

## 18BGE52C- GEOGRAPHY OF WORLD RESOURCES-UNIT 3

### Iron Ore

Iron ore is the source of primary iron for the world's iron and steel industries. It is therefore essential for the production of steel, which in turn is essential to maintain a strong industrial base. Almost all (98%) iron ore is used in steelmaking. Iron ore is mined in about 50 countries. The seven largest of these producing countries account for about three-quarters of total world production. Australia and Brazil together dominate the world's iron ore exports, each having about one-third of total exports.

The iron ore is found in following four types:

**Magnetite:** It is the most important and best kind of iron ore. It contains about 72 percent metallic iron in it. It is black in colour.

**Hematite:** It is also an important source. It contains about 60-70 percent metallic iron in it. It is red and brown in colour.

**Limonite:** It contains about 30 to 40 percent metallic iron in it. It is mostly yellow in colour. It is a low-grade iron ore.

**Siderite:** It has more impurities. It contains about 48 percent metallic iron content in it. It is brown in colour. It contains a mixture of iron and carbon. It is a low-grade iron ore.

#### **Distribution of Iron ore across the world**

Iron ore is widely distributed around the world. China is the world's largest producer of iron-ore followed by Brazil and Australia at the second and third position respectively.

Majority of the world's total reserves of iron ore of 3,20,000 million tonnes is located in North America, Russia, United Kingdom, Brazil, South Africa and India.

#### **Russia**

It has one of the largest proven reserves of iron ore. Important iron-producing regions of Russia are the Ural region, Kuzkas region in Siberia, Angara and Krasnoyarsk.

#### **Ukraine**

Good quality ore with high iron content is found in Kirvoij Rog region of Southern Ukraine, Kursk Magnetic Anomaly(KMA) and Kerch peninsula.

#### **Europe**

Sweden is an important region where good quality iron ore is found. Major areas of iron-ore mining in Sweden include Kiruna, Gallivare and Danmora. Another important region is Lorraine in France. Apart from this, Normandy, Pyrenees, Selsia and Phalia region of Germany, and Cleveland, Midland and Scotland region of United Kingdom are major mining ore areas of Europe.

#### **North America**

The major iron ore mining areas are the Lake Superior region including Mesabi, Vermillion, Marquette, Cuyana, Manomimi and Gogebic; Alabama state including the Birmingham and Red Mountain region of South Applatians; and in Canada including the Wright, Sept Isles and Schefferville regions.

**South America**

Brazil is known for its one of the largest reserves of iron ore in the world. Other important regions of iron ore mining are Orinoco Valley of Venezuela and La Sarena area of Chile.

**Africa**

The major iron ore mining areas of Africa are Liberia, South Africa, Algeria, Morocco and Tunisia. The iron and steel industry of Africa is still under-developed. As a result, most of the iron is exported.

**Australia**

Pilbara region, Mt. Goldsworthy, Mt. Tom Price, Mt. Newman, Tailoring peak, Kalanooka region, Queensland, New South Wales and Tasmania are important iron ore bearing areas of Australia.

**Asia**

China has large iron ore reserves in Shenyang region of Manchuria; Muhar and Tahyeh region of Xinjiang valley. The Philippines has also good quality iron ore deposits in Mindanao.

**Distribution of Iron Ore in India**

India is one of the richest countries of the world in iron ore deposits, particularly the hematite ore. According to the latest Indian Year Book, 95 percent of the hematite resources are distributed in Odisha, Jharkhand, Karnataka and Goa. Magnetite resources are estimated at around 10,619 million tons out of which only 59 million tons is situated mainly in Goa, Rajasthan and Jharkhand. The rest 10,560 million tons or the 99 percent of the magnetite resource is in 'Remaining Resources' category which is mainly found in Karnataka (74 percent) and Andhra Pradesh (14 percent).

---

# Bauxite

## World Distribution of bauxite

The important bauxite producers are (their percentage in world's production is given in bracket): Australia (31.34%), China (18.41%), Brazil (13.93%), Guinea (8.36%), Jamaica (3.98%), Russia (1.64%), Venezuela (2.39%), Surinam (1.99%), Kazakhstan (2.44%), Greece (1.09%), Guyana (0.60%) and Vietnam (0.01%).

