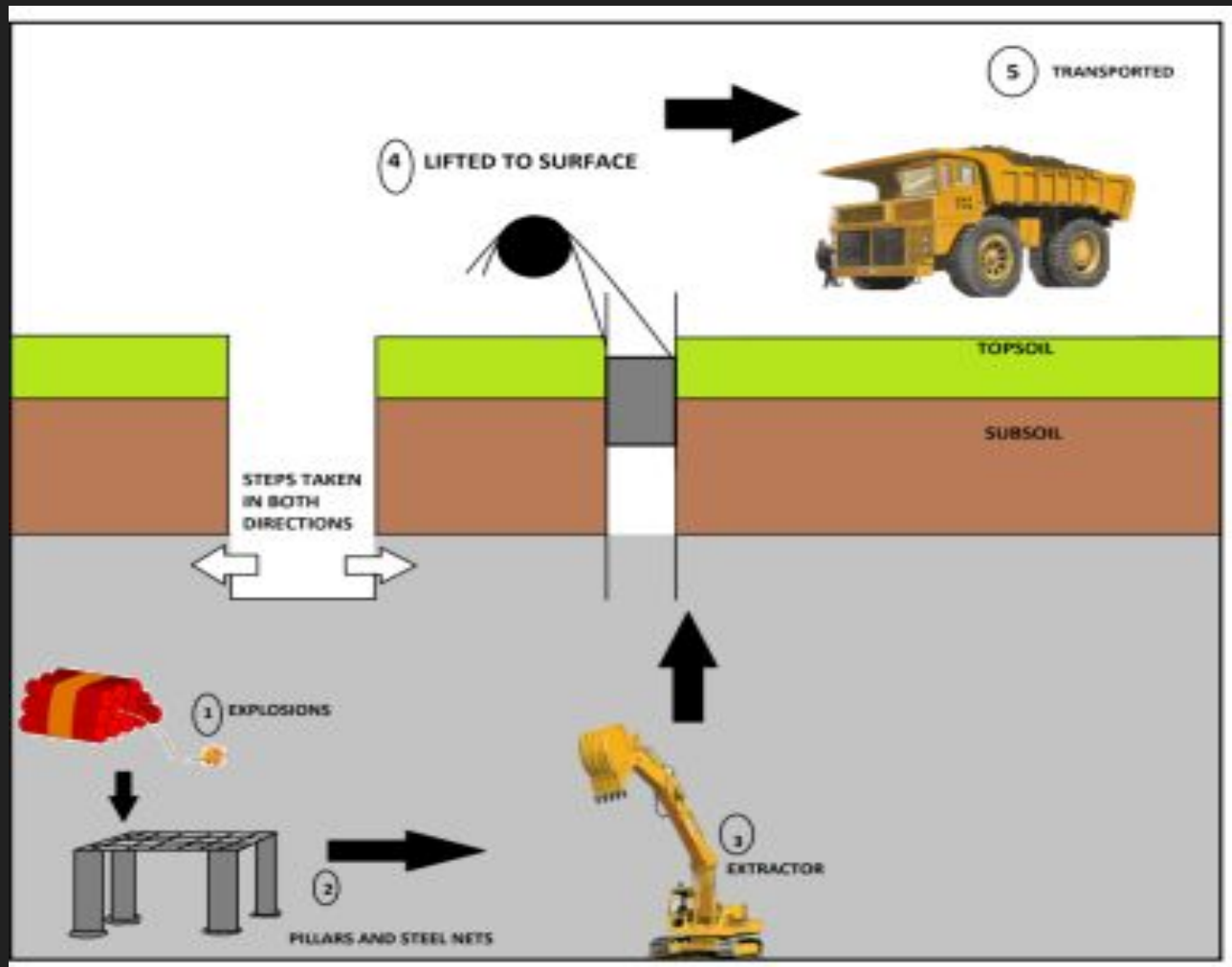
# Adit Mining

1. Adit method of mining is used when a mineral layer is exposed near the surface of a hill.
2. In this technique a single near horizontal or multiple layers are dug into the mineral layer.
3. Explosives are used to blast and loosen the rock.
4. Once this has been carried out, pillars and steel nets are installed.
5. This prevents the roof of mine from caving in and steel nets prevent rocks from falling down and killing the miners.
6. Then diggers are used to remove the mineral bearing rock and which is then transported by rail or donkeys to the mine entrance after which is loaded into trucks



