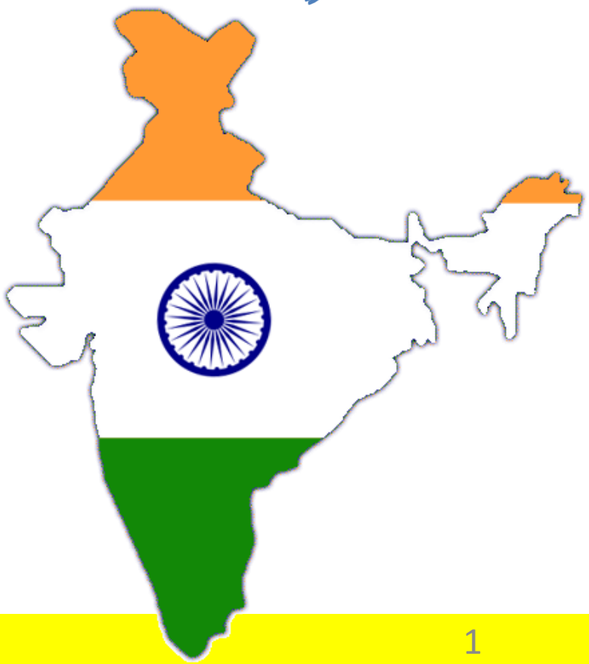
Year & Sem. – IV Year (VII Sem.)

Subject – Power Generation Sources (7EE6-60.2)

Unit – 1

Topic: Energy Scenario -India



VISSION AND MISSION OF INSTITUTE

Vision:

To become a renowned center of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.

Mission:

M1: Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.

M2: Identify, based on informed perception of Indian, regional and global needs, areas of focus and provide platform to gain knowledge and solutions.

M3: Offer opportunities for interaction between academia and industry.

M4: Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

VISSION AND MISSION OF DEPARTMENT

Vision:

The Mechanical Engineering Department strives to be recognized globally for excellent technical knowledge and to produce quality human resource, which can manage the advance technologies and contribute to society through entrepreneurship and leadership.

Mission:

M1: To impart highest quality technical knowledge to the learners to make them globally competitive mechanical engineers.

M2: To provide the learners ethical guidelines along with excellent academic environment for a long productive career.

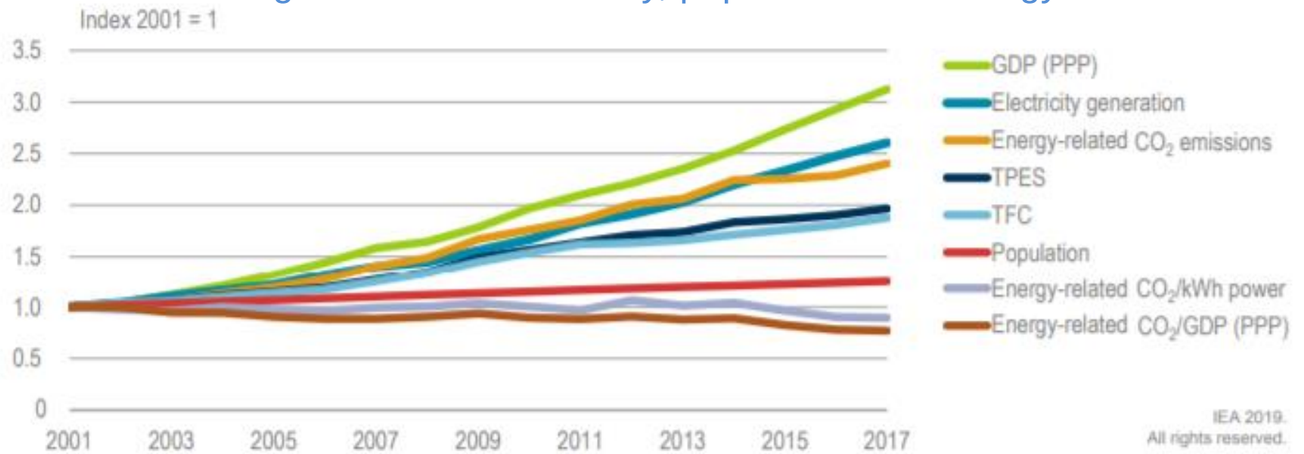
M3: To promote industry-institute linkage.

INTRODUCTION

India’s achievements in the energy sector in recent years have been outstanding. Led by Prime Minister Shri Narendra Modi and his ministers, the Government of India is implementing reforms towards a secure, affordable and sustainable energy system to power a robust economic growth.

India is fortunate to have fairly rich and varied energy resources. However, these are unevenly distributed. India has been traditionally using conventional Energy resources like coal, cattle dung, electricity etc. since a long period of time. But we have also shown tremendous enthusiasm in using non-conventional resources like solar energy ,geothermal energy, tidal energy etc.

Trends in the growth of the economy, population and energy indicators



India's energy demand and emissions are steadily growing, driven by strong growth in GDP.