Australia is the largest producer of bauxite in the world. It accounts for 31.34 per cent of the world's production of bauxite and also has about 40 per cent of the bauxite reserves. The Cape York Peninsula, New South Wales and Western Australia are the main bauxite-producing provinces.

China accounts for 18.41 per cent of the world's total bauxite production and ranks second in production. Hunan, Guichou and Sichuan are the main bauxite mining provinces.

Brazil is the third largest producer of bauxite in the world and contributes 13.93 per cent to world production. The central region is the main producing area.

India ranks 4th in bauxite production in the world and produces 11 per cent of the world production in 2009. Madhya Pradesh, Chhattisgarh, Jharkhand, Odisha, Maharashtra, Andhra Pradesh, Tamil Nadu and Gujarat are the major producers of bauxite. Guinea produces more than 8 per cent bauxite of the world and ranks 5th in the world.

Jamaica is also a leading producer of bauxite, contributing about 4 per cent of the world's output. Jamaica is also having large reserves of bauxite. The other bauxite-producing countries are Venezuela, Surinam, Kazakhstan, USA, Greece, Guyana, Indonesia, Hungary, France, Russia, Turkey, Malaysia, Ghana, Sierra Leone, British Guiana, etc.

## World Distribution of coal reserves

# Copper

Copper is found in every continent and produced in more than 40 countries of the world.

- Area distribution: Copper ore resources are abundant in the world, and mainly distributed in North America, Latin America and central Africa.
- Country distribution: In the world, copper resources are mainly concentrated in Chile, the United States, Zambia, Russia and Peru. Chile is the country with the richest copper resources in the world, its copper metal reserves accounting for around 29% of the worldwide total. At the same time, Chile is the world's largest copper producer and exporter.
- The figures of copper reserves reported by the United States Geological Survey (USGS) in 2014 were as follows:

Reserves (Data in thousand metric tons of copper content)	
United States	39,000
Australia	87,000
Canada	10,000
Chile	190,000
China	30,000
Congo (Kinshasa)	20,000
Indonesia	28,000
Kazakhstan	7,000
Mexico	38,000
Peru	70,000
Poland	26,000
Russia	30,000
Zambia	20,000
Other countries	90,000
World total (rounded)	690,000

- Production and consumption

Mine production (Data in thousand metric tons of copper content)		
Country	2012	2013
United States	1,170	1,220
Australia	958	990
Canada	579	630
Chile	5,430	5,700
China	1,630	1,650
Congo (Kinshasa)	600	900
Indonesia	360	380
Kazakhstan	424	440
Mexico	440	480
Peru	1,300	1,300
Poland	427	430
Russia	883	930
Zambia	690	830
Other countries	2,000	2,000
World total (rounded)	16,900	17,900

# Gold

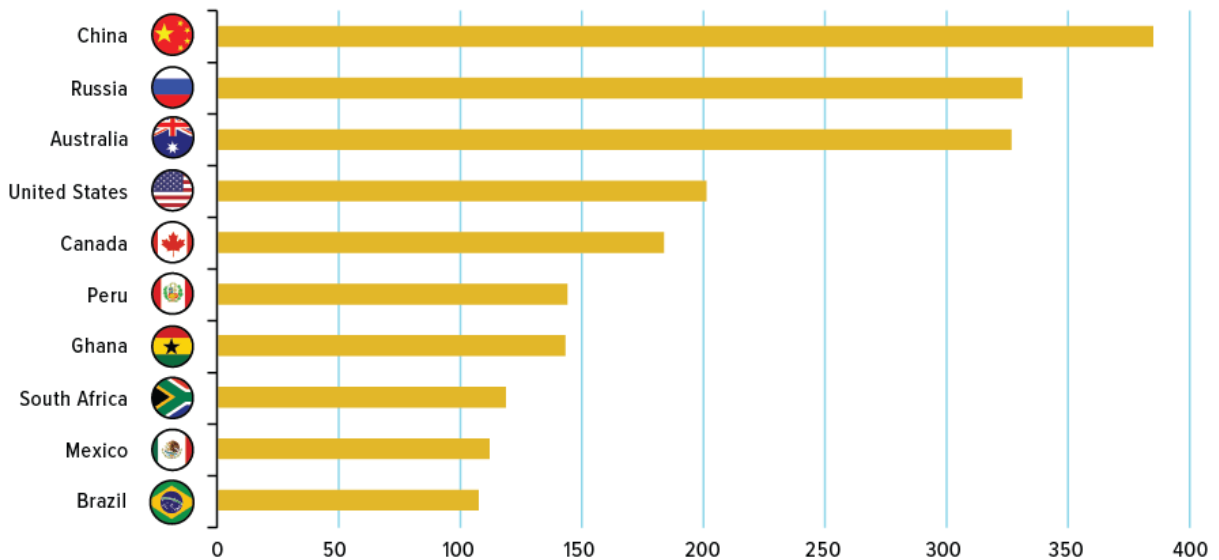
Gold is one of the rarest elements in the world, making up roughly 0.003 parts per million of the earth's crust. In 2019, global gold mine production was a reported 3,463.7 tonnes – down one percent from the year prior – and the first year-over-year decline in output since 2008. Gold production has remained relatively steady since 2010,.

