General Knowledge Today

Infra-1-Cement, Coal, Thermal, Hydel, Wind, Solar Power

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Contents

Model Questions

1. *"Fly Ash was once discarded as a waste but today, it is increasingly emerging as a major input material in several industries." Discuss.*
2. Explain the distribution of coal resources of India throwing light on the coal quality and its impact on India's economy.
3. *"The supreme court decision regarding cancellation of the coal blocks was a logical outcome of flawed captive mining policy."* Discuss critically.
4. *"Coal mines were nationalized because of the shortcomings in the way it was run by private parties."* In the light of the above statement, critically discuss the implications of the enabling provisions made in Coal Mines (Special Provisions) Act, 2015 towards commercial mining of coal in India.
5. *"The past and present government have resorted to allocate coal mines on such a premise that the coal blocks of the country are just waiting to be exploited."* Critically examine in the light of environment concerns.
6. The Ultra Mega Power Projects were envisioned under the "Power for all" vision in 11th five year plan. However, so far only two UMPPs are producing power. Critically examine the issues that derailed this government initiative.
7. Discuss the various reasons behind poor financial performance of the State Electricity Boards citing various government efforts to tackle the problem.
8. *"The operational needs of hydro & thermal stations are complimentary and the balanced mix helps in optimal utilization of the capacity." Explain.*
9. *"India is making significant progress in the development of the onshore wind power plants. However, so far progress in the offshore wind power generation has been almost nil."* Why progress in offshore wind farming is important? Discuss citing key challenges and the recently launched National Offshore Wind Power Policy.
10. Critically examine various constraints in use of rooftop PVs in India in the light of recently scaled up targets of Jawaharlal Nehru National Solar Mission.
11. The NDA Government has scaled up the target of Jawaharlal Nehru National Solar Mission to five fold at 1,00,000 MW (100GW) to be achieved by 2022. Do you think this target is realistic? Argue.

Cement Industry

Basic Facts About Cement

Discoverer of Portland Cement

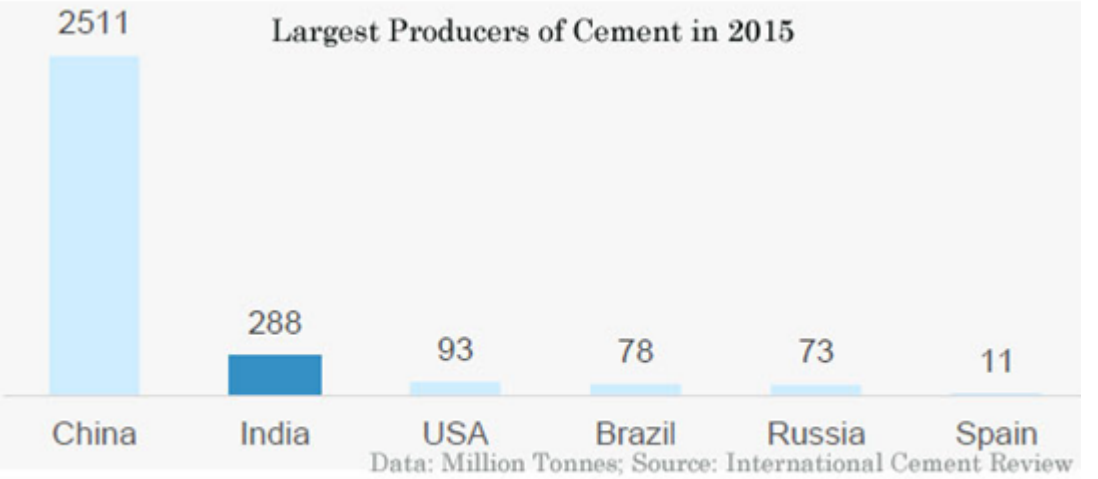
- Portland Cement was discovered by **Joseph Aspdin** in 1824. He called it Portland cement because what he discovered resembled the limestone found in Portland.

Historical Facts

- In 1904, a small cement factory South India Industrial Ltd. was established in Madras in 1904.
- The first large scale cement manufacturing company was Indian Cement Company Ltd. that started producing cement in 1914 at Porbundar in Gujarat. Other units included Katni (Madhya Pradesh 1915) and Lakheri (Rajasthan 1916).
- In those days, Cement was an import material, but due to availability of raw material, cheap labour etc. the industry grew very soon. In World War-I period, the above three factories came under the control of the government.
- In 1936, all the cement companies except one agreed and formed **Associated Cement Companies Ltd. (ACC).** Government launched Cement Expansion Scheme in 1948 to launch new cement factories. In five year plans also, cement industry got due care.

India's position in Global Cement Production

- Currently, India is second largest producer and consumer of cement after China. However, China's production is nearly nine times higher than India.



Number of plants and production data

- There are two types of plants in Indian cement industry viz. Large plants and Mini / white

cement plants. There are 188 large plants with installed capacity of 378mtpa and current (2015) production is 246mt.

- The number of Mini / white cement plants is 365 with total installed capacity of 11.7mtpa and production 33.66 mt.

Largest Producer States

- Maximum number of large cement plants are located in Andhra Pradesh, followed by Tamil Nadu & Rajasthan. Andhra Pradesh and Rajasthan are largest cement producing states while Maharashtra is largest consumer state of Cement.

Cement Clusters

There are 7 cement clusters in India, which account for around half of production.

1. Satna (Madhya Pradesh),
2. Chandrapur (North Andhra Pradesh and Maharashtra),
3. Gulbarga (North Karnataka and East AP),
4. Chanderia (South Rajasthan + Jawad & Neemuch in MP),
5. Bilaspur (Chhattisgarh),
6. Yerraguntla (South AP),
7. Nalgonda (Central AP).

Major Cement Companies

- Cement Industry is private sector dominated. ACC is India's largest cement producer. Other largest players are Gujarat Ambuja, Ultratech, Grasim, India Cements, JK Group, Jaypee Group, Century, Madras Cements, Birla Corp.

Per Capita Consumption

- In 2014, India's per capita consumption of cement was 225 kg; which is much lesser than the developed and other developing economies.

National Council for Cement and Building Materials

- This is a registered society that provides scientific, technological and industrial services support to the cement, related building materials and construction industries and carries on its activities through its units located at Ballabgarh, Hyderabad and Ahmadabad.

Cement Making – From Slurry to Clinker to Cement

- Limestone (CaCO3) in 3 parts, and Clay in 1part are the raw material to make cement. These are mixed, grinded and water is added to make "slurry".
- This slurry is heated to 1400-1500°C in rotary kiln. At 1000°C, the $CaCO_3$ breaks into Quick Lime (CaO) and CO_2. CaO reacts with Silica (SiO_2), Alumina (Al_2O_3) and Ferric oxide (Fe_2O_3) in clay and gives a hard substance called "Clinker", which is actually a mixture of dicalcium

silicate, tricalcium silicate and tricalcium aluminate.

- Clinker is mixed with some 2-5% Gypsum and then grinded to fine powder which is called Cement. Gypsum is often added to Portland cement to prevent early hardening or "flash setting". The more time it takes, more adequately is it hardened.
- Virtually all the cement produced globally is mixed with sand, aggregates and water, and used to make concrete and mortars. Concrete is second only to water as the most consumed substance on earth, with nearly three tons used annually for each person on the planet.

Grades of Cement

- Various grades of cement such as 43, 53 etc. correspond to the average compressive strength attained after 28 days. Better is the grade, better is compressive strength.

Hydraulic Cement

- Portland Cement is called hydraulic cement because it hardens and sets faster due to chemical reaction with water.

Dry Process v/s Wet Process

- Cement is produced using the wet, the semi-dry, and the dry processes. In 1960, the wet process accounted for 90% of the production. It has now decreased to around 10%. The dry process accounts for around 90% of India's cement production. The semi-dry process never played an important role in Indian cement production. Its share in total installed cement capacity has been small over time. It currently accounts for 2% of total production

White cement

White Portland cement is made from raw materials containing **little or no iron or manganese**, the substances that give conventional cement its gray color. So the secret of the White cement is raw material. Apart from that only whitest chalk is used together with light colored sand in production of white cement. White cement production needs usually 40% higher energy than the normal grey cement and this contributes to the high price of white cement.

The difference between ordinary cement and while cements are thus as follows:

- The amount of chromium, manganese, iron compounds is significantly less in white cement in comparison to gray cement
- Production of white cement consumes significantly more energy in comparison to gray cement

Kindly note that the setting behaviour and strength development of white cement is almost equivalent to grey cement. Further, Gypsum is used in the making of both white cement and ordinary grey cement.

Environmental Issues of Cement

Environment Concerns of Cement

The cement making process involves a lot of pollution and has been under the criticism for environment concerns. Under the Prevention and Control of Pollution (Uniform Consent Procedure) Rules, 1999, Cement has been classified as a RED industry, signifying heavy pollution and covered under Central Action Plan. Almost every stage in cement production causes air and noise pollution. With reference to Indian Cement Industry, the following are specific issues begetting environment problems:

- Limestone is the major raw material used in production of cement. In comparison to other countries, India's limestone is of low grade with low calcium carbonate content.
- Coal is the major fuel used in Indian cement industry. *Indian coal is limited in quantity and lower in quality with a low calorific value and higher ash content.*

Cement Sustainability Initiative

The Cement Sustainability Initiative is the joint contribution of **25 major cement companies** of the word which is working with World Business Council for Sustainable Development for the sustainable development in the cement industry. It works in six core areas viz. Climate protection, Fuels and raw materials, Employee health & safety, Emissions reduction, Local impact and Internal business processes.

Environmental Impacts of Surface Concretization

Surface concretization is one of the major environmental issues in urban areas around the world. Concretization is not always harmful but depends upon the circumstances. Since cement is major component of concrete; the it contributes a lot in the harmful environmental impacts caused by concrete. Such impacts include:

- Cement Industry is a major contributor for carbon dioxide, a major GHG. It leads to global warming and climate change.
- Concrete causes surface runoff of the water. This might result in soil erosion, water pollution and flooding.
- Concrete is a major contributor of Urban Heat Island because of the massive rise in temperatures since concretised surface gets heated up much faster and also loses heat at night at faster rate.
- Concretised surface emits / radiates harmful Ultraviolet-B rays, which are hazardous to human / animal health. Further, concrete has presence of many substances which might causes toxicity and health problems.
- Concrete can also lead to radioactive pollution because of presence of various natural

radioactive elements (K, U and Th) in concrete dwellings. However, it depends on the type of raw material used for the creation of the concrete.

- Excessive concretised surface also causes 'visual pollution' as a concretised surface looks barren in contrast with the aesthetically beautiful green area.
- Concrete dust is a source of air pollution.

However, despite of various impacts listed above, planned use of concrete can help us to have many sustainable benefits. For example, concretization is used in creation of dams, diversion and deflection of flood water; so it is a valuable tool for flood control.

Problems and Policy in Cement Industry

Six industries viz. Aluminum, cement, fertilizer, iron and steel, glass, and paper are energy-intensive industries. Together they consumer 40% fuel in the manufacturing sector. All of them have a common problem of drastic power cuts, mainly due to shortage of coal. Other problems include inadequate availability of wagons for transport; limited availability of furnace oil. Further, since the industry is dependent on infrastructure activity and demand from real estate sector; any slump in these would directly affect the industry. In recent times, most companies are sitting on idle capacity due to low demand.

Government Policy

Cement was one of the government controlled industries earlier. Partial decontrol was introduced in 1982 and with 1991 policy reforms, all controls were withdrawn. Today, Government allows 100% FDI in cement industry. However, due to environment concerns, the cement industry has to comply to stringent environment rules.

Coal Sector

Facts About Coal

Coal is primarily made of Carbon, Hydrogen, Oxygen, Nitrogen, Sulphur and varying quantities of aluminium, zirconium and many other minerals. In terms of increasing carbon content, hardness, heat content and decreasing moisture coal is of three types viz. Lignite, Bituminous and Anthracite. Further, Peat, first step in formation of coal. Peat is not coal nut is the is wood that has undergone some transformation towards coal formation and the material contains a large amount of moisture and the carbon content is very low.

The below table differentiates the key qualities of each of the above:

Characteristic	Peat	Lignite	Bituminous	Anthracite
Colour	Dark-brown	Blackish Brown	Black	Greyish Black

Characteristic	Peat	Lignite	Bituminous	Anthracite
Lustre	No lustre	No lustre	Some lustre	Metallic lustre
Appearance	Earthy / woody appearance with dead, original plant material	Less woody in appearance	Striped	shiny metallic appearance
Natural moisture	Highest	High	Relatively lower	Lowest
Hardness	Softest	Softer	Soft	Hardest
Upon burning	Smoke	Smoke	Large smoke	Smokeless
Carbon Content	<40%	<40%	40-90%	>90%

Bituminous is also called has coking coal because it's used to make coke for steel industry.

Coke

Coke is nearly pure carbon that is produced after diving off the volatile constituents of the coal. Natural Coke is formed when the coal seam is intersected by a volcanic intrusion, which heats it in absence of air. Artificial coke is produced by heating bituminous coal in the absence of oxygen at some 2000°C. Coke has higher heat value than the coal itself and is used to generate extremely high temperatures needed for metal refinery / steel industry. In steel industry, apart from providing required higher temperatures, Coke also serves as a chemical reducing agent to produce pure iron from molten iron ore in a blast furnace.

Coal Tar

Coal Tar is the by-product of making coke or coal gas. It's a complex , highly viscous mixture of some 200 compounds including phenols, polycyclic aromatic hydrocarbons (PAHs), and heterocyclic compounds.

Coal tar is generally used in:

- Inflammable material to fire boilers in industries
- Medicated products such as shampoo, ointments etc. and also as a treatment for dandruff and psoriasis, as well as being used to kill and repel head lice.
- In Chemical industry as precursor to some chemicals such as hair dyes.
- In beautifying the pavements.

Coal Tar is not used in road construction like asphalt. Asphalt is sticky, black and highly viscous liquid or semi-solid present in crude petroleum's and in some natural deposits.

Coal Gas / Syngas

Coal gas / syngas is obtained by destructive distillation of coal. It is a mixture of hydrogen (50%), Methane (35%), carbon monoxide (10%), Ethylene (5%) and other volatile hydrocarbons, carbon dioxide and nitrogen. Before natural gas became popular in 1940s and 1950s, Coal gas was the primary source of gaseous fuel for the United States and the UK. It was used for lighting, cooking, and heating and was often supplied to households via a municipally owned piped distribution system.

Coal Liquefaction

Coal liquefaction is the process of creating liquid fuels (Hydrocarbons) from coal, generally by a process called Bergius process.

Fly ash

When coal is burnt (e.g. in coal fed power plants), two types of ash is produced. One that falls in the bottom of the boiler is called bottom ash. Another is made of fine particles that are driven out along with the flue gases. These fine particles are captured using the electrostatic precipitators or some other filtration equipments when the flue gases reach at Chimney of the plant. This is called Fly Ash and is made of Silica, Aluminium oxide, calcium oxide and some potentially toxic elements such as arsenic, beryllium, cadmium, barium, chromium, copper, lead, mercury, molybdenum, nickel, radium, selenium, thorium, uranium, vanadium, and zinc etc.

Uses of Fly Ash

Fly Ash was once discarded as a waste but today, it is increasingly emerging as a major input material in several industries including cement, agriculture, construction, Paints etc.

- Fly Ash is added as a mixture to cement for building construction, laying of roads and landfills.
- The bricks and blocks made of fly-ash are stronger and cheaper than conventional bricks
- Fly ash can help transform barren wasteland into lush green forests
- Pigments extracted from Fly Ash can be very useful in manufacturing of paints

Fly Ash bricks

In construction industry, Fly ash is used in making of bricks and concrete. Fly Ash Bricks are well proven building material and can be used as an alternate to the ordinary burnt clay bricks with equivalent strength. The Government promotes the use of Fly Ash Bricks. BIS (Bureau of Indian Standards) has issued the code IS:12894-2002 for ash bricks.

Further, an MOEF notification mandates that every construction agency engaged in the construction of buildings within a radius of 100 km. from a coal or lignite based thermal power plant shall use only fly ash based products for construction.

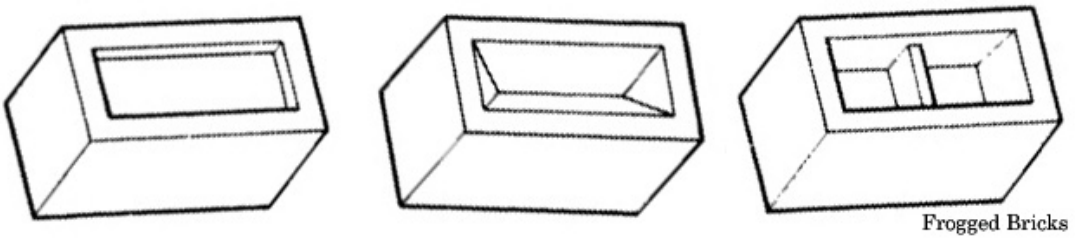
Construction of Fly Ash Bricks

The raw material to make Fly Ash bricks includes Fly Ash, Sand and Lime (or Cement). All of these

are mixed with water in a pan mixer to produce a semi dry mix. It is then placed in moulds of a machine (a hydraulic or vibratory press) to produce bricks of uniform size. These bricks are air dried for one/two days in a shed and then water cured for 14-21 days.

Advantages of Fly Ash Bricks

Fly ash bricks are produced with/without frog. Fogged Bricks have depression in one face as shown below:



Frogged Bricks

These bricks require less plaster thickness and save cement mortar. They are environment friendly because they are produced by by-product of thermal power stations. They save agriculture land used in brick kilns. In comparison to clay bricks, the Fly Ash bricks are less energy intensive. Further, they can be made at the construction site itself.

Fly Ash Concrete

In comparison to cement only, the Fly Ash improves the performance and quality when used in concrete. Fly ash as a part of the concrete saves water ; lowers heat of hydration; reduces the corrosion of steel and makes the concrete becomes strong quickly. This is because the fly ash reaches its maximum strength more slowly than concrete made with only Portland cement.

Burning of Coal: Impacts on Environment

Coal burning generates millions of tonnes of wastes including fly ash, bottom ash, oxides of carbon, nitrogen and sulphur, Volatile Organic Compounds, mercury, uranium, thorium, arsenic, and other heavy metals. High sulphur coal can cause Acid Rain which may result in soil deterioration and changes in soil chemistry due to addition of sulphur and nitrogen compounds in the soil. It also results in interference with groundwater and water table levels due to mining, contamination of land and waterways and destruction of homes from fly ash spills.

Coal beneficiation

Coal is treated in processes called “beneficiation” to prepare a material that meets the certain requirements. These processes may result in low ash quantity and low sulphur content. They include the following:

- Sizing, controlled by a crushing and screening process
- increasing heating value, by removing non-combustible ash and rock by gravity separation

- Removing or controlling undesirable mineral and chemical components (sulfur, sodium, and trace elements) by a combination of gravity separation and blending.

Traditionally, most coal preparation was primarily concerned with sulfur and ash reduction. Today, however, much more sophisticated processes have more narrow and complex physical and chemical requirements for coal stock.

Coal Resources of India

Most of the coal mined in India comes from the rock formations of two geological ages viz. Lower Gondwana and Tertiary. About 80 per cent of the coal deposits in India is of bituminous type and is of non-coking grade. This is one of the reasons that India has to rely upon imports of coking coal.

Gondwana Coal

Gondwana coal has overwhelmingly higher share (99%) in India's coal resources and the entire coal mined in the peninsular plateau part belongs to this category. This coal was formed in carboniferous period between 600 to 300 million years ago. The coal obtained from the Gondwana formations is mainly bituminous and needs to be converted into Coke before it can be used in the iron and steel industry.

Distribution of Gondwana Coal

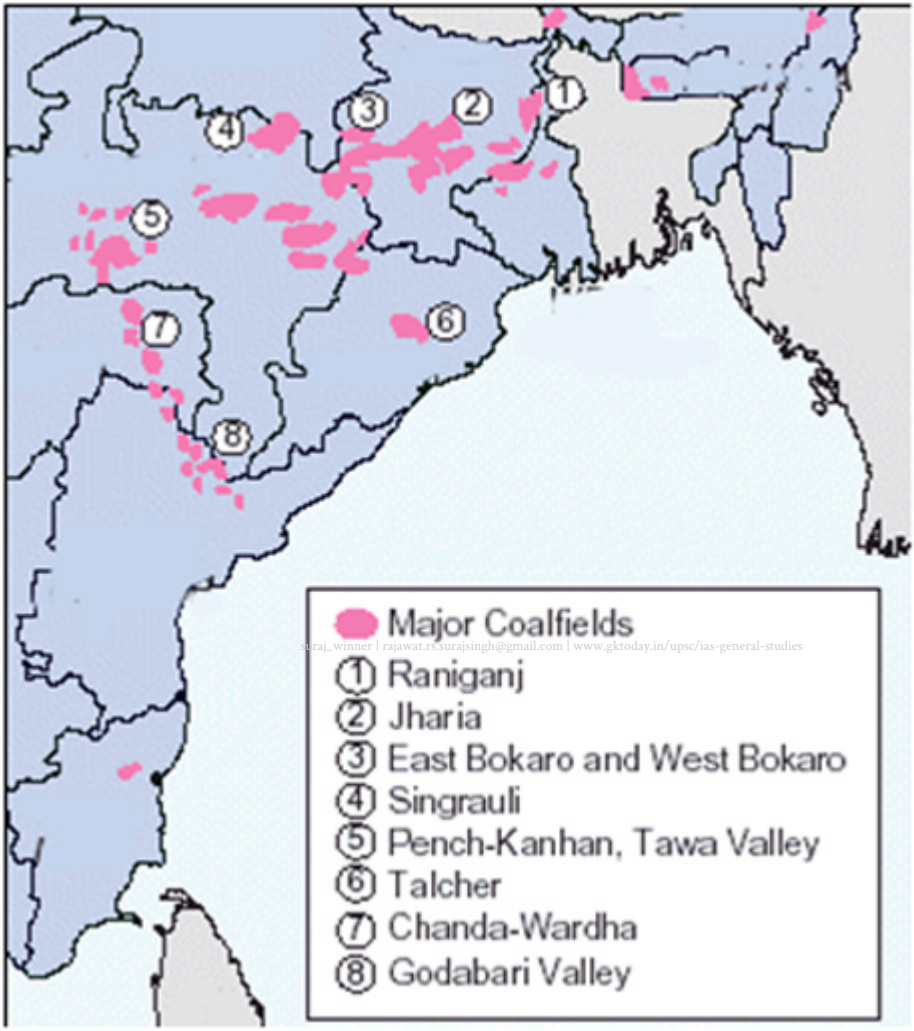
The Gondwana coal mines are located in river valleys of Damodar, Mahanadi, Godavari, Son and Narmada. Damodar valley is home to largest coal mines in Jharkhand-West Bengal coal belt located in Jharia (largest coal field of India), Raniganhj (second largest coal field of India), Bokaro, Giridih, Karanpura , Chandrapur, Tatapani, Talcher, Himgiri, Korba, Singrauli etc.

On the basis of geological units, there are three different Gondwana formations viz. Raniganj Formation, Barkar Formation and Karharbari Formation. **Karharbari Formation** is the oldest coal formation in India.

The states in which Gondwana coal fields are found include Jharkhand, Orissa, Chhattisgarh, West Bengal, Madhya Pradesh, Andhra Pradesh, Maharashtra, Uttar Pradesh, Bihar, Sikkim, Assam, with the quantity of reserves in the same order.

Tertiary coals

Tertiary coal fields share only 1% of coal production of India. Such fields occur in Assam, Arunachal Pradesh, Meghalaya and Nagaland and also in small quantities in Jammu & Kashmir. It is extracted from Darangiri, Cherrapunji, Mewlong and Langrin (Meghalaya); Makum, Jaipur and Nazira in upper Assam, Namchik – Namphuk (Arunachal Pradesh) and Kalakot (Jammu and Kashmir).



Tertiary coal is the lignite coal . Lignite also occurs in the coastal areas of Tamil Nadu, Pondicherry, Gujarat and Jammu and Kashmir. The coal is of inferior quality with around 30 to 50% carbon. India's largest ignite deposits are at Neyveli in Tamil Nadu.

Coal Mines

81% of the coal production in India comes from open pit mines while underground mining currently accounts for around 19% of national output.

Coal Sector Policy Issues

The importance of coal in the economy can be gauged from the fact that *around 54 % of the current*

total installed electricity generation capacity and 70% of current electricity generation is coal based. Currently, India is third largest coal consuming country after China and USA. Since most of the coal produced in India is of non-coking quality; and has high ash content, India has to import around 85 million tonnes of coal every year. Of this, around 25 million tons is metallurgical coking coal for the iron & steel industry. The balance is thermal coal used by power plants (50%), cement industry (17%) and other industries (33%). India imports its coal mainly from Australia, Indonesia, New Zealand and South Africa.

Nationalization of Coal Mines

Increasing coal production has been one of the key policy objectives ever since India got freedom. Coal sector was in private hands in British Era but after independence the sector went into government control. First government organizations were National Coal Development Corporation (NCDC) and Singareni Collieries Company Ltd. (SCCL).

- The major nationalization of coal mines occurred in 1970s when the Coking Coal Mines (Nationalisation) Act, 1972 brought all coking coal mines and the coke oven plants (other than TISCO and ISCO) under the Bharat Coking Coal Limited (BCCL), a new Central Government Undertaking. All these mines were nationalized under the Coal Mines (Nationalisation) Act, 1973. To manage the non-coking coal mines, the Coal Mines Authority Limited (CMAL) was set up and National Coal Development Corporation were brought under the Central Division of the CMAL.
- In 1975, Coal India Limited was formed as a holding company with five subsidiaries namely Bharat Coking Coal Limited (BCCL), Central Coalfields Limited (CCL), Eastern Coalfields Limited (ECL), Western Coalfields Limited (WCL) and Central Mine Planning and Design Institute Limited (CMPDIL).

The Indian coal sector was thus dominated by Government and remains so even today. Coal India Ltd. has 81% share in production while Singareni Collieries Company Ltd has 9.5% share. Remaining coal comes from privately owned collieries and captive coal mines.

1993 Amendment of CMNA

The Coal Mines Nationalization Act 1976, or the CMNA had a provision that *mining lease to any institution that is not "Central government, Central government company or Central government corporation" is illegal*. In 1993, this act was amended to allow for sub-leases to be granted if two conditions are satisfied:

1. the reserves of coal in the area are in isolated small pockets or are not sufficient for scientific and economical development in a coordinated and integrated manner

2. the coal produced by the sub-lessee will not be required to be transported by rail.

This implies that if the coal blocks had junk, it could be sub-leased and that the junk could not blacken our railroads. With this, the central government had introduced its **Captive mining policy in 1993**.

Captive Mining Policy

Captive Mining Policy is there in place since 1970s but it became a major policy only after 1993. In 1970s, all the coal mining private leases were terminated via the Coal Mines (Nationalization) Amendment Act 1976 but some exceptions were allowed because the nationalized coal companies were unable to fully meet demand. Since 1976, the captive mines were allocated to Iron and Steel companies only. Via the 1993 amendment, the captive mines were allowed to be allocated to power producing companies too. In 2007, captive mining were allowed for coal gasification and liquefaction also.

The concept of captive mining means that some mines are allocated to the companies for its own need. The captive mining concept was devised so that the Iron, Steel and Power producing units could get uninterrupted supply of coal. Via this policy, government started giving coal blocks to companies for captive use. The condition was that these companies could only use the coal for their own use such as in power projects, steel mills, etc. but the sale of coal in open market was not permitted.

From 1993 till 2011, the Coal Ministry under 6 years of NDA rule and rest 11 years under UPA rule had allocated 194 coal blocks for captive mining of which 142 were explored and balance 52 remained either partially explored or unexplored.

Coalgate

In a March 2012 draft report, the CAG accused Government of India of allocating coal blocks in inefficient manner during 2004-2009 period.

- The basic argument of CBI was that the government chose to NOT to allocate the coal blocks by process of competitive bidding.
- Coal blocks were given free resulting in the block-owners making windfall gains.
- The functioning of the screening committee which evaluated the coal applications was opaque.
- A few companies got more than required coal.
- Companies with political links got multiple blocks while more deserving candidates did not get any.
- Ministers and CMs of the coal rich states lobbied for allotment to desired private players.