Important Units

MMTPA- Million Metric Tonne Per Annum.
MMSCMD- Million standard cubic metres per day
TMT- Thousand Metric Tonne
MMT - Million Metric Tonne
Mtoe - Million Tonnes

CURRENT ENERGY SCENARIO IN INDIA: FACTS & FIGURES

1. Production and Consumption.

- **India** is the fifth largest **energy** consumer in the world. While the world consumes 12000 million tonnes of oil equivalent (mtoe) of **energy** resources, **India** consumes 4.4% of the world **total** (524.2 mtoe).

- The national **electric** grid in **India** has an installed **capacity** of 370.106 GW as of 31 March 2020. Renewable **power** plants, which also include large hydroelectric plants, constitute 35.86% of **India's** total installed **capacity**

- The International **Energy** Agency estimates **India** will add between 600 GW to 1,200 GW of additional new **power generation capacity** before 2050. This added new **capacity** is similar in scale to the 740 GW total **power generation capacity** of the European Union (EU-27) in 2005.

- India has electrified more than 600,000 villages.

- India is the Third largest economy in the world , in terms of purchasing power after China & US.

- India had the world’s largest energy access deficit in terms of electricity–270 million people

CURRENT ENERGY SCENARIO IN INDIA: FACTS & FIGURES

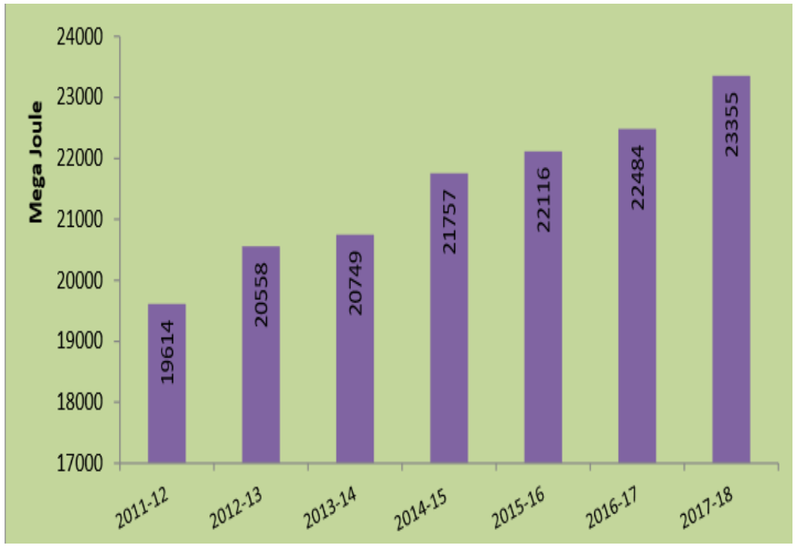
2. Imports and Exports.

- Imports of the Coal during 2008-09 to 2017-18 increased at a CAGR of 13.44% whereas the Exports during the corresponding period decreased at (-) 0.96%.
- During the period 2008-09 to 2017-18, the imports of Natural Gas and Crude Oil increased at CAGR of 9.44% and 5.20% respectively.
- The imports of petroleum products, during the period 2008-09 to 2017-18 increased at CAGR of 6.67%, whereas during the same reference period the exports registered an increase of 5.55%.
- For electricity, the net imports witnessed significant change in last two years i.e. 2016-17 and 2017-18. The exports have robust increase at CAGR of 61.83% during 2008-09 to 2017-18 whereas the imports registered a decline with CAGR of (-) 0.50%.