Gold has already been discovered and explorers have to dig deeper to find economically viable deposits. For example, South Africa was once the top gold-producing country by far, digging up over 1,000 tonnes in 1970, but annual output has fallen steadily since. On the other hand, several nations have emerged in the last few years as growing gold producers.

China takes the number one spot of global gold producers by a wide margin. The top 10 rankings saw a big shift in 2019 – Russia took the lead over Australia to claim second, Indonesia fell off the list and Brazil joined the ranks as the tenth largest producer. Ghana also jumped ahead of South Africa to become the continent's top producer.

## Top 10 Gold Producing Countries in 2019

Annual Gold Output in Tonnes



Source: World Gold Council, U.S. Global Investors

Until 2006 South Africa was the world's largest gold producer. In 2007 increasing production from other countries and declining production from South Africa meant that China became the largest producer, although no country has approached the scale of South Africa's period of peak production during the late 1960s and early 1970s. In 1970 South Africa produced 995 tonnes or 32 million ounces of gold, two-thirds of the world's production of 47.5 million ounces.

# Manganese

Manganese is a chemical element with the symbol Mn and atomic number 25. It is not found as a free element in nature, it is often found in minerals in combination with iron. Manganese is a transition metal with a multifaceted array of industrial alloy uses, particularly in stainless steels. Manganese phosphating is used for rust and corrosion prevention on steel. Ionized manganese is used industrially as pigments of various colors, which depend on the oxidation state of the ions. The permanganates of alkali and alkaline earth metals are powerful oxidizers. Manganese dioxide is used as the cathode (electron acceptor) material in zinc-carbon and alkaline batteries.

## **China:**

China now emerged as a highest manganese-producing country in the world. Its production in 2007 was 3,16,500 metric tons which was 21.6 per cent of the total world production. The major manganese-producing areas of China are Kiangsi, Hunan, Kuangsi, Kwangtung, Kuangsi and Kwichou.

## **Kazakhstan:**

It is the second largest producer of manganese in the world. Its production in 2007 was 23, 69,000 metric tons, which was 16.2 per cent of the world production.

## **South Africa:**

It produces about 1.62 million tons of manganese annually. It ranks third in the world and its share is 11 per cent in the world manganese production. The important manganese-producing area of South Africa is the Cape Province where Krugersdorp, Postonaburg, Manganore are the major mining areas.

## **Australia:**

The manganese production of Australia is 7.6 per cent of the total world production. The manganese-producing areas are located in Leonara, Victoria, Queensland and Woodie

## **India:**

Although India ranks 8th in the production of manganese in the world, but its reserves are of considerable importance because it possesses the largest manganese reserves in the world. At present, manganese is produced in Odisha, Madhya Pradesh, Chhattisgarh, Maharashtra, Jharkhand, Andhra Pradesh and Karnataka.

It produced nearly 4.7 per cent manganese output of the world. The main manganese reserves exist in a 1,250 km long belt stretching from Vadodara (Gujarat) in the west to the Damodar valley (Jharkhand) in the east.

