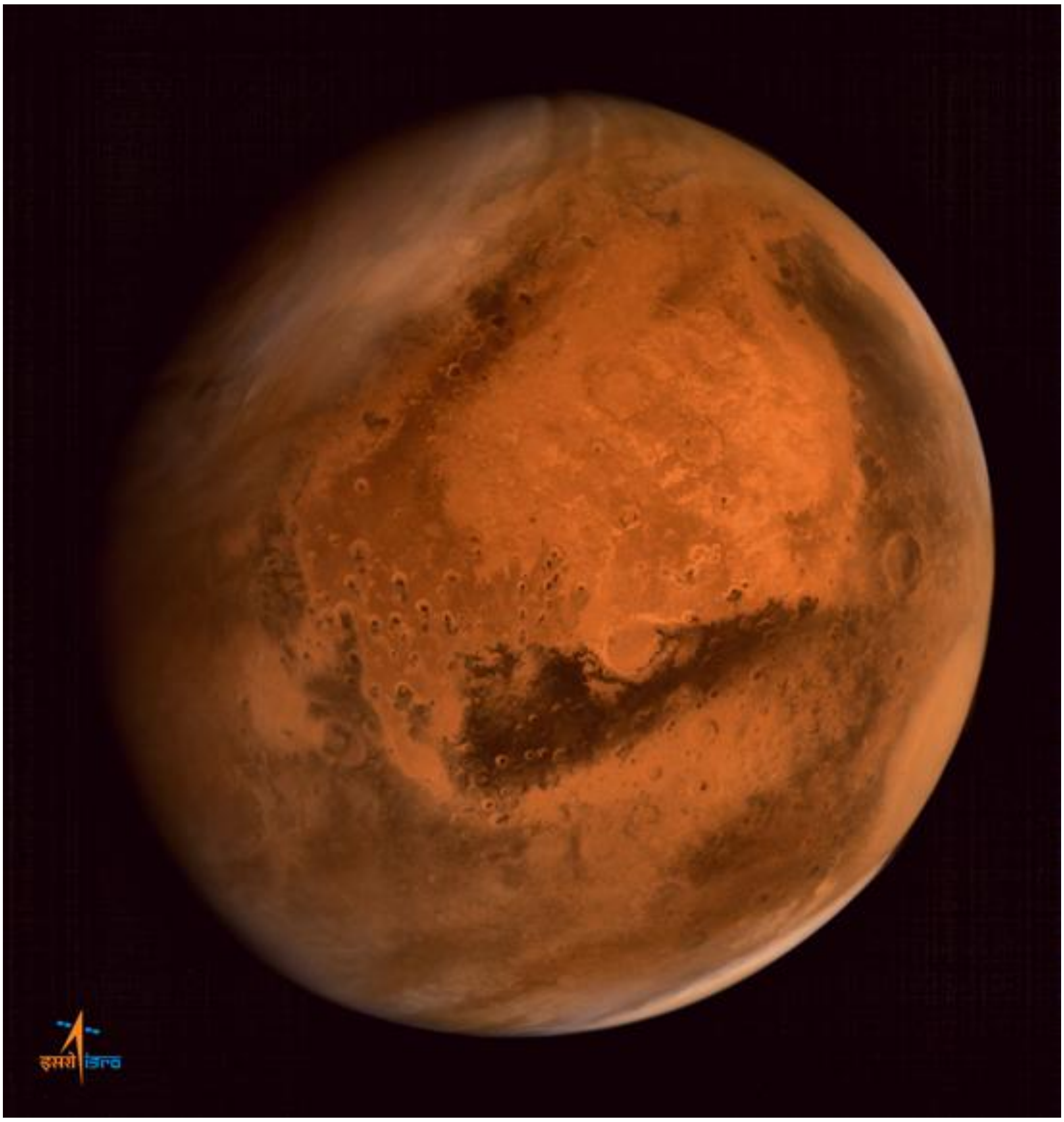
KENDRIYA VIDYALAYA SANGATHAN
CHENNAI REGION
SUMMATIVE ASSESSMENT II
SESSION 2015
STD VIII SCIENCE OTBA THEME I

MARKS 10
TIME 30 min

UNDERSTANDING THE ENVIRONMENT OF MARS

Read the text and answer the question



Mosaic image of Mars as seen by Viking 1, February 22, 1980

The **climate of Mars** has been an issue of scientific curiosity for centuries, not least because Mars is the only terrestrial planet whose surface can be directly observed in detail from the Earth with help from a telescope.