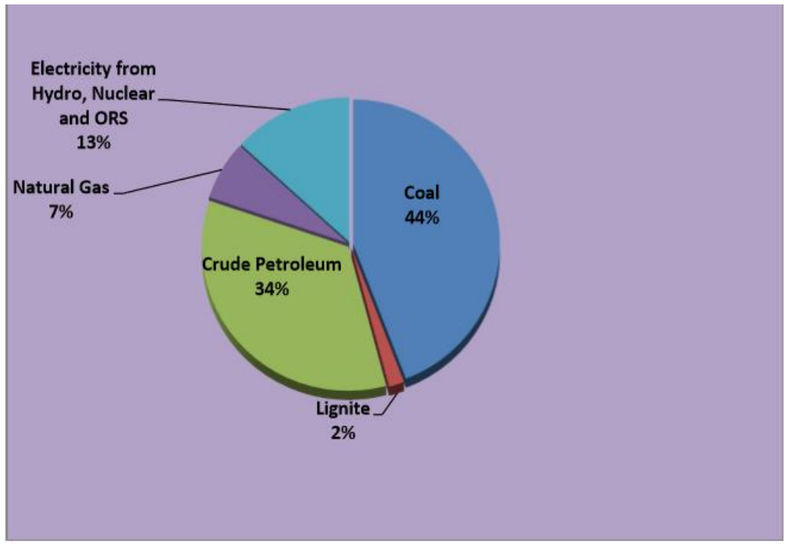
CURRENT ENERGY SCENARIO IN INDIA: FACTS & FIGURES

3. Usage of Energy

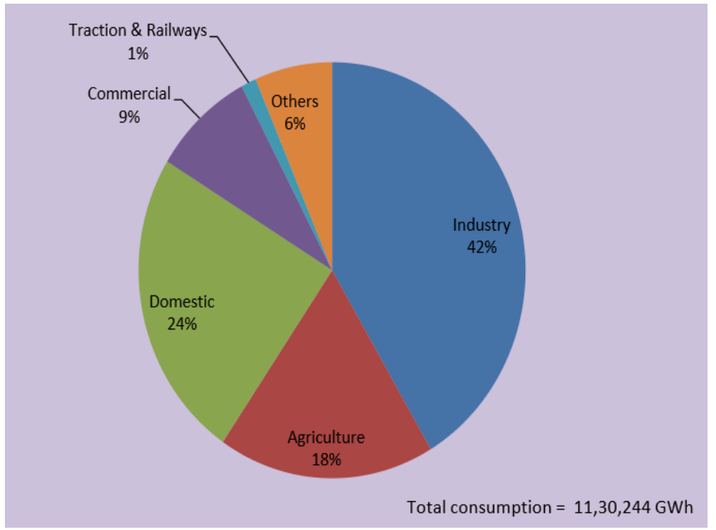
- The maximum energy intensive sector was industrial sector accounting about 56% of total energy consumption.
- Per Capita consumption of Energy showed a CAGR of 2.54% for the period 2011-12 to 2017-18.



Per Capita Energy Consumption from 2011-12 to 2017-18



Source wise Consumption of Energy during 2017-18



Consumption of Electricity by Sectors in India during 2017-18

* Data available on Govt. Website, other sources are not much reliable

CURRENT ENERGY SCENARIO IN INDIA: Coal and Lignite

- India has the world 5th largest coal reserves. In India, coal is the bulk of primary energy contributor with 54.20% share equivalent to 1,98,525 MW April 2020.

- Total installed capacity of washeries in the country is around 127.56 million tonne per Year (MTY) as on 31.3.2018. As on 31.03.18, a total of 52 washeries, both PSUs and Private, were operating in the country comprising both Coking (28.78 MTY) and Non-Coking Coal (98.78 MTY)

- **India** is the second largest **producer** of **coal** in the world, after China. The **production** of **coal** was 675.40 million metric tons (744.50 million short tons) in 2017–18, a growth of 2.66% over the previous year.

- Coal-fired power plants account for 59% of installed electricity capacity.

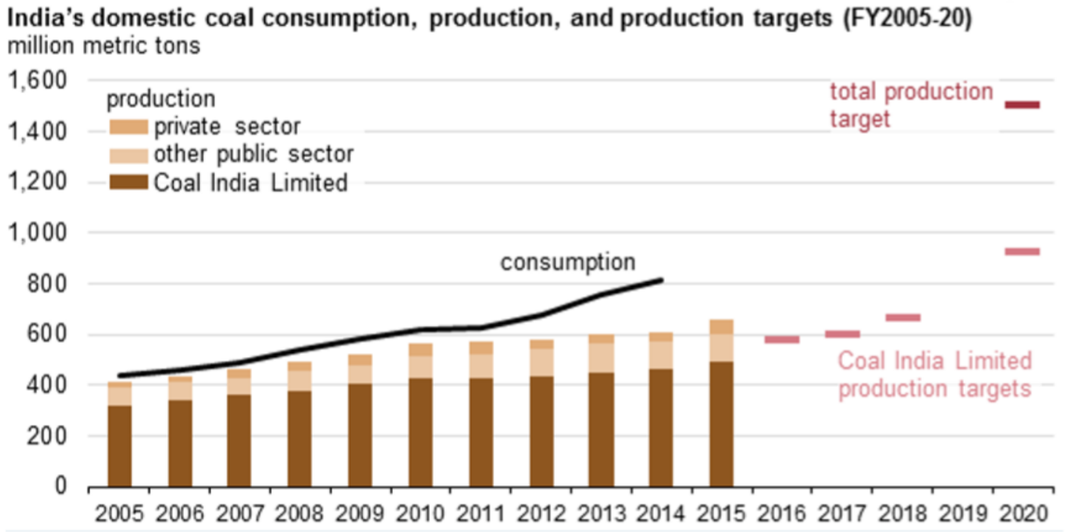


FIG: COAL CONSUMPTION IN INDIA

CURRENT ENERGY SCENARIO IN INDIA: Natural gas

- India's natural gas supply from domestic fields is about 89 million standard cubic metres per day (mmscmd).
- In FY 2018-19, the total gas consumption in India was around 148.02 MMSCMD. The share of domestic gas and imported RLNG was about 48% & 52% respectively
- The **production** of **natural gas** was 31.73 billion cubic meters in 2017–18, growing by 60.86% over the previous year. **India** accounted for 0.77% of world **natural gas production** in 2016–17. Which is declined 5 per cent to 31,180 MMSCM during 2019-2020

- Important Projects:

1. Jagdishpur – Haldia/