# Coal

Coal is a widespread resource of energy and chemicals. Although terrestrial plants necessary for the development of coal did not become abundant until Carboniferous time (358.9 million to 298.9 million years ago), large sedimentary basins containing rocks of Carboniferous age and younger are known on virtually every continent, including Antarctica (not shown on the map).

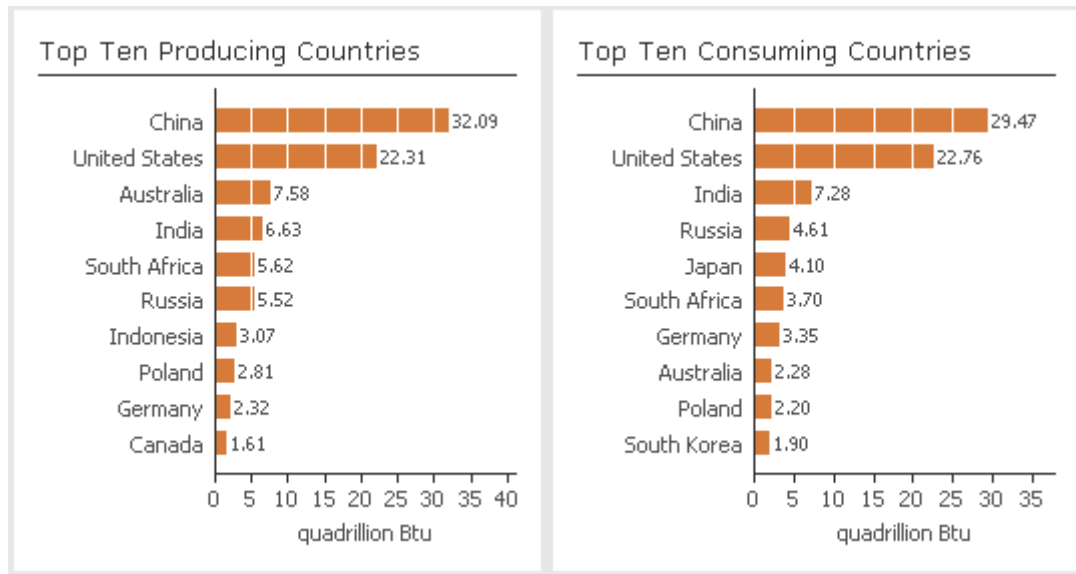
The presence of large coal deposits in regions that now have arctic or subarctic climates (such as Alaska and Siberia) is due to climatic changes and to the tectonic motion of crustal plates that moved ancient continental masses over Earth's surface, sometimes through subtropical and even tropical regions.

World coal reserves and resources are difficult to assess. Although some of the difficulty stems from the lack of accurate data for individual countries, two fundamental problems make these estimates difficult and subjective. The first problem concerns differences in the definition of terms such as proven reserves (generally only those quantities that are recoverable) and geological resources (generally the total amount of coal present, whether or not recoverable at present).

- Most of the Russia's coal in Siberian Region is untapped.
- Carboniferous coal of Great Lakes and Appalachians region helped USA become a leading industrialized nation.
- Coal reserves in Ruhr and Rhineland region coupled with rich iron deposits have made Germany a leading industrial super power of Europe.
- England too benefited immensely from its coal reserves of South Wales, Yorkshire, Manchester, Liverpool etc. Industrial revolution began here mainly due to rich coal reserves.
- Brazil is a leading coal producer in South America. Most of the coal goes into power generation. Excess production is exported to China.
- Australia is a leading producer of coal. Most of its coal is exported to China, Japan etc. Australia has rich coking coal deposits. India imports coking coal mainly from Australia.
- China's coal is of poor quality. It imports metallurgical grade coal from Australia.
- South Africa is the only region in Africa with significant amount of coal reserves.

Nearly 75 percent of the world's recoverable coal resources are controlled by five countries: the United States (about 22 percent), Russia (about 15 percent), Australia (14 percent), China (about 13 percent), and India (about 10 percent).

## Coal producing and Consuming Countries



## Petroleum

Petroleum is not distributed evenly around the world. Slightly less than half of the world's proven reserves are located in the Middle East (including Iran but not North Africa). Following the Middle East are Canada and the United States, Latin America, Africa, and the region made up of Russia, Kazakhstan, and other countries that were once part of the Soviet Union.