# Shaft mining

1. Shaft mining is used when the mineral layer is found deep in the soil.
2. First a vertical layer is dug to reach the mineral layer.
3. Once the mineral layer is reached then a horizontal layer is dug in both sides into the mineral layer.
4. Explosives are used to blast and loosen the rock. Once this has been carried out then pillars and steel nets are installed. This prevents the roof of mine from caving in and steel nets prevent rocks from falling down and killing the miners.
5. Then diggers are used to remove the mineral containing rock after it has been blasted apart by dynamites.
6. This is then transported by rail to the lift, whereas then it is lifted to the surface to be transported by trucks.
7. It must be noted that ventilation shafts are also dug along the length of mine along with main shaft to prevent the build-up of explosive odourless gases like methane



# Opencast mining

1. Opencast mining is used when the mineral layer is exposed near the surface of the earth.



2. Firstly the vegetation is cut, topsoil and subsoil removed.
3. Then explosives are used to blast and loosen the rock.



4. Then diggers are used to remove the mineral containing rock which is then transported by huge trucks carrying 500 tonnes in one go onto the surface.



5. Opencast mine is a big hole in the ground with pathways for trucks running on the diameter of the mine

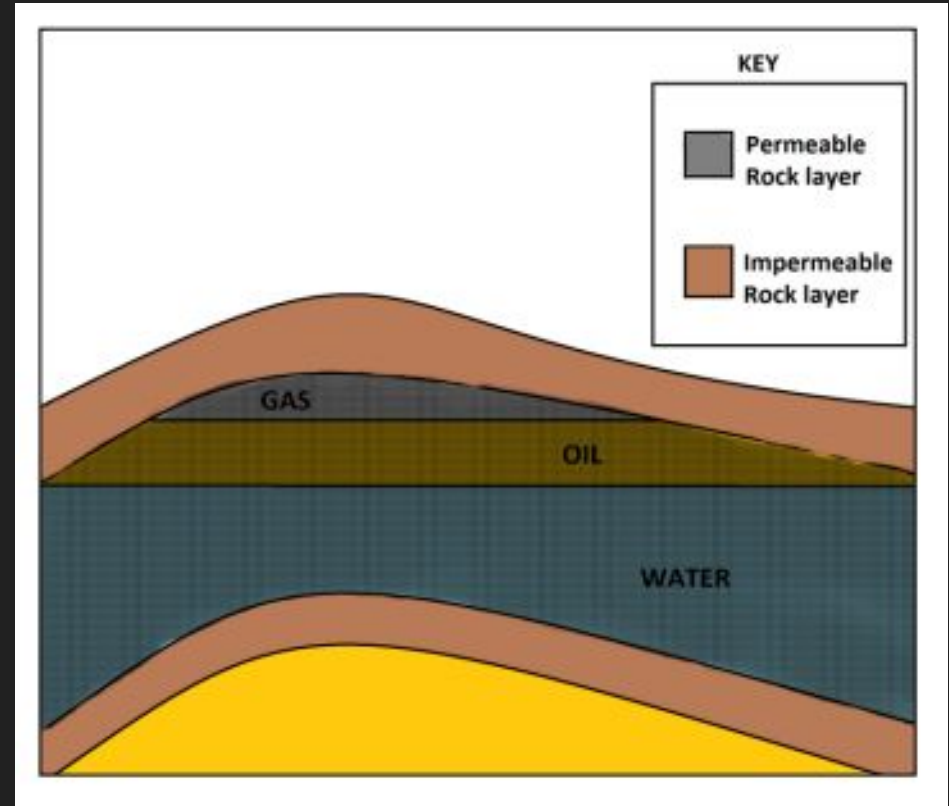
# Derrick

Firstly, the geo-physicists look for certain topographical characteristic of seabed or land. They look for an **anticline trap**.