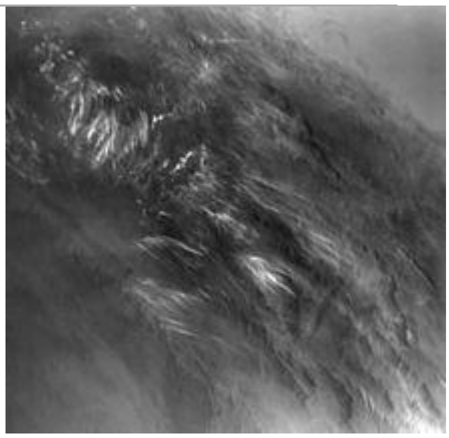
Although Mars is smaller at 11% of Earth's mass and 50% farther from the Sunthan the Earth, its climate has important similarities, such as the polar ice caps,seasonal changes and the observable presence of weather patterns. It has attracted sustained study from planetologists and climatologists. Although Mars's climate has similarities to Earth's, including seasons and periodic ice ages, there are also important differences such as the absence of liquid water (though frozen water exists) and much lower thermal inertia. Mars' atmosphere has a scale height of approximately 11 km (36,000 ft), 60% greater than that on Earth. The climate is of considerable relevance to the question of whether life is or was present on the planet. The climate briefly received more interest in the news due to NASA measurements indicating increased sublimation of the south polar icecap leading to some popular press speculation that Mars was undergoing a parallel bout of global warming, though global average temperature has actually cooled in recent decades.

Mars has been studied by Earth-based instruments since as early as the 17th century but it is only since the exploration of Mars began in the mid-1960s that close-range observation has been possible. Flyby and orbital spacecraft have provided data from above, while direct measurements of atmospheric conditions have been provided by a number of landers and rovers. Advanced Earth orbital instruments today continue to provide some useful "big picture" observations of relatively large weather phenomena.

The first Martian flyby mission was Mariner 4 which arrived in 1965. That quick two day pass (July 14–15, 1965) was limited and crude in terms of its contribution to the state of knowledge of Martian climate. Later Mariner missions (Mariner 6, andMariner 7) filled in some of the gaps in basic climate information. Data based climate studies started in earnest with theViking program in 1975 and continues with such probes as the Mars Reconnaissance Orbiter.

This observational work has been complemented by a type of scientific computer simulation called the Mars General Circulation Model. Several different iterations of MGCM have led to an increased understanding of Mars as well as the limits of such models. Models are limited in their ability to represent atmospheric physics that occurs at a smaller scale than their resolution. They also may be based on inaccurate or unrealistic assumptions about how Mars works and certainly suffer from the quality and limited density in time and space of climate data from Mars.

Weather



Martian Morning Clouds - Viking Orbiter 1 (February 12, 2014).

Mars' temperature and circulation vary from year to year (as expected for any planet with an atmosphere). Mars lacks oceans, a source of much inter-annual variation on Earth. Mars Orbiter Camera data beginning in March 1999 and covering 2.5 Martian years[12] show that Martian weather tends to be more repeatable and hence more predictable than that of Earth. If an event occurs at a particular time of year in one year, the available data (sparse as it is) indicate that it is fairly likely to repeat the next year at nearly the same location give or take a week.

On September 29, 2008, the Phoenix lander took pictures of snow falling from clouds 4.5 km above its landing site near Heimdall crater. The precipitation vaporized before reaching the ground, a phenomenon called virga.

Temperature

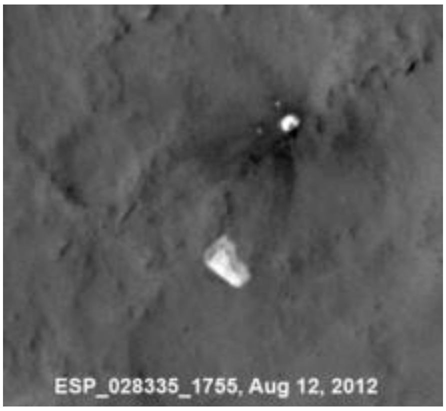
Martian temperatures have been measured by various means:

Measurements of Martian temperature predate the "Space Age." However, early instrumentation and techniques of radio astronomy produced crude, differing results.

Differing *in situ* values have been reported for the average temperature on Mars with a common value being −55 °C (218 K; −67 °F). Surface temperatures may reach a high of about 20 °C (293 K; 68 °F) at noon, at the equator, and a low of about −153 °C (120 K;