The amount of oil and natural gas a given region produces is not always proportionate to the size of its proven reserves. For example, the Middle East contains approximately 50 percent of the world's proven reserves but accounts for only about 30 percent of global oil production (though this figure is still higher than in any other region). The United States, by contrast, lays claim to less than 2 percent of world's proven reserves but produces roughly 16 percent of the world's oil.

Two overriding principles apply to world petroleum production. First, most petroleum is contained in a few large fields, but most fields are small.

Second, as exploration progresses, the average size of the fields discovered decreases, as does the amount of petroleum found per unit of exploratory drilling.

The world's proven reserves but produces roughly 16 percent of the world's oil.

Since the construction of the first oil well in 1859, some 50,000 oil fields have been discovered. More than 90 percent of these fields are insignificant in their impact on world oil production. The two largest classes of fields are the supergiants, fields with 1 billion or more barrels of ultimately recoverable oil, and giants, fields with 500 million to 5 billion barrels of ultimately recoverable oil. Fewer than 40 supergiant oil fields have been found worldwide,



yet these fields originally contained about one-half of all the oil so far discovered. The Arabian-Iranian sedimentary basin in the Persian Gulf region contains two-thirds of these supergiant fields. The remaining supergiants are distributed among the United States, Russia, Mexico, Libya, Algeria, Venezuela, China, and Brazil.

### **Major oil-producing countries**

As mentioned above, petroleum resources are not distributed evenly around the world. Indeed, according to estimates published for 2015 by the U.S. Department of Energy, as few as 15 countries account for more than 75 percent of the world's oil production and hold roughly 93 percent of its reserves. Significantly, those countries are projected to have a correspondingly large percentage of the world's remaining undiscovered oil resources, which are estimated by the extrapolation of known production and reserve data into untested sediments of similar geology.

### **Saudi Arabia**

Saudi Arabia has the second largest proven oil reserves in the world—some 268 billion barrels, approximately 16 percent of the world's proven reserves—not to mention significant potential for additional discoveries. The discovery that transformed Saudi Arabia into a leading oil country was the Al-Ghawār oil field. Discovered in 1948 and put into production in 1951, this field has proved to be the world's largest, generating an estimated 55 billion barrels after 60 years of production. Saudi officials estimate that this field contains more than 120 billion barrels in recoverable reserves, if waterflooding (that is, water injection that forces oil from the oil reservoir) is considered. Another important discovery was the Saffāniyyah offshore field in the Persian Gulf in 1951. It is the third largest oil field in the world and the largest offshore. Saudi Arabia has eight other supergiant oil fields. Saudi fields, as well as many other Middle Eastern fields, are located in the great Arabian-Iranian basin.