Then they send a series of sound waves through the soil, which are bent and reflected by the different layers of rock below

The refracted and reflected waves or echoes are collected by special microphones on surface and data is collected and fed into powerful computers, which analyze it and build up an image of rock layers

They bring in a derrick or drilling rig on sea



# Derrick Continued

A tall, lattice-structured oil derrick is the central focus of the image, extending from the bottom towards the top. The structure is made of dark metal beams and is set against a background of a grey, overcast sky. The derrick's top section is slightly out of focus, while the lower parts are sharper. The overall tone is industrial and somewhat somber due to the weather.

Mud and water is sent down and retrieved, to remove rock which has been cut and also to cool the drilling rig

Once they reach a certain depth at which they believe they would find the oil, they retrieve the cutters and send other equipment, which sends sound wave through the rock

If it is feasible then drilling will resume and once the hydrocarbon field has been reached, gas at high pressure starts coming at from the well.

A cap with a pressure sensor and regulator is installed and connected with a pipeline to transport gas. After the gas has been exhausted oil flows out and is sent to a processing plant

# Factors affecting the Mineral production

1. Topography
2. Location
3. Commodity prices
4. Transport
5. Ownership / investment

# Effects of mining

1. Environmental
2. Minners
3. Economical



# Environmental impacts

- 1. Mining can have significant environmental effects, impacting ecosystems, water quality, air quality, and biodiversity**
- 2. Mining activities often involve the removal of vegetation and topsoil, leading to habitat destruction. This can result in the displacement or loss of plant and animal species, disrupting local ecosystems.**
- 3. This can also lead to soil erosion**
- 4. Mining operations can contaminate water sources through the release of chemicals, heavy metals**
- 5. Dust and emissions from mining operations can contribute to air pollution**
- 6. Certain mining processes release greenhouse gases, contributing to climate change. Or global warming**
- 7. Underground mining can cause land subsidence, where the land surface sinks or collapses due to the removal of underlying materials.**



# Economical impacts

- 1. mining can have social impacts, such as displacement of communities, changes in traditional land use, and conflicts over resource access.**
- 2. One of the most direct economic benefits of mining is the creation of jobs**
- 3. Mining can generate substantial revenue for governments through taxes, royalties, and other fees imposed on mining companies. These revenues can be used for public infrastructure, social programs, and other development initiatives.**
- 4. mining operations may lead to the establishment of businesses providing equipment, logistics, and other support services.**
- 5. Mining projects often require significant infrastructure development, including roads, railways, ports, and energy facilities.**
- 6. countries that export minerals, mining can be a major source of foreign exchange earnings.**
- 7. the presence of valuable mineral deposits can attract foreign and domestic investment**

# Pakistan Imports

## ➤ IRON AND STEEL

Pakistan imports around \$400 million worth of iron and steel related products annually from countries like Japan, Russia, and Ukraine etc