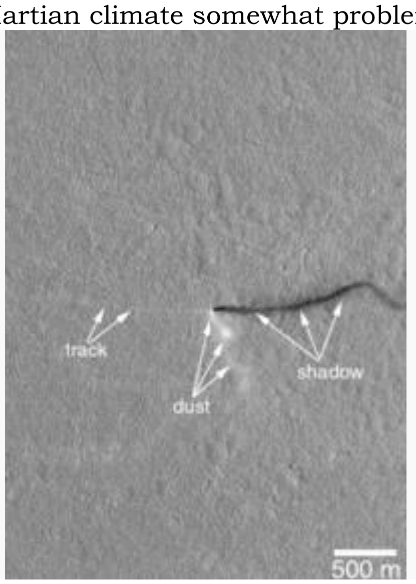
−243 °F) at the poles. Actual temperature measurements at the Viking landers' site range from −17.2 °C (256.0 K; 1.0 °F) to −107 °C (166 K; −161 °F). The warmest soil temperature on the Mars surface estimated by the Viking Orbiter was 27 °C (300 K; 81 °F). The Spirit rover recorded a maximum daytime air temperature in the shade of 35 °C (308 K; 95 °F), and regularly recorded temperatures well above 0 °C (273 K; 32 °F), except in winter.
It has been reported that "On the basis of the nighttime air temperature data, every northern spring and early northern summer yet observed were identical to within the level of experimental error (to within ±1 °C)" but that the "daytime data, however, suggest a somewhat different story, with temperatures varying from year-to-year by up to 6 °C in this season.This day-night discrepancy is unexpected and not understood". In southern spring and summer, variance is dominated by dust storms which increase the value of the night low temperature and decrease the daytime peak temperature. This results in a small (20 °C) decrease in average surface temperature, and a moderate (30 °C) increase in upper atmosphere temperature.
The datasets "suggest generally colder atmospheric temperatures and lower dust loading in recent decades on Mars than during the Viking Mission, though Viking data had previously been revised downward.The TES data indicates "Much colder (10-20 K) global atmospheric temperatures were observed during the 1997 versus 1977 perihelion periods" and "that the global aphelion atmosphere of Mars is colder, less dusty, and cloudier than indicated by the established Viking climatology," again, taking into account the Wilson and Richardson revisions to Viking data.

Wind[edit]



Curiosity rover's parachute flapping in the Martian wind (HiRISE/MRO) (August 12, 2012 to January 13, 2013).

The surface of Mars has a very low thermal inertia, which means it heats quickly when the sun shines on it. Typical daily temperature swings, away from the polar regions, are around 100 K. On Earth, winds often develop in areas where thermal inertia changes suddenly, such as from sea to land. There are no seas on Mars, but there are areas where the thermal inertia of the soil changes, leading to morning and evening winds akin to the sea breezes on Earth.[36] The Antares project "Mars Small-Scale Weather" (MSW) has recently identified some minor weaknesses in current global climate models (GCMs) due to the GCMs' more primitive soil modeling "heat admission to the ground and back is quite important in Mars, so soil schemes have to be quite accurate. "[37] Those weaknesses are being corrected and should lead to more accurate future assessments, but make continued reliance on older predictions of modeled Martian climate somewhat problematic.



Martian Dust Devil – inAmazonis Planitia (April 10, 2001) (also) (video (02:19)).
At low latitudes the Hadley circulationdominates, and is essentially the same as the process which on Earth generates thetrade winds. At higher latitudes a series of high and low pressure areas, calledbaroclinic pressure waves, dominate the weather. Mars is dryer and colder than Earth, and in consequence dust raised by these winds tends to remain in the atmosphere longer than on Earth as there is no precipitation to wash it out (excepting CO_2snowfall).[38] One such cyclonic storm was recently captured by the Hubble space telescope (pictured below).
One of the major differences between Mars' and Earth's Hadley circulations is their speed[39] which is measured on an overturning timescale. The overturning timescale on Mars is about 100 Martian days while on Earth, it is over a year.

Table

	Mars	Earth
Atmosphere (composition)	Carbon dioxide (95.32%) Nitrogen (2.7%) Argon (1.6%) Oxygen (0.13%) Water vapour (0.03%) Nitric oxide (0.01%)	Nitrogen (77%) Oxygen (21%) Argon (1%) Carbon dioxide (0.038%) Water vapour (1%)
Atmosphere (pressure)	7.5 millibars (average)	1.013 milibars (at sea level)
Deepest Canyan	Valles Marineries 7 km deep 4,000 km wide	Grand Canyon 1.8 km deep 400 km long 149,597,891 kilometers
Distance from sun (average)	227,936,637 kilometers	149,597,891 kilometers
Equatorial Radius	3,398 kilometers	6,378 kilometers
Gravity	0.375 that of Earth	2.66 times that of Mars
Largest Volcano	Olympus Mons 26km high 602km in diameter	Mauna Loa (Hawaii) 10.1 km high than 121 km in diameter
Length of Day	24 hours, 37 minutes	Just slightly under 24 hours
Length of Year	687 Earth days	365 days
Polar Caps	Covered with a mixture of carbon dioxide ice and water ice	Permanently covered with water ice
Surface Temperature (average)	-63 degrees C	14 degrees C
Tilt of Axis	25 degrees	23.45 degrees
Number of Satellites	2 (Phobos and Deimos)	1 (Moon)

Mangalyaan - India's Mars mission

The Mars Orbiter Mission MOM, sometimes called Mangalyaan, is India’s first mission to Mars set for launch aboard a Polar Satellite Launch Vehicle in November 2013 for an arrival at Mars in 2014. The 1,337-Kilogram spacecraft carries a suite of five instruments to study Mars, its atmosphere and acquire photos of the Red Planet. Most importantly, the mission serves as a demonstration mission with the main objective of placing Mangalyaan in orbit around Mars as a study for future spacecraft and mission design.

Image: Indian Space Research Organization

The mission was put together on rather short notice – being approved in August 2012 with just 15 months to go until the Interplanetary Launch window that comes once every 26 months. The development of the mission was initiated one year earlier.