### **Iraq, Kuwait, and Iran**

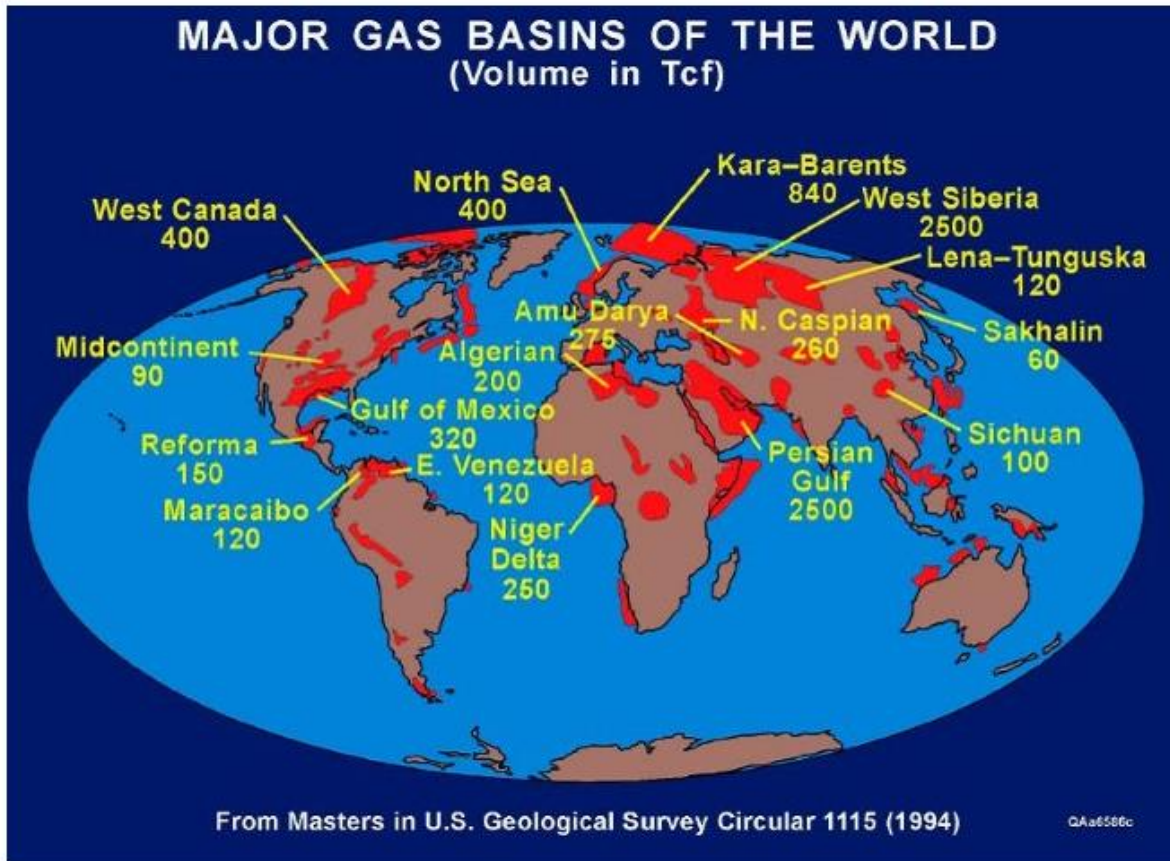
The Middle Eastern countries of Iraq, Kuwait, and Iran are each estimated to have had an original oil endowment in excess of 100 billion barrels. Together they account for more than 23 percent of all proven reserves in the world. These countries have a number of supergiant fields, all of which are located in the Arabian-Iranian basin, including Kuwait's field at Al-Burqān, which was discovered in 1938. Al-Burqān is the world's second largest oil field, having originally contained 75 billion barrels of recoverable oil. Iraq possesses a significant potential for additional oil discoveries, primarily in its southwestern geographic region, where an estimated 45–100 billion barrels of crude oil are thought to reside. This resource has been slow to develop, because of the country's involvement since 1980 in major wars and subsequent civil unrest.

## Natural gas

- Consists primarily of methane and
- Propane, butane, pentane, and hexane are also present.
- Liquefied petroleum gas (LPG) == Mixture of butane and propane.
- Commonly occurs in association with crude oil.
- Natural gas is often found dissolved in oil or as a gas cap above the oil.
- Sometimes, pressure of natural gas forces oil up to the surface. Such natural gas is known as associated gas or wet gas.
- Some reservoirs contain gas and no oil. This gas is termed non-associated gas or dry gas.
- Often natural gases contain substantial quantities of hydrogen sulfide or other organic sulfur compounds. In this case, the gas is known as “sour gas.”
- Coal bed methane is called ‘sweet gas’ because of its lack of hydrogen sulfide.

### Uses of Natural Gas

- Electric power generation.
- Industrial, domestic, and commercial usage.
- Many buses and commercial automotive fleets now operate on CNG.
- It is an ingredient in dyes and inks .
- Used in rubber compounding operations.
- Ammonia is manufactured using hydrogen derived from methane. Ammonia is used to produce chemicals such as hydrogen cyanide, nitric acid, urea, and a range of fertilizers.



### Natural Gas in Russia

- Russia has the largest natural gas reserves in the world (1,680 Trillion Cubic Feet (tcf)).
- It periodically changes place with the United States as the world's largest or second largest producer.
- Some of the world's largest gas fields occur in a region of West Siberia and east of the Gulf of Ob on the Arctic Circle. The world's largest gas field is Volga-Urals region also has significant gas reserves.

### Natural Gas in Europe

- Dutch coast and the North Sea (off the coast of Norway) have proven reserves.