- Private players resold the allocation and coal produced in the open market

The scam began to unearth when a BJP MP Hansraj Ahir kept saying that some companies with captive coal blocks were changing hands. In 2012, the draft CAG report said that the Government had lost Rs. 10.6 lakh crore due to not auctioning these blocks. This number was later revised in the final report to Rs. 1.86 lakh crore. The substantial difference between high market price of coal sold by CIL and lower cost of coal produced by captive blocks; was one of the criteria to ascertain the loss in the CAG report.

CBI Probe and Autonomy Issues

The Central Vigilance Commission (CVC) directed a CBI inquiry in May 2012 on the basis of compliant of two BJP MPs viz. Prakash Javedkar (currently Environment Minister) and Hansraj Ahir.

The UPA government refuted the CAG claims on the basis of argument that it's a "presumptive loss theory" as no mining had taken place yet. Taking a defensive stand, UPA also created its Inter-ministers group to review the allocation process, and de-allocate the coal blocks or forfeiture of the bank guarantees of the companies.

But meanwhile, a PIL was filed in Supreme Court in September 2012. This petition sought cancellation of 194 coal blocks. The apex court agreed to hear the case while monitoring the CBI inquiry. However soon, in the backdrop of apprehensions regarding autonomy of the CBI, the SC asked CBI to not to share probe details with government.

In May 2013, the CBI submitted to the Court that law minister Ashwani Kumar had been vetting its responses and affidavits to the Court in this case. In fact, the agency admitted that Ashwani Kumar and two government officials had changed some parts of its affidavit, though it also maintained that these parts related to preliminary enquiries and changes in these parts did not change the overall character of the report. However, this revelation made the apex court come down heavily on CBI and the government, calling CBI a "*caged parrot that has many masters*" and asking the government to ensure greater functional autonomy for CBI in investigation in corruption cases.

Subsequent hearings in the case led to CBI filing affidavits on specific details of its demand for greater autonomy. At the same time, the Centre has also filed its objections against few of the demands for autonomy by CBI.

Cancellation of the Blocks

In April 2013, a report by Standing Committee on Coal and Steel was tabled in the Parliament. This report said that the coal blocks were distributed in unauthorized manner between 1993 and 2008. This report also said that the mines where production not started should be cancelled.

In June 2013, the CBI registered an FIR against Congress MP Naveen Jindal and Dasari Narayana

Rao, former Minister of State for coal. In 2013, CBI also filed FIR against Kumar Mangalam Birla and former coal secretary PC Parekh. These cases against these two was closed in 2014. In the same year, the Supreme Court established a special CBI court to try all coal field allocation cases.

Implication of coal scam on Economy

The adverse impact of the above mentioned scam was on the competitive advantage. The blocks were taken away from Coal India and were given for captive use. The PSU did not have enough coal to meet the rising demand from the thermal power projects. The companies which relied on coal, could not compete with the companies which had captive coal blocks. The country was already dependent on coal import and this dependence further increased.

The Standing Committee on Coal and Steel revealed in 2013 that despite the country being in an acute coal shortage, just 30 of the 195 captive coal blocks had begun mining.

Supreme Court Decision

In October 2014, Supreme Court cancelled the allocation of 214 out of 218 coal blocks. The judgement said that the screening committee has never been consistent, transparent and there was no proper application of mind. The four coal blocks which were exempted included two ultra mega power projects

- Moher and Moher Amroli Extension (Sasan Power Ltd)
- Tasra (Steel Authority of India Ltd)
- Pakri Barwadih (National Thermal Power Corporation)

A few companies decided to petition the Supreme Court to review its order. The supreme court decision was feared to bring cloud on investments in power sector, affecting some 28000 MW power capacity, to further dependency on coal imports. Also, a large part of non-performing assets (NPA) belong to iron & steel sector, so there was fear of rising NPAs in Public Sector banks. Part of the commentariat said that government decision would loss to state in terms of royalty, cess and taxes.

Critical Analysis: Implications of Supreme Court Decision

The supreme court decision was a logical outcome of the case. This decision allowed fresh, transparent means of apportioning finite natural resources. The country is plagued by a morally compromised system in which public policy is often overshadowed by power, influence and 'connections'. Arbitrary, non-transparent and ad hoc processes have eroded public faith in decision-making. The verdict, similar to the earlier one that cancelled 122 telecom licences allotted illegally, is an affirmation of the principle that the courts will not countenance the undesirable nexus between public office holders and big business, or anyone profiting from venality.

The judgment was a vindication for those who stand for transparency and probity in the process of commercial exploitation of natural resources.

The Coal Mines (Special Provisions) Act, 2015

Immediately after the August 2014 SC decision that held 214 captive mine allocations illegal, the NDA Government brought an ordinance called Coal Mines (Special Provisions) Ordinance. Later, the ordinance was replaced by Coal Mines (Special Provisions) Act, 2015.

Salient Features

Objective

The objective of this act is to empower the government to allocate the coal mines on the basis of competitive bidding to ensure continuity in coal mining operations and promote optimum utilisation of coal resources.

Schedule-I, II and III mines

All the 204 mines whose allocation was cancelled by the Supreme Court, are defined in the act as 'Schedule-I coal mines'. Out of these, the 42 mines which were already producing and ready to produce coal were defined as 'Schedule-II coal mines'. Other 32 coal mines which are at various stages of development were defined as Schedule-III coal mines. These coal mines are meant for specified end-use and the Central Government has been empowered to move mines from Schedule I to schedule-III.

No end use restriction to participate in auction

This act provides that there shall be no end use restrictions on the eligibility to participate in the auction, other than for Schedule II & III coal mines, in which mines will be auctioned only for end use in power, steel & cement sectors.

Nominated Authority

The act empowers the Central Government to appoint a Nominated Authority under a person with joint secretary rank to conduct auction/ allotment and vesting and transfer of all interests, rights and titles of these coal mines in the successful bidder. Nominated Authority is assisted by experts and other officers.

Proceeds of auction

All proceeds of auction will be received by the Nominated Authority and will be disbursed to the respective states. The prior allottes will be paid compensation for land and immovable infrastructure developed by them prior to cancellation of their allotment. For disbursal of payments, a 'Commissioner of Payments' is to be appointed.

Other provisions

The central government is empowered to appoint custodian(s) for operation and management of the coal mines until they are allocated via auction. The act has provisions for rehabilitation and compensation for displaced persons. The act provides that any dispute shall be adjudicated by the Tribunal constituted under Coal Bearing Areas (Acquisition and Development), Act, 1957.

E-auction of Coal Mines- Current Status

By end of October 2015, the Government has conducted three rounds of auction of the coal mines. The first two phases of coal auction for 40 producing blocks were held between February to April 2015. These would fetch the coal bearing states a revenue of Rs. 2.85 Lakh Crore in a period of 30 years. Both power / non-power companies participated in this auction. The government also conducted a third round of auction in August 2015 but proceeds were only Rs. 4364 crore because of the legal issues that have tangled the mines put at auction. The government is currently working to chalk out the process and formalities of the fourth round of auctions.

Analysis

In the above discussion, we have studied the basic facts and current situation of coal industry in India. The analysis of the current issues related to coal should be done in the light of the following two important issues:

- **Commercial Coal Mining Debate:** The recently passed act opens the possibility of commercial mining in India. What are the possible socio-economic consequences? Do we stand in favour of it or against it?
- **Sustainability of Coal Mining Debate:** Is the coal rush is based on some artificially inflated demand? Won't the coal burnt put huge amount of toxic chemical in the environment? To what extent promotion of coal is justified?

Commercial Coal Mining Debate

Commercial Mining means mining the coal with an objective to make it on open market, not tied to some specific end use. Coal Mines Nationalisation Act, 1973 or CMNA provided that all rights/titles in relation to the coal mines shall stand vested in the Central Government. It also provided that no person other than the Central Government or a government company or a corporation managed or controlled by the Central Government can engage in coal mining.

However, the recently passed act has some enabling provisions which would further lead to opening of commercial mining in the country. We note here that this act has neither amended the CMNA nor explicitly makes declarations regarding commercial mining. It provides that there shall be no end use restrictions on the eligibility to participate in the auction, other than for Schedule II & III coal mines, in which mines will be auctioned only for end use in power, steel & cement sectors. Further, since government has power allocate the plants without end use restriction too, it opens up commercial coal mining after a gap of some 42 years since 1972, when nationalization of coal mines took place.

The government's plans as coming out in the form of various statements of Coal secretary /

Ministers, and they can be summarized as follows:

1. Government will be allotting mines to state entities for commercial mining first; in the next phase, private entities would be assigned mines.
2. To start with, the Coal Ministry is trying to allow commercial extraction of coal in mines which are already with state governments.
3. As of now, there is no commercial mining of coal in the country. They will hold auctions for private firms to mine and sell coal in the near future.

We note here that after the government had promulgated the Coal Mines (Special Provisions) Ordinance, 2014 in October 2014, there was a strike in the Coal India Ltd (CIL) workers. One of the demands of the striking workers was that government should remove the clause in the coal ordinance which allows private commercial mining. The strike was called off when government assured to set up a joint committee to look into the issue.

There are several reasons to oppose commercial mining. One reason is to look back and see under what conditions, government nationalized coal mining in 1970s. The reasons included:

- Adequate capital investment to meet the burgeoning energy needs of the country was not forthcoming from the private coal mine owners.
- Unscientific mining practices adopted by some of them
- Poor working conditions of labour in some of the private coal mines

Thus, coal mines were nationalized because of the shortcomings in the way it was run by private parties. The government wanted to ensure smooth investment and uninterrupted supply of coal for the growing demand; so that it could prevent rapid depletion of natural resources by well-planned extraction and to ensure the safety and well-being of the workers.

However, where do we stand today?

After 42 years, we find that the state monopoly in coal has been extremely inefficient. Country is forced to import hundreds of millions of coal every year. There is a need to take bold political decisions so that multiple coal producers can competitively produce coal and there is an uninterrupted supply of coal for various needs. However, existing issues also need urgent attention such as reconstruction and reorganising of old mines; coal theft; illegal mining; updating the obsolete technologies etc. Given past experience with privatisation, it is right to be apprehensive that they might employ labour at low wages with poor social security. Government should address these apprehensions at priority level.

Coal Versus Environment Debate

The past and present government (despite huge potential revenues) have resorted to allocate coal

mines on such a premise that the coal blocks of the country are just waiting to be exploited. Is the coal rush is based on some artificially inflated demand? Won't the coal burnt put huge amount of toxic chemical in the environment? This debate is based on these arguments:

- Both coal mining and coal burning have destroyed the environment; deprived people of their livelihoods and have spread toxic pollution poisoning the food chain systems that sustain life.
- Thus, being a responsible member of the international community, India should do everything that contains use of coal and promotes clean technology.
- Indian coal is of poor quality, and there is a need to cover up the deficit with better technology and efficiency but most plants in the country have lacked that.
- Generating power with more and more coal will put pressure on other resources such as water also.

None of the above arguments are baseless. There is a need to develop integrated policies that would reduce the pressure on natural resources and minimise the amount of pollution. Further:

- The focus needs to be on energy efficiency and environmental friendly technologies such as renewable energy.
- There is need for efficient demand management. While the coal based power plants should meet the base load demand, additional demand should be increasingly met by solar and wind power.

Thus, there is a need to include efficiency improvements in coal and the electricity sectors, and make a decisive shift in favour of renewable sources of energy. For example, on average, the Indian power plants using India's coal supply consume about 0.70 kg of coal to generate a kWh, whereas United States thermal power plants consume about 0.45 kg of coal per kWh.

Power Sector

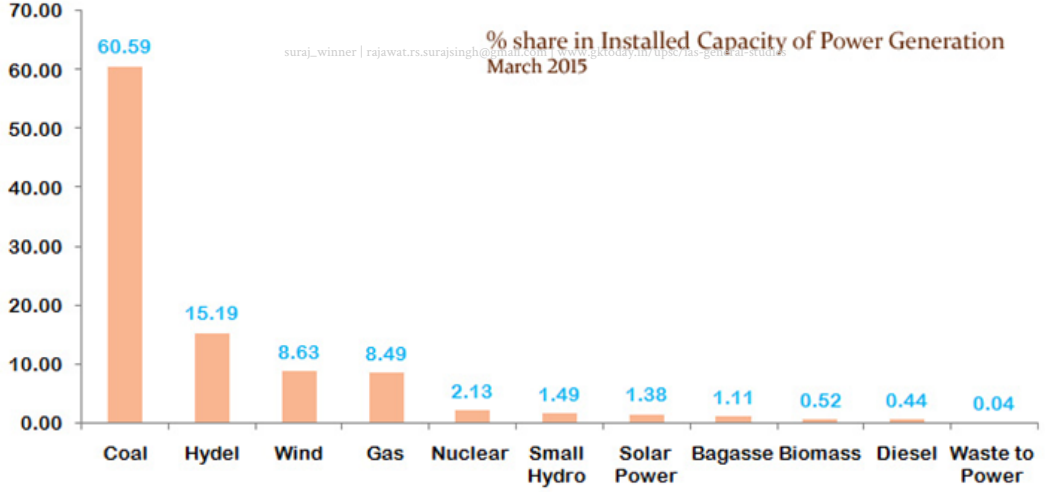
India's first power plant was started in 1897 in Darjeeling, followed by commissioning of a hydropower station at Sivasamudram in Karnataka during 1902.

Current Installed Capacity

As of March 2015, the installed capacity of power generation in India is around 271.7 GW of which 72% is in Non-renewable sector while 28% is in renewable sector. The thermal power is produced in Coal, Gas and Diesel based power plants. Nuclear power is produced in nuclear plants. Renewable power includes Hydel plants and other renewable sources such as wind, biomass, bagasse, waste-to-power and solar power.

Installed Capacity of Power Generation in India			
Thermal	Coal	164636	60.59
	Gas	23,062	8.49
	Diesel	1,200	0.44
	Nuclear	5,780	2.13
Renewable	Hydel	41,267	15.19
	Small Hydro	4,055	1.49
	Wind	23,444	8.63
	Biomass	1,410	0.52
	Bagasse	3,008	1.11
	Waste to Power	115	0.04
	Solar Power	3,744	1.38
	Total	2,71,722	100.00
			Data: MW, March 2015

The below chart shows the decreasing order of share of various methods of electricity generation in total installed Capacity.



The following decreasing orders you should remember for Prelims examinations:

- In total installed power: Coal>Hydel>Wind>Gas>Nuclear
- Among Non-renewable sources: Coal>Gas>Diesel
- Among Renewable Sources: Hydel>Wind>Solar>Biomass>Waster to Power

Power Generation & Consumption

In 2014-15, India produced 1,106 TWh power. With this, India is third largest producer of electricity in the world with around 4.8% share in global electricity production. The per capita

electricity generation is 1,010 kWh. Per capita electricity consumption is 746 kWh, which is lower compared to many countries.

Commercial and Non-commercial Energy

Commercial energy consists of coal, petroleum and electricity. These sources are commercial in the sense that they command a price and the user have to pay for them. Non-commercial sources of energy- also known as traditional sources of energy- consist of firewood, vegetable wastes and dried dung. These are called non-commercial sources, as they are supposed to be free and command no price. Actually, the non-commercial sources such as firewood and dried dung have started commanding a price in urban areas and to some extent in rural areas as well. More than 60 percent Indian households depend on traditional sources of energy for meeting their cooking and heating needs.

Thermal Power

Thermal power plants, producing energy from coal, gas and diesel constitute 69.52% of the installed capacity of India. Of this, 60.59% {or 87% within the thermal power} is shared by coal. India's 80% coal produced is consumed by coal based power plants only and despite that we need to continuously import coal.

Important Thermal Power Plants

Currently India has around 116 coal based thermal power plants. Of these, **Vindhyachal Thermal Power Station** at Singrauli district in Madhya Pradesh is the largest power station with an installed capacity of 4760 MW. This is followed by Mundra Thermal Power Station (Adani Power) with installed capacity of 4620MW, Mundra Ultra Mega Power Project (Tata Power) with 4000MW and Sasan Ultra Mega Power Project (Reliance Infrastructure) Sasan with 3960 MW power generation capacity.

Key Constraints in Coal Based Plants

The constraint of coal quality and quantity has been a major bottleneck in growth of thermal power. Most of the coal produced in India is Gondwana coal, which is of *low calorific value and high ash content*, thus the fuel value is poor. Due to high ash content, government has mandated the use of beneficiated/ blended coals whose ash content has been reduced to maximum of 34%, in power plants located beyond 1000 km from pitheads, and those located in critically polluted areas, urban areas, and ecologically sensitive areas.

India has an extensive review process, one that includes environment impact assessment, prior to a thermal power plant being approved for construction and commissioning. The Ministry of Environment and Forests has published a technical guidance manual to help project proposers and to

prevent environmental pollution in India from thermal power plants.

Ultra Mega Power Projects (UMPP)

The coal fired Ultra Mega Power Projects were envisioned by the UPA Government under the "Power for all" vision of the 11th plan documents.

Initially 16 UMPPs each with a capacity of about 4000 MW were identified in various parts of the Country. Out of them, four projects viz. Sasan in Madhya Pradesh (Reliance Power), Mundra in Gujarat (Tata Power), Krishnapatnam in Andhra Pradesh (Reliance Power) and Tilaiya in Jharkhand (Reliance Power) were awarded to developers respectively. Only two viz. Sasan and Mundra are in operation. From Tilaiya UMPP, Reliance has quit citing inordinate delays. Krishnapatnam is also deferred so far. Rest are either deferred or their status is unknown.

UMPP Key Features

UMPP are launched by Ministry of Power in association with Central Electricity Authority and Power Finance Corporation. They are awarded to developers on the basis of tariff based competitive bidding. They are not wholly owned by Government. They have minimum capacity of 4000MW and they are ONLY coal based power projects.[currentuser_id]

The government had invited bids for two more UMPPs at Bedabahal in Odisha and Cheyyur in Tamil Nadu in 2015 but their bids were cancelled due to poor response.

What went wrong?

The UMPPs have several problems. Firstly, there is issue of land acquisition. For such projects, the work of acquisition of land is done by the Government. Land acquisition is a big issue everywhere in the country and particularly in naxal areas, it's very difficult. Tilaiyya power plant of Jharkhand is in such area and has faced inordinate delays. Secondly, administrative delays have several financial overheads. Mostly, the infrastructure projects are financed via debt and any delay will reduce the viability of projects due to increasing interest burden. Further, since UMPPs were awarded via competitive bidding, any delay will further cause lower internal rate of returns (IRR). Thirdly, coal supply to such plants is a big issue. Coal for these plants was supposed to be imported or used from local/ captive mines. Out of the two functional UMPPs, Mundra UMPP of Tata Power is using imported coal while Sasan is using local coal. The Indian coal has low calorific value, high silica content and high ash content, which increases the capital expenditure of such plants, as they need to invest more in advanced equipments. Fourthly, the developers need to sell the electricity to State Electricity Boards (SEBs), which don't have good payment records. The state bodies are already suffering due to their AT&C losses. Fifthly, there was an absence of clarity on coal price and power-

purchase agreements. UMPPs works on Design, Build, Finance, Operate, and Transfer (DBFOT) model. The power producers say that this model does not address all the risks associated with the projects because all losses go to the power generator, before he transfers the project.

Current Status:

Due to lack of enthusiasm among the private players, the government has decided to come up with a new standard bid document, which would address the issues related coal price pass-through and power-purchase agreements.

The State Electricity Boards Problems

Power development during the last 60 years has been significant but still India has faced chronic power shortage. The key reasons behind power shortage include – rising demand not matched with production; dependency of Hydel power on monsoon; delay in commissioning of new capacity in coal in thermal and nuclear plants; non-availability of coal, issues in new power plants and so on.

The main problem area in the power sector is the poor performance of the State Electricity Boards (SEBs). They cite two types of losses for their poor performance viz. T&D losses and AT&C losses.

Transmission & Distribution (T&D) Losses

These losses are due to inefficiency in transmission including theft. A substantial part of theft is attributed to the agriculture sector. This concept is now replaced with AT&C losses.

Aggregate technical and commercial (AT&C) losses

This refers to difference between total units feds into the distribution and the total units for which payment was collected. The T&D losses did not account the loss due to non-realization of the payment. TheAT&C loss captures technical as well as commercial losses and is true indicator of total losses to the SEBs.

Reasons of AT&C Losses

The key reasons to AT&C losses include Power theft, non-billing, incorrect billing, inefficiency in collection of payments, leakage in transmission and lack of investment in upgrading the transmission infrastructure. Due to these problems, most state electricity boards have become unviable and unprofitable. The seriousness of the problem may be gauged with the fact that all India AT&C losses are around 27% (in early 2000s, these losses were around 38%).

Such a high percentage of loss have plagued the financial health of the electricity boards. Due to political pressure and a huge agricultural lobby in all states, they are not able to upwardly revise the tariffs. Many of these SEBs were not able to service their debts and this led to rising NPA, ringing alarm bells in banking sector.

APDRP Programme

To strengthen the Transmission and Distribution network and reduce the AT&C losses, government

had launched an scheme called Accelerated Power Development & Reform Programme (APDRP) in 2001. The objective of this scheme was to bring down the AT&C losses to below 15% in urban areas in five years. Under this scheme, the central government provided grants to upgrade the T&D network. But, the inability to use the grants doomed this scheme. subsequently, the scheme was restructured and re-launched in 2008 as Restructured APDRP (R-APDRP). The restructured scheme was broken into two parts viz. Part A and Part B. Under Part A, financial assistance was provided to prepare baseline data using new technologies, while under Part-B, the central government provided support for renovation, modernization and strengthening of 11 kV level Substations, Transformers/Transformer Centres etc. The states were asked to constitute State Electricity Regulatory Commission and achieve the target of AT&C loss reduction at 3% per year to continue receiving assistance under this scheme. The scheme was launched with a lot of fanfare and optimism, but it could live up to the hype and euphoria. The first thing was that the project moved at snail's pace. The SERCs were floated, IT companies joined the bandwagon, bids, tendering and re-tendering were all around. Pilot towns were announced. A new crop of IT consultants, GIS Consultants and Billing Consultants came up. When the dust sat down, we find that the AT&C losses were still high. The objective was to reduce the AT&C (aggregate technical and commercial) losses from the current level of over 30 per cent to less than 15 per cent over next five years, by automating and integrating IT. This Herculean task remains undone even today.

Then, the NTPC and PGCIL were entrusted with the task of imparting consultancy to the aspiring DISCOMS. Both the organization were novice in the field of distribution of electricity, having no exposure to the complexity of distribution network and working of distribution units with no knowledge of constrains and problems of Discoms. APDRP could not achieve the desired goals within the stipulated time.

V.K. Shunglu Committee & Chaturvedi Panel

In 2010, this panel was constituted to look if there is elephant in the room. It was mandated to look into financial problems of the SEBs/distribution utilities and to identify potential corrective steps. What came out in the form of recommendations was that SEBs should be able to raise tariffs; upgradation and computerisation of system; distribution franchisee model etc. For debts of SEBs it recommended that a SPV (Special Purpose Vehicle) should be established to buy the bank loans of discoms, whose chairman should be appointed by RBI and RBI should provide a line of credit to SPV for buying the bad loans. But RBI did not even respond on this recommendation

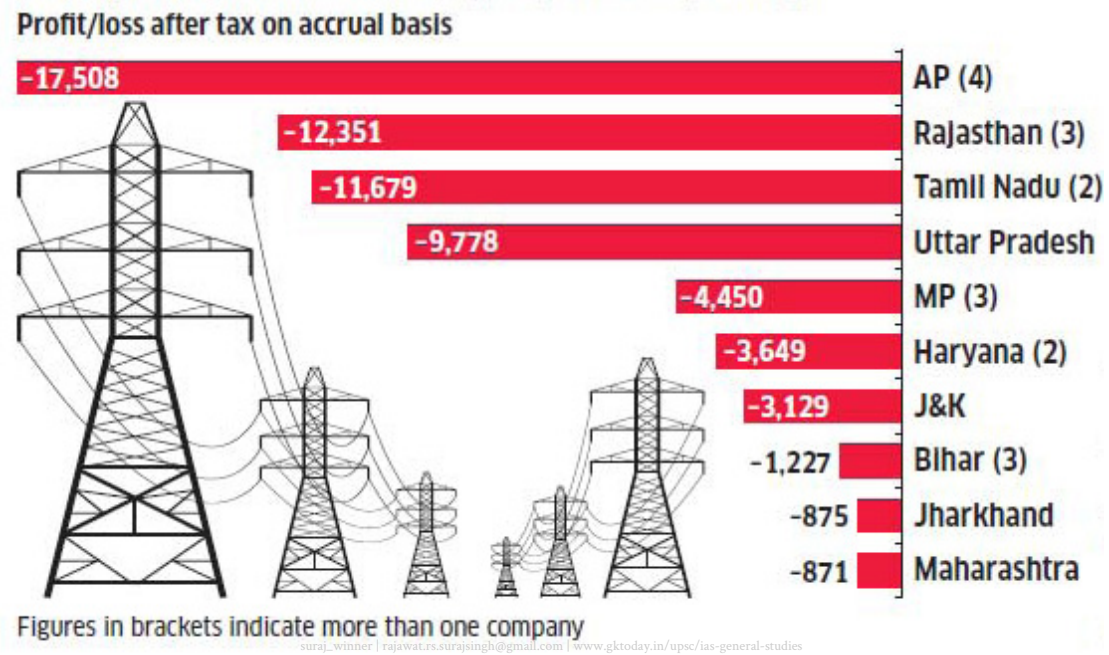
The Shunglu committee report did not have many practical suggestions, so another BK Chaturvedi committee was established in 2012. This panel came up with a plant that government should absorb

half of the loans of the SEBs and convert it into state government bonds. Remaining half should be restructured by the RBI and a moratorium on interest payment should be put in place. With this, the central government announced a bailout package worth Rs. 1.90 Lakh Crore in 2012. Under this plan, 50 per cent of the short-term outstanding liabilities of discoms was to be taken over by state governments. Rest 50 per cent loans would be restructured by providing moratorium on principle and best possible terms for repayments. The package was to provide immediate relief to discoms.

But the problem is that such packages don't provide long term relief. The key to problem of SEBs is theft of electricity and until and unless they are able to address that issue, no government package can be sustainable. Such a package was provided in 2001-02 also but then still the SEBs defaulted on payment to NTPC and NHPC for power purchased from them. All states continue to drag their feet without learning lessons from past.

Current Status

Tackling the problem of AT&C losses and reviving the SEBs in India is a mammoth task which cannot be done mere by change in government at the centre. UPA government was replaced by NDA but the AT&C losses are still standing at 27% in Rajasthan, 48% in Bihar and 34% in Haryana and within this range in many other states. We note here that during 2012-13, power distribution companies selling directly to consumers were making profits in only six states viz. Delhi, Punjab, Kerala, West Bengal, Gujarat and Sikkim.



The NDA government quickly came up its Integrated Power Development Scheme. This scheme was basically to help states to achieve the AT&C target by strengthening transmission lines and distribution networks, separating feeders, greater metering, and IT-enabling the entire system.

Integrated Power Development Scheme

Integrated Power Development (IPDS) scheme launched by Modi Government is basically a new avatar of Restructured Accelerated Power Development Programme of UPA. This scheme focuses on improvement of T&D networks across India. It promises help in reduction of AT&C losses, establishment of IT enabled energy accounting / auditing system, improvement in billed energy based on metered consumption and improvement in collection efficiency.

The scheme has been launched with an outlay of Rs. 44,011 crore for 12th and 13th plans. All discoms including private discoms and state power departments are eligible to get financial assistance under it. The discoms can prioritize what fraction of their infrastructure work is to be strengthened and can apply for assistance with their detailed project reports. The projects supported under this scheme need to be completed within 24 months. Like R-APDP, Power Finance Corporation is nodal agency for this scheme.

The grant portion of this scheme is 60% for normal states and 85% for special category states. They can also get 15% additional grant if they do the work within prescribed milestones viz. timely

completion of the scheme, reduction in AT&C losses as per trajectory. The discoms need to enter into tripartite agreement with PFC and State Government to be enable to get all support.

Rural Electrification & DDUGJY

Rural electrification is necessary to stimulate the growth of small-scale industries and promote a more balanced and diversified economy. Between 1950 and 2001-02, the number of villages electrified had increased from a mere 3,000 to 5,19,000. The UPA Government had launched Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) under which 90% grant was provided by Govt. of India and 10% as loan by REC to the State Governments to make the villages go electrified. This scheme has been now replaced with Deen Dayal Upadhyaya Gram Jyoti Yojana. This scheme focuses on feeder separation for rural households and agricultural purpose; strengthen the distribution and sub-transmission infrastructure, including metering at all levels in rural areas.