The Mars Orbiter Mission was approved by the Indian Government after the Indian Space Research Organization completed a project study.

Mangalyaan was approved for a total project cost of $69 million. In 2012, the individual components of the orbiter began assembly before the spacecraft came together in March 2013. The instruments started integration with the spacecraft in April to begin testing in August and September without much margin of error for meeting the launch window that stretches from October 28, 2013 to November 19, 2013.

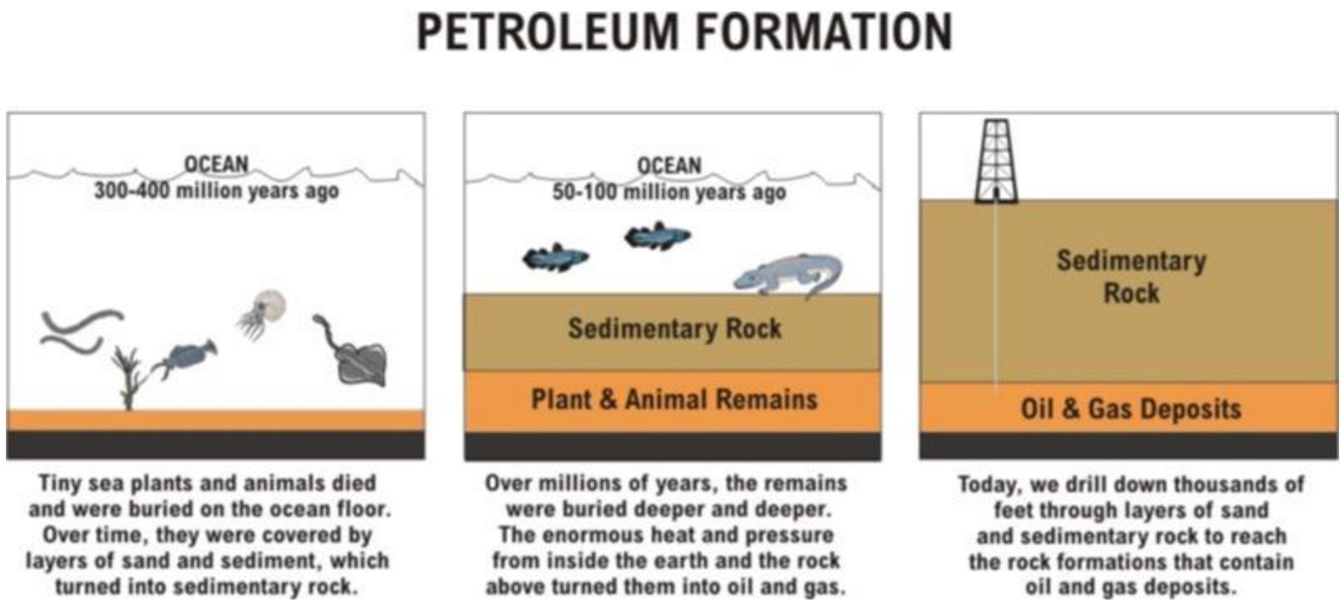
KENDRIYA VIDYALAYA SANGATHAN CHENNAI REGION

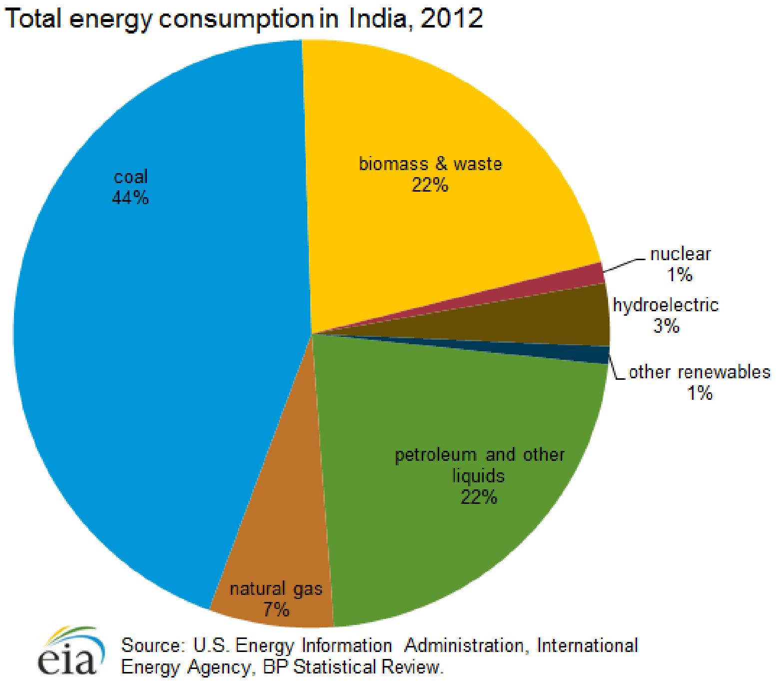
SUMMATIVE ASSESSMENT II **OTBA 2015 THEME II**