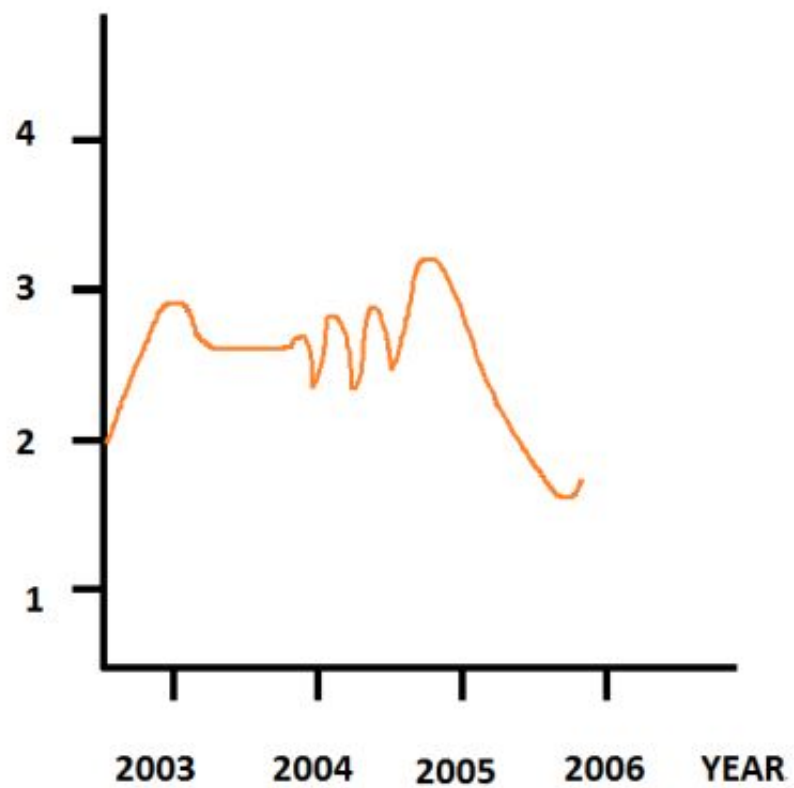
## ➤ CRUDE OIL AND PETROLEUM PRODUCTS

Pakistan imports around \$5 billion worth of these products, from countries like Saudi Arabia, UAE and Qatar etc

## ➤ COAL

Pakistan imports around \$300 million of coal and related products from countries like South Africa and Indonesia

PRODUCTION /million tonnes



# NATURAL GAS OF PAKISTAN

## ➤ RESERVES AND DEMAND

Pakistan's gas reserves are around 27-42 trillion cubic feet, while annual production is 900,000 million cubic feet. So at current rate of consumption the reserves will last around 30-45 years

## ➤ USAGE AND TRANSPORT

Natural gas is used as a fuel for cars, about 2.5 million of them in Pakistan. Also, it is used for making fertilizers, for cooking, making hydrogen and other organic compounds like methanol etc

Natural gas is transported on land by two means; pipelines and cylinders. The infrastructure of pipelines in Pakistan will be explained later. The use of cylinders means that only little amount of gas can be carried at once. Refilling takes time, risk of explosion due to faulty cylinders is an added concern. The cylinders are heavy and difficult to move

The demand for natural gas is increasing due to use of CNG to run cars, making fertilizers (more demand), to generate power as it is cheaper than oil and coal, used for cooking in homes (as it burns cleanly and is easy to transport)

## Distribution of Gas Pipeline Network

### ➤ Sindh

- Two pipelines meet at Karachi. One branches east and crosses Indus. It connects Hyderabad with other gas producing fields in Lower Sindh and in Northern Sindh like Khairpur. This pipeline then enters Balochistan. From these fields does this pipeline start
- While the other runs on the west bank of Indus connecting field of Sari (from where it originates) and then it enters Southern Punjab



## ➤ **Punjab and Khyber-Pakhtunkhwa**

- Pipeline enters Southern Punjab and connects Multan with Faisalabad. At Faisalabad, it branches into two; one heading towards Lahore and other towards Islamabad.
- The pipeline reaches Lahore and has now been extended to Sialkot
- The other upon reaching Islamabad extends towards Peshawar

## ➤ **Balochistan**

- A pipeline enters from Sindh and connects fields in Balochistan like Marri and Sui with Quetta

## ➤ RESERVES AND DEMAND

Pakistan's oil reserves are around 300-700 million barrels, while annual production is 24 million barrels. So at current rate of consumption the reserves will last around 12-30 years. To fulfil its demands, Pakistan imports around 116 million barrels per year

## ➤ USAGE AND TRANSPORT

Oil is used to make solvents, roads, jet fuel, wax, lubricants, fuel for cars, to produce electricity and polymers.