The scheme has budgetary outlay of 76,000 crore rupees for implementation of the projects of which Union Government will provide grant of 63,000 crore rupees.

Hydel power

Hydro-electric power is a renewable natural resource known for their almost nil GHG emission. The *oldest Hydropower power plant in India is in Darjeeling District* in West Bengal. Its installed capacity is 130KW and was commissioned in the year 1897.

India began with a humble 560MW capacity in 1950-51. With over 41000 MW installed capacity and 15.2% share in total installed capacity, hydropower is second largest source of electricity generation after coal. However, in these years, the relative importance of Hydro power has come down mainly because the thermal power outperformed it.

Advantages of Hydro power

Hydropower is considered to be most economical source of power. Since no fuel is burnt to produce power, there is no problem of pollution. Oil, coal and natural gas resources which can be used for producing electricity are in short supply and have implications in terms of high costs and exert greater pressure on foreign exchange resources; Hydel power can easily replace them.

Is Hydropower completely clean?

Hydropower is *not completely clean* because the dams produce significant amount of CO_2 and Methane, both GHGs. When a large dam is built, flora gets immerged in water and rots under anaerobic conditions producing methane. Thus, whatever negative impacts of Hydropower are there, they are mainly because of alternation of surroundings of the dams, natural habitats and wildlife.

The hydropower generation is highly capital-intensive mode of electricity generation but being

renewable source of energy with no consumables involved; there is very little recurring cost and hence no high long term expenditure. It is cheaper as compared to electricity generated from coal and gas fired plants. It also reduces the financial losses due to frequency fluctuations and it is more reliable as it is inflation free due to not usage of fossil fuel.

Key problems in harnessing Hydro Power

India has one of the largest hydropower potential in the world but only one fifth of that potential has been harnessed so far. The key problems include high investment costs in building large dams, dependency on hydrology, problem of environment, loss or modification of the fish habitat and displacement of the local populations. These projects have long gestation period in comparison to thermal power projects.

Types of Hydro Power Projects in India

There are two types Hydro power projects in India viz. large and small. The small hydro projects has a capacity of less than 25 MW. The small hydro projects come under the Ministry of New and Renewable Energy. Ministry of Power is responsible for large hydro projects. The small hydro projects are further classified into Micro, Mini and small projects as follows:

Class	Station Capacity in kW
Micro Hydro	Up to 100
Mini Hydro	101 to 2000
Small Hydro	2001 to 25000

World's largest Hydro-electric power station

Three gorges project in China on Yang-Yang river is the largest power station in the world having installed capacity of around 18,200 MW.

Hydel Power+Thermal Power mix: Solution of Seasonal Load Curves

Seasonal load curves of India's regional grids match with the pattern of hydro power generation. During summer/monsoon season when the generation at hydro power plants is high, the load factor of the system is high due to heavy agricultural load. During winter, the thermal stations operating at base load and hydro stations working as peak load stations will take care of weather beating loads. *Thus the operational needs of hydro & thermal stations are complimentary and the balanced mix helps in optimal utilization of the capacity.*

Problem of Sedimentation in Reservoirs

Sedimentation and silting in reservoirs leads to reduction in active storage capacity; makes flood management difficult and causes damaged to turbines due to abrasive action of silt. This is a major problem of the hydropower generation. The following are some approaches to tackle sedimentation problem of reservoir:-

- **Catchment Area Treatment** (CAT) for reduction of silt load includes forestations of the catchment area and constructions of check dams on the tributaries and upstream of the river.
- Effective desilting arrangements for prevention of silt.
- Silt resistant equipments of withstanding the silt.
- Effective operation of the reservoir to minimize silt deposition.

Wind Power

Despite being a newcomer in this field, India currently has fifth largest installed wind power capacity in the world. By March 2015, India had 23,444 MW installed capacity of wind power which is 8.63% of all installed capacity and third largest after thermal and Hydel. The government has set a target 60,000 MW by year 2022. With this much installed capacity, India has fifth rank in the world after China, United States, Germany and Spain. We note here that currently, India is world's largest biomass, third largest solar and fifth largest wind energy producer. Indian company Suzlon has expanded beyond the country and has 7.7% market share worldwide in wind turbine sales.

Important Facts

- Almost three fourth of India's wind energy is generated between May to September because that period coincides with South West Monsoon.
- Currently, installed capacity of wind power in India is spread in north, south and western parts. As of now, East and North East have no wind power connected to grid. Among the three regions, maximum installed capacity is of south, followed by west and north.
- Among states, maximum wind power installed capacity is of Tamil Nadu with 7455MW installed capacity, followed by Maharashtra, Gujarat and Rajasthan. Tamil Nadu shares 35% of India's total wind power installed capacity.
- Among the various wind farms, Muppandal windfarm at Kanyakumari in Tamil Nadu has largest capacity of 1500MW. Jaisalmer Wind Park of Suzlon is the second largest with 1064MW.
- Currently, all wind power is generated in onshore wind farms. India has *not yet entered into the offshore wind power generation*. Although some demonstration projects have been done so far.
- Wind energy accounts for around 70 per cent of installed capacity among renewable and almost all investment in India is coming through private sector investments.

Importance of wind power

Worldwide, wind energy is accepted as one of the most developed, cost-effective and proven renewable energy technologies to meet increasing electricity demands in a sustainable manner. While onshore wind energy technologies have reached a stage of large scale deployment and have

become competitive with fossil fuel based electricity generation, with supportive policy regimes across the world, exploitation of offshore wind energy is yet to reach a comparable scale. India has achieved significant success in the onshore wind power development, with over 23 GW of wind energy capacity already installed and generating power.

Attraction and challenges to offshore wind power

The offshore wind farming is of two types viz. shallow water and deep sea farming. Most progress around the world has been done in case of shallow water wind farms only. The offshore wind faming is attractive because of several reasons such as stronger winds for efficient generation of power; no impact on real estate value of land as in case of onshore wind farming; its ability to fulfil the demand of the heavily populated coastal regions and no significant environment costs.

The key challenges to offshore wind farming include heavier investments, better technology, maintenance issues etc. Further deep sea wind farms come with the challenges of assigning no-go areas for commercial shipping. There would be a need to devise new lanes, proper lightning for ships to pass on.

National Offshore Wind Power Policy

India is making significant progress in the development of the onshore wind power plants. However, so far progress in the offshore wind power generation has been almost nil. A 100MW offshore wind power plant was started in Gujarat for demonstration purpose only. Since India has more than 7600 Kilometres of coast, the prospects of development of offshore wind power are very bright.

In September 2015, the Union Cabinet has approved the National Offshore Wind Energy Policy. With this, the Ministry of New & Renewable Energy (MNRE) has been authorized as the Nodal Ministry for use of offshore areas within the Exclusive Economic Zone (EEZ) of the country and the National Institute of Wind Energy (NIWE) has been authorized as the Nodal Agency for development of offshore wind energy. Government has paved way for development of the offshore wind farms up to the seaward distance of 200 Nautical Miles (within its Exclusive Economic Zone) from the base line.

With the introduction of the National Offshore Wind Energy Policy, India would try to replicate the success of the onshore wind power development in the offshore wind power development.

Solar Power

Importance of Solar Power

The importance of solar power can be gauged from the fact that the energy that reaches from sun on earth for one hour is more than enough to satisfy the global energy demand for an entire year, if all the heat and light can be harnessed. But practically, it's not possible. There are some technologies we

have for harnessing this energy to make it usable. These include solar heating, photovoltaics, solar thermal energy, solar architecture and artificial photosynthesis.

The solar energy is highly appealing because of two reasons viz. first, large magnitude of solar energy available and second, its clean, renewable source of energy. The energy output of1 Kilo Watt solar energy is roughly equivalent to the burning of 170 pounds of coal and releasing of 300 pounds of carbon dioxide into the atmosphere". Thus, solar energy is non-polluting, viable and renewable source of energy that can mitigate the challenge of global warming.

Active and Passive Solar Energy

The difference between active and passive solar energy is of how the solar energy is collected and harnessed. A passive solar system does not involve the mechanical devices to capture the solar energy. One example is of green houses. In green houses, the sun's rays pass through the glass roof / windows and the interior absorbs and retains the heat. The passive solar energy collectors simply work on the basic law of thermodynamics that heat moves from warm to cool areas and surfaces. The passive collectors would pass on the heat captured from sun via convection.

In contrast, the active solar system uses external devices to collect, store and convert the solar energy. They absorb the solar energy, store it for later use and convert it to make it usable. These include photovoltaic systems, concentrated solar power and solar water heating.

Photovoltaic System & Concentrated Solar Power

Photo-voltaic (PV or SPV i.e. Solar PV) cell converts solar optical energy directly into electrical energy. In recent times, PV market has emerged as one of the fastest growing markets around the world.

Each PV is essentially a semiconductor device. These cells have currently low energy conversion efficiency, which implies that they are able to generate electricity only out of 1/6th of solar light striking them. There are several reasons of this low efficiency of 15-17%. Firstly, around 30% of the light is reflected. This reflectance can be reduced only by 3-5% by surface texturing and anti-reflection coating. Secondly, all the photons cannot contribute in the production of the photovoltaic current. Only photons within a range of frequency corresponding to the so called 'band gap' of the semiconductor material can be used for this purpose. The photons with lower frequency are lost and the photons with higher frequency than this range appear as heat. Further, since the PV units are exposed to sun, they tend to leak energy as their temperature rises. Efforts are on to increase the efficiency of the PV cells.

Types of PV systems

There are four types of the PV solar cells viz. standalone, PV Hybrid, Grid Connected and solar

power satellite. The standalone system are the self-sufficient solar cells which have a battery connected for its own purpose. One example is solar street light, which has its own PV power generating device, a battery and a fluorescent lamp. It is self sufficient, not connected to any grid. Another example of standalone PV systems are home lighting systems that work with one or two lights along with a small fan.

The standalone PV systems have seasonal dependence and not reliable in periods of solar irradiance. So, to make them reliable, the Hybrid PV systems have evolved. In such system, the PV system is associated with a complimentary power generation device such as a diesel generator unit, which provides "power conditioning".

The Grid connected PV system is connected to a state grid and works to supplement the grid power during the daytime when a substantial quantum of solar energy is present.

The solar power satellite is at conceptual stage only. The idea is that most part of solar energy is absorbed by the atmosphere and is difficult to utilize due to low density of energy flux. So, the PV devices could be arrayed in space as a geostationary satellite. It will receive solar light 24 hours in a day and would convert the energy into power efficiently. The power thus generated will be converted into a narrow microwave beam of around 10cm wavelength and would be transmitted to earth to be received by an antenna, which would be connected to grid. Microwave is not threat to aircrafts and birds.

Various constraints in use of PVs in India

Efficiency Issue

The traditional crystalline solar cells are flat plate, made from silicon wafers. These cells have a low efficiency of 12–18 per cent. Second-generation solar cells are called thin-film solar cells because they are made from amorphous silicon or nonsilicon materials such as cadmium telluride. Third-generation solar cells are being made from variety of new materials besides silicon, including solar inks using conventional printing press technologies, solar dyes, and conductive plastics. Each of these generations tries to harness maximum fraction of the solar irradiation. One of the latest technology produces the multi-junction solar cells which comprise several layers of semiconductors. The single-layer crystalline silicon cells are able to catch only a part of the solar spectrum while several layers trap the entire spectrum. In such cells efficiencies reach up to 50 per cent. Currently, such technology is not very common in India.

Land Issue

Land is needed to spread the PV cells to produce substantial energy. For any large solar project, land makes highest of all the projected costs. To produce 1MW of electricity, roughly 5 acre land is needed. The emerging options to overcome this issue include installing the solar PV systems on

water bodies such as lakes, reservoirs, canals etc. Another option is to install them on large dams / reservoirs used for Hydel power production. Further, a new concept of floating photovoltaic systems has emerged whereby the PV is installed in floating condition over water bodies.

Price Issue

Currently coal provides power at about Rs. 2 a unit as compared solar power at a range of Rs 11 to Rs 7. However, lots of considerable hope is from this segment that costs would come down dramatically and solar power would be equivalent to other modes in near future. This is because prices have come down significantly from Rs.17.90 per unit in 2010 to under Rs.7 per unit in current year. To bring down the cost and achieve grid parity, government had launched the Jawaharlal Nehru National Solar Mission in 2010, whose target has been now upwardly revised to five times of what it planned initially.

Concentrating solar power (CSP)

Concentrating solar power uses the sun's heat to generate electricity. What is basically done is to use the mirrors and lenses to concentrate the sun's rays on the absorber and use this heat to make a fluid get heated up to 500°C to produce electricity by running a electric generator. Thus, SPV and CSP are two fundamentally different methods of harnessing the solar power.

Government Policy on Solar Power

As of October 2015, India's total commissioned solar power capacity is 4575.308MW. Rajasthan, Gujarat and Madhya Pradesh are leading states with solar power installed capacity. Currently, India is world's sixth largest country in terms of installed capacity, but is number one in terms of solar electricity production per watt installed. This is mainly due to availability of 300 clear sunny days in a year and high insolation, particularly in western part of India.

Jawaharlal Nehru National Solar Mission

In January 2010, the UPA Government had launched National Solar Mission (which was later renamed as Jawaharlal Nehru National Solar Mission) with an aim to install the solar power generation capacity of 20,000 MW by the end of the 13th Five Year Plan in 2022. This plant was to be completed in three phases as follows:

- **Phase-I** 2010-2013 target 1,000-2,000 MW.
- **Phase-II** 2013-2017 target 4,000-10,000 MW.
- **Phase-III** 2017-2022 target 20,000 MW.

The NDA Government has scaled up the target to five fold at 1,00,000 MW (100GW) to be achieved by 2022. There are two separate targets to be achieved viz. 40 GW Rooftop and 60 GW through Large and Medium Scale Grid Connected Solar Power Projects. If this target is achieved, India would

be one of the largest Green Energy producers in the world and would be surpassing several developed countries.

Salient Features of the mission

The mission would involve total investment of Rs. 6 Lakh Crore in the installation of 100GW of solar power. Currently, the mission

The total investment in setting up 100 GW will be around Rs. 6,00,000 Crore. Out of this, a significant amount of Rs. 90,000 Crore would be invested using the so called Bundling Mechanism with thermal power.

What is Bundling Mechanism?

The thermal energy giant NTPC will built its own 3300MW solar power capacity and would tender another 3000MW under this power bundling scheme. The meaning of power bundling is that NTPC would tender private players to produce solar energy and would bundle that energy with thermal energy to sell at an average rate. We note that NTPC would bring in two solar parks, one at Anantpur in Andhra Pradesh and another at Conoon in Tamil Nadu with 1500 and 1000MW capacity respectively.

Support Interventions

[currentuser_id]T0 achieve the massive target, the government would provide the following support interventions:

- Changes in land use regulations and tenancy laws to faciliate aggregation and leasing of land by land holders / farmers for solar projects
- Identification of large lands, government offices for rooftop projects
- Clear survey of wastelands and identification of transmission infrastrucre
- Develop a Green Energy Corridor (solar power transmission network is being called corridor here)
- Setting up exclusive parks for domestic manufacturing of solar PV modules
- Making provisions of 10% renewable energy and rooftop SPV mandatory for constructions in urban areas
- Making changes in building bye-laws to make mandatory provisions for rooftop solar power in new constructions
- Considering infrastructure status for solar projects
- Tax free solar bonds
- Make rooftop a part of housing loans
- Amend the Electricity Act for strong enforcement of Renewable Purchase Obligation (RPO)

and for providing Renewable Generation Obligation (RGO)

- Integrate the measures with Integrated Power Development Scheme (IPDS)
- Bring down / eliminating customs and excise duty on solar power inputs.

Critical Examination

Currently, India has little over 4GW of installed solar capacity. In order to reach 100GW by 2022, the installed capacity would need to double every 1.5 years. This implies that the installed capacity needs to grow by some 62%. During the tenure of the earlier government, the speed of execution was tardy. The effective and speedy implementation need clear cut policy regime. Given the fact that less than 1% of the uncultivated land of the country can be used to install a 60GW solar capacity, the target seems to be massive but not impractical target. Since most such projects need land to be implemented, the central role has to be played by the state governments as land comes under their powers. Some states such as Gujarat and Karnataka have created land banks while some other states such as Rajasthan is giving land on 25 years lease. Such state driven initiatives are key to success of this mission. Further, long term, low interest debt finance; proactive role of power ministry in expanding the Green Corridors and exemptions from taxes, charges etc. help for quick implementation of the project.

The mission also includes installation of 40GW rooftop PVs in India. Government would need to provide impetus to production of domestic solar cells by giving various incentives. Currently, India's production of solar cells is not competitive and faces massive competition from Chinese solar cells.

General Knowledge Today

Infra-2: Oil Sector, Oil Prices, Energy Security

Integrated IAS General Studies:2016-17
Last Updated: November 13, 2016
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Contents

Prelims MCQ Topics

Largest producers, consumers and exporters of oil; BTU/ Joule; Upstream, Downstream in petroleum; Sweet, Brent and Sour Crude Oil; location of gas oil fields; Industry wise use of Natural Gas in India; Specific gravity in oil; Vertical Integration versus Horizontal Integration; OPEC Members; Oil Bonds; APM and non-APM Gas and PPAC's role; Oil prices and current account / revenue deficit; Shale Gas; Jambusar; CBM; Gas Hydrates; Carbon Tax; National Clean Energy Fund; Petroleum And Explosives Safety Organisation.

Mains Model Questions

1. Critically examine the circumstances that led to Oil Crisis of 1973. To what extent similar circumstances might appear in near future? Discuss.
2. To what extent the authority of OPEC in deciding the global oil prices has eroded? What are the factors that led to this erosion? Examine.
3. Explain the current system of global oil pricing.
4. To what extent the New Domestic Natural Gas Pricing Guidelines, 2014 have addressed the confusion created by APM and Non-APM system of gas pricing in India. Discuss throwing light on its salient features.
5. Discuss the key features of the New Exploration Licensing Policy (NELP) throwing light on its role in oil industry.
6. Discuss the implications of deregulation of the petroleum prices on economy.
7. "In last one and half year, the Global oil prices have fallen sharply." Examine the reasons and its implications for oil producers, consumers and environment.
8. Cheaper oil will not eliminate structural challenges facing Asia's biggest economies although it presents a huge opportunity for both India and China. Explain.
9. "The Plasma Pulse Technology (PPT) seems to be an answer to significant environment costs of traditional shale gas production technologies." Discuss.
10. What do you understand by energy security? Critically examine the link between Food, Water and Energy Securities.
11. India needs an Integrated Energy Policy to provide clean, safe and convenient form of energy to all sectors in an economically viable manner. Discuss Critically.

Oil Sector Basics

Petroleum and Natural Gas are mixtures of liquid, gaseous, and solid hydrocarbons along with some other compounds. Different types of molecules give them liquid/ gaseous states and different colour , viscosity and odour. Similar to coal, oil and gas are fossil fuels formed in the sedimentary rocks from

buried dead flora / fauna including algae and phyto/zooplankton. Most petroleum of the world is extracted via drilling, while there are some natural oil springs / petroleum seeps as well in world.

The petroleum products have been used since ages however, world's first petroleum refinery was established in mid of 19th century in Poland by a chemist named Ignacy Łukasiewicz.

Current Global Production Figures

Largest Proven Oil Reserves

With total 297 billion barrels, world's largest proven oil reserves are located in Venezuela. Next countries with largest proven oil reserves are Saudi Arabia, Canada and Iran.

Largest Producer Countries

Traditionally, Russia and Saudi Arabia have been world's largest oil producers. In 2012, Russia was world's largest oil producer with 544MT oil production followed by Saudi Arabia (520Mt). Since 2014, United States has emerged as world's largest oil producing country, followed by Saudi Arabia, Russia and China. In terms of production, India stands at **20th** number among the world's countries.

Largest Consumer Countries

United States is largest Consumer of Oil in the world, followed by China, Japan and India. Russia is fifth largest consumer of Oil. Japan is the largest non-producing Consumer of Oil.

Top Oil Importers

United States is largest importer of Oil, followed China, India and Japan. India is world's 3rd largest importer of oil.

Top Oil Exporters

Saudi Arabia is largest exporter of oil in the world, followed by Russia, UAE and Iran.

Key Concepts Related to Oil Sector for Prelims

Barrel and BTU

One barrel of oil is 42 U.S. gallons or 35 British gallons or 158.987295 litres.

British Thermal Unit is the amount of heat required to raise the temperature of 1 pound of water by 1 degree Fahrenheit. It is equal to 1055.05585 joules.

Upstream, Midstream and Downstream Industries

The petroleum industry can be divided into three parts viz. upstream, midstream and downstream. Upstream refers to searching for and the recovery and production of crude oil and natural gas. The upstream industry is also known as Exploration & Production (E&P) sector. The downstream sector refers to refining of the crude oil and selling distribution of natural gas and products derived from the crude oil. The products are LPG, Gasolene, Jet Fuel, Petroleum coke, asphalt, lubricants, synthetic rubber, plastics, antifreeze, pesticides , Pharmaceuticals and synthetic fibers. Midstream refers to the transport of the Petroleum products is done mainly by pipelines globally. Midstream involves transport of the crude oil to refinery and refined products to the consumers.

Sweet, Brent and Sour Crude Oil

Sweet crude oil contains less than 0.5% Sulphur, while sour crude contains more than 0.5%. Sweet crude oil has a sweet aroma because of less sulphur. The low quantity of sulphur makes it more suitable / easier to produce gasoline that is why sweet crude oil is expensive. Presence of sulphur makes it toxic and also the production of gasoline is expensive. Brent Crude Oil is a sweet crude oil mainly produced in North Sea. It is largest of the several key classifications of crude oil comprising of Ekofisk, Brent Crude, Forties, Brent Sweet Light Crude and Oseberg. Its manufacturer also known as London Brent, Brent petroleum and Brent Blend.

Sour Crude Oil and the Gulf War Syndrome

Due to high sulphur content, the Sour Crude oil can be toxic and corrosive, particularly when it contains high levels of hydrogen sulfide (H2S). At low concentrations has the odor of rotten eggs. At high concentrations the breathing of hydrogen sulfide (H2S) is right away fatal. At even higher concentrations, the hydrogen sulfide (H2S) can spoil the Olfactory Nerve, making the gas in fact odorless and undetectable, whilst paralyzing the respiratory system. Its effects on the human body may be alike to that of Gulf War Syndrome (headaches, dizziness, chronic fatigue, memory problems, birth defects, skin problems and breathing problems viz. asthma).

Doctor test

Doctor test is the name of a qualitative method of detecting undesirable sulfur compounds in petroleum distillates, that is, of determining whether oil is "sour oil " or "sweet oil".

First discovery of Oil in India

First oil well of India was drilled by Assam Railway & Trading Company in 1865, just 6 years after world's first oil well was drilled in United States in 1859. First discovery of oil took place in Digboi in Assam in 1889.

Oil policy immediately before and after independence

- Before World War -II, India's oil exploration was under the multinationals / private companies and they produced a small amount of oil in north east. After independence, the Assam Oil Company was nationalized and currently, it is a division of the Indian Oil Corporation. There was a complete no to private participation in oil exploration after independence. The Industrial Policy of 1956 declared that – future development of oil industry will be responsibility of state.

Initial discoveries of oil in India

- The first oil discovery of Independent India happened in 1953 near Nahorkotiya (Naharkatiya) in Assam. Other discoveries included Ankleshwar in Cambay Basin in 1958; Mumbai High in Mumbai Basin in 1972; Cauvery in 1958 (Karaikal-1); Jaiselmer sub-basin in

1958 (Manhertibba- 1) and Assam-Arakan yoma fold belt in 1973 (Baramura-1).

- In later 1950s, the government established an Oil and Natural Gas directorate under Geological Survey of India for oil exploration. It was later converted into Oil and Natural Gas Commission and finally 1995, it was changed into Oil & Natural Gas Commission (ONGC). Indian Oil Company was established in 1959.

Oil Reserves, Production and Foreign Trade

The oil reserves of the country are shown in several types of figures such as probable reserves, proven reserves, strategic reserves etc. Probable / Indicated reserves means oil has been sampled and an estimation has been made but the quantity / quality has low level of certainty. Thus, indicated reserves show low level of confidence.

On the other hand, Proven reserves can be recovered from a deposit with a reasonable amount of certainty. Thus, proven reserves indicate the confidence in their production.

Strategic reserves refer to the inventories maintained by the government / industry to tackle any contingency leading to energy crisis.

Oil and Gas Reserves

As per the 2014 data, India's total proven oil reserves are close to 5,650-5,710 million barrels. In terms of proven oil reserves, India is 24th country in the world. Venezuela and Saudi Arabia are largest countries in terms of proven reserves. In 2014-15, India's Natural Gas reserves were 1488.73 BCM (Billion Cubic Meter).

Current Production and Import Stats

The crude oil production for the year 2014-15 is at 37.461 Million Metric Tonnes (MMT) as against production of 37.788 MMT in 2013-14, showing a decrease of about 0.87%. The reason for decrease are twofold, firstly the natural decline in the old and ageing fields; and secondly, production of crude oil was affected due to less production from Rajasthan and Andhra Pradesh. Import of Crude Oil during 2014-15 was 189.432 MMT with an oil bill of Rs. 6,87,350 crore. This implies that 75 per cent of total oil consumption is being met through imports, India's dependence on imports for petroleum and petroleum products is very high. India continues to be a net importer of Oil. India also exports Petroleum products and with approximately 13.8 % share in the total exports of India, Petroleum remains far below the other products. Petroleum, Crude Oil and other products are India's largest Import Commodity.

Key Oil / Gas fields of India and their states

India's oil producing states / UTs are Assam, Tripura, Manipur, West Bengal, Mumbai, Gujarat, Jammu & Kashmir, Himachal Pradesh, Tamil Nadu, Andhra Pradesh, Coastal Kerala, Andaman & Nicobar. Main oil / gas fields are located in below regions:

- Gujarat – Cambay , Kutch
- Assam – Upper Assam, Amguri,
- Rajasthan -Jodhpur, Barmer, Jaisalmer, Bikaner, Naguar
- Andhra Pradesh: Krishna Godawari Basin
- Tamil Nadu – Cauvery Basin
- Odisha – Mahanadi Basin
- Maharastra – Mumbai Offshore
- Arunachal Pradesh – Kharsang Oil Field
- Madhya Pradesh – Sohagpur
- Jharkhand – Jharia, Bokaro
- West Bengal – Ranigunj

Mumbai High

Mumbai High is an offshore oilfield 160 kilometers off the coast of Mumbai and under the operations of ONGC. First offshore well was shrunk here in 1974.

Mangla Area

Mangla Area is located on RJ-ON-90-1 (the Rajasthan Block) in Barmer district of Rajasthan. It is being operated by Ciarn Energy and is supposed to have 3.6 billion barrels of oil.

KG D6

D-6 block in the Krishna Godawari basin is in Andhra Pradesh and here Reliance Industries discovered the biggest natural gas reserves in India in 2002.

Oil Refineries in India

Some of important refineries of India are as follows:

- **Barauni Refinery, Bihar:** Located in Bihar and was built in 1964 with the help of USSR.
- **Bongaigaon Refinery, Assam :** Located at Bongaigaon, Assam. Bongaigaon Refinery and Petrochemicals Limited (BRPL) is a subsidiary of IndianOil(IOC).
- **Chennai Petroleum Corporation Limited:** It has two refineries viz. Manali Refinery Chennai and Nagapattinam refinery in Cauvery Basin.
- **Digboi Refinery, Assam: This is oldest refinery and was set up in 1901 in Digboi , Assam**. It was took over later by IOC.
- **Essar Refinery, Gujarat** : Essar Refinery is under commissioning at Vadinar, Gujarat. It is a private sector refinery under Essar Group.
- **Gujarat Refinery, Gujarat** : Located near Baroda Gujarat and is largest refinery of IOC and largest public sector refinery of India.
- **Guwahati Refinery, Assam**: Guwahati Refinery is located at Noonmati Assam. It is owned

by Indian Oil Corporation.