### Natural Gas in North America

- The United States has proven natural gas reserves of 273 tcf.
- Its largest gas field, Hugoton extends through the Oklahoma, Texas and Kansas.
- Canada has an estimated 62 tcf of proven natural gas reserves.
- The largest gas field is in Alberta.
- Much of Mexico's natural comes from Gulf of Mexico.

### Natural Gas in Africa

- Central basin of Algeria and Niger Delta have proven reserves.

### Natural Gas in Middle East

- There is an enormous gas potential in the Middle East associated with the major oil fields in the Arabian-Iranian basin.

- Iran and Qatar have the second and third largest natural gas reserves in the world, behind Russia.

### **Natural Gas in Asia**

The largest gas field in Asia is in the North Sumatra basin of Indonesia.

### **OPEC – Organization of Petroleum Exporting Countries**

12 member oil supply cartel.

Iran, Iraq, Kuwait, Saudi Arabia, Venezuela, and later joined by Qatar, Indonesia, UAE, Libya, Algeria, Nigeria, Gabon and Angola.

This group bargains with international Oil Companies so that profit margin will be high. They control production and supply [for better profit margin] of crude oil to keep it below international demand.

It is only recently that Crude oil's prices have crashed due to shale boom in US — the largest importer of oil and gas.

### **Hydroelectric Power Generation**

- Most people associate the use of water power with the damming of rivers, but hydroelectric energy can also be generated by the harnessing of the tides.
- A hydrogenerating station generally consists of a dam that traps a large quantity of water, a spillway that releases surplus water in controlled fashion and a powerhouse.
- Hydroelectricity is produced by harnessing the gravitational force of flowing water.
- Compared to fossil fuel-powered energy plants, hydroelectric power plants emit fewer greenhouse gases. But the construction of hydroelectric power plants and dams requires huge investment.
- According to the International Hydropower Association's 2017 Hydropower Status Report, an estimated 31.5 gigawatts (GW) of hydropower capacity was put into operation in 2016, bringing the world's cumulative installed capacity to 1,246 GW.
- China alone accounted for almost one third of global hydropower capacity and added about 11.74 GW of new capacity in 2016.

### **Nuclear power plants**

- As nuclear power plants are considered to be a low-carbon energy source, the technology is widely thought of as a more environmentally-friendly option.
- When compared to renewable sources of energy such as solar and wind, the power generation from nuclear power plants is also considered to be more reliable.
- Although the investment required to bring a nuclear power plant online is significant, the costs involved in operating them are relatively low.
- Nuclear energy sources also have a higher density than fossil fuels and release large amounts of energy.
- Due to this, nuclear power plants require low quantities of fuel but produce a vast amount of power, making them particularly efficient once they are up and running.

### **Coal-fired power plants**

- According to the World Coal Association, coal-fired power plants accounted for about 37% of global electricity in 2018, with China possessing the world's largest fleet.
- Coal-fired power plants use steam coal as a source to generate electricity and consequently emit a significant amount of harmful gases into the atmosphere.
- In a bid to reduce greenhouse gas emissions, many developed nations have already announced plans to phase out coal-fired power plants.
- Canada plans to phase out its coal plants by 2030, while the UK has set a deadline of 2025 and Germany is aiming to remove the technology from its electricity grid by 2038. A number of other European countries are expected to following suit soon.

### **Diesel-fired power plants**

- Using diesel as the fuel, this type of power plant is used for small-scale production of electric power.
- They are installed in places where there is no easy availability of alternative power sources and are mainly used as a backup for uninterrupted power supply whenever there are outages.
- Diesel plants require only a small area to be installed and offer higher thermal efficiency compared to coal-fired power plants.
- Due to high maintenance costs and diesel prices, the power plants have not gained popularity at the same rate as other types of power generation plants such as steam and hydro.

### **Geothermal power plants**

- The three main types of geothermal plants include dry steam power stations, flash steam power stations and binary cycle power stations, all of which use steam turbines to produce electricity.
- The installed capacity of geothermal energy has gradually increased worldwide over the past decade, up from just short of 10 GW in 2010 to almost 14 GW in 2019.
- Geothermal power plants are considered to be environmentally friendly and emit lower levels of harmful gases compared with coal-fired power plants.