STD VIII SUBJECT-SCIENCE

Coal and Petroleum

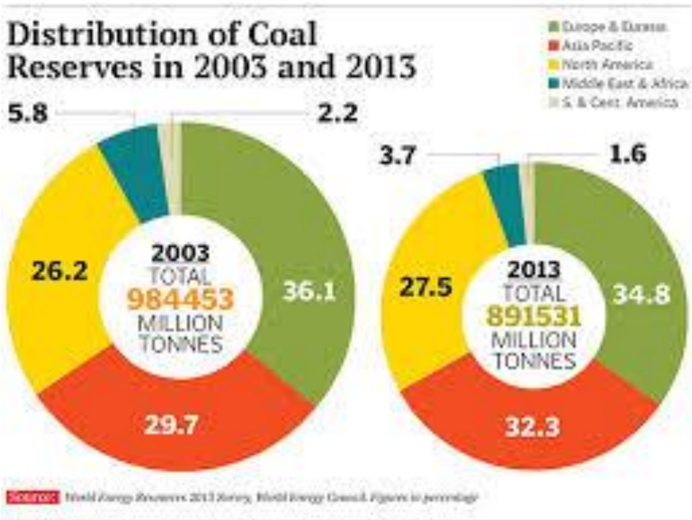
Crude oil, **coal** and **natural gas** formed from the prehistoric matter of plants, animals, zooplankton and other life that was buried sometimes miles deep inside the Earth and subjected to high temperatures and high pressure over millions of years. These three so-**called fossil fuels include** a wide assortment of carbon-based substances.





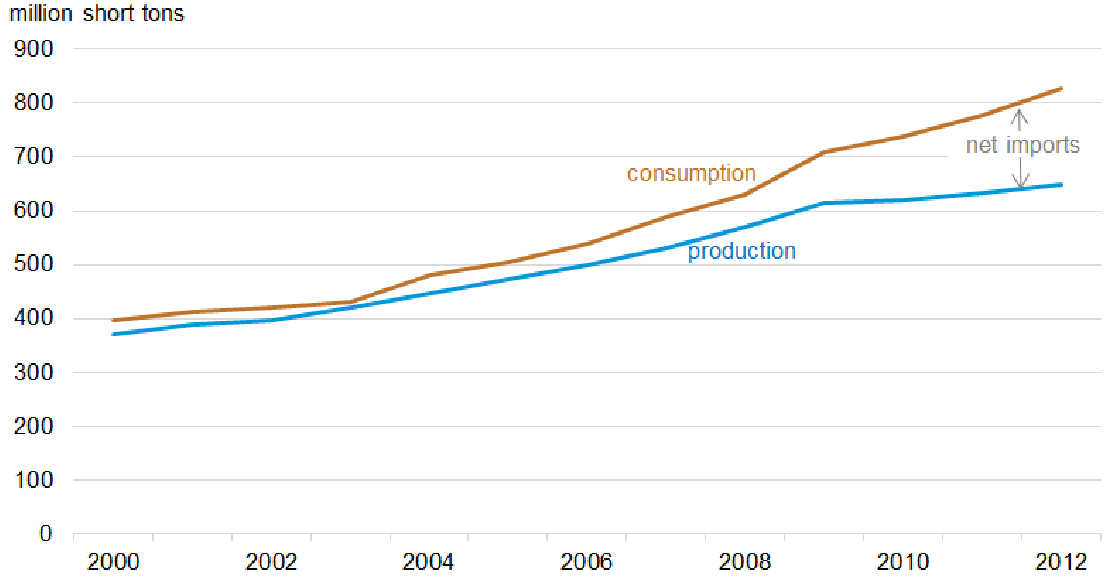
COAL

Coal is India's primary source of energy. The country has the world's fifth-largest coal reserves, and ranked third largest in terms of both production and consumption in 2012.



GRAPH 1

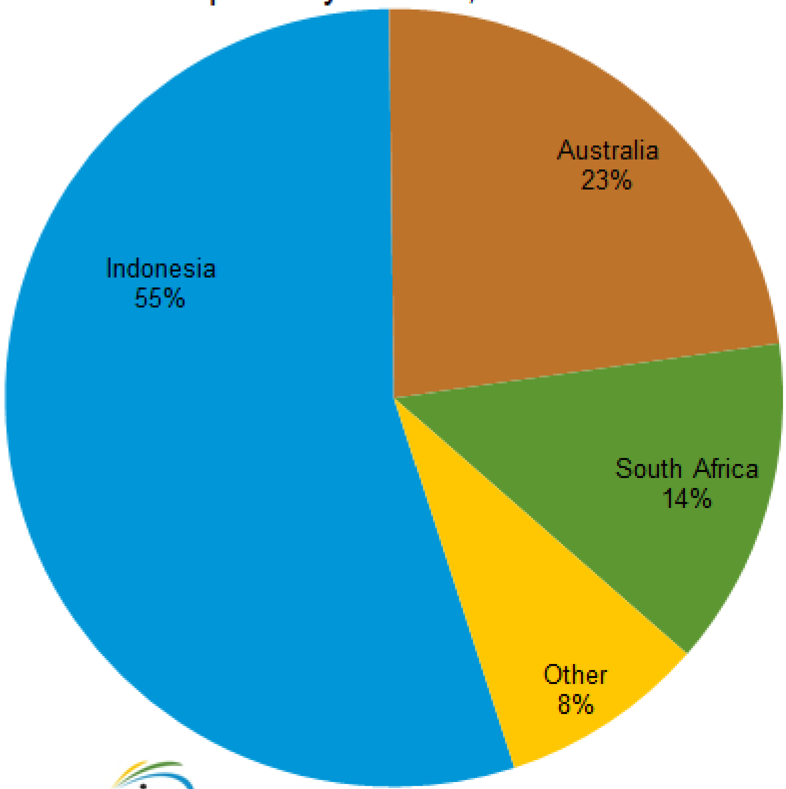
India coal consumption and production, 2000-12