Oil is taken out from the ground at **OILFIELDS**, and it is separated into its constituent fractions (kerosene, petrol, diesel, wax etc) at **OIL REFINERIES**. Usually refineries are located closer to both oilfields and cities to reduce transport costs

# Oil Reserves of Pakistan

1. 300-700 million barrels
2. Can last 12-30 years
3. Make solvents, jet fuel, wax , lubricant , electricity



## REASONS FOR INCREASE IN OIL IMPORTS

- Increased electricity demand due to growing rural and urban population (homes). Most of electricity produced in Pakistan comes from these thermal power stations
- Growth of industries etc (wax, lubricants, solvents, fertilizers etc are manufactured locally to reduce import costs)
- Growing number of middle class families, which can afford cars etc (and buy refrigerators etc)
- Mechanization of farms (use of harvesters, tractors etc) which require fuel
- Use of diesel tubewell in villages to provide water for irrigation
- Use of new diesel locomotives in trains (modernization)
- Old oil wells have become less productive

- There has been a lack of foreign investments in oil fields of Pakistan because of institutional mismanagement

Oil is transported by pipelines and tankers. The oil pipelines network in Pakistan will be explained later. Tankers are used to transport oil where pipelines can't go (due to topography or low demand, which means project isn't feasible) or where pipelines don't exist. This in turn is expensive in the long run as pipelines may require a lot of capital to build but are cheap to maintain. Tankers on other hand themselves require fuel and maintenance. Heavy tankers also cause damage to roads



## Distribution of Oil Pipeline Network

### ➤ Sindh

- From the Port of Karachi, the **KMK pipeline** (Karachi to Mehmood Kot) originates. It carries imported oil and refined oil from refineries like Indus Refinery and Pakistan Refinery (both are in Karachi)
- From Port Qasim, the **White oil pipeline** begins; carrying refined imported oil north. The pipeline starts from the west bank of Indus river
- These two pipelines run on both banks of River Indus respectively and then enter into Southern Punjab

### ➤ Punjab

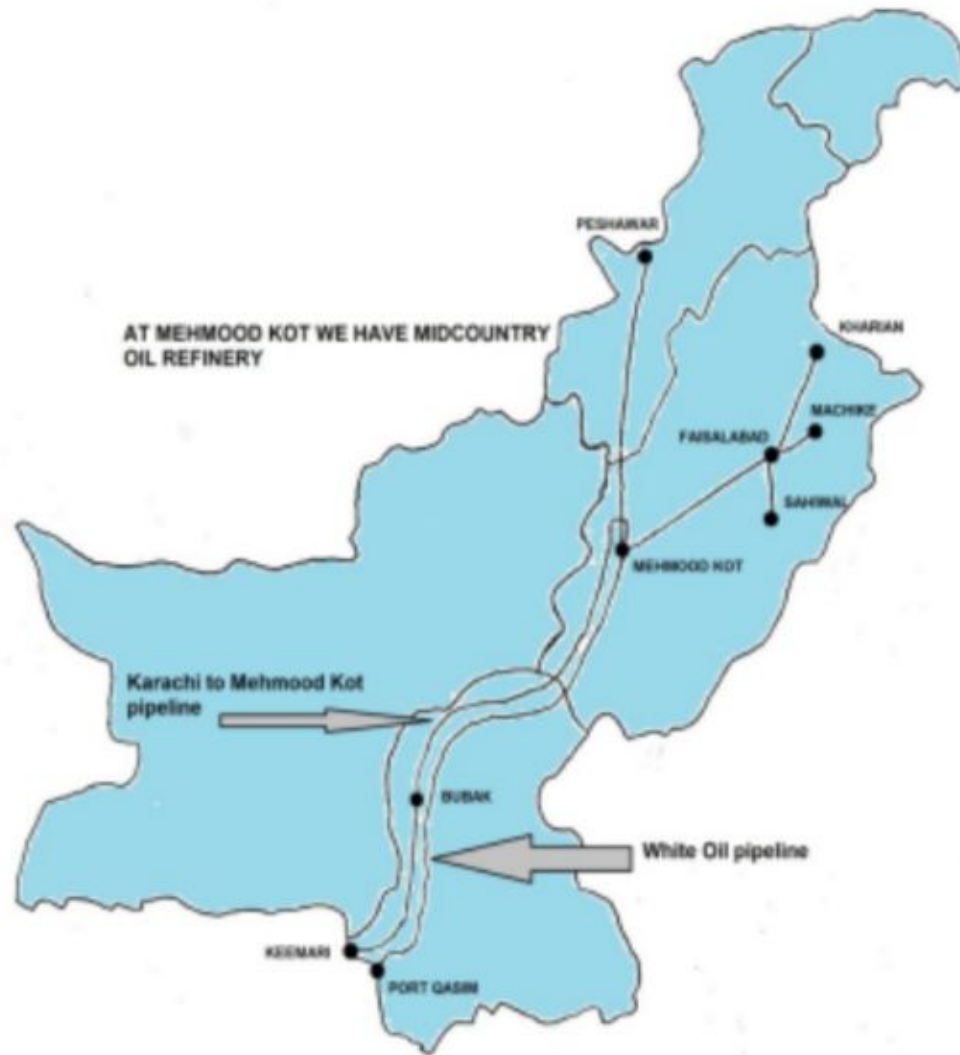
- These two pipelines meet at Mehmood Kot near Multan at **Mid-Country Oil Refinery** (serves demand of oil in Southern Punjab, Khyber-Pakhtunkhwa etc). From the refinery one pipelines branches east and other branches west into Khyber-Pakhtunkhwa
- The one that goes east it connects with Faisalabad. From there it heads in three directions that is North towards Kharian, South towards Sahiwal and East towards Machike