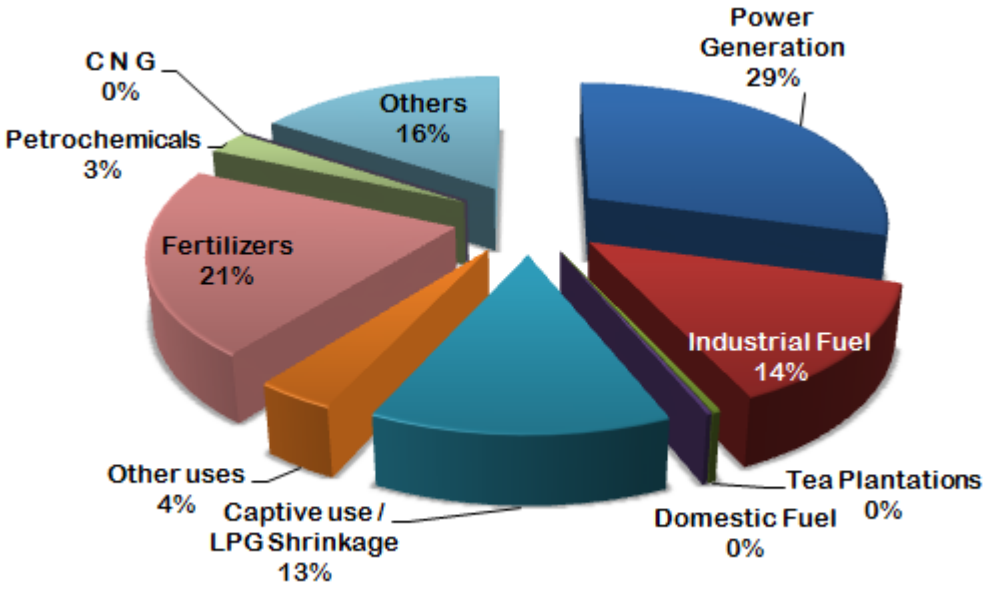
- **Haldia Refinery, West Bengal** : Haldia Refinery is located in West Bengal
- **Kochi Refineries Ltd (KRL), Kerala** : Kochi Refineries Ltd (KRL) is located at Kochi and is owned by Bharat Petroleum Corporation Ltd.
- **Mangalore Refinery and Petrochemicals Limited, Karnataka**: Mangalore Refinery and Petrochemicals Limited is now acquired by ONGC and was set up in 1998.
- **Mathura Refinery, Uttar Pradesh**: Mathura Refinery is owned by Indian Oil Corporation and is located in Mathura. It was alleged for causing white marble of Taj Mahal to yellow./
- **Jamnagar Refinery, Gujarat** : The Jamnagar Refinery is owned by Reliance Industries in Jamnagar, Guajarat. *It is the largest Greenfield refinery in the world.*
- **Mumbai Refinery, Maharashtra :** Mumbai Refinery is located in Mumbai and was promoted by Esso before being aquired by the Government of India.
- **Mumbai Refinery Mahaul. Maharashtra :** Mumbai Refinery Mahaul is under Bharat Petroleum Corporation Ltd.(BPCL)
- **Panipat Refinery, Haryana :** Panipat Refinery belongs to Indian Oil Corporation Ltd.
- **Vizag Refinery, Andhra Pradesh:** Visakhapatnam Refinery is of HPCL.

Butcher Island

Butcher Island is also known as Jawahar Deep and is off Mumbai Coast. There lies an oil terminal used by the port authorities to offload it from oil tankers.

Industry wise use of Natural Gas in India

India is the world's seventh largest energy producer, accounting for 2.49% of the world's total annual energy production. Around 60% of the natural gas produced in India is used for Energy purpose. Out of this, maximum amount is used in Power Generation, followed by Industrial Fuel and LPG use.



In Non-energy purposes, Maximum amount of Natural Gas is used in India in Fertilizer Industry as feedstock.

Global Petroleum Prices

The crude oil prices about which we generally read in newspapers are the spot price per barrel or per 159 litres. The rate at which Crude oil is sold in market is highly dependent on its grade, its *specific gravity*, its sulphur content, and its location of production as well as delivery (for logistics reasons).

Specific gravity in oil

Regarding Specific gravy in oil, there is an **API gravity** or American Petroleum Institute gravity which measures how heavy or light petroleum liquid is compared to water. If the API gravity is greater than 10, Crude oil is lighter and floats on water; if less than 10, it is heavier and sinks.

On the basis of several parameters, there can be several types of crude oils. Due to this, there are certain **benchmark crude oils** used for pricing of the oil. This means that a benchmark crude oil serves as a reference point for the many other crude available. The important benchmark crude oils are Argus Sour Crude (ASC), Bonny Light , Brent, Dubai , Indonesian, Isthmus-34 Light , Japan Cocktail , OPEC Reference Basket , Tapis , Urals and West Texas Intermediate (WTI). Out of them, the three primary benchmarks are WTI, Brent Blend and Dubai.

The OPEC basket is used by OPEC, Tapis Crude is traded in Singapore, Bonny Light is used in Nigeria and Isthmus-24 light is used in Mexico.

Pricing in Pre OPEC Era

The world oil prices were first administered by the large multinational oil companies in the 1950s and 1960s in the name of a 1927 *Red Line agreement* and one more such agreement. At that time, the international oil industry outside the United States, Canada, the USSR and China was characterised by the dominant position of a group of large multinational oil companies called **Seven Sisters** or the **seven oil majors**. These majors controlled 85% of the crude oil production in the world outside Canada, USA, Soviet Russia and China.

In those times, the host governments did not participate in production or pricing of crude oil and acted only as competing sellers of licences or oil concessions. In return, host governments received a stream of income through royalties and income taxes.

Each of the Seven Sisters was **vertically as well horizontally integrated.** They had control of both upstream and downstream operations. These companies were able to control the rate of supply of crude oil going into the market through joint ownership of companies that operated in various countries. The vertical and horizontal linkages enabled them to control the bulk of oil exports and prevent large amounts of crude oil accumulating in the hands of sellers, thus minimising the risk of sellers competing to dispose of unwanted crude oil to independent buyers and thus pushing prices down. Thus a kind of *oil companies cartel* was developed, this so called cartel was able to administer the prices till 1972.

Vertical Integration versus Horizontal Integration

Vertically integrated companies in a supply chain are united through a common owner. Usually each member of the supply chain produces a different product or service, and the products combine to satisfy a common need. It is contrasted with horizontal integration which occurs when a firm is being taken over by, or merged with, another firm which is in the same industry and in the same stage of production as the merged firm, e.g. a car manufacturer merging with another car manufacturer.

Pricing in the OPEC era

In 1960, OPEC was formed to counter the cartel and try to control the prices of oil. Between 1965 and 1973, global demand for oil increased at a fast rate with an average annual increase of more than 3 million barrel per day during this period. Most of this increase was met by OPEC countries which massively increased its production from around 14 million b/d in 1965 to close to 30 million b/d in 1973.

About OPEC

The Organization of the Petroleum Exporting Countries is an intergovernmental organization of twelve oil-producing countries made up of Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela. OPEC has had its headquarters in Vienna since 1965, and hosts regular meetings among the oil ministers of its Member Countries. Indonesia withdrew in 2008 after it became a net importer of oil, but stated it would likely return if it became a net exporter again.

Thus, between 1965 to 1973, the share of OPEC in the global crude oil production increased from 44% to 51%. This was followed by certain politico-legal events. In August 1971, the United States triggered the collapse of Bretton Woods system by unilaterally pulling out of Bretton Woods Accord, taking the US off the Gold Exchange Standard, allowing dollar to float.

Gold Exchange Standard

In this system, only the value of the U.S. dollar had been pegged to the price of gold and all other currencies were pegged to the U.S. dollar. allowing the dollar to "float".

Shortly thereafter, Britain followed the suit, floating the pound sterling. The industrialized nations followed suit with their respective currencies.

These respective currencies started fluctuating. In anticipation of the fluctuation, the industrialized nations also increased their reserves by printing more money. The result was a depreciation of the value of the U.S. dollar, as well as the other currencies of the world.

By that time, the oil was priced in dollars. The depreciation in dollar meant that the oil producers were now receiving less real income for the same price. So, the OPEC issued a joint communiqué saying that, from then on, they would price a barrel of oil against gold.

Oil Crisis of 1973

The huge demand for oil makes the oil markets as the sellers market. There was a significant power of the OPEC countries in the oil market in contrast with the multinational oil companies.

The decision of the OPEC to sell oil against Gold led to the so called **Oil Shock.** The prices of oil became extremely volatile. As of then, there were no institutional mechanisms to update prices rapidly enough to keep up with changing market conditions. In 1973-74, there was a substantial rise in the prices of Oil

In 1973, as a part of the Arab-Israel conflict, the Syria and Egypt launched an attack on Israel. The political crisis led to huge rise in oil prices. The western countries insisted on paying low prices to oil producing nations and at the same time also selling inflation priced goods (for example wheat) to oil producers. In October 1973, the OPEC countries placed an embargo i.e. a cut in production by five percent from previous month's output, and to continue to cut production over time in five percent

increments.

The pro-Israel policies of United States then led Libya to announce that it would embargo all oil shipments to the United States. The same suit was followed by Saudi Arabia and the other Arab oil-producing states. Oil stopped flowing to America and Western European countries.

Over the long term, the oil embargo changed the nature of policy in the West towards increased exploration, energy conservation, and more restrictive monetary policy to better fight inflation. The price of oil quadrupled by 1974 to nearly US$12 per barrel. The impact was dramatic on Middle East counties, they accumulated huge wealth. The other impact of this crisis was that the countries of the world recognized the importance of this vital commodity and started exploring / conservation oil and looking for other alternatives.

Oil Crisis of 1973 and Oil Glut of 1980s

The 1973 oil crisis had turned oil from a cheap to a very expensive energy source. During the 1973 energy crisis, the price of oil had quadrupled. The prices of virtually administered by OPEC for the next few years. In 1979, there was a political turmoil in Iran when amid massive popular agitations, the Shah of Iran Mohammad Reza Pahlavi, fled his country and Ayatollah Khomeini became the new leader. The oil sector of Iran was greatly affected as the production curtailed and exports suspended.

The new regime resumed the oil exports; but by that time the exports became inconsistent and in lower volumes. This pushed the oil prices up. By this time Iran was biggest exporter of Oil. The inconsistent export of oil by Iran was tried to make up with the increased exports from Saudi Arabia and other OPEC nations, but by that time, the widespread panic had resulted in the unexpectedly high prices of oil. This is called 1979 Oil Crisis. In 1980, the war between Iran and Iraq started. Thus, oil production in Iran nearly stopped, and Iraq's oil production was severely cut as well. After that there was an increase in both production and export of oil from other countries such as Mexico, Nigeria, and Venezuela. Oil started flowing the market from North Sea and Alaska. *The net result was that the grip of OPEC on oil prices diminished gradually.*

In 1981, the production of oil by OPEC was surpassed by that of other countries. Additionally, its own member nations were divided among themselves. Saudi Arabia, trying to gain back market share, increased production and causing downward pressure on prices. Oil prices fell gradually and then there was a surplus crude in the market. This is called Oil Glut of 1980s. The result of the Oil glut was that the oil prices plummeted and the oil cartels lost its unity. The glut also adversely affected the other oil exporters such as Mexico, Nigeria, and Venezuela, whose economies had expanded in the 1970s, were plunged into near-bankruptcy, and even Saudi Arabian economic power was significantly weakened.

Current Market Related System of Oil Pricing

The collapse of the OPEC administered pricing system in 1986-1988 ushered in a new era in oil pricing in which the power to set oil prices shifted from OPEC to the so called "market". This system was first adopted by the Mexican national oil company PEMEX in 1986. Soon, it received wide acceptance among most oil-exporting countries and by 1988 it became and still is the main method for pricing crude oil in international trade. The reasons which led to development of market related pricing of the oil prices are as follows:

- The frequent waves of protests and political crises led to disruption supplies to multinational oil companies
- OPEC oil production reduced and emergence of many suppliers outside OPEC
- Development of a complex structure of interlinked oil markets which consists of spot and also physical forwards, futures, options and other derivative markets referred to as paper markets
- Technological innovations that made electronic trading possible allowing 24-hour trading from any place in the world. It also gave rise to new market participants and allowed the development of a large number of trading instruments both on regulated exchanges and over the counter.

The current reference, or pricing markers, is Brent, WTI, and Dubai/Oman. The oil price reporting agencies (PRAs) are an important component of the oil industry. The prices that these agencies identify or assess underlie the basis of long-term contracts; spot market transactions, futures markets contracts and derivatives instruments. PRAs use a wide variety of methods to identify the oil price which may include the volume weighted average system, low and high deals done, and market-on-close (MOC).

On the onset of the Global Financial Crisis in 2008, there was a dramatic rise in the prices of crude oil to as high as $148/bbl the international market. This was followed by an equally dramatic fall. This posed a challenge to the economy of oil importing countries including India.

Domestic Pricing of Petroleum

The oil prices in India have been traditionally regulated by the Government.

Administered Price Mechanism

From 1970s to 2002, there was an Administered Price Mechanism (APM) system in place in oil sector. Under this system, the oil and gas sector was controlled at four stages viz. production, refining, distribution and marketing. The supply of raw material to the refineries at point of refining was done at a predetermined price called 'delivered cost of crude'. The finished products were also

made available at predetermined priced called 'ex-refinery prices'. The overall regime was based on the principle of compensating normative cost and allowing a pre-determined return on investments to the oil companies. For example ONGC and OIL were compensated for their operating expenses and allowed a 15% post-tax return on the capital employed. Both ONGC and OIL sold crude to refineries at $7-8 per barrel when the prevailing oil price was $17-19. Government regulated sourcing and import of crude, its refining as well as its sale till it reached the end consumer.

This system worked till 1980s when there was an upward swing in the oil prices. The escalating demand made the PSU's overburdened and this started the series of additional imports of crude oil at very high costs. So the need was felt for deregulation and decontrol. There were some other reasons also that led to dismantling of the APM in late 1990s. Firstly, the the idea of providing returns on cost-plus formula was not encouraging to encourage efficiency in prduction because it was not at all profit motivated. Secondly, oil sector had started getting gradually decontrolled in late 1980s and part by part foreign, private investment was made opened in most activities of this sector. So long only PSUs were players, government was able to effectively control the investments and costs. But as the entry of the private sector happened; the inflated costs posed a risk to the PSUs. Thirdly, since any government decision could affect the profitability; the oil sector did not see any substantial investments.

After the new Industrial Policy of 1991, the government first opened refinery sector for private participation. This led to emergence of one of the largest players – Reliance Refinery. The decision to move from a the industry to a market driven petroleum sector was the most important decision which resulted in the dismantling of the Administered Price mechanism in April 2002.

Under the new regime, Oil Marketing Companies (OMCs) were made free to set retail product prices based on a so called import parity pricing formula. *The domestic refining and retail sector was also opened to private-sector firms, leading to the emergence of a small private-sector retailing presence in India consisting of firms such as RIL.* Because of the importance of LPG and kerosene, per unit subsidies funded from the government's budget were maintained on LPG and on a fixed proportion of supplied kerosene.

This system continued till mid-2004, **when it was effectively abandoned**, with the *Central Government once again centrally controlling upward price revisions.* The government used to increase / decrease the price of petrol and diesel, and the prices of LPG and kerosene prices have remained effectively fixed due to heavy subsidy upon them.

- The prices of petrol and diesel were protected because of the importance of these products as transport fuels (especially as they are widely used in public transport, food freight, etc).

- Diesel in particular is important, as it makes up over one-third of India's petroleum product consumption, and has uses outside transport, e.g., as an input into agricultural production.

The abolishment of APM led to the private-sector to rapidly set up retail operations and all of a sudden we saw rise of many new petrol pumps belonging to RIL, Shell and Essar. But when the prices again come under de facto control of the government, these three private firms which had retail license in India were forced to close their retail outlets across India, because of uneconomical business of retail trading of petrol and diesel.

Till recently, India maintained price controls on four "sensitive" petroleum products – petrol, diesel, liquefied petroleum gas (LPG), and kerosene. India's government-owned Oil Marketing Companies (OMCs) were tasked by the Government of India (GoI) to sell these products in retail markets at a centrally determined sales price. Upward revisions to prices in response to higher global crude prices were rare. The upwards revisions were subject to all kinds of political implications as well.

The objective of these controls was to insulate consumers against high global crude oil prices. But due to frequent ups and downs in the oil prices, the Oil Marketing Companies started recording significant "**under-recoveries**" on the sale of sensitive petroleum products. Under recoveries is a measurement that represents more or less the difference between the refinery-gate **cost of refined product** paid by OMCs and their managed sale price.

Under-recoveries are calculated as the difference between the cost price and the regulated price at which petroleum products are finally sold by the OMCs to the retailers after accounting for the subsidy paid by the government.

A large part of these under-recoveries is compensated for by additional cash assistance from the government (over and above the fiscal subsidy). *Some part is also compensated by the upstream companies* while remaining portion remains uncompensated to the OMCs. In 2008, the highest prices of crude oil in the international market led the OMCs under-recoveries to be around USD 25 billion. The Government had to issue hundreds of billions of Indian rupees to OMCs to counteract mass under-recoveries since 2005 in order to maintain the solvency of these key companies. Most of this funding was done using the debt securities called Oil Bonds. The drag on fiscal condition of the country was very acute.

Oil Bonds

The mechanism for oil bonds was devised in 2005-06. The oil bonds issued by the government typically have maturities of ranging between 5-7 years, although maturities can be up to 20 years. Oil companies used these bonds to sell them in the bond markets or to use as collateral to raise cash. But there were several issues with them. Firstly, the Indian oil bonds were not given Statutory Liquidity Ratio (SLR) status by RBI. This implied that they could not be counted as the verifiable liquid assets in the reserves of Indian banks to make up requisite SLRs. *This had an adverse implication upon the tradability of oil bonds on secondary bond markets.* Secondly, government released different kinds of bonds such as farm bonds and fertilizer bonds, causing a significant bond market glut in India. The OMCs had compete in buyers' bond markets to sell their fixed-yield assets, leading to falling bond prices.

Deregulation of petrol and diesel

In June 2010, the petrol prices were first deregulated. In October 2014, the NDA government lifted government control from diesel pricing also.

Domestic Pricing of Natural Gas

India has a complex and heterogeneous gas pricing system mainly composed of two pricing regimes viz. APM (Administrative Price Mechanism) and non-APM (aka. free market gas). The APM gas price is declared by Petroleum Planning and Analysis Cell (PPAC). The non-APM/free market gas is of two types viz. domestically produced gas from JV (Joint Venture) fields and imported gas.

Earlier, the JV gas pricing was done on the basis of a so called "Production Sharing Contract", while for imported gas, the pricing was done under so called "Special Purchase Agreement". This is before C. Rangarajan committee report.

APM Gas	•PPAC
JV Gas	•Production Sharing Contract
Imported Gas	•Special Purchase Agreement

The issues were created when APM gas supplies went down and non-APM gas started in volume and supply. The wide gap between the two created problems. Since APM gas was primarily given to the power producers and fertilizers producers; their demand was to be met from non-APM gas which was costlier. The Ministry of chemicals and fertilizers / Ministry of Power resisted price rise while ministry of petroleum pushed for rise in prices. The tussle continued till recent times.

Meanwhile, a CAG report alleged in 2011 that Reliance had violated the terms of contract of exploring non-APM gas in the KG Basin. The report said that the CAG used false accounting-methods to show high costs and operating expenses to keep the profit low; and increased the sale

price of gas without Government's permission from $2.34 mmBtu to $4.2 mmBtu.

The core issue in both the cases was the widening gap between APM and Non-APM pricing, however, in reliance case, it was more of profit intentions. The reliance had entered into a Production sharing contract with the government of India for exploring gas in KG Basin. Since the company needed to share profits with the government **after** deduction of the costs and expenses; any false inflation in cost and expenses would reduce government's profit share.

Amid this conundrum, the UPA Government established the C Rangarajan committee to decide upon a rational formula of the gas price. This committee devised a formula on the basis of three major global benchmarks and increased the prices to $8.4 per mmbtu , double of what was fixed in Production Sharing Contract. Once Modi government was in power, it came up with New Domestic Natural Gas Pricing Guidelines, 2014 in October 2014.

New Domestic Natural Gas Pricing Guidelines, 2014

In October 2014, the Government of India notified New Domestic Natural Gas Pricing Guidelines, 2014. Under this policy, it tweaked the Rangarajan formula and came up with its own formula based on several benchmarks. This policy made it clear that price of gas will be revised every 6 months duration. With this policy in place, natural gas in the country was priced at an average price of liquefied natural gas (LNG) imports into India and benchmark global gas rates. The immediate price was $5.05 per mmbtu on gross calorific value basis and $5.61 per mmbtu on net calorific value basis, applicable from April 2014. This was much below that the Rangarajan formula price of $8.4 per mmBtu.

The pricing regime is applicable to all natural gas produced domestically, irrespective of the source, whether conventional, shale or coal-bed methane (CBM) produced in the public sector or by the private sector firms.

Current Status

The gas pricing formula as per New Domestic Natural Gas Pricing Guidelines will be applicable till March 31, 2019. The government does revision of gas prices every six months. Recently, on October 1, the government cut the price of natural gas by 18 per cent to $3.81 per million British thermal unit (mmBtu) on a gross calorific value basis from the current $4.66 per mmBtu. On a net calorific value basis, the price has been cut to $4.24 per mmBtu from $5.5 at present. This takes the price back to the level it was before the new policy came into effect.

National Exploration License Policy 1997

The dismantling of the APM was followed by National Exploration License Policy 1997, which became effective in February, 1999. Since then licenses for exploration are being awarded only

through a competitive bidding system and *National Oil Companies (NOCs) are required to compete on an equal footing with Indian and foreign companies to secure Petroleum Exploration Licenses (PELs).*

Salient Features of New Exploration Licensing Policy (NELP)

The main features of NELP are :

- Private participation for Intensive exploration of Indian basins.
- Provide avenue for opening up of acreages in ultra deep water & frontier areas.
- To bring-in new & state of art technology in exploration & exploitation.
- Level playing field to all participating companies.
- Transparent Bid Evaluation system.

This was started with a view to make India a great investment destination for exploration. Under the NELP, the government actively promotes the exploration of hydrocarbon blocks. So far 9 rounds of NELP have been successfully carried out. Under these nine rounds more than 300 blocks have been given out for exploration with an investment of around $20 billion.

Currently, Modi Government is planning to launch the 10th round of auctions of oil and gas exploration blocks under the New Exploration Licensing Policy (NELP) in the next 6-12 months. The NELP-X round would be held with a revenue-sharing model, wherein a bidder has to quote the amount of oil or gas output it is willing to offer to the government from the first day of production; whereas in the existing system of production sharing contract (PSC), the contractors are allowed to recover the entire cost of exploration and production before sharing the profit with the government. However, many explorers have opposed the revenue-sharing model, citing higher risk, particularly for deep and ultra-deep water blocks.

The Government was also willing to review the current NELP terms as it was in news in 2010 that Government would move to Open Acreage License Policy (OALP). In order to offer blocks under OALP, however, a national data repository (NDR) is required. Directorate General of Hydrocarbons (DGH) has appointed HLS Asia (HLSA) to set up the NDR by 2016-17.Open acreage will enable bidders to bid for blocks on offer at any time of the year. The data for these blocks would be made available to the bidders through the NDR. Pakistan is using such system. The NDR will play a much larger and significant role in the exploration and production scenario in the coming years.

Critical Evaluation of NELP

There is no doubt that NELP policy has been successful in giving the oil and gas sector a thrust. It resulted in discoveries such as Cairn India's Barmer fields and RIL's KG-D6 block. However, 15 years down the line the fact that only six blocks have started production also suggests its implementation failures. Nonetheless before the implementation of NELP, barely 11% of India's sedimentary basins

area was under exploration. But to achieve the target of 80% more transparency is required in its implementation.

Deregulation of Prices

The Government of India has historically subsidized energy with the objective of protecting consumers from international price volatility and providing energy access for its citizens, especially the poor. However, energy subsidies place a heavy burden on government budgets, while often failing to reach their targeted beneficiaries. In June 2010, the Indian government deregulated the price of petrol. However, prices for diesel, kerosene and domestic LPG continue to be regulated. Even in the case of petrol, OMCs can only change prices every fortnight, and only after seeking approval from the government. In October 2014, the government has deregulated the diesel prices also.

Implications

The move to deregulate the petroleum prices has been a boon for the Indian oil companies and has brought cheer to the faces of ordinary consumers. All three related factors are playing in the favourable zone viz. the composition of Indian crude oil basket, global prices of its elements and the rupee-dollar exchange rates.

The deregulation which means the oil companies will be able to change price at a time of choice cannot override strong political realities of India which mean that despite the deliverance of oil price deregulation the government can step in at any moment if the stakes becomes too high to give way to a sound commercial action. Also, the subsidy given to fossil fuels should not be unlimited. This can have dangerous consequences for the environment. Even the energy consumption patterns have to be changed for the poorest in the country which can happen if the subsidies are targeted and not the blanket distributions.

US Oil Boom and Dip in Global Oil Prices

In last one and half year, the Global oil prices have fallen sharply. From 2010 till mid of 2014, the oil prices were fairly stable above $100 per barrel, however, currently the prices are below $50 per barrel.

Reasons

There are several reasons for this decline. Firstly, the demand is low because of weak economic activity, increased efficiency, and a growing switch away from oil to other fuels. Secondly, turmoil in Iraq and Libya—two big oil producers with nearly 4m barrels a day combined—has not affected their output; thirdly, USA has become the world's largest oil producer. Though it does not export crude oil, it now imports much less, creating a lot of spare supply. Fourthly, the Saudis and their Gulf allies

have decided **not** to sacrifice their own market share to restore the price.

Falling demand and US Shale Gas Boom

The high prices provided incentives for drilling and exploration in unconventional areas such as exploration of Arctic region by Russia, exploration of shale gas by USA in North Dakota. United States and Canada entered into the shale gas boom after they successfully developed the fracturing and horizontal drilling techniques. Further, United States also skyrocketed its domestic production of oil, which led it to get the first place among all oil producing countries. The increased domestic production of oil and shale gas exploration from Alberta and North Dakota eased United States demand from Middle East. Since demand was lost, price came down beyond the capability of OPEC to hold it. International demand of oil also reduced in China due to its domestic production as well as recession in economy.

Turmoil in Middle East

Despite the shale gas boom in US, the prices of oil did not fall considerably because of OPEC induced cut in oil production and supplies. However, from mid of 2014 onwards, the Libyan rebels opened two terminals for export of oil.

Further, this was probably for the first time that there was no consensus among the OPEC countries to decrease the supply because of fear of losing market share. Thus, supply did not fall while demand went down causing prices to go down. We note here that OPEC countries including Saudi Arabia could curb production sharply to correct the prices. But they know that benefit of this would easily pass on to countries they detest such as Iran, Russia etc. With over USD 900 Billion in reserves, Saudi has the capability to tolerate lower oil prices quite easily. It has $900 billion in reserves. Further, its own cost of production of oil is very less.

Increasing share of renewable energy

In recent years, there has been a continuous increase in the share of the renewable energy around the world. This is supplemented with the development of efficient solar PVs and continuous fall in their prices.

Implications

On oil exporting countries

For the countries that produce oil, the fall in prices has led to huge loss of revenue. Further, the lack of coordinated action from OPEC countries has exposed their own vulnerability. OPEC has already lost its dominance on oil price scenario and some countries such as Saudi Arabia have not stood with this group in the fear of loss of market share. The impact on Venezuela can be see reeling under high inflation. Russia, whose 70% export income came from oil exports is hit hard with changing oil economics. The countries which don't have sufficient foreign exchange reserves such as Iran, Iraq

and Nigeria are among the worst hit.

Oil Importing Countries

Countries such as India have traditionally paid huge import bills. They have been able to decrease their fiscal deficit to great extent. After deregulation of petrol, there was a fall in prices because petrol prices are now linked with market. China, Japan, India have benefits because of low oil prices.

Impact on environment

The impact on environment should be seen in conjunction with the below three factors:

- The share of fossil fuels in the total power sector is decreasing since 1970 due to increasing share of renewable energy around the globe.
- Due to falling oil prices, there may be an increase in consumption due to availability of fuel at low prices.
- However, since prices are low, the exploration in new and unconventional areas gets discouraged.

In summary, the impact of lowering prices of oil have both negative and positive impacts on environment.

Future perspective

The prices of oil seem to be low in near future. However, any decrease in supply, further conflicts in Middle East, increased demand in Europe / China might cause the prices to jump.