Source: U.S. Energy Information Administration.

Our consumption is more than the production so we are importing .

India coal imports by source, 2012



Source: Global Trade Atlas.

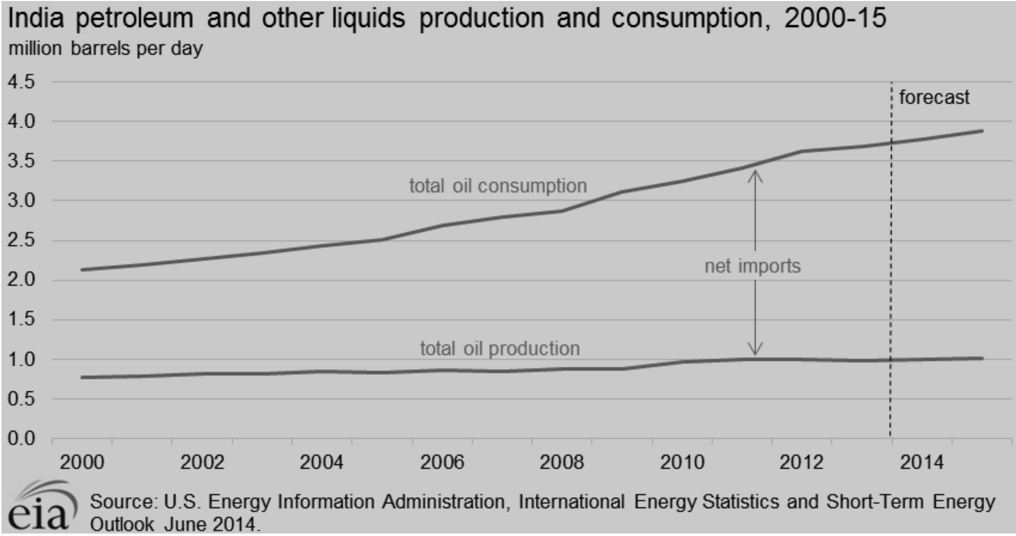
Like all fossil and biofuels, all coal produces carbon dioxide when it is burned. Some coals can produce more energy per pound, and each source of coal has naturally-occurring pollutants that can be released when the coal is burned or stored, including radioactive materials and toxic metals like mercury. . Coal is also the source of countless mining and transportation accidents and steady supply of **greenhouse gases**. Coal-fired power plants produce small particulates — tiny dusts — that can harm lungs, as well as sulfur and nitrogen compounds that cause acid rain.

PETROLEUM

Humans have known about **petroleum**, or **crude oil**, for centuries, but the substance wasn't considered terribly interesting until the mid 1800s, when it was distilled into kerosene and found to be a good, cheap alternative to burning whale oil in oil lamps. At that time, only the wealthiest could afford whale oil, which was preferred over candles or animal fats. Americans and others worldwide quickly adopted petroleum and learned to make an unending stream of useful products from it. Simultaneously, a worldwide obsession with striking oil was born.
The earliest combustion engines were invented before gasoline, diesel or kerosene, but automobiles started becoming available by the late 1800s, a few decades after petroleum exploration began in earnest.

India's largest energy source is coal, followed by petroleum and traditional biomass and waste. India was the fourth-largest consumer of crude oil and petroleum products in the world in 2013, after the United States, China, and Japan. T**he country depends heavily on imported crude oil, mostly from the Middle East.**