### ➤ Khyber-Pakhtunkhwa

- Pipeline enters from central Punjab and goes to Peshawar

## ➤ Balochistan

- A pipeline enters from Karachi into Hab, where the Hab Refinery refines oil to be used by industry in Hub Tehsil



# COAL

1. Pakistan's coal reserves are around 185,000 million tonnes, current production is 3 million tonnes
2. The main problem with coal found in Pakistan is its quality. Quality is judged from variety of factors including carbon content, moisture content, ash and sulphur content, and last but not least the heating value. Most of coal found in Pakistan falls around either lignite or sub-bituminous category

# Types of coal

**Lignite**, also referred to as brown coal, is the lowest rank of coal and used almost in cooking and domestic use

**Sub-bituminous coal**, whose properties range from those of lignite to those of bituminous coal, is used primarily as fuel for steam-electric power generation.

**Bituminous coal**, dense mineral, black but sometimes dark brown, used primarily as fuel in steam-electric power generation, with substantial quantities also used for heat and power applications in manufacturing and to make coke

## Coals from pakistan and which is better.

1. Coal from **Thar** has lower ash and sulphur content and higher heating value as compared to field at Lakhra. **Sindh (lignite to sub-bituminous.)**
2. **Lakhra** coal dries up and has lower moisture content when brought to surface but it crumbles when exposed to air and can combust
3. Coal from **Sor** has low ash and sulphur content and high carbon content, as compared to all coalfields in **balochistan.**  
(sub-bituminous to bituminous.)
4. Coal from **Makerwal** is superior as it has high carbon, **punjab and Kpk (sub- bituminous to bituminous.)**

# Uses

A large pile of dark coal dominates the foreground and middle ground. In the background, a yellow excavator is visible, partially obscured by the coal pile. The sky is a pale, overcast grey.

1. Most of coal found in Pakistan is used to make bricks around 80%
2. Rest is used by cement industry, which blends it with imported coal to reduce their costs.
3. The coal used for power generation is first washed to reduce its sulphur and ash content.
4. Coal can also be turned into a gas, and then used as a fuel