Falling Global Oil Prices and Impacts on India: Analysis

India is likely to benefit from this fall. Key points are discussed below:

On Exchange Rate

The drop in crude oil prices substantially cuts India's oil import bill. This helps to reduce demand of foreign exchange and this boosts foreign currency reserves. As the demand for foreign currency is low, this may also appreciate domestic currency Rupee against Dollars. This in turn will improve exchange rate of domestic currency against foreign currencies.

On Inflation

Petrol and diesel prices in India are now decided by the market price of crude. The fall in prices is likely to lower these prices in the market. This will bring down the energy costs and transport costs. This will overall result in lower inflation in goods and services, especially food items. Low inflation also helps to improve the investment scenario in the country. Reduction in inflation will prompt central bank to reduce key policy rates, thus increase liquidity in the market and boost economic growth.

On Current Account Deficit

Every $1 decline in crude prices brings down the current account deficit by about $1billion. The nearly $10 per barrel decline can therefore drive a substantial improvement in the current account.

Fiscal Deficit

Low prices of crude will in turn bring down fuel subsidy bill of the government, thus giving it a room to mobilize resources to some other priority sector or for social development. Government is also trying to boost its finances through disinvestment, savings on fuel prices will add to revenue.

In summary, the lowered crude oil prices will help the government to achieve its targets related to Low Inflation, Low fiscal deficit and CAD.

What should be done by Government?

India has all reasons to be pleased as the oil trends will spell a huge improvement in current account deficit, correct the government's balance sheet and also tame inflation considerably. The government has to maintain a smart balance between cutting and retaining different subsidies for diesel, liquefied petroleum gas, kerosene etc. It has to free space for expenditure on infrastructure, education and healthcare. So the subsidies on fertilisers will have to be rolled back which will need a lot of political capital. Prudent supply-side reforms have also to be fitted in well in the growth story so that the government's performance in the elections in two major states in India does not take a hit.

Likewise China has to act smart as contrary to India it is facing a slowing economy. The government is trying to plug the gap by speeding the $1.1 trillion infrastructure projects. However, cheaper oil should not serve as an incentive to reduce carbon footprints but a smooth transition to energy-efficient fuels. China has to work on its state-owned enterprises as the Central Bank can now comfortably cut the key interest rates. At the same time, it has to work to boost its private sector which is more productive and efficient. China has worked on building its strategic energy reserves but it will have to work harder to overcome the structural challenges to revamp the economy.

Shale Gas

Shale refers to a sedimentary rock resulted from compaction process of small old rocks containing mud and minerals – such as quartz and calcite, trapped beneath the earth surface. The shale gas is the natural gas trapped within these shale rocks. It is one of the unconventional type of natural gas along with coal bed methane, tight sandstones, and methane hydrates.

Problems in Extraction

The importance of shale gas can be gauged from the fact that an estimated 35% of world surface rock is made of shale formations. However, extraction of shale gas is difficult and tardy process. The difficulty is mainly because of less permeability of the shale rocks, which does not allow significant fluid flow. Due to low permeability, commercially viable production of shale gas needs fracturing of the rocks for, the fracturing provides permeability. For many years, this gas was produced from natural fractures, but as there was development of modern technologies such as horizontal drilling / hydraulic fracturing (aka fracking); more and more artificial fractures around the well bores were

created. This skyrocketed the production of shale gas and led to the so called Shale Gas Boom in United States. This shale gas boom has also contributed partially in the recent fall of global oil prices. The hydraulic farming aided shale gas production has rejuvenated the natural gas industry in the United States.

Extraction process

The extraction process of shale gas involves two methods:-

Horizontal drilling

Under this technique a vertical well is drilled to the targeted rock formation and then at the desired depth, the drill bit is turned horizontally, exposing the well to more of the producing shale.

Hydraulic Fracturing

In this technique, water along with chemicals and sand are pumped into the well and a fracture or crack is developed in the shale rock to release the hydrocarbons trapped in shale formations to flow from the shale into the well.

Hydraulic fracturing when used in conjunction with horizontal drilling, it enables gas producers to extract shale gas at reasonable cost and rapidly as it enhances the flow of gas quickly to the desired well.

Shale Gas in India

Various estimates, including those by leading firms, put Indian reserves of shale oil and gas at large numbers describing Shale oil and gas are more widespread than natural oil and gas. Major regions of availability are Gujarat, Rajasthan, central India, KG Basin and offshore areas in Bay of Bengal. The assessment of shale formations has started in India at various sites. Also, a MoU have been signed between USA and India for sharing technical knowledge in shale-gas exploration.

Jambusar

Jambusar located near Vadodara in Gujarat is India's first shale gas exploratory successfully drilled in Cambay region.

Problems with Fracking Technology

The Fracking technology uses huge amount of water that needed to be transported to the fracking site, at significant cost. Further, several chemicals are used in fracking which are supposed to be carcinogenic. Contamination of the groundwater is a significant carbon cost. The key problems of extracting shale gas are enumerated below:

- Expensive technique of fracturing and horizontal drilling technology
- Large scale use of water and chemicals
- Contamination of ground water aquifers
- Risk of earthquakes
- Coincide of many common areas under shale gas and natural gas reserves producing

problems in contemporary extraction of shale gas and natural gas.

- Under mismanagement, the hydraulic fracturing fluid can be released by spills, leaks or various other exposure pathways polluting the surroundings.
- Shale gas transportation and storage is a difficult process.

Plasma Pulse Technology (PPT)

Plasma Pulse is a relatively new technique introduced to the enhanced oil recovery (EOR) industry in the United States. It is also being cited the main reason behind *next shale gas boom* in United States. It is already being used in production in Russia, Eastern Europe, and China. It was first introduced to the U.S. industry in 2013. The Plasma Pulse Technology (PPT) is developed to overcome the disadvantages of presently used fracking technology to recover gas and oil from shale rock.

Plasma Pulse Technology is one of the so called Enhanced Oil Recovery (EOR) technologies. It allows to extract up to 90% of the original oil / gas in reservoir after the standard production methods fail to extract more oil or gas. The PPT was invented at St. Petersburg State Mining University in Russia.

Under this technology, a series of impulse waves are used to enhance the permeability of rocks for a period such as one year. It has been found that one treatment of Plasma Waves would keep the enhanced permeability for around one year and such one treatment would result in three times increment in gas production.

Since Plasma-Pulse Technology works without any chemicals, it is deemed to be environmentally friendly. The treatment is created to clear the well drainage area of sedimentation clogging at the perforation zone and increase the permeability of the reservoir at the same time. This technology reminds us of the many science fiction movies in which they suggested to use this technology with futuristic weapons.

Advantages of Plasma Pulse Technology

- It does not use any chemicals.
- It is an easy-to-deploy technology that uses vibrations, or electrically generated plasma impulses to reduce viscosity, increase permeability and improve flow of oil and gas to the surface for extraction.
- It is designed toimprove production costs effectively and without resorting to acidization, hydro-fracking or other environmentally harmful processes.
- With Plasma Pulse, the well stimulation process usually only requires a few hours to complete using a one-man crew and a single wireline truck.Other techniques like fracking can often take days to complete.

- Once the Plasma Pulse Treatment has been completed, the well can go back into production immediately.

How it works

Instead of injecting high pressure fluid into a well to create small fractures to aid during the oil recovery process, the Plasma Pulse Treatment produces a high energy plasma arc that generates a tremendous amount of heat for a fraction of a second and the subsequent hydraulic impulse wave created removes any clogged sedimentation from the perforation zone, i.e. scale, fines, drilling mud, etc. The series of impulse waves/vibrations also penetrate deep into the reservoir causing nano-fractures in the matrix and increases the permeability. Oil can then flow more easily from the reservoir into the well and be pumped to the surface. The end result is an increase in sustained production which can last for as long as a year.

Coal Bed Methane

Coal Bed Methane (CBM) is natural gas found in coal seams. It mainly consists of Methane (CH_4) with minor amounts of nitrogen, carbon dioxide and heavier hydrocarbons like ethane.

CBM was wasted and vented out into the atmosphere during the initial years of mining resulting in greenhouse emissions. CBM was a serious safety hazard while conducting coal mining operations. However, CBM is a precious energy resource and an unconventional form of natural gas. Given the fact that country's energy requirement will rise with growth and development, CBM being a clean source of energy has garnered global significance with the emergence of active CBM players like Canada, Australia, and India.

Exploitation of Coal Bed Methane and Oil & Natural Gas has been placed under the administrative control of Ministry of Petroleum. They are governed by *Oil Fields (Regulations and Development Act, 1948)* and *Petroleum and Natural Gas Rules, 1959*. The safety aspects are covered under the *Oil Mines Regulation, 1984.*

Advantages of CBM as a fuel

- CBM is an environmentally safe gas: Methane has been labelled as a Green House Gas (GHG) by United Nations Framework Convention on Climate Change (UNFCCC). Its global warming potential is 21 times more than that of the Carbon Dioxide. But CBM is considered as a clean fuel which on combustion emits only carbon dioxide and water. So, is not only considered as an efficient fuel.
- Using CBM as a fuel will halt its emission into environment and thus reducing emission of green house gas from coal mining.
- Extraction of CBM prior to coal mining activities makes mining activities safer by degassing

the coal seams.

- Extraction of CBM would help in increasing the domestic gas production. Currently, contribution of CBM to domestic natural gas production is 1.6%.

CBM resources in India

India has fourth largest proven coal reserves in the world. So it has significant prospects for exploiting CBM. But as of now there is no data available related to the total prognosticated CBM resources in the country. The Ministry of Petroleum and Natural Gas in consultation with Ministry of Coal has identified around 26,000 sq.km area for the operation of CBM.

Issues related to Coal Bed Methane

Some issues and limitations have been identified in areas where operations of CBM and coal mines are being carried out simultaneously. In such areas it is preferred that coal mine operators are an active participant in CBM activities so that the responsibilities with respect to safety are shared by both. The following are some of the issues with respect to the simultaneous operations of Coal Bed Methane and coal mining by multiple owners:

- There is a possibility of damage of gas wells due to blasting/caving/ subsidence of overlying strata, resulting in explosive atmosphere in coal mines during simultaneous extraction of coal and CBM in the same vertical boundary by two different owners.
- Multiple ownership for simultaneous exploitation may not be desirable for the life, health and safety of the workers employed in such mines.
- Simultaneous operation over the same leasehold area requires the development of Safe Operating Procedures (SOP) for each operation based on assessments of risks.

Other issues:

- Overlap issues with Coal Blocks/ Oil/ Gas/ Other projects on existing CBM blocks. For instance an Airport project has been permitted over na existing CBM block. This has hampered the progress of CBM development.
- Land Acquisition and Water handling problems. Land acquisition problems for CBM blocks are severe as it requires a large number of wells for effective drainage of CBM. Also some CBM Blocks are located in the tribal land areas in the states of Jharkhand, Chhattisgarh and Madhya Pradesh. CBM wells tend to produce large volumes of water during the initial period to lower the pressure in the coal seams. Disposing this water which has high salinity and total dissolved salts (TDS) constitutes a significant expense.
- Delay in grant of permission from state governments. Consent to operate (CTO) from state governments are delayed.
- Delay in grant of statutory clearances like environmental clearances.

- Availability of Gas Infrastructure and Gas grid: As the CBM fields are located in isolated areas, integrated gas pipeline infrastructure forms a critical issue. CBM Blocks in the states like Jharkhand, Chhattisgarh and Madhya Pradesh do not have any nearby industrial belt for local consumption of CBM.

Benefits of extracting methane before mining operations

- Enhances the productivity of coal because less slowdowns in production caused by gas.
- Reduction in dust concentrations due to reduction in velocity.
- Improves safety of mines due to the lower methane contents.
- Improved worker comfort.
- Reduction in fan operating costs due to the need of reduced air requirements for dilution of methane.

Gas Hydrates

A gas hydrate is a *water lattice in which light hydrocarbon molecules are embedded resembling dirty ice.* Naturally occurring gas hydrates are a form of water ice which contains a large amount of **methane** within its crystal structure. Gas hydrates are restricted to the shallow lithosphere (2000-4000 m depth), they remain stable up to 18°C with pressurization.

- Hydrates are seen as a future alternate energy resource by abstracting methane from solids below the sea-beds in deep oceans and the permafrost regions of the world.
- Gas hydrates are a source of methane
- Vast continental margins with substantial sediment thickness and organic content, provide favorable conditions for occurrence of gas hydrates in the deep waters adjoining the Indian continent.
- Gas hydrates hold the danger of natural hazards associated with sea floor stability, release of methane to ocean and atmosphere, and gas hydrates disturbed during drilling pose a safety problem. So, Safe exploitation of methane from hydrate reservoirs calls for a massive research program.
- Exploitation of Gas hydrate can also help in Carbon sequestration, Carbon capture and storage and Carbon trap technologies

National Gas Hydrate Programme

National Gas Hydrate Programme was initiated in 1997. India is a pioneer in the field of gas hydrate. In accordance with the roadmap for the National Gas Hydrate Programme (NGHP), India has already acquired core samples with the help of the US drill ship JOIDES Resolution. In December 2008, a memorandum of understanding (MOU) was signed between the Directorate General of

Hydrocarbons and the U S Geological Survey for cooperation on exchange of scientific knowledge and technical personnel in the field of gas hydrate and research. The second NGHP expedition has been planned in 2010 to map the prospects of gas hydrate in Krishna Godavari and Mahanadi deepwater area.

Analysis: Energy Security and Integrated Energy Policy

What is energy security?

Energy security refers to the secure availability of natural resources for energy consumption. Modern economies depend on energy and its unavailability would cause significant vulnerability to economy as well as national security.

How the Food Water and Energy Securities are linked together?

In spite of the technological advances made in past few decades, a substantial part of the global population still faces food, water and energy shortages, with the aim of achieving security in all three areas far from being realized. However, to look at the three – food, water and energy securities – as separate issues will be a misstep in realizing the dream of achieving security in all three sectors. There are several evidences to show that there exist linkages between food, water and energy securities and that governments world over should take into account this linkages while framing policies.

Water security is defined as access to safe drinking water and sanitation; food security is defined as availability and access to sufficient, safe and nutritious food to meet the dietary needs and food preferences for an active and healthy life; and energy security is defined as access to clean, reliable and affordable energy services for cooking and heating, lighting, communications and productive uses.

The link between food, water and energy securities can be explained through various examples. Water is required in extraction, mining, and refining processes for mineral fuels like coal; as also for producing hydroelectricity. Besides, it is also required for hydraulic fracturing in extracting new sources of energy like shale gas and shale oil as well as for growing feedstock for biofuels. Conversely, energy is required in extracting groundwater, treating and transporting drinking water. It is also used for desalination of sea water. So, shortage in either water or energy can lead to non realization of security in the other sector. Agriculture – on which food security is dependent – consumes the maximum amount of global freshwater today. Food production is also dependent on diesel pump sets which are used to extract groundwater for irrigation, and on mechanized equipments such as tractors, threshers, harvesters, etc. Further in the supply chain, transport of food to markets is also dependent on motorized vehicles which consume diesel or petrol. In fact, one of

the major causes of food inflation is increase in global oil prices. Thus, it can be seen that a shortage in any one of the three resources –food, energy or water – will affect the supply of other two as well. Thus, a nexus approach – an approach which integrates management and governance across the sectors is required to achieve security on all three fronts.

Integrated Energy Policy

The Manmohan Singh government had launched an Integrated Energy Policy in mid 2000s. That policy envisaged an energy mix that focused on augmenting the domestic energy resource base and increasing efficiency while strategizing India's stakes in energy assets overseas. The broad vision behind the Integrated Energy Policy was to reliably meet the demand for energy services of all sectors including the lifeline energy needs of vulnerable households in all parts of the country with safe, clean and convenient energy at the least cost.

Recently, NITI chairman Arvind Panagariya had renounced that NITI would soon launch an Integrated Energy Policy under NITI Ayog.

The below analysis gives some input on how and what should be content of an Integrated Energy Policy for India.

What should be the broader aims of an Integrated Energy Policy?

The following should be the major aims of an Integrated Energy Policy.

- Reduce Energy Requirements
- Expand Resource Base in both conventional and unconventional areas and both renewable and non-renewable sources.
- Build Strategic Oil Reserve (SOR)
- Implement Power Sector Reforms
- Increase efficency in fossil fuels consumption
- Independent regulation to achieve competitive efficiency
- Reduction in cost of Power
- Boosting Energy Related R&D
- Exploring Waste to Energy Potentials

Why there is a need of an Integrated Policy?

There is a need to provide clean, safe and convenient form of energy to all sectors in an economically viable manner. To achieve this objective India needs to expand its energy base by exploring all possible energy resources whether conventional or non conventional. Along with this India needs to pursue such strategies which manages demand side problems and promote conservation of coal and petroleum with a focus on increasing energy efficiency which shall remain India's most important concerns regarding energy security till 2030.

What should be the Energy Priorities for India?

Achieving energy security, first and foremost requires development goals in rural areas where poverty condition are currently the greatest. This will require greater access and improved energy services as a means to reach education, health, water and other goals in these rural areas. Expanding energy services is a means to generate increased employment and income generating opportunities- and is therefore a pre- requisite to increased value adding activities in rural areas. For the policy – maker helping create a sustainable energy pathway will require broad social consensus around the strategic choices of economic, environmental and social development. Depending on their current state of development and priorities, India is likely to pursue different paths towards a variety of sustainable development options. It will require different policy mixes, likely incorporating fiscal, regulatory and research and development efforts. Transparency, stakeholder involvement and institutional flexibility will be the key ingredients for any set of decisions.

IESS, 2047

The IESS, 2047 is an online energy scenario building tool, which aims to explore a range of potential future energy scenarios for India, for diverse energy demand and supply sectors, leading up to 2047. 21 Energy Demand and Supply sectors, and 50 levers that will impact our energy system are available to the user. Combination of the above choices offer hundreds of energy pathways till the year 2047.

Miscellaneous Topics

Carbon Tax

The tax that is levied on the carbon content of fuels is called Carbon Tax. So, in Carbon Tax, the burning of fossil fuels viz. coal, petroleum products such as gasoline and aviation fuel, and natural gas is taxed in proportion to their carbon content.

The result is an increase in the competitiveness of non-carbon technologies compared to the traditional burning of fossil fuels. It directly helps to protect the environment while raising revenues.

Carbon Tax in India

India does not have a de jure Carbon tax, there has been de facto carbon tax. There are several examples:

NCEF

In 2010, the government had launched the National Clean Energy Fund (NCEF) whereby it imposed a clean energy cess on coal produced in India as well as imported coal @ Rs.50 per tonne. This is one example of de facto Carbon Tax. In the Union budget 2014-15, this cess was raised to Rs. 200 per tonne. In July 2015, this fund was worth Rs 17,000 crore.

The objective of such taxes is to limit the consumption of polluting fuels and promote use of clean energy. However, this fund is not doing what it was supposed to do i.e. finance the clean energy.

Only levying a cess does not reduce pollution by itself. The government needed to use this fund to provide support to clean energy infrastructure in the country.

Excise Duty

Currently the government sets aside Rs. 4 per litre of the petrol / diesel excise duty for a dedicated road cess. This is also one kind of Carbon Tax whereby tax on fossil fuel is to be used to develop infrastructure.

Petroleum and Explosives Safety Organisation

Petroleum And Explosives Safety Organisation (PESO) is a non-statutory body that control and administers the usage of explosives, petrol stations in India. The agency issues licenses for Operation of Petrol Stations, Licenses to operate Petroleum Product Transportation vehicles, Licenses for Refineries, Petrochemical Complexes, etc. The Department is headed by Chief Controller of Explosives and is headquartered at Nagpur. PESO has its headquarters in Nagpur and it is responsible for the administration of a host of laws pertaining to the regulation of explosives. These include the Explosives Act, 1884; the Inflammable Substances Act, 1952 and the Explosives Rules, 2008.

This organization was making news recently in the wake of horrific blast in Petlawad, in Jhabua district of Madhya Pradesh, which killed around hundred people. The blast was caused due to an stockpile of gelatine sticks stored illegally in a building. This blast exposed the menace of illegally storing explosives in congested residential areas in several parts of India. The sale and transport of such explosive materials are regulated by the PESO. While PESO said that no such license was issued to the owner of that building, it threw light on the inability of PESO to monitor all explosive substances everywhere in the country. In 2011, PESO had announced plans to computerise its operations but so far it has not been done.

General Knowledge Today

Infra-3: Civil Aviation, Ports, Road sector

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Model Questions

Prelims MCQ Topics

Commission of Railway Safety, Functions of Directorate General of Civil Aviation versus Airports Authority of India, Gagan Project, Open Sky Policy, 5/20 Rule, Route Dispersal Guidelines , Major Ports (please check trivia given in module), Differentiation between the Major Ports and Minor Ports, National Waterways, National Highway Development Project, SARDP-NE.

Mains Model Questions

1. What is Gagan Project? Examine its potential benefits with respect to India's civil aviation sector.
2. Airlines spend some 13–15 percent of their revenues towards Maintenance, Repair and Overhaul (MRO) and presently this revenue goes to countries outside India. What are roadblocks to a vibrant MRO industry in India? Discuss in the light of Draft National Civil Aviation Policy 2015.
3. What do you understand by Open Sky. Discuss India's Open Sky Policy with reference to Draft National Civil Aviation Policy 2015.
4. What do you understand by the so called 5/20 rule prevalent in Civil Aviation Sector in India. Discuss the dissenting views on this rule and current government stand in this context.
5. To what extent forcing airlines to accept social obligation of flying to remote part of the country is justifiable? Discuss in the light of Route Dispersal Guidelines.
6. Critically Discuss the key proposals of Draft National Civil Aviation Policy 2015.
7. Differentiate between the Major Ports and Minor Ports. What are the current issues in the Ports sector development in India? Discuss.
8. What is the objective of the corporatization of the Ports? Do you think, corporatization of the ports will be a game changer in Port development in India?
9. Discuss the salient features of the Sagarmala Project.
10. What ails India's Road Transport Economy? Discuss the initiatives taken by the Government to expedite projects under NHDP.

Civil Aviation

India is the fastest-growing aviation market. Liberalisation of the aviation sector in nineties resulted in a remarkable growth, as a large number of private service airlines entered the sector. The total number of airports or airfields recognisable from the air are more than 475 however, only 75 are in use and the number of operational airports is 68. The most important driving factors for civil aviation in India include ideal geographic location between the eastern and

western hemisphere; a 300 million strong middle class and a rapidly growing economy. A shift in global traffic to Asia Pacific is also an important factor for India's Civil Aviation Industry.

The formulation of national policy in civil aviation is done by Ministry of Civil Aviation. It also oversees the airport facilities, air traffic services, carriage of passengers and goods by air, safeguarding civil aviation operations, regulation of air transport services, licensing of aerodromes, air carriers, pilots and aircraft maintenance engineers.

Commission of Railway Safety

Kindly note that Commission of Railway Safety, a body responsible for safety in rail travel and operation comes under the administration of Ministry of Civil Aviation not railways.

Sector Overview

In Civil Aviation public sector, we have National Aviation Company of India Limited (Air India), Indian Airlines, Alliance Air and Air India Charters Ltd. while in private sector we have six private scheduled operators, viz., Jet Airways (India) Ltd., Jetlite Airlines, Go Airlines (India) Pvt. Ltd., Spicejet Ltd., Paramount Airways Pvt. Ltd., and Inter Globe Aviation Ltd. (IndiGO). Further, there is a new category of scheduled airlines i.e. Scheduled Air Transport (Regional) services has been introduced to enhance connectivity to smaller cities and within a region. MDLR airlines is operating as regional scheduled airlines in northern region. Three cargo airlines viz., Blue Aviation Pvt Ltd., Deccan Cargo and Express Logistics (Pvt.) Ltd. and Aryan Cargo Express Pvt. Ltd. are operating scheduled cargo services in the country.

Directorate General of Civil Aviation

DGCA is the civil aviation regulatory body responsible for regulating of air transport services to/from and within India in accordance with the provisions of Aircraft Rules, 1937. The key functions include licensing of pilots and aircraft maintenance engineers; granting certificates of airworthiness; coordination with ICAO (International Civil Aviation Organization), Licensing of aerodromes and air carriers; Safety oversight and surveillance, advising government in matters of air transport including those related to bilateral air services agreements; type certification of aircraft.

Bureau of Civil Aviation Security

This office was originally started as a part of DGCA in the wake of a hijacking in 1970s. Since 1987 Kanishka Tragedy, it is working as an independent organization under Ministry. It lays down standards and measures in respect of security of civil flights. It is the apex body in civil aviation security in India.

Indira Gandhi Rashtriya Uran Akademi

This was started in Raebareli, UP to improve the standards of flying and ground training of commercial pilots.

Airports Authority of India

AAI is responsible for building airport infra in India. Its website mentions that it currently manages 115 airports. It collaboration of Canada, AAI has established **National Flying Training Institute Private Limited at** Gondia in Maharashtra for training of pilots at its Rajiv Gandhi National flying Training Institute (RGNFIT).

Gagan Project

GPS-Aided Geo Augmented Navigation (GAGAN) system is being jointly developed by ISRO and AAI for providing augmentation service for GPS over the India, Bay of Bengal, South-east Asia and Middle East along with expansion up to Africa. The system with the help of reference and uplink station will provide corrections to the GPS signal in order to improve air traffic management. It is 10 times more precise compared to GPS and radio navigation aids used for precision landing. Presently, GAGAN Payload is already operational through GSAT-8 and GSAT-10 satellites. The 3rd payload will be carried onboard GSAT-15 satellite to be launched October 2015.

Benefits of Gagan

It will make airline operations more efficient by increasing fuel savings, direct routes, ease of search and rescue operations, reduced workload of flight crew and Air Traffic Controllers and cost savings due to withdrawal of ground aids.

Airport Economic Regulatory Authority (AERA)

AERA was established in May, 2009 with the prime objective to create a level playing field and foster healthy competition among all major airports, encourage investment in airport facilities, regulate tariffs of aeronautical services, protection of reasonable interest of users, operate efficient, economic and viable airports at notified airports.

National Aviation Company of India Ltd. (Air India)

Air India and Indian Airlines merger attained its official status on the formation of National Aviation Company of India Ltd. (Air India) in 2007. Post merger the new entity is known as Air India while its mascot is retained as 'Maharajah'. The new company seven subsidiaries viz. Hotel Corporation of India (HCI), Air India Charters Ltd. (Air India Express), Air India Air Transport Services Ltd, Air India Engineering Services Ltd, Vayudoot Ltd, Airlines Allied Services Ltd. (Alliance Air) and IAL Airport Services Ltd.

Policy / Issues Civil Aviation

FDI Policy

100% Foreign Direct Investment (FDI) is permitted for Greenfield airport projects under the automatic route. Up to 74%-100% in brownfield airport projects. Up to 49% FDI is permitted in domestic scheduled passenger airlines under the automatic route. 100% permitted for NRIs. Up to 49% FDI under the automatic route is permitted in Non-Scheduled Air Transport Service. FDI above 49% and up to 74% is permitted under Government approval route. 100% FDI permitted for NRIs.

Airport Privatization

The UPA government had contemplated to privatize the airports in India with a view to enhance the airport infrastructure. At present, four out of six metro airports viz. New Delhi, Mumbai, Hyderabad and Bangalore are run by private operators. The UPA government wanted more airports to be privatized, despite of resistance from airlines. That government had floated a global tender in 2013 to give management contract to private firms for six airports in Chennai, Kolkata, Ahmedabad, Jaipur, Lucknow and Guwahati. However, this did not happen mainly because of expensive upgrades. Further, the private parties were more interested in acquiring the airport lands and play in real estate segment instead of civil aviation.

The NDA Government had invited bids in January 2015 to develop four air ports viz. Chennai, Kolkata, Ahmedabad and Jaipur in public-private partnerships (PPP). But even after extending its deadline for several times, not many showed keen interest. Thus, the government has now scrapped the project.

You may read the background of Airport Privatization at GKToday here.

MRO Industry

The importance of aircraft Maintenance, Repair and Overhaul (MRO) industry can be gauged with the fact that airlines spend some 13–15 percent of their revenues towards maintenance, which makes it the *second-highest cost item for airlines after fuel*. India's MRO industry is at a nascent stage with over 90% of Rs. 5000 crore MRO expenditure being spent outside India in Sri Lanka, Singapore, Malaysia, UAE etc. Currently, India's share is just 1% in global MRO industry and it is growing with rapidly growing number of the aircrafts in both civil and defense; and rapidly growing fleet capacity of the aircrafts.

Key Challenges

There are several roadblocks to a vibrant MRO industry in India. **Firstly,** the key international airports have lack of hanger space, which is needed for temporary protective storage of the aircrafts.

Secondly, setting up MRO is highly capital intensive with high initial as well as recurring investments and a long break-even time. **Thirdly**, operating a credible MRO is highly dependent on investing in the right manpower – that is regularly trained and optimally utilised with a strong focus on quality and turnaround time. It also requires continuous investment in tooling, certification from safety regulators. In India, there are 60 different aircraft types operating in a total market of about 350 aircraft (business jets, turboprops and helicopters). Each individual type requires trained technical manpower, tooling, and approvals from regulator as well as the OEM to enable an MRO to offer world-class maintenance services. **Fourthly**, non-availability of spare parts in leads to frequent grounding of aircraft for lack of spares. The custom duty regime has also discouraged the MROs from stocking parts on behalf of customers.

In summary, the key issue for the government is to have adequate infrastructure to create a level playing environment for Indian MROs when they compete with their global peers to attract business into the country.

What should the government do?

Firstly, the heart of the MRO industry is in human resource. Government needs to develop environment for preparing skilled human resource to deal with complex aerospace systems. For that, the existing institutions needed to upgraded and expanded to world class level.

Secondly, there is a need to encourage the domestic MRO companies to keep continuously receiving the global accreditations and certifications. This is because most of the aircrafts are leased from European or American companies and it becomes impetrative for Indian MRO to comply with Federal Aviation Administration (FAA) or the European Aviation Safety Agency (EASA) certifications.

Government should consider giving some special status to the MRO related financing requirements and tax incentives similar to the IT and ITES industry. *Currently, the spare parts are subject to custom duties & VAT and MRO service is subject to service tax. This makes Indian MRO to be 30% costlier than those in the neighbourhood such as Sri Lanka, Dubai, Hong Kong, Singapore and China.* The tax regime can be changed in favour of the industry.

Steps provisioned in Draft National Civil Aviation Policy 2015

The Draft Civil Aviation Policy has been released by the NDA Government on 31st October 2015. For MRO industry, it has the following provisions:

- Services under MRO to be zero rated
- The tools and toolkits for MRO will be exempted from custom duty.
- The process of custom clearance of parts will be simplified.

- Foreign aircraft brought to India for MRO work will be allowed to stay for the entire period of maintenance or up to 6 months, whichever is lesser, provided it undertakes no commercial flights during the stay period.
- Prompt visa to Foreign MRO experts, Temporary Landing Permits for foreign pilots operating an aircraft to and from India for the purpose of servicing.
- MRO will be declared as a separate category instead of clubbing it with Ground Handling (GHA) for security procedures and remove restrictions on foreign registered aircraft for MRO work.
- The Union Ministry will persuade states to exempt VAT on MRO.
- Rationalization of other levies.

Open Sky Policy

Open sky refers to an agreement between two countries to allow any number of airlines to fly from either of them without any restriction on number of flights, number of destinations, number of seats, price and so on. However, this is a general definition. In actual practice, there are always some restrictions.

India's current Open Sky agreements

Currently, India has open sky agreements with US without restriction. Further, it has such agreement with some restrictions wit UK' a limited open-sky with ASEAN and bilateral agreements with more than 100 countries.

- There is no restriction on number of flights, seats or destinations to / from United States.
- India has open-sky with UK with restriction on frequencies with respects to flights to and from Mumbai and Delhi.
- For some tourist destinations of ASEAN, India has limited open sky policy.
- India has also entered into bilateral agreements with more than 100 countries over landing points, traffic rights, seasons, capacity etc.

Open sky policy in National Civil Aviation Policy 2016

The National Civil Aviation Policy 2016 has proposed to remove all restrictions on number of flights to and from destinations in SAARC and a radius beyond 5000Kms. Within that radius (covering West and South Asia as well as the countries to the east) flying rights will be auctioned. The government would *enter into Open Sky agreement with SAARC countries and countries with territory located entirely beyond a 5000 km radius from New Delhi.* Under this:

- Unlimited flights above the existing bilateral rights will be allowed to and from major ports of the country.

- Additional seats above the existing seats within the 5000km radius from New Delhi will be auctioned.

The above proposals imply that European airlines and SAARC airlines (which fall outside 5000 kilometres from New Delhi) will have unlimited access, in terms of number of flights and seats, to some airports in India. For countries within 5000 kilometres, the rights will be auctioned so that the revenue accrues to the government. The government has also restricted this to few airports to protect the domestic airlines.

Air India-Indian Airlines Merger Story

Air India, formerly named Tata Airlines was founded by JRD Tata. It was converted into a Public Limited Company on July 29th 1946 and renamed as **Air India**, primarily operating on international routes.

Indian Airlines (Indian Airlines Limited from 1993 and Indian Airlines Corporation from 1953 to 1993) was a major Indian airline based in Delhi and focused primarily on domestic routes, along with several international services to neighbouring countries in Asia. It was state-owned, and was administered by the Ministry of Civil Aviation. It was one of the two flag carriers of India, the other being Air India.

On 7 December 2005, the airline was rebranded as Indian for advertising purposes as a part of a program to revamp its image in preparation for an initial public offering (IPO). The airline operated closely with Air India, India's national carrier. Interestingly both companies also made an attempt at merging in 1986 as well.

In 2007, the Government of India announced (As per some recommendations of **Dharmadhikari Report**) that Indian would be merged into Air India.

Justice Dharmadhikari committee, 2007

The Justice Dharmadhikari Committee was formed to look into the human resources issues at Air India created as a result of the 2007 merger between Air India and Indian Airlines. Key recommendations on ways and means of harmonisation and rationalisation of the merged workforce included fixed pay scales, grant of seniority to employees, promotion and career progression, Pay linked incentives and a Voluntary Retirement Scheme.

As part of the merger process, a new company called the **National Aviation Company of India Limited** (now called Air India Limited) was established, into which both Air India (along with Air India Express) and Indian (along with Alliance Air) would be merged. Once the merger was completed, the airline – called Air India – would

continue to be headquartered in Mumbai and would have a fleet of over 130 aircraft.

Reasons that led to the Merger

- Escalating costs of Aviation Turbine Fuel (ATF)
- Immense competition from private and low cost airlines
- Increased cost pressures due to acquisition of additional aircraft
- Leadership crisis due to frequent change of the chairman-cum-managing director
- Air India could not fully use the bilateral rights unlike foreign airlines which took maximum advantage
- Declining passenger traffic in the premium class

What the merger tried to achieve

- Economies of scale in areas such as maintenance, ground operations, the use of landing slots and parking rights etc
- Volume Discounts in areas such as fuel purchase, insurance
- Increased fleet size such that the combined fleet was of over120 aircraft, currently over 150 aircraft, placing it among the top 10 airlines in Asia, and the top 30 in the world
- *Hub and spoke system* which could be achieved by the merger of the international and domestic airlines
- Leverage and pool-in of resources such as manpower, infrastructure and assets, better aircraft and resource allocation
- Star Alliance membership (Air India has been invited to join the 21 member consortium)

Post Merger Problems

- Incomplete integration of official positions, of IT systems and as well as infrastructure due to different aircraft flown by the two companies, and inability of employee unions to accept merger
- Decline of customer service due to integration issues
- Ballooning of losses due to
    - increasing prices of ATF
    - decreased passenger traffic during recession
    - unnecessary and costly acquisition of aircraft fleet
- Leadership crisis continues due to frequent change of CEOs (4different CEOs in last 2 years)
- Increased competition from domestic airlines as well as international airlines due to unfavourable government policies.

5/20 Rule

The so called 5/20 rule is prevalent in civil aviation in India only and not other countries. This rule says that before an airline is allowed to fly abroad, it must be at least 5-year-old and must have at least 20 aircraft in its fleet. This implies that a domestic airline needs to have *a fleet of 20 aircraft and operational experience of 5 years* to start international operations.

Rationale behind 5/20 rule

This rule is in India only and the logic behind having such rule was that the domestic airlines must attain enough maturity and capability before they go international.

Implications and current status

The rule is bizarre and has pushed down the Indian players. This is because of this policy that the government allows any foreign carrier to offer services here while younger domestic carriers are denied permission to fly overseas. Thus, it does not allow to create a genuinely competitive environment within the country.

Despite having bilateral air services agreements with more than 100 countries, India was unable to utilize its full potential. So there has been a demand from new players to scrap this rule. However, the incumbent airlines have supported this rule to avoid competition from new players. The current government is expected to replace the 5/20 rule with concept of so called Domestic Flying Credits (DFCs) system. In this system, instead of years, the domestic airlines will need to earn miles to go global. The airlines will earn points by flying to domestic / remote areas of the country; and once they have earned enough points; they will be eligible to go global.

Route Dispersal Gridlines

The core philosophy behind the route dispersal guidelines is that via these, the government makes the airline operators accept the social obligation to fly to the northeast and other remote parts of the country. The route dispersal guidelines mandate the airlines to fly unviable routes connecting cities in the north-eastern region, Jammu & Kashmir, Andaman & Nicobar Islands and Lakshadweep.

Route Categorization

The DGCA had first framed and issued the guidelines in 1994, whereby, all routes were divided into three categories viz. Category – I, II and III.

Route categorization was based on traditionally surplus generating routes (Category – I), loss making routes (Category – II) and the remaining routes (Category – III).

- **Category – I**routes were largely inter-metro routes and generated surplus that cross subsidized losses largely on Category – II routes that served regions of difficult terrain and

destination in remote areas.

- **Category – II**routes included routes connecting airports in North-Eastern region, Jammu and Kashmir, Andaman & Nicobar and Lakshadweep.
- **Category – III**routes were routes other than those included in Category – I and Category – II.

It was obligatory on the part of scheduled airlines to deploy on Category – II, IIA and III routes, a specified percentage of capacity deployed in Category – I routes as per the following:

1. On Category – II routes, at least 10% of the capacity deployed on routes in Category – I.
2. On Category – IIA routes, at least 10% of the capacity deployed on routes in Category – II.
3. On Category – III routes, at least 50% of the capacity deployed on routes in Category – I.

Rationale behind Route Dispersal Guidelines

It's obvious that if there were no route dispersal guidelines, no airline operator would like to fly to unviable routes connecting cities in the north-eastern region, Jammu & Kashmir, Andaman & Nicobar Islands and Lakshadweep.

Demand to scrap route dispersal guidelines

There have been demands from the airlines to scrap these guidelines as they force the airlines to deploy flights in commercially not so viable routes; and this balloons their expenditures. The UPA government had started the process to overhaul the RDGs with an idea to re-categorisation of 25-odd cities, changing the geographical spread of the RDG. Domestic airlines have been seeking relief in terms of the amount of mandatory flying required to meet the guidelines.

RDGs and Draft National Civil Aviation Policy 2015

The draft National Civil Aviation Policy 2015 does not propose to abolish the Route Dispersal Guidelines. The document proposes that more routes will be added up in the Category I (metro) routes as destinations more than 700 km away domestically with annual traffic of 500,000 passengers will also become a part of it. As is the case presently, the airlines will need to deploy at least 10% of the capacity on the metro routes in the North Eastern region, Jammu & Kashmir, Andaman & Nicobar Islands and Lakshadweep (Category-II routes). The airlines will need to take the permission of the civil aviation ministry to withdraw existing operations in "north east region, Islands and Ladakh."

Draft National Civil Aviation Policy 2015

On October 31, 2015, the NDA Government has put a Draft National Civil Aviation Policy 2015 in public domain and invited comments from all stakeholders. The policy will be revised after public comments and will come in effect possibly from April 2016. The salient points have been summarized below:

Key Proposals

On 5/20 rule

The policy keeps all options open on 5/20 rule i.e. to abolish it, to tweak it or to replace it with DFC (Domestic Flying Credits) system.

Route Dispersal Guidelines

The government has decided not to scrap the RDGs. Instead, more rotes will add to the Category-I.

Open Sky Policy

The government has proposed to open the skies for destinations outside 5,000 km from New Delhi. This would help Europe, Australia, South America among others to operate flights to and from India without any restriction on the number of flights and seats.

Regional Connectivity Scheme

The policy proposes that a regional connectivity scheme will commence from 1 April 2016 in which the airfares for a one-hour flight will be capped at Rs. 2,500. This has to be done via revival of un-served or under-served airstrips. The government will create a **Regional Connectivity Fund** by charging 2% cess on air tickets on international and domestic routes excluding the intra-remote areas for viability gap funding.

Maintenance, Repair and Overhaul (MRO) Industry

For MRO industry, the policy suggests various tax rebates and incentives. It proposes to make MRO services exempt from service tax; custom free import of MRO tools & toolkits; free stay for foreign aircrafts in India for MRO purpose for six months; Prompt visa to Foreign MRO experts, Temporary Landing Permits for foreign pilots operating an aircraft to and from India for the purpose of servicing etc.

Code Share Agreements

The airlines in India will be free to enter into code-share agreements with foreign carriers for any destination within the country on a reciprocal basis. No prior government approval will be needed for this.

Services At airports

The airlines will be allowed to self handle the services at airports including check-in, luggage handling, aircraft cleaning and servicing, loading and unloading of food and beverages.

Helicopter hubs

Government to launch a separate set of regulation for helicopters by 1 April 2016 to facilitate the development of four helicopter hubs.

Airport Development

The airports will continue to be developed via PPP model.

Taxation measures

Tax incentives will be given to airlines to boost the aviation sector especially in custom and not on

aviation fuel. Proposed a slew of tax incentives for airlines and maintenance works.

FDI

Proposed hiking Foreign Direct Investment (FDI) in domestic airlines to over 50 per cent in open skies policy, which is 49 per cent at present.

Ticketing

Airlines will not be allowed to charge more than 2500 rupees for one hour flight between two small cities under regional connectivity scheme. Proposes 2 per cent levy on all domestic and overseas tickets for funding the Scheme.

Critical Analysis

The key notable proposals in the Draft National Civil Aviation Policy are on viability gap funding for regional routes, liberal bilateral traffic rights, opening up foreign direct investment (FDI) in aviation, self-handling airport operations and retaining the route dispersal guidelines. The policy aims to provide affordable flights to small-towns and small income travellers. It opens the civil aviation sector to large number of foreign airlines and aims to create jobs by making India an Asian hub for MRO industry. However, it has not correctly addressed the ambiguous 5/20 rule that distorts the level playing field for new airlines. Further, the policy proposes to impose cess on some routes (to provide regional connectivity) and lower airfares on less dense routes. It does not guarantee increase in traffic. This approach might not prove to be correct because it still does not encourage flying to and from new destination.

We note that out of 476 airports and airstrips, only 75 are in use at present. The airports are under-utilized because of lack of adequate demand. There is a need for setting no-frills airports in non-metro cities with centre-state cooperation.

Ports Sector

India has a total 13 major ports and 200 notified minor and intermediate ports. Ports play vital role in the overall economic development. About 95 per cent by volume and 70 per cent by value of the India's international trade is carried on through maritime transport.

Major Ports

India has 13 major ports viz. Kolkata Port, Paradip Port, New Mangalore Port, Cochin Port, Jawaharlal Nehru Port, Mumbai Port, Kandla Port, Vishakhapatnam Port, Chennai Port, Tuticorin port, Ennore Port, Mormugao Port and Port Blair Port. Out of them, the Mumbai, JNPT, Kandla, Manglore, Cochin and Momugao are located at western coast while Kolkata, Vishakhapatnam, Paradeep, Chennai, Tuticorin and Ennore are located on East Coast. Port Blair is located in Andaman and Nicobar islands.

Notable trivia about these ports for prelims are listed below:

Kolkata Port

- Only riverine major port in India.
- Known for twin dock systems viz., Kolkata Dock System (KDS) on the eastern bank and Haldia Dock Complex (HDC) on the western bank of river Hooghly.

Paradip Port

- located at confluence of river Mahanadi in Bay of Bengal in Odisha.
- It was the first major port on East Coast commissioned in independent India.

New Mangalore Port

- Located at a site called Panambur in Karnataka at Gurupura river confluence with Arabian Sea.

Cochin Port

- located on the Willington island on the South-West coast of India; located on the cross roads of the East-West Ocean trade
- The port is called natural gateway to the vast industrial and agricultural produce markets of the South-West India.

Jawaharlal Nehru Port

- It is also known as Nhava Sheva and is the largest container port in India, handling around half of containers of all major ports.
- It is located on eastern shore of Mumbai harbour off Elephanta Island and is accessed via Thane creek.

Mumbai Port

- One of the oldest modern ports of India. Initially the location was used by navies of Shivaji.

Kandla Port

- Kandla port was built after partition as the Karachi port on western coast had gone to Pakistan. It is known for handling much of the crude oil imports of India.

Vishakhapatnam Port

- Vizag port is located in Andhra Pradesh and is known for bulk of Cargo handling on east coast.

Chennai Port

- **Chennai Port** is the largest port in the Bay of Bengal and second largest port of India after JNPT. It is largest port at east coast.

Tuticorin Port

- This port has been now renamed as V.O.Chidambaranar Port. It is located in the Gulf of Mannar.
- Tuticorin is the only port in South India to provide a direct weekly container service to the

United States.

Ennore Port

- This port is now named as Kamarajar Port Limited. It is first corporate port of India and is registered as a public company with 68% stake held by government.

Mormugao Port

- Mormugao port in Goa is leading iron ore exporting port of India.

Port Blair Port

- Port Blair is the 13th and youngest major port of India declared so in 2010. The port is of strategic importance to India and is closer to two international shipping lines viz. Saudi Arabia-Singapore and US-Singapore.

Differentiation between the Major Ports and Minor Ports

India currently has 13 Major ports and 200 notified minor and intermediate ports. There is **no strict association** of the traffic volume with these terms. For example, the Mundra port of Gujarat is a minor port, but it has registered a traffic volume much larger than some of the major ports. *The classification of Indian ports into major, minor and intermediate has administrative significance. The maritime transport falls under the "concurrent list" of the constitution and thus is to be administered by both the Central and the State governments.*

So, while the Union Shipping Ministry administers the major ports, the minor and intermediate ports are administered by the relevant departments or ministries in the nine coastal states viz. West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Goa, Maharashtra and Gujarat. Many of the 200 minor and intermediate ports are merely "notified"; little or no cargo handling actually takes place there.

Sagarmala Project

The key objective of Sagarmala project develop port infrastructure in India that results in quick, efficient and cost-effective transport to and from ports. It also includes establishment of rail / road linkages with the port terminals, thus providing last mile connectivity to ports; development of linkages with new regions, enhanced multi-modal connectivity including rail, inland water, coastal and road services.

Historical Background

In August 2003, the NDA Government under Atal Bihari Vajpayee had announced a **Sagarmala project**, which targeted a total investment of Rs.1 Lakh crore for direct and indirect development of the port sector. The Sagarmala project was expected to infuse new life into the neglected sectors of the maritime industry the inland waterways, coastal shipping and ship-building and repairs.

However in 2004, NDA government was ousted from power. The UPA-I renamed this project as

National Maritime Development Programme in 2005. At that time, the cargo handling capacity of India was around 300 Million MTs and government sought to achieve 800.41 Mt by 2011-12. But like many other projects, this was also marred with tardy implementation. So far in March 2015, the cargo handling capacity stands at 871 Million Metric tonnes. In 2010, the UPA-II government launched Maritime Agenda 2010-20 with an objective to create a port capacity of around 3200 MT to handle the expected traffic of about 2500 MT by 2020. This included various components such as capacity augmentation, port modernization, efficient management of shore infrastructure, efficient maintenance of the ports, rail / road connectivity, efficiency improvement of flotilla units and optimum utilization of the port assets.

The NDA Government has again revitalized the same project with its own name Sagarmala project after coming back to power in 2014.

Three Pillars of Sagarmala Project

The current version of Sagarmala initiative focuses on three pillars of development as follows:

- Supporting and enabling Port-led Development
- Port Infrastructure Enhancement, including modernization and setting up of new ports
- Efficient Evacuation to and from hinterland.

The administrative framework

National Sagarmala Apex Committee

At apex level, a National Sagarmala Apex Committee (NSAC) will be created to provide overall policy guidance. It will be headed by shipping minister.

Sagarmala Development Company (SDC)

In September 2016, Indian Government has incorporated the Sagarmala Development Company (SDC) under Companies Act, 2013. It would be having initial Authorised Share Capital of Rs. 1,000 Crore and a Subscribed Share Capital of Rs. 90 Crore. {Click here to understand meaning and types of share capital}

This company will serve as a special purpose vehicle {SPV) in project development and also as a nodal agency for coordination and monitoring of sagarmala project. Other functions include:

- Preparation of detailed master plans for the Coastal Economic Zones (CEZs) identified as part of the NPP and provide a framework for ensuring the integrated development of Indian maritime sector.
- To manage the coastal community development scheme and fund coastal community development projects identified under the Sagarmala Project.

The company will also be raising funds as debt/equity (as long term capital), as per the project requirements/ by leveraging resources provided by the Government of India and from multi-lateral

and bilateral funding agencies. SDC will also aim to increase the scope of private sector participation in project development.

Sagarmala Coordination and Steering Committee

At national level, the government will constitute a *Sagarmala Coordination and Steering Committee* (SCSC) under Cabinet Secretary with Secretaries of the Ministries of Shipping, Road Transport and Highways, Tourism, Defence, Home Affairs, Environment, Forest & Climate Change, Departments of Revenue, Expenditure, Industrial Policy and Promotion, Chairman, Railway Board and CEO, NITI Aayog as members. This committee would provide coordination between various ministries, state governments and agencies connected with implementation and review the progress of implementation of the National Perspective Plan, Detailed Master Plans and individual projects.

National Perspective Plan

The Union Government would prepare a National Perspective Plan (NPP) for the entire coast of India integrating the Industrial Corridors, Dedicated Freight Corridors, National Highway Development Programme, Industrial Clusters and so on. It will also identify the potential geographic regions called Coastal Economic Zones (CEZs). The coastal states have been suggested to set up State Sagarmala Committee to be headed by Chief Minister/Minister in Charge of Ports with members from relevant Departments and agencies.

Key Activities

- Port-led industrialization
- Port based urbanization
- Port based and coastal tourism and recreational activities
- Short-sea shipping coastal shipping and Inland Waterways Transportation
- Ship building, ship repair and ship recycling
- Logistics parks, warehousing, maritime zones/services
- Integration with hinterland hubs
- Offshore storage, drilling platforms
- Specialization of ports in certain economic activities such as energy, containers, chemicals, coal, agro products, etc.
- Offshore Renewable Energy Projects with base ports for installations
- Modernizing the existing ports and development of new ports.

This strategy incorporates both aspects of port-led development viz. port-led direct development and port-led indirect development.

Summary of Sagarmala Project

Sagarmala project aims at holistic port infrastructure development along the 7,500-km-long coastline

through modernisation, mechanisation and computerisation. Under this port-led development framework government hopes to increase its cargo traffic three-fold in next 5 years. It will benefit around 14 per cent of country's overall population from at least 13 States and Union Territories. If inland waterways programme is included in it will benefit at least 55 per cent of all population. Two ports Kandla (Gujarat) and Paradip (Odisha) are being developed into Green Smart Cities and the Government is eyeing at 4,500 rupees profit from ports this fiscal. At Navi Mumbai Special Economic Zone, government is investing 4,000 crore rupees which will provide employment to 1.5 lakh youth.

Corporatization of Ports

At present, all major ports except Ennore are run by the Port Trusts under the **Major Port Trusts Act**, 1963. Ennore, which opened in 2001, is run as a company under India's Companies Act. The concrete proposal to corporatize ports and bring them under the purview of the Companies Act, 1956, first came up in 2001, when the Ennore port was set up as a corporate entity. A Bill to amend the Major Port Trust (MPT) Act, 1963, was introduced in the Lok Sabha in the same year. The Bill, however, lapsed with the dissolution of Parliament.

The plan also failed because some 54,000 employees and their unions were opposed to the move. Workers unions argue that the Major Port Trusts Act gave enough autonomy to the ports, but due to interference from the government, these ports cannot function independently. The real reason for their opposition could be concern that once corporatized, they would lose board seats and, thereby, bargaining clout with the port management.

Port as a Corporate versus Post under Trust

The process of corporatization means that there is a change in legal structure. Its should ***not*** *be confused with privatization or disinvestment.* The ownership prior to and after the corporatization remains with the Government. Thus, no major impact can be expected by mere change in the legal structure.

- Under the Major Port Trusts Act of 1963, the ports trusts are managed by the Boards of Trustees. There is not much difference after their corporatization. However, corporatization is seen as a *major step towards facilitating liberalisation and subsequent privatization of Ports.* The current format has operational restrictions and administrative controls for government. It is said that control factor caused hindrance in the growth of the ports.

What are expected outcomes?

- Functional Autonomy
- Increased Productivity and Efficiency

- Quicker and Timely Decision Making
- Accountability of Management.

The corporatized ports which do not fall under the purview of Major Port Trusts Act of 1963 are exempted from regulation by the Tariff Authority for Major Ports (TAMP) and are free to fix their own tariff.

Can it be a Game Changer?

Corporatization itself is no panacea for all problems of the ports sector. Even as a corporate Port, a port is subject to all the regulations and procedural restrictions as a government entity. Once becoming the government owned corporate, these ports would be required to compete in the market with private enterprise in every aspect of their commercial activities. Thus, corporatization by itself cannot be a game changer for ports development. Controlling bureaucracies severely limit performance of public enterprise managements. Unless this realisation is achieved and the situation remedied, mere structural changes will have little impact and in fact would undermine such policy initiatives.

Inland Water Transport

India draws a substantial network in terms of inland waterways in the form of rivers, canals, backwaters and creeks. India's total navigable length is 14,500 km out of which about 5200 km of river and 4000 km of canals can be used by mechanised crafts. Freight transportation by waterways is still an underutilized resource across the country in comparison to other economies like United states, China and European union. When compared the total cargo moved (in tonne kilometres) by inland waterway was reported to be 0.1% of total inland traffic across the country.Cargo transportation in India is generally confined to a few waterways in Goa, West Bengal, Assam and backwaters of Kerala.

Inland Waterways Authority of India

Inland Waterways Authority of India (IWAI) is the statutory body in charge of the waterways in India. Its headquarters is located in Noida, UP. Its main function is to build the necessary required infrastructure in these waterways, surveying the economic feasibility of new projects and also administration and regulation.

National Waterways

There are 14,500 kilometres (km) of navigable and potentially navigable inland waterways in the country of which the following six inland waterways have been declared as National Waterways:

- **National Waterway-1:** Allahabad-Haldia stretch of the Ganga-Bhagirathi-Hooghly river (Total length-1620 km) in the states of Uttar Pradesh, Bihar, Jharkhand and West Bengal

- **National Waterway-2:** Sadiya-Dhubri stretch of the Brahmaputra river (Total length-891 km) in the state of Assam
- **National Waterway-3:** Kollam-Kottapuram stretch of West Coast Canal and Champakara and Udyogmandal canals (Total length-205 km) in the state of Kerala
- **National Waterway-4:** (Total length-1027 km) in the states of Andhra Pradesh and Tamil Nadu and the Union Territory of Puducherry
- **National Waterway-5:** (Total length- 588 km) in the states of West Bengal and Odisha
- **National Waterways 6:** National Waterways 6 is a proposed waterway between Lakhipur and Bhanga of the Barak River with a length of 121 km. This was announced in Buget 2013-2014.

The Inland Waterways Authority of India will execute the project in two phases. The first will be completed by 2016-17 and the second by 2018-19, integrating the waterways in the northeast and helping cargo transport through Assam, Nagaland, Mizoram, Manipur, Tripura and Arunachal Pradesh.

Roads Sector

- India has the second largest road network in the world with a total length of 46.90 Lakh kilometres. The road network can be broadly classified into five broad categories viz. Expressway; National Highways (NHs); State Highways (SHs); Other & rural roads.
- Out of this, only 1 Lakh kms comes under National Highways and 1.60 Lakh kms under state highways. Rest are 'other' roads. Thus, only 2% of road length in India is covered under National Highways. Currently, around 1200 kilometres length is covered by express highways, highest category of roads in the Indian road network
- Roads handle around 60% of freight and 87% passenger traffic in the country.

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National Highways

As of August 2015, India has one Lakh kilometres of National Highways connecting major cities and state capitals. Most of these highways are in two lanes. Around 1300 kilometres have been converted into four and six lane expressways.