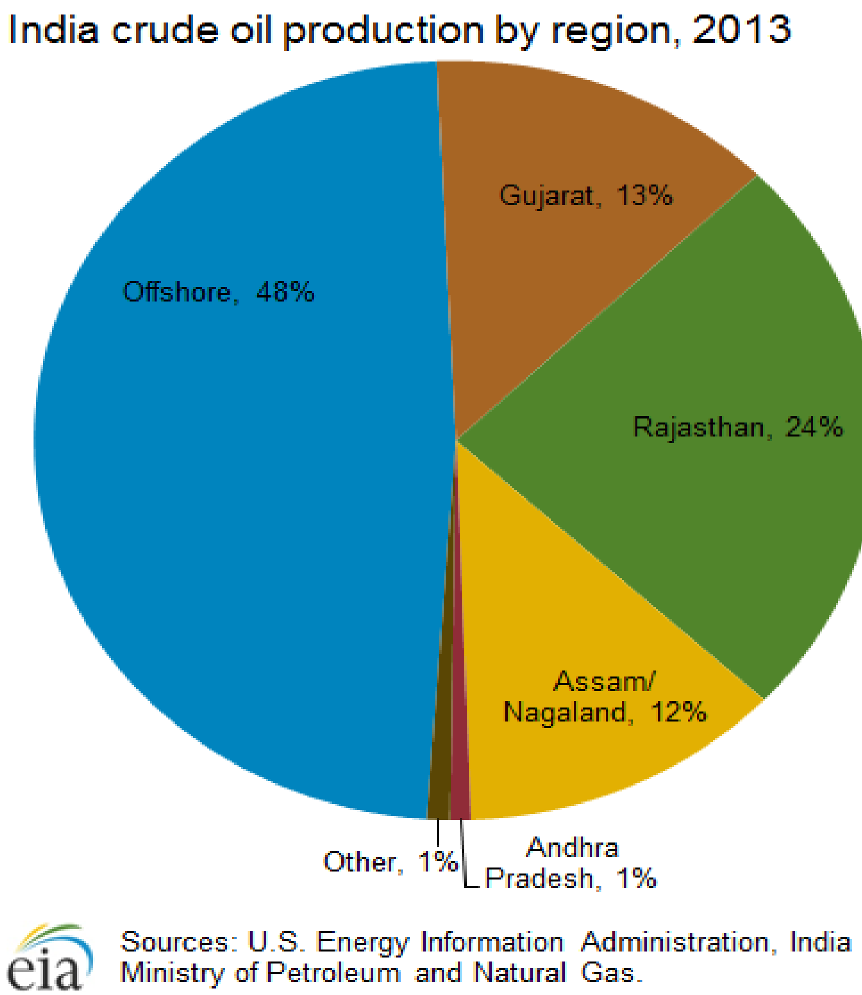
GRAPH 2

- 

In this graph also, we can see that the total consumption is more than total oil production

India was also the fourth-largest net importer of crude oil and petroleum products. The gap between India's oil demand and supply is widening, as demand reached nearly 3.7 million barrels per day (bbl/d) in 2013 compared to less than 1 million bbl/d of total liquids production.

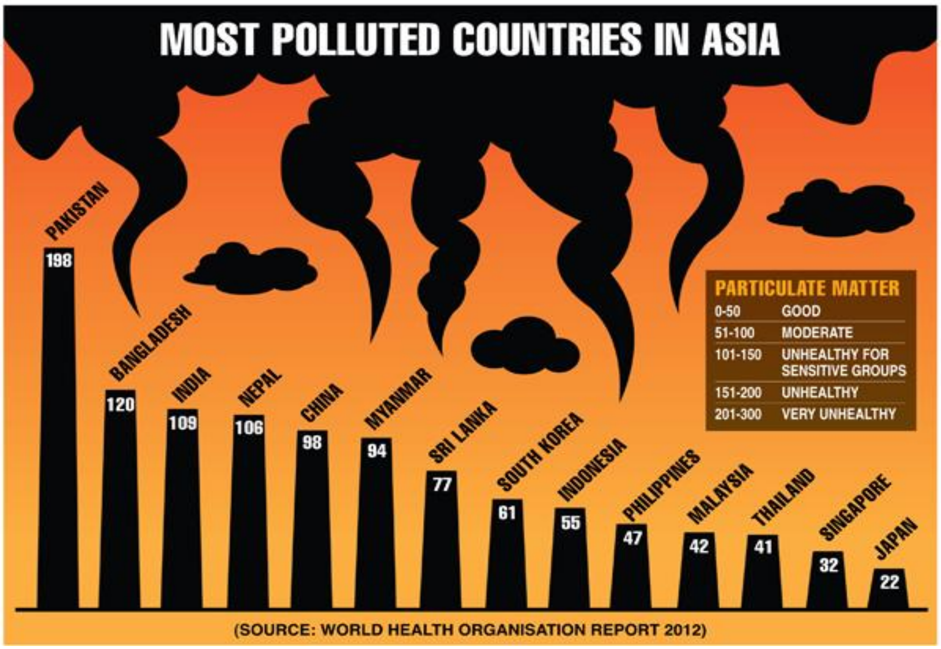
EIA projects India's demand will more than double to 8.2 million bbl/d by 2040, while domestic production will remain relatively flat, hovering around 1 million bbl/d.



According to the Oil & Gas Journal (OGJ), India held nearly 5.7 billion barrels of proved oil reserves at the beginning of 2014. About 44% of reserves are onshore resources, while 56% are offshore. Most reserves are found in the western part of India, particularly the Western offshore area near Gujarat and Rajasthan. The Assam-Arakan basin in the northeastern part of the country is also an important oil-producing region and contains more than 23% of the country's reserves and 12% of the production.