Key Facts

World's Second Highest Motorable Highway

The Leh-Manali Highway, connecting Shimla to Leh in Ladakh is world's second highest-altitude motor highway.

National Expressways

India has two National Expressways viz. National Expressway-1 (NE-1) and National Expressway-2 (NE-2).

National Expressway-1: Ahmedabad Vadodara Expressway has been designated as National Expressway-1, also known as Mahatma Gandhi Expressway. It is a 93 kilometres 4 lane expressway built by Atal Bihari Vajpayee government in early 2000s.

National Expressway-2: The Sonipat (Kundli)-Ghaziabad-Palwal expressway is the National Expressway-2. It is still under development.

State Expressways

There are 13 state expressways in India including Mumbai-Pune, Ambala-Chandigarh, Delhi-Gurgaon, Delhi-Faridabad, Kundli–Manesar–Palwal, Faridabad-NOIDA-Ghaziabad, Kalyani Expressway, DND Flyway, Bengaluru-Mysore, Chennai HSCTC, Hyderabad Elevated Expressways, Belghoria Expressway and Yamuna Expressway

New Numbering System in National Highways

From 2011, the Ministry of Road Transport and Highways had adopted a new systematic numbering of National Highways. This new system will indicate the direction of National Highways whether it is **East-West (odd numbers)** or **North-South (even numbers)** and also the geographical region where it is located, increasing from east to west and from north to south.

The new scheme is thus based upon:

1. Orientation
2. Geographic location of the highway.

As per this system, all the north-south oriented highway have even numbers increasing from the east to the west and all east-west oriented highways will be odd numbered increasing from the north to the south of the country.

- As per this scheme , the single longest national highway is NH 44 which will run from Srinagar to Kanyakumari.

- The shortest Highway is 966B,in Kerala from Kundannur in NH 66 in Eranakulam to Wellington Island(Port). The distance is 5.9 km only.
- The map is available on this link

National Highways Authority of India

National Highways Authority of India (NHAI) is responsible for management of a network of National Highways in India. It is a statutory authority, established by **NHAI act, 1988**. It was made autonomous in 1995. It is responsible for the development, maintenance, management and operation of National Highways, totalling over 70,548 km.

National Highway Development Project

National Highway Development Project (NHDP) is being implemented by NHAI. It involves creation and upgradation of 49,260 kms of roads and highways work and construction in order to boost economic development. The Phase I began in 2000 under the NDA Government and 8,917km National Highway was built during NDA rule. There are total seven phases so far of which Phase-I was completed. Rest of the phases are either in proposed state or incomplete. The current 12th plan focuses on completion of ongoing phases of NHDP and also upgradation to four or more lanes of about 32,750 km.

SARDP-NE

NHAI is also helping in implementation of the Special Accelerated Road Development Programme for North Eastern Region (SARDP-NE). SARDP-NE is a project to upgrade National Highways connecting state capitals to 2 lanes or 4 lane in north eastern region.

Funding of NHDP

A part of the fuel cess imposed on petrol and diesel is allocated to the National Highways Authority of India (NHAI) for funding the NHDP. This money goes to **Central Road Fund**, which was established by the parliament via Central Road Fund Act 2000. This fund is often criticised for slow utilization of money, inappropriate allocation and mismanagement of Fund. The NHAI leverages the cess resources to borrow additional funds from the debt market.

PPC versus EPC in road construction

The road projects were traditionally done under Public Private Partnership. In PPP, the public and private partnership happens in four ways viz. Build Operate & Transfer (BOT), Build-Operate-Transfer (Annuity), Build-Operate-Transfer (Toll) and Design, Build, Finance, Operate & Transfer (DBFOT). Lack of investor interest in PPP projects due to financial reasons and projects not making commercial sense to the developers are major reasons why the governments are moving to Engineering Procurement and Construction (EPC) mode. Many PPP projects of UPA rule plunged into financial, legal and other problems.

EPC is not a new model but is an older model than PPP. Highway projects of 3,055 km were awarded through the EPC mode in 2005-06 but afterwards it rapidly lost its sheen. The next year, only 345 km were awarded, slipping to 89 km in the following year. Under EPC, the government funds the construction and the road developer only has to develop the project in a stipulated period of time. In the BOT mode, the developer invests in the project and recoups it either through tolling rights or annuity. Since EPC contract promise guaranteed price, guaranteed timeline for completion, single point of responsibility and higher control; they were preferred by developers.

EPC mode is being adopted to ensure implementation of projects to specified Standards with a fair degree of certainty relating to cost and time and with a view to enabling a transparent, fair and competitive roll out of National Highway projects.

General Knowledge Today

Infra-4 : Indian Railways

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Mains Model Questions

1. What do you understand by the Guarantee System in Indian Railways? Discuss its role in the initial years of Indian Railways.
2. "For the betterment of Indian Railways, numerous committees and panels have been created from time to time." Examine the important committees and their recommendations.
3. Critically discuss the key recommendations of Bibek Debroy Committee with reference to Indian Railways.

4. To what extent the proposed Railway Regulatory Authority of India is different from earlier proposal of the Rail Tariff Committee. Critically examine its potential implications for Indian Railways.
5. "Construction of Dedicated Freight Corridors will lead to multiplier effects for economy." Amplify.
6. Critically examine the reasons that led to deterioration of the financial health of the Railways, while suggesting a solution framework for the same.
7. Apart from being a commercial organization; Indian Railways is required to engage in so called Social Service Obligations. What are they and what is their importance to India? Examine.
8. Critically discuss the introduction of private investment in Indian Railways taking examples of the experience of the western countries?
9. Elucidate the Government policy on FDI in Indian Railways. To what extent, liberalization in this policy is in favor of the Indian Railways? Discuss keeping view the social impacts.
10. "The need is for The Railways have to become lean and mean, competitive and efficient so that it can compete with the airlines for one segment of passengers, and with road transport for the movement of goods." Discuss in the light of various issues around restructuring the

Railway Board.

Basic Facts

Early History

The earliest proposals for railways in India were made in Great Britain in the 1840s. The proposals involved construction of Railways by companies incorporated in England and a minimum profit being guaranteed by the East India Company. With this, the people out there started entering into lobbying in support of these proposals by banks, traders, shipping companies etc. On 1 June 1845, the East India Railway Company was established in London with a capital of UGB 4 million, most of which was raised in London. Similarly, the on August 1, 1849, the Great Indian Peninsula Railway was incorporated via an act of the British Parliament.

Sindh, Sultan and Sahib

During Lord Dalhousie's regime, on April 16, 1853 at 3:35pm a train with 14 railway carriages and 400 guests left Bombay's Bori Bunder for Thane, with a 21-gun salute. The three locomotives were fancily named Sindh, Sultan, and Sahib. This 75 minutes journey was the first Journey of Indian Railway that embarked an era of development thereafter.

The Thomason Loco

However, the above was a passenger service and we have traces of Railway in terms of freight career from an earlier date also. In 1851, a steam loco, Thomason, was used for transporting construction material in Roorkee for the Solani viaduct, which was a part of the construction in the Salony Valley. The locomotive Thomason was assembled on the spot from parts transported from Calcutta. Second locomotive to arrive in India was Falkland (named for a governor of Bombay), used by the contractors of the GIPR for shunting operations on the first line out of Bombay that was being built.

First Railway Foundry

From the modest beginning in 1853, the development of Railway was very fast. The first railway foundry was set up at Jamalpur Workshop in 1893 and it produced the first steam locomotive in 1899. By 1900, around 40000 kilometer of railway was completed. However, in the next 50 years, the construction got slackened and only 16000 kilometers of Railway line was constructed in next 50 years.

Operations in Beginning

Originally, the Indian railways were operated by the private companies owned by the British businessmen. They were granted free land and given a guarantee of minimum returns on capital.

Guarantee System

These two companies entered into contract with East India Company for construction of two small

railway lines near Calcutta and Bombay respectively. With this, the Indian Railways started its modest beginnings in 1853, when the first Railway train journeyed a distance of 22 miles from Bombay to Thana. Since the investors in England had strong interest railways in India; they wanted the British Parliament to create a Guarantee System. In the Guarantee System, any company that constructed railways in India was guaranteed a certain rate of interest on its capital investment. This guarantee was to honored by the East India Company. The railways which were made on this arrangement were called Guaranteed Railways. The guarantee was for a return of 5% annually, and the right for the railway company to pull out of the venture and get compensation from the government at any time. In return, the companies needed to pay to the Government when they earned more than 5%, half the surplus every year. Further, the Government had right to control expenditure and operation and to purchase railways at the expiry of 25 year.

However, there were many issues with the guarantee system. Major issue was that since the investors were assured of 5% return, they had no motivation to improve economy of the railways. {Read this document for an insight in colonial legacy of Indian Railways}

Modification in Guarantee System

The first Railway Company was taken over by the government of India in 1925. Gradually, the other Railway companies were also taken over and in 1950; the railways from the princely states were also taken over by the Government of India. Thus, 1950 onwards, the Railways become a unified state enterprise.

State ownership of the Railways was not achieved in a year or two but it took many decades in the process. In 1869, it was John Lawrence, who recommended the development of Railway lines under the state and thus the development of Railways through government agencies started very early. But it was very slow and till 1891, the Government could add only 3297 miles.

In 1879, the first old guaranteed Railways was purchased (East Indian Railway). In later era, the Indian princely states, district boards and other local authorities also took part in the development of Railways. But it was till 1900, that the Railways never showed profit. From 1882 till 1900, the existing companies became reluctant to invest in Railways and provide additional capital to development. So, a new modified guarantee system was developed which worked from 1882 till 1924. Under this, the Government took over the works such as branch and feeder lines which were un-remunerative.

Establishment of Railway Board

In 1900, Railways showed a small profit for the first time. In 1901, Thomas Robertson was appointed the special commissioner to examine the organization and working of the Railway and thus began the drastic changes in the administration of the Railways.

The Robertson commission recommended the appointment of a "Railway Board" with a chairman, 2 members and 1 secretary. In 1905, the Railway Board was set up. The Railway Board was made subordinate to the Government.

MacKay Commission

Sir James MacKay Commission was set up by Secretary of States for India, John Morley in 1907 to look into the problems of administration and finances of Railways. The commission found out that there was a friction in the Government and the Board and this caused bottlenecks in the speedy business of the Railways. The commission recommended the modification of the Railway Board and thus in 1909; the Railway Board was reconstituted with 3 members. It was again modified in 1914 and one member with commercial and financial knowledge was appointed.

In 1920, it was decided that all 3 members of the Railway Board must possess experience and knowledge in the working of the Railways.

Acworth Committee

In 1920, an East Indian Railway Committee was constituted under the chairmanship of Sir William Acworth. This committee consisted of 10 members and among them 3 were Indians viz.

- V S Sriniwas Sastri (Member of Council of States) ,
- Purshottam Das Thakurdas (representing Indian Commercial Interests) and
- Rajendra Nath Mukherjee.

The Acworth Committee recommended the consolidation and nationalization of the Indian Railways. Based upon the recommendations of Acworth Committee, the Finances of Railways were separated in 1924 and thus from 1924 onwards, the Railway Budget is separated from the General Budget.

Key Facts about Route Length

Kindly note the following facts about your Prelims Examination.

- Indian Railway is World's fourth largest railway US, Russia and China. It carries some 23 million passengers everyday and around 1060 million tons of freight in a year.
- As on 31.03.2011, the route length of Indian Railways is around 1.14 Lakh kilometres.
- Among states, the highest route kilometres are in UP, which shares 13.6% of India's total route kilometres. Next largest states in terms of route kilometres are Rajasthan, Maharashtra, Andhra Pradesh and Gujarat.
- Broad gauge (1676 mm) accounts for close to 85% of total route length. The share of meter gauge has and narrow gauge are 11.2 and 3.8% respectively.

Zones and Divisions

The number of Zones of Indian Railways was 6 before 1951. 2 more Zones were added in 1951. In

1952, the number of Zones became 9. At present Indian Railway has 16 Zones, however, Kolkata Metro, which is not a part of any zone is considered to be 17th Zone of Indian Railway. The making of Kolkata Metro as an independent zone was notified by the Railway Board in December 2010. The headquarters of the various zones are listed in below table:

Sr	Name	Headquarters	Sr	Name	Headquarters
1	Southern	Chennai	9	South Central	Secunderabad
2	Central	Mumbai	10	East Central	Hajipur
3	Western	Mumbai	11	North Western	Jaipur
4	Eastern	Kolkata	12	East Coast	Bhubaneswar
5	Northern	Delhi	13	North Central	Allahabad
6	North Eastern	Gorakhpur	14	South East Central	Bilaspur
7	South Eastern	Kolkata	15	South Western	Hubli
8	Northeast Frontier	Maligaon	16	West Central	Jabalpur

Each Zone is headed by a General Manager (GM) who reports directly to the Railway Board.

Sanskriti Express

'Sanskriti Express' was the special exhibition train that was run to commemorate the 150th Birth Anniversary of Rabindranath Tagore.

Duronto Trains

Duronto Trains were initially started by Lalu Prasad Yadav during his tenure as Railway Minister in 2004-05 as Sampark Kranti Expresses. Currently, there are 27 Duronto trains running in India.

Rajdhani Express

Rajdhani Express was introduced in 1969, for providing high-speed connections from various railway stations in the capital city of New Delhi to the capital cities of various states in India. First Rajdhani Express left New Delhi station for Howrah station to cover a distance of 1,445 km in 16 hours 55mins.

Fastest Train of India

The New Delhi Habibganj Shatabdi Express is fastest train of India running at 155 kilometers per hour. runs at a peak speed of 150 km/h, which makes it the fastest train in India. All Shatabdi trains cover the whole journey Up & Down on the same day

Garib Raths

Garib Ruth were introduced by the Indian Railways in 2005 to provide fully air-conditioned travel to those passengers who could not afford the expensive tickets of the fully air-conditioned coaches as in Rajdhani Express and Shatabdi Express. They are no-frill AC trains. First Garib Rath train journeyed from Saharsa, Bihar to Amritsar, Punjab.

5 Digit numbering System

From December 20, 2010, the railways is deploying a 5 digit numbering system instead of the 4 digit system. The need is due to the fact that the Indian Railways runs 10,000 trains daily. Only a prefix of the digit 1 will be added to the four-digit numbers of the existing trains to make the transition smoother. The special trains run to clear festivals and holiday rush shall have the prefix of 0 (zero)

Longest Rail Bridge of India

India's largest rail bridges are

1. Bandra–Worli Sea Link, Mumbai
2. Mahatma Gandhi Setu, Patna
3. Vikramshila Setu, Bihar
4. Vembanad Rail Bridge.

North East Region Rail Development Fund

The North East Region Rail Development Fund is a non-lapsable fund approved in 2011 for National Projects in the North Eastern Region. The NERRDF is to be funded to the tune of 25% through Railway Gross Budgetary Support (GBS) and balance 75% by Ministry of Finance as non-dividend additionally to GBS. The funds to be provided as non-dividend bearing additional budgetary support by Ministry of Finance may be allocated at the beginning of the year.

UNESCO World Heritage Sites in Indian Railway

There are two UNESCO World Heritage Sites on IR viz. the Chatrapati Shivaji Terminus and the Mountain railways of India. Mountain railways of India is not contiguous, but consists of three separate railway lines located in different parts of the country viz.

- The Darjeeling Himalayan Railway, a narrow gauge railway in West Bengal
- The Nilgiri Mountain Railway, a metre gauge railway in the Nilgiri Hills in Tamil Nadu
- The Kalka-Shimla Railway, a narrow gauge railway in the Shivalik mountains in Himachal Pradesh. In 2003 the Kalka Shimla Railway was featured in the Guinness Book of World Records for offering the steepest rise in altitude in the space of 96 kilometre

Apart from that there are two lines under consideration:

- Maharaja Railways , a narrow gauge line of just 0.6m width from Gwalior to Sheopur of 198 km. in length is world's longest narrow gauge railway line.

- Neral-Matheran Railway , a narrow gauge railway connecting Matheran is also a historic line.

Railway Convention Committee

Prior to 1924, the Railway Finances were a part of the Central Government Finances. From 1924 onwards, the Railway Budget was separated from the Central Government budget and that continues till date. The finances of the Railways are determined by the Railway Convention committees since the Railway Convention 1950.

Railway Convention Committee

The railway convention committees are appointed every 5 years by convention to review the finances of the Indian Railways, constitution and administration of the various railway funds including the Railway Revenue Fund , Railway Reservation Fund etc.

Composition

There are 18 members (12-Lok Sabha; 6-Rajya Sabha) in the Railway Convention Committee. The Lok Sabha members are nominated by speaker and Rajya Sabha members are nominated by Chairman of Rajya Sabha (i.e. Vice-President). Minister of Railway and Minister of Finance are amongst the nominated members of Railway Convention Committee. Chairman of the Railway Convention Committee is appointed by Speaker.

Functions

- To review rate of dividend to be paid by Railways to Government and make suggestions in that relation.
- Level of appropriation to various funds of Railways like the Depreciation Reserve Fund, Development Fund, Capital Fund, Pension Fund, etc.
- Any other matter as referred to the committee by Lok Sabha speaker.

Backgrounders

For the betterment of Indian Railways, numerous committees and panels were created. As early as in 1994, Prakash Tandon Committee, made comprehensive proposals for change. In 1997, a McKinsey report was prepared on behalf of the Asian Development Bank. Thereafter, there were two status reports, in 1998 and 2002 under Nitish Kumar; Rakesh Mohan Committee 2002; followed by a white paper and a Vision 2020 in 2009 under Mamata Banerjee; followed by two reports in 2012, one led by Anil Kakodkar on safety and the other led by Sam Pitroda on modernisation. The NDA Government came up with two high level committees viz. DK Mittal Committee and Bibek Debroy Committee. They all address the same basic issue – how to get the Railways going?

Important from them are discussed below:

Rakesh Mohan Committee Report 2002

More than a decade ago, the Rakesh Mohan Committee observed that Indian Railways over the past

decade (1991-2002) has fallen into a vicious cycle of *under investment, mis-allocation of scarce resources, increasing indebtedness, poor customer service and rapidly deteriorating economics*. The root cause of the decade of decline is an unstable political system increasingly driven by short-term political compulsions.

- This committee came up with radical suggestion of corporatization of Indian Railways. It suggested, that Indian Railways must eventually be corporatized into the Indian Railways Corporation (IRC).
- The government would need to set up an Indian Rail Regulatory Authority (IRRA), which would be necessary to regulate IRC's activities as a monopoly supplier of rail services.
- IRRA was necessary to distance IRC from the government. IRC would be governed by a reconstituted Indian Railways Executive Board (IREB). The government should be in charge of setting policy direction and constituting IRRA and IREB.

The report suggested that once the broad framework of a proposed restructuring is accepted, the Government of India and the railway ministry would need to set up a special task force to frame new legislation enabling a new organisational framework. This task force would have to commence operations with a thorough review of the Indian Railways Act and the Indian Railway Board Act.
New legislation would need to be drafted so that it:

- Mandated corporatisation of the Indian Railways into IRC
- Permitted a revamp of the Railway Board
- Redefined the relationship between the government and a revamped IREB
- Provided for exemption from taxation (excise, sales tax, and so on) for the period of transition, say five to seven years
- Permitted private participation in railway operations
- Facilitated the induction of personnel form outside the railways
- Mandated the subsidisation of social responsibilities to the extent of funds provided by the government
- Set up a social safety net to take care of surplus labour

These recommendations were made 13 years ago and we can make out that these were radical and politically, ahead of their time. The report was not liked by the entire railway establishment and was soon thrown in the dustbin.

Anil Kakodkar Committee 2012

The report of the high-level safety review committee under the Chairmanship of former chairman of Atomic Energy Commission Anil Kakodkar was submitted in February 2012.

The Kakodkar Committee has made a slew of recommendations of which some of the key ones are:

- Stopping the practice of introduction of new trains without commensurate inputs to the infrastructure
- Having a statutory Railway Safety Authority and measures to strengthen the present Railway Safety Commission to undertake meaningful regulatory inspections
- Setting up a Railway Research and Development Council at the apex level directly under the government. This council should have Advance Railway Research Institute and five railway research centres for key safety-related railway disciplines
- Adoption of an advanced signalling system based on continuous track circuiting and cab signalling similar to European train control system Level-II
- Total elimination of all level crossings (manned and unmanned) within five years.

The estimated cost of the implementation of Kakodkar recommendations was Rs. One Lakh Crore.

Sam Pitroda Committee 2012

Sam Pitroda used to be the advisor of former Prime Minister Manmohan Singh. The 'Committee on modernization of Indian Railways' headed by Sam Pitroda had unveiled an ambitious Rs. 8.39 lakh crore modernisation roadmap for Indian railways to be carried out in 'mission mode' in next five years. This biblical report touched almost every area of operation and management of Indian Railways and came up with five strategic planks viz. modernisation of core assets; exploration of new revenue models; review and assessment of capital projects sanctioned and work-in-process; focus on enablers and mobilisation of resources.

Based on this five-pronged strategy "15 focus areas" were identified and selected for attention.

MODERNISATION GRID: 15 FOCUS AREAS				
Core assets	Track and bridges	Signalling	Rolling stock	Stations and terminals
Revenue models	PPPs	Land	Dedicated Freight corridors	High speed trains
Projects	Review of existing and proposed projects			
Enablers	ICT	Indigenous development		Safety
Resources	Funding	Human resources		Organisation

The Pitroda Committee strongly recommended the "mission mode" approach for all these 15 focus areas with clear objectives, measurable milestones, tangible deliveries and well-defined timelines.

Some of the parts and parcels of the report focussed on the below measures:

- Modernisation of 19,000 km of existing tracks
- Strengthening of 11,250 bridges to sustain higher load at higher speed
- Eliminating all level crossings

- Implementation of automatic block signalling on major routes; A centralized train monitoring system right from Rail Bhawan.
- Deployment of on board train protection system with cab signalling on all other routes.
- GSM-based mobile train control communication system; Stress on complete upgradation of railway's communication system
- New generation locomotives
- Train sets for high speed inter-city travel
- Heavy haul freight bogies
- Green toilets on all passenger trains
- Modernisation of 100 major stations
- Development of 34 multi modal logistics
- Real time information system and internet facility at 342 railway stations
- Development of public private partnership (PPP) models and policies in various areas of railways to attract private investment to augment core capabilities such as stations and terminals
- High speed railway lines
- Elevated rail corridor
- Private freight terminals
- Leasing of wagons, loco and coach manufacturing, captive power generation and renewable energy projects.
- Construction of North-South, East-West, East-Coast and Southern Dedicated Freight Corridors covering 6,200 km in next ten years.
- Commercialization of surplus land to generate additional revenue for railways.
- Implementing the track occupancy and mobile train radio communication (MTRC) for seamless communication
- Substantial hike in Gross Budgetary Support to sustain the modernization drive.
- Railways should venture into captive power generation through the PPP route
- Effectively commercialize land and air space to mobilize Rs 50,000 crore.

The Pitroda panel had also recommended construction of a high speed railway line between Ahmedabad and Mumbai with Speed of 300 kmph. It wanted to reshuffle the Railway Board and its head to work as Chief Executive Officer. It also wanted to give authorization to Zonal railways to take investment decisions along with accountability for return on capital, transport output, safety, and profitability.

D K Mittal Committee

The High Level Committee headed by DK Mittal submitted its report on 26 December 2014. This committee had made large number of recommendations for short term and medium/ long term action plan relating to improving revenue generation from passenger and freight operations, asset monetization and resource mobilization, and increasing efficiency. Many of the recommendations require changes in operational systems and procedures, large investments in facilities and infrastructure, and organizational changes over a long time frame. Such recommendations as are considered feasible for immediate implementation have been taken into account for framing the Railway Budget for the financial year 2015-16.

Bibek Debroy Committee 2015

The Bibek Debroy Committee is a high level committee for "Mobilization of Resources for Major Railway Projects and Restructuring of Railway Ministry and Railway Board" created by NDA Government after coming into power in 2014. This is yet another Biblical size report in 319 pages and reviews almost all areas of Indian Railways operations. The key recommendations of this committee are as follows:

Establishment of Independent Regulator RRAI

The report recommends setting up an overarching Railway Regulatory Authority of India (RRAI) as an independent regulatory body. The independent regulator shall ensure fair and open access and set access charges; establish tariffs in cases where there the market fails to discover a price; and adjudicate disputes between the track-owning organization and train operators; and between competitors. This will make fair and open access a reality and open up both freight and passenger trains, in competition with IR. The Railway Board should continue only as an entity for the Indian Railways (PSU).

Transition to commercial accounting

Indian Railways should shed its complicated accounting and move to standard commercial accounting by following principles and norms accepted nationally and internationally. Appropriate financial disclosures will facilitate investors in assessment of risk and taking decision to invest in Indian Railways. It will also help Railways to quantitatively assess impact of policy interventions on cost of various services.

Streamline recruitment & HR processes

The present systems of recruitment into Indian Railways through various channels need to be streamlined. It recommended that present eight organized Group 'A' services in Indian Railways can be broadly categorized in two bigger groupings viz. technical and non-technical services. The Indian

Railway Technical Service (IRTechS) comprising the existing five technical services (IRSE, IRSSE, IRSEE, IRSME and IRSS) and the Indian Railway Logistics Service (IRLogS), comprising the three non-technical services (IRAS, IRPS and IRTS).

Focus on core areas

Indian Railways should focus on core activities to efficiently compete with the private sector. It will distance itself from non-core activities, such as running a police force, schools, hospitals and production and construction units. Immediate integration of the existing Railway schools into the Kendriya Vidyalaya Sangathana set-up. Instead the needs of the children of Railway employees could be met through subsidizing their education in alternative schools, including private schools.

Decentralisation

Decentralisation should happen at the bottom level duties. To ensure proper decentralization, there is a need to delegate enhanced powers, mainly related to tenders connected with works, stores procurement, service or even revenue-earning commercial tenders, to the DRMs. Finance must completely be under the DRM; ADRMs should be an explicit part of the administrative chain; some earnings by the Division should be retained at the level of the Division.

Indian Railway Manufacturing Company

Presently wagons are produced by the private sector. Coaches and locomotives could follow the same. The Committee proposes that all these existing production units whether it is for coaches or locomotives should be placed under a government SPV known as the Indian Railway Manufacturing Company (IRMC).

Encouraging private entry

Private sector should be allowed into running both freight and passenger trains in competition with Indian railways. Private participation should also be allowed in various Railway infrastructure services and non-core activities like production and construction. A separate track holding company, which remains public, be formed to provide access to railway tracks to private players. This track holding company will be neutral between Indian Railways and the private players.

Joint Venture with State governments

Railways should partner with State governments in construction of new suburban lines. There are too many Zones and Divisions and thus a rationalization exercise is required.

Changing relationship between government & Railways

A separate Railway budget should be phased out progressively and merged with the General Budget and eventually also integrate the Ministry of Railways with Ministry of Transport.

Raising resources

An Investment Advisory Committee may be set up, consisting of experts, investment bankers and

representatives of SEBI, RBI, IDFC and other institutions for raising resources for investment.

Rail Tariff Authority

Currently, setting of tariffs for railways is the function of the Railway Board. Revising rail fares is a politically sensitive issue. Every year, the Rail budget is passed without any substantial rise in the Rail tickets. The railway's passenger subsidy is a whopping Rs. 25000 crore per year.

To free the rail tariffs from political influences, Rail Tariff Authority was proposed during UPA rule and Manmohan Singh cabinet had approved setting up of such an authority to advise the Railway ministry on fare revision and freight revision.

Functions of the Rail Tariff Authority

- The Railways would 'accept the recommendations ordinarily' but if it disagrees with the advise, it would send the recommendations back to the authority which will review its decision.
- The proposed RTA is to engage with all the stakeholders, including Railways, consumer groups, container operators etc before it advises the government on determination of fares and freight rates.
- Other than rationalizing the fare structures, the RTA has would also have the responsibility of increasing the quantum of freight sent in Railways and also reduce cross subsidization.

Current Status

Rail Tariff Authority would be a statutory body and currently, the NDA government is in process of framing a draft bill. The Railway Ministry has announced that Rail Tariff Authority will be in place by FY 2019.

Railway Regulatory Authority of India (RRAI)

An independent Railway Regulatory Authority of India was recommended by the Bibek Debroy Committee for Mobilization of Resources for Major Railway Projects and Restructuring of Railway Ministry and Railway Board.

This committee observed that in Indian Railways, the same organization deals with three prime functions viz. policy making, the regulatory function and operations. Making a case for shifting the regulatory power from government (Railway Ministry) to an independent statutory body with quasi-judicial powers, the committee recommended that such body will be able to provide a level-playing field to private players who have been reluctant to enter the railway sector.

Proposed Key Features

- According to the committee, the Rail Regulatory Authority of India would be a quasi-judicial body, independent of Railway Ministry and will have its own separate budget

- It should have powers for economic regulation, including, wherever necessary, tariff regulation, safety regulation and fair access regulation
- It should have access to railway infrastructure for private operators, service standard regulation, licensing and enhancing competition and setting technical standards.
- The Commissioner of Railway Safety should be integrated with or merged into the RRAI.
- It should be given task of overseeing rules and norms that ensure the fair competition for Special Purpose Vehicles that have been created through railway connectivity projects.
- Currently, the RDSO (Research, Design and Standards Organization) is playing dual role – as a technical advisor to the Railway Board and as a standard setting organization. The committee recommended that the job of setting the standards to be shifted to RRAI.
- The committee further recommended that the RRI should be able to do Public Service Costing exercise, independent of railways. Via this exercise, the RRAI would determine the costs incurred by Indian Railways and other service operators in providing social services such as construction, operation and maintenance of lines in specified locations and in providing specified rail services on select branch lines.
- The issues like consumer complaints, including class action complaints will not be addressed by RRAI.
- Adjudicate on disputes among licensees/private partners and the Ministry, subject to review in appeal.

The Bibek Debroy committee has thus gone much farther than the Rail Tariff Committee as suggested earlier. The mandate of the proposed Rail Tariff Committee is to be strictly limited to the tariff-related matters and as a less powerful body. In contrast, the RRAI is a super-authority, which appears to be above ministry in some cases.

Current Status

The RRAI is in proposed state.

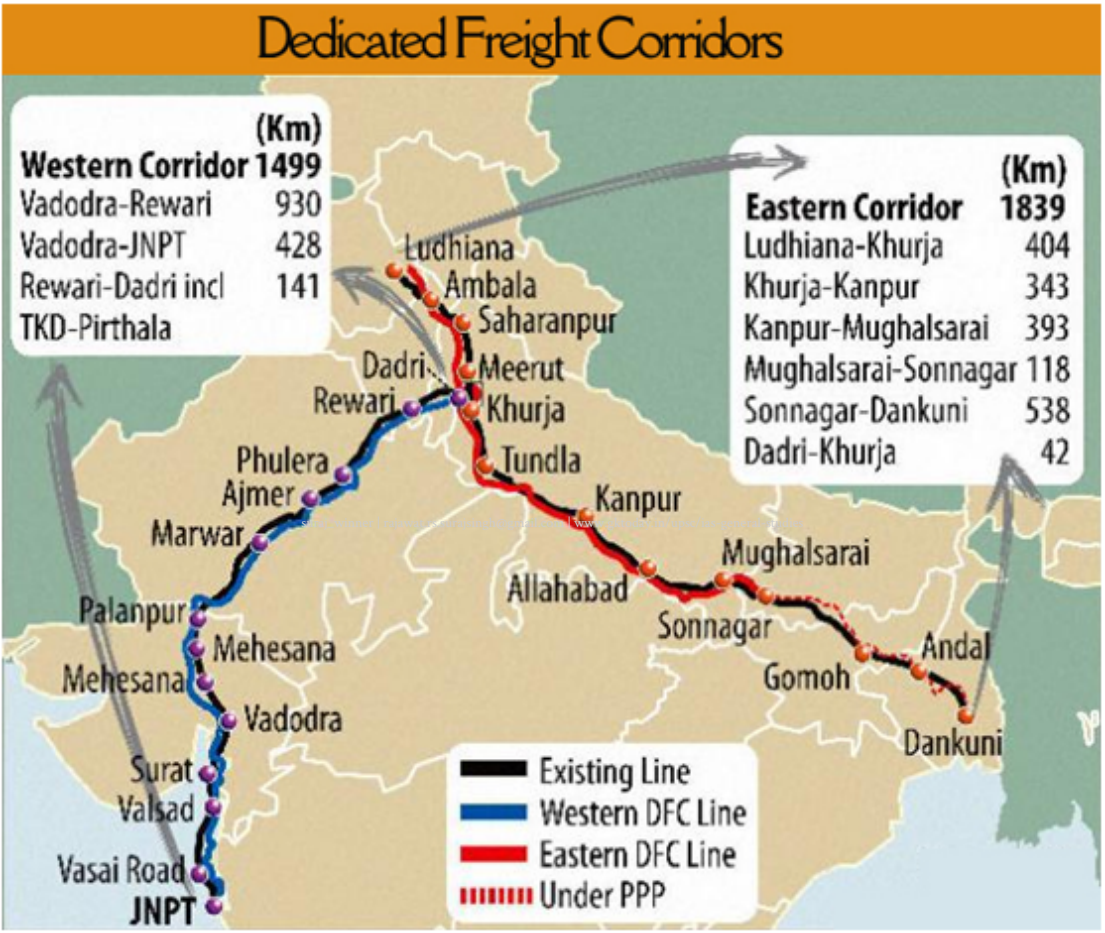
Dedicated Freight Corridor (DFC) Project

The Eastern and Western Dedicated Freight Corridors (DFC) are a mega rail transport project being undertaken to increase transportation capacity, reduce unit costs of transportation, and improve service quality. The Eastern DFC (1839 route kilometres (RKM) extends from Dankuni near Kolkata to Ludhiana in Punjab, while the Western DFC (1499 RKM) extends from the Jawahar Lal Nehru Port (JNPT) in Mumbai to Dadri /Rewari near Delhi.

An SPV *Dedicated Freight Corridor Corporation of India Limited* was set up to implement the project. The DFCCIL is constructing 3,300 km long Eastern and Western freight corridors for exclusively

movement of goods trains for Railways.

Out of 10,703 ha of land to be acquired for the project, 7,768 ha (73 per cent) has already been awarded (by March 2013) under the Railway Amendment Act (RAA) 2008.



Apart from the Eastern and Western DFCs, a feasibility study has also been undertaken on four future freight corridors, viz.

- East-West Corridor (Kolkata-Mumbai)
- North-South Corridor (Delhi-Chennai)
- East Coast Corridor (Kharagpur-Vijayawada)
- Southern Corridor (Goa-Chennai).

The Dedicated Freight Corridor Corporation of India (DFCCI) is building what would be the country's largest infrastructure project involving almost 3,300 kilometres of railway track.

Construction of DFC project will provide transport infrastructure to carry heavy loaded trains and ease out congestion of train movement on existing Indian Railway network besides facilitating utilisation of surplus capacity to introduce new passenger services.

Currently, railways share in freight transportation is about 36 per cent of total goods transported in the country and the Railways aims to increase it substantially.

Funding of DFC

The major part of Eastern Dedicated Freight Corridor is being funded by World Bank and the Western Dedicated Freight corridor is being funded by Japan International Cooperation Agency (JICA). Some parts are being built in PPP Mode.

Potential Benefits to Railways, Economy and Environment

- The current speed of goods trains in India is 25/26 km per hour. Once the DFC is ready, the speed will go up to 75-80 km per hour.
- The DFC will allow for the first time to have a time-tabled freight services for movement of the cargo to the gateway ports with guaranteed transit time. This would enhance international connectivity from India.
- The axle load of wagons will go up from 22.9MT to 32.5 MT.

- Goods moved by road have three times the emission rate in comparison to the corresponding movement by rail. The DFC, once completed is expected to replace 4 Lakh trucks in each corridor and thus would significantly contribute to environment. It will also reduce congestion and bottlenecks in the road and rail networks.

Current Status

The DFC is entangled into 1600 court cases and 6000 arbitration cases, of which around half have been resolved. Most of these cases pertain to land acquisition. Due to this, DFC has missed several deadlines. Currently, it is expected that this Rs. 81.4 Crore project will be completed by 2019.

Analytical Note

For years, freight trains suffered second class treatment as express trains and other passenger trains got priority to use the tracks. As a result, goods never reached their destination in time. Both industry and the railways suffered as a result. Exporters, anxious to reach their consignments to destination within deadline, were among those who preferred to move their goods by road, even though it is a far more expensive mode of transportation. This led to a sharp decline in share of freight carried by railways from 86 per cent in 1950-51 to 36 per cent by 2011-12, even as total freight traffic grew exponentially. In comparison, in many countries, about 50 per cent of freight moves through the railway network. So providing separate and exclusive tracks for freight trains is the need of hour.

Following are its benefits:

1. The existing rail network runs on a combination on diesel and electricity. But the dedicated freight corridor will operate entirely on electric trains so there will be less generation of greenhouse gases.
2. The new tracks being laid for the freight corridor can handle heavier trains – this will increase freight handling capacity of railways. Freight train capacity is proposed to be more than doubled from the current 6,000 tonnes to 13,000 tonnes. The western corridor would primarily cater to containerised traffic, mostly exports and imports, while the eastern corridor will be used most to move coals from mines in east India to power plants in north. It is also proposed to operate double stack container trains, thereby increasing the handling capacity of the railways and also help decongest ports when consignments arrive. Therefore overall it will help in faster movement of goods.
3. Moving most freight trains to the new corridor will also benefit passengers – it will reduce congestion on the main tracks and enable passenger trains to move faster.

Construction of will lead to multiplier effects for economy. For example, higher economic growth requires investment in infrastructure. These corridors will help in faster transport of raw material like cement; steel etc. Along with this transportation cost will also decrease.

Current Issues and Analytical Notes

From the construction of the first railroad in India that began in 1850, and the first train that was run on April 16, 1853 from Bombay (now Mumbai) to Thana (Thane), to the unimaginable growth of the railway network, the India's biggest Public Sector Undertaking has come a long way. Today, Indian Railways has the honor of being called one of the largest and busiest rail networks in the world.

India Railways is an extremely critical component not only in India' s economic revival but also in national integration. However the state of Indian railways is in shambles. Since independence, it has added just around 11,000 kilometers of track (China by contrast added 14,000 kilometers between 2006 and 2011 alone). Further revenues have grown at a mere 2.8 per cent compounded annual growth rate while cost have risen sharply by close to 11 per cent compounded annual growth rate. More than 60 per cent of modernization and capacity-building projects announced or in various stages of implementation over the years, are financially non-viable. And these are only some of the figures that tell a story of neglect and policy paralysis Indian Railways has suffered from.

Various Financial Problems Indian Railways

Indian Railways faces chronic financial problems. The annual rate of increase in cost has overtaken

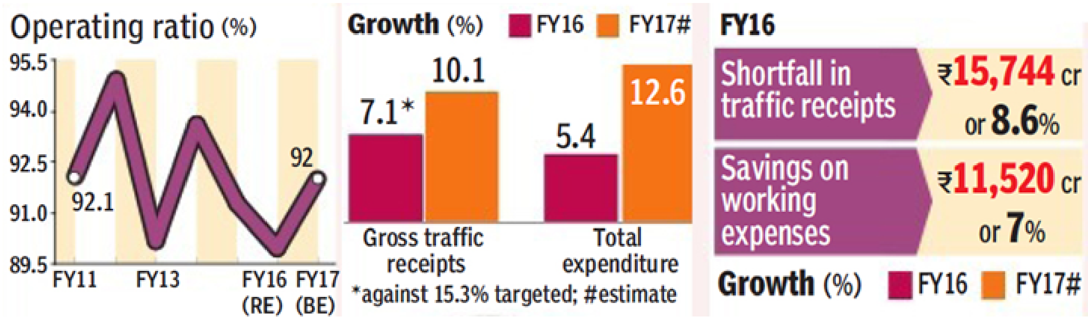
that of revenues during the last few years. There are several reasons of deterioration of the financial health of the Railways. These include, a high operating ratio, cross subsidization, social service obligations, salaries not a function of commercial viability and competition with roads.

Operating Ratio

The financial health of the railways is determined by its Operating Ratio (OR). Operating Ratio indicates how much railway spends to earn a rupee. An Operating Ratio of 90% means that Railway is spending 90 paisa to earn 100 paisa (i.e. one rupee). A lower figure of Operating Ratio is thus regarded better and is indicative of better financial health of the system. Operating Ratio can be decreased by reducing expenditure and augmenting income and efficiency. Income can be increased by raising fares and expanding its revenue streams. Raising passenger and freight fares are always politically sensitive issues.

Historically, an Operating Ratio of Indian railway was not a problem in 1960s and 1970s. The best ever OR of Indian Railways was 74.7% in 1963-64. However, for the last few decades, this ratio is lingering between 92 to 98.5%.

In 2014-15, the budgeted Operating Ratio was 92.5% against which it has been able to get some better position by achieving 91.3%. In 2015-16, the operating ratio is 90% mainly due to savings of Rs. 8,720 crore. However, for 2016-17, the government has targeted an O.R. of 92%.



The key reason for 2% increase in budgeted OR is the additional burdens of Rs. 21,000 crore on account of 7th pay commission.

We note here that in 2008-09, when the railways had to implement the 6th Pay Commission report, the Operating Ratio had gone chaotic. In 2007-08, the OR was 75.9% due to good economic growth and robust earnings from freight. Thereafter, the O.R. went up to 88.3% in 2008-09 and 95.3% next year. Further, half of railways earnings generally go towards meeting wage and pensions. Thus, despite of charting out above 10% revenue growth plan, this budgeted OR of 92% seems to be unrealistic. The logic behind this is that around half of railways' earning go towards meeting wage and pension bills of employees in normal course, and due to huge pay pressure, the ratio might

worsen in budget year 2016-17. The calculations of railway might go haywire due to absence of a solid road map to boost the earnings.

Cross Subsidization

Indian Railways has to meet the aspirations of two kinds of end-users viz. passenger segment and the freight segment. Freight segment has traditionally been used to cross-subsidize the first in the hope that both will then flourish; however, neither has. Money earned through freight traffic got diverted to meet the shortfalls in passenger revenue, and thus the development of freight traffic infrastructure suffered. This also implies that the passenger fares were kept artificially low through cross-subsidies. But due to this, there was never enough money left to invest into the passenger amenities. This is the reason that Indian Railways is not able to provide even the basic passenger amenities.

Further, the cross subsidization by diversion of freight earnings has also helped only till a point. Raising freight fare beyond that point would become counterproductive by driving away freight business. Overall, the problem of cross subsidization has severely affected the internal revenue generation of the Indian Railways.

Social Service Obligations

Railways is barely able to cover its expenses because of the massive Social Service Obligation imposed by years of populist budgets. Apart from being a commercial organization; in the larger social and national interest, Indian Railways is required to engage in *certain uneconomic operations to provide affordable transport facilities to poorer sections of society and to facilitate the movement of essential commodities at below normal costs.* The losses incurred by Railways on this particular account are called Indian Railways "*Social Service Obligation*".

Key elements of Social Service Obligation
1 Loss incurrent by transporting essential commodities carried below cost
2 Loss incurred in passenger and other coaching services;
3 operation of uneconomic branch lines;
4 new lines opened for traffic during the last 15 years.

The latest budget documents reveal that Indian Railways carry Social Service Obligation of more than Rs. 20,000 Crore, which is nearly 16.6% of Gross Traffic Receipts and is almost half of Railways' Plan Outlay under budgetary sources. The result is that:

- Railways can hardly have adequate resources for its development works.

- Most of money it gets is spent on its running, thus no money for looking beyond running operations. This is shown by the operating ratio which denotes what percentage of money goes into running the Railways. Surplus has decline and there are hardly any resources for development works. There is a rising dependence on budget.
- The Rail budget documents reveal that currently, Railways loses 23 paise per passenger per km.
- In the words of former Railway Minister Gowda, Railways are into the situation of severe funds crunch for many years, which is a result of the '*decade of golden dilemma*' – the dilemma of choosing between commercial viability and social viability.

Salaries not function of commercial viability

The salaries of the Railway staff are NOT fixed in relation to the earning potential of the Railways. Some argue that the pay scales of Railways employees are fixed by Central Pay Commission which is an extraneous organization; and unlike a commercial organization, the salaries are not function of commercial viability. Further, the pension liabilities are met out of its own earnings and not from the Consolidated Fund of India, as in the case of the other Ministries.

Competition with Roads

Since the railway routes are saturated and quality of service is low / unreliable; the railways are losing market to roadways. Further, since most of the national highways run parallel to railways, they are consistently eating up the revenues of the railways.

Path of Course Correction for Indian Railways
1 Reprioritization of the works
2 Leveraging idle resources
3 Increasing domestic investments and FDI
4 Relying on Public Private Partnership
5 Transparency in Procurements
6 Aggressive indigenization of imported products
7 Development of locomotives, coaches and wagon leasing Market.

Privatization of Indian Railways: Is It The Solution?

So far, the private sector's participation in railways has been very less in India, compared to sectors like ports, telecom, electricity, airports and roads. Several attempts have been made in the past to involve the private sector in various arenas like wagon procurement and leasing, freight trains and container operations, terminals and warehousing facilities, catering services, and other rail infrastructure through schemes framed by the ministry.

But problems like policy uncertainty, absence of a regulator to create a level playing field, the lack of

incentives for investors and procedural or operational issues have significantly restricted private sector participation.

However the increasing inefficiency of Indian railways has strengthened the clamor of many experts for privatization of railways. But the question is – should the Government go for complete or partial privatization of railways?

Answer is NO. Railways is the backbone of the country and a most important means for the common people. Thousands of people commute from their native place to their work place on daily basis. Agricultural products could reach the remotest corners of the country only because of railways, thereby helping the farmers to get a good price as well as consumer's affordable products.

Keeping in view the dependence of the common people on railways, the idea of complete privatization cannot be considered because private players are driven by profit motive which will not be favorable for the people. Therefore private participation can be the key for increasing efficiency rather than privatization.

This opinion is reiterated by the Bibek Debroy Committee, which favored private participation and not privatization of railways.

Debroy committee has looked at the railway restructuring experiences from multiple countries, including Japan, the United Kingdom, Germany, Sweden, Australia and USA. *The report says that key lesson which can be learned from UK is to retain the rail-track and infrastructure as a publicly-owned monopoly, while opening up rolling stock operations (wagons, coaches, locomotives etc.) for passengers and freight to the private sector.* The report further says that in these countries, which opened up to competition, the entry of competitors lowered prices and led to better services.

Therefore, the Indian railways can be separated into two organizations- one responsible for the track and infrastructure; and another that will operate trains under private hands. Further it has suggested setting up a company which will own the railway infrastructure in form of special purpose vehicle.

Currently the problem is that there is no competition as both maintaining the infrastructure and running the operations are done by the government. Segregation of functions with private participation will increase the competition thereby increasing the efficiency. It will also be profitable for govt. as the government would charge the operator.

Moreover the railways should leverage its properties by allowing private parties to build luxury hotels, restaurants and other facilities, at a time when real estate is very expensive. This will generate revenue as well as help in task of modernization of railways.

Further Indian Railways is locked into non-core segments such as running hospitals and schools for its employees. Handing over of these institutions to private players through a transparent bidding

process could significantly cut costs.

Therefore, the Government could bring in *private capital or technology to the extent of improving the functioning of railways* so that Indian Railways can look forward to evolving itself into a more efficient and commercially viable organization.

But this requires the creation of level playing field for private players with an independent regulator – with statutory backing and independent of the railway ministry as well as the Railway Board to maintain transparency.

FDI in Railways

Currently FDI in IR is fully opened up in 17 areas. A foreign player can invest up to 100% in most segments of rail infrastructure such as suburban rail, metro rail, locomotive and rolling stock and dedicated freight lines, Railways electrification, Signaling systems, Freight terminals, Passenger terminals etc. In high-speed rail projects — informally called bullet trains — a foreign player is now allowed to run a parallel and fully privatized railway company, completely detached from the existing IR network. *But FDI continues to remain prohibited in Railway Operations.*

Mechanism

FDI in rail infrastructure up to 100% will be cleared through automatic route, which means no approval from the Foreign Investment Promotion Board would be required. However, proposals involving FDI beyond 49% in sensitive areas from a security point of view would have to be brought by the Ministry of Railways before the Cabinet Committee on Security for consideration on a case to case basis.

Analysis

Allowing FDI in railways is a much debated topic. Proponents of FDI argues that present infrastructure of Indian Railways is inadequate to cope up with the rising demands. The immediate requirement is to enhance the capacities on railways to decongest the routes and vertical expansion in cities towards upgrading the infrastructure. To meet the funding requirements of railways, which according to the 12th Five Year Plan were estimated to be approximately Rs. 8.4 lakh crore, allowing substantial foreign direct investments is critical. However keeping in view the present fiscal constraints, Railways has to explore all possible means both within and outside the country to mobilize resources to develop a high class infrastructure to cater to the future needs. It is expected that opening up of 17 sectors can attract upto Rs 90,000 crore FDI into Indian Railways. But it is necessary that Indian Railways needs investments both financial and technological so that domestic capacity could also be enhanced. Therefore Indian Railways has now no option but to take the FDI route to become more competitive. Attracting FDI is highly desirable, but the success of the FDI

story will depend on how much freedom the private players get to fix tariffs and market their products

Therefore, FDI liberalization in the sector would help in modernisation and expansion of the railway projects but the govt. has to move cautiously because of the security risk involved although various concerns have already been taken into account by placing strict approvals of govt. for FDI in strategic areas.

Revamping Organisational Structure Of Railways

Over the years, in the absence of any strategic focus, the railways have steadily deteriorated in terms of service quality, safety and financial performance. Any improvement in given areas require a complete overhauling of the organizational structure of railways.

Many committees and experts have advised for more than a decade now to restructure the Railway Board to cater to the business segments of Railways but nothing changed in its restructuring.

The Government has promised restructuring of the railway board. At present, the Indian Railways is an over-centralized, top heavy structure, divided on departmental lines. The government is working on a revamp plan that would separate its policy-making and operations arms to curb inter-departmental rivalry which is seeped in the culture of protecting vested interests.

Currently, Railway Board is the top-most decision making body of Indian Railways – which performs the multiple roles of concessionaire, authority and regulator. The moot question is – how an authority can do all these functions without conflict of interest? Moreover, performing so many functions by single body will not only promote inefficiency but also leads to centralization of power.

Therefore the recently formed Bibek Debroy Committee in its report has envisaged three entities – the ministry of railways, the railway board and the regulator.

The role of the ministry will be policy formulation for the entire sector and the Railway Regulatory Authority of India (RRAI) will have the powers and objectives of economic regulation, including, wherever necessary, tariff regulation, safety regulation and fair access regulation. It will ensure a level-playing field to the private sector, which have been reluctant to enter the railway sector. The panel has further advocated that the regulator should have independent budget and it must be set up statutorily so that it is truly independent of the railway ministry.

Further, the committee recommended that the railway board should function like a corporate board for railways. The chairman of the railway board should be like a chief executive office and the composition of the railway board should be changed to five members (traction and rolling stock, passenger and freight business, human resources and stores, finance and PPP, and infrastructure) and two independent experts.

Above mechanism will lead to segregation of policymaking and operational functional which is a pre requisite for any successful organization as policymaking focuses on long-term issues and operations focuses on day-to-day functioning of the organization.

Along with the division of functions the committee envisaged the decentralization of decision-making whereby the head of each zone must be fully empowered to take all necessary decisions without reference to the railway board. The report says that the zonal railways should have full powers for expenditure; re-appropriation and sanctions, subject to it meeting its proportionate earning target. Therefore if different zones will work independent centers then it will increase efficiency. The recommendations if implemented will bring increase the competitiveness of the sector and will boost the much needed investments in the sector.

Safety Issues In Railway

Over the last 10 years, there has been a substantial rise in the rate of passenger casualties. For the three decades of 1965-96, the number of deaths in accidents remained mostly under 100, except for the occasional bad year. During the last decade things have turned grim. In nine out of the 10 years since 2003-04, there have been over 100 deaths due to accidents; in six of these years it has been over 200, and in three over 300.

A lot of accidents involve derailments, collisions between trains and mishaps at level crossings. For Instance: There are 30,348 level crossings (18,785 manned and 11,563 unmanned) in India. An estimated 43 per cent of accidents and 67 per cent of deaths were because of these in 2012-13. Ideally, level crossings should be done away with entirely. If the TVU (train vehicle unit), the product of the average number of trains and vehicles that pass through a level crossing during a 24-hour period, is low, the level crossing should be closed and merged with a nearby one. If the TVU is high, the level crossing should be replaced by a road under-bridge (RUB), road over-bridge (ROB) or subway. But nothing significant has been done in this respect. Till hundred percent safety measures are taken, Railway Board should explore the use of Geo-spatial technologies which combine Global Positioning System (GPS), Geographic Information System (GIS) and Remote Sensing to make Unmanned Level Crossings (UMLCs) safer for road users thereby avoiding accidents threats.

Further, for many years now there has been talk about increased use of non-combustible and non-inflammable materials in railway coaches. The Railways took a policy decision to make the shift, and coach production units were asked to go in for fire-retardant material. But this is obviously a slow process and new coaches could be made with them. The problem persists with the old coaches still in use. A major drive to check passengers carrying stoves or inflammable materials was launched, and met with some success. Two other major sources of fire incidents relate to overheating wheels and

electrical short circuit. With advances in technology, it should be possible for the Indian Railways to detect such hazards in time to prevent a fire. Smoke detectors and circuit breakers have become commonplace and can easily be installed in trains. It is anybody's guess whether all trains have operational fire extinguishers and if every railway station is equipped to fight fires. Several inquiries and Commission reports have pointed to gaps in safety measures and suggested follow-up action. The Kakodkar committee on safety last year pointed to an "implementation bug" and recommended a massive Rs.1 lakh crore programme over five years to ensure complete safety on the wheels. It suggested an allocation of Rs.20,000 crore a year, which can also be generated by means of a safety cess on passengers. The Railways should take the issue of safety much more seriously, and look at this and other ways of funding the required measures.

Recent Initiatives in Indian Railways

High Speed Bullet Trains

Ministry of Railways took steps for introduction of High Speed Bullet Trains in the country on Mumbai-Ahmedabad corridor. It is the part of the Ministry's ambitious plan to have Diamond Quadrilateral network of High Speed Rail connecting major metros and growth centers of the country. One new route between New Delhi and Chennai has been identified for introducing bullet train and China has been entrusted with the task of undertaking feasibility study of this line.

Next Generation e-ticketing system

In a move to provide more hassle-free services to railway users, Indian Railways launched new IT initiatives/applications developed by its autonomous organization, Central Railway Information Centre (CRIS). It has developed NGet system which can book 7200 online tickets instead of 2000 tickets per minute and now to attend 2,00,000 enquiries instead of 50000 per minute. The revamped website is expected to raise IRCTC's daily revenue by 67 per cent.

RAILSAVER

In a move to further improve energy efficiency on Indian Railways, a web based Electrical Energy Management System, RAILSAVER, developed by CRIS inaugurated. The portal RAILSAVER will provide a perfect IT based platform for energy consumption data which will pave the way for systematic collection, assimilation, interpretation and analysis of data in evolving future strategies for conceiving, implementing and further intensifying energy conservation efforts on Indian Railways. This portal will further facilitate in saving energy upto 15% by the year 2020 through improved energy efficiency measures as laid down in Railways vision document.

Yatri Ticket Sewa Kendra (YTSK)

Under this scheme, agents of Indian Railways can operate ticketing terminals at various locations in the cities and towns for issuing reserved tickets and unreserved tickets. The scheme is aimed at

expanding the reach of the ticketing systems of Indian Railways and evokes the principles of PPP and provides for revenue sharing between the private operators and Indian Railway.

Project Nilgiri

Google and Indian Railways have partnered together to create '**Project Nilgiri**' that will deliver Wi-fi access to around 400 railway stations across India. Google has collaborated with RailTel for the platform and infrastructure to get started with the project. The project that uses Google's Fiber technology is still in its pilot stage.

Other Initiatives

In a bid to make things easier for passengers, IRCTC has launched a pilot project of ticket booking through non-internet based mobile phones. If the pilot goes well, the new development will enable people using non-internet based mobile phones to easily access Railway ticketing services through SMS/IVRS/USSD. The facility is user-friendly, secure and also eco-friendly, as no print-out is required.

Concluding Remarks

The need is for The Railways have to become lean and mean, competitive and efficient so that it can compete with the airlines for one segment of passengers, and with road transport for the movement of goods. The operating ratio also needs to be reduced. Given the need for such massive doses of investment, it is about time that the Ministry and the Board sit with the private sector to make it attractive for PPPs.