However, India still imports kerosene and liquefied petroleum gas (LPG) products for domestic use. In particular, many rural areas of India use LPG and kerosene along with traditional biomass as cooking fuels .The government is encouraging a shift from kerosene used in cooking fuel in rural areas to LPG, a cleaner and less-expensive fuel. Liquid fuels have competed with natural gas in the past few years as the power and fertilizer industries are using natural gas as a substitute for some naphtha and fuel oil supply. Diesel remains the most-consumed oil product, accounting for 42% of petroleum product consumption in 2013.

Most of the energy that we use today comes mainly from the three exhaustible resources of the earth:coal, petroleum and natural gas. The amount of coal , petroleum and natural gas present in the earth is limited . The known reserves of coal ,petroleum and natural gas present in the earth will last only for about 100 years. Once the present stock of coal ,petroleum and natural gas present in the earth gets exhausted ,no new supplies of these fossil fuels will be available to us in the near future because it takes millions of years to convert the dead organisms into fossil fuels in nature.So, fossil fuels should be used with care and caution and not wasted at all so that the existing reserves of fossil fuels can be used over as long a period as possible.Moreover , the burning of fossil fuels is a major source of air pollution . The use of fossil fuels is also linked to global warming because they produce a lot of greenhouse gas carbon dioxide on burning.So the use of lesser fossil fuels will lead to cleaner environment and smaller risk of global warming.



. See the statistics of the pollutants emitted by fossil fuels

Fossil Fuel Emission Levels
Pounds per Billion Btu of Energy Input

Pollutant	Natural Gas	Oil	Coal
Carbon Dioxide	117,000	164,000	208,000
Carbon Monoxide	40	33	208
Nitrogen Oxides	92	448	457
Sulfur Dioxide	1	1,122	2,591
Particulates	7	84	2,744
Mercury	0.000	0.007	0.016

Source: Natural Gas Issues and Trends 1998

Steps to Reduce the Consumption of Coal and Petroleum

Coal is used mainly to produce electricity. So, if we can save electricity, then the consumption of coal will be automatically reduced. Similarly, the petroleum products kerosene and LPG are used for cooking food, and petrol and diesel are used as fuel in motor vehicles, so if we can save on kerosene, LPG, petrol and diesel, then the consumption of petroleum will also get reduced. Some of the steps which can be taken to conserve energy resources (like coal and petroleum) are as follows:

1. Switch off the lights, fans, television and other electrical appliances when not needed. This will save a lot of electricity.

2. Use energy efficient electrical appliances to save electricity. This can be done by using Compact Fluorescent Lamps (CFL) and fluorescent tube-lights instead of traditional filament-type electric bulbs (because CFL and tube-lights consume much less electric energy as compared to filament-type electric bulbs for producing the same amount of light).

3. Use stairs to climb at least up to three floors of a building instead of taking a lift. This will save electricity.

4. Pressure cookers should be used for cooking food to save fuels like kerosene and LPG.

5. Good quality stoves should be used to burn fuels like kerosene and cooking gas (LPG) so as to obtain maximum heat.

6. Solar cookers should be used to cook food whenever possible.

7. The use of biogas as domestic fuel should be encouraged in rural areas.

8. Bicycles should be used for covering short distances to save precious fuel like petrol (which is used in cars, scooters and motorcycles).

9. Public transport system (local bus and train service) in the cities should be improved so that people do not commute in their personal vehicles. This will save a lot of petrol and diesel.

10. Fuel efficient engines of motor vehicles should be designed to reduce the consumption of petrol and diesel.

Energy Conservation in India

Energy conservation Act. – 2001 provides for a **Bureau of Energy Efficiency (BEE)**for the efficient use of energy and its conservation.

National Energy conservation Award Scheme - 2005 was launched.

"National Campaign on Energy conservation" was launched by P.M. on National Energy conservation Day – 14 Dec, 2004.

On 18 May 2006 "National Energy Labeling Programme" was finally launched.

Petroleum conservation Research Association (PCRA) (1978) – to promote conservation of Petroleum products in the major sectors like transport, industry, households and Agriculture.

It is promoting the use of Bio fuels and Urban Energy Management, and Jatropha based diesel in rural sector.

Conservation of Coal enjoins maximum recovery of in- situ reserves.

Mechanized open cast mining- presently adopted technology .

Long wall and continuous mining technology – yields 70- 80% recovery but its adoption has not been possible in India due to difficult geo- mining conditions.

The coal Conservation and Development Act- 1974.

Publicity & Awareness creation on new & Renewable energy sources

Rajiv Gandhi Akhshay Urja Divas (20 August) to commemorate the birth anniversary of the late P.M (since 2004).

Public Awareness Programmes are organized on mass scale on this day.

District Advisory Committees have been set up with the Collector as its Chaiman to create awareness.

Renewable energy Clubs are been set up in **AICTE** recognized Engg. Colleges all over the country.

Media Workshops are being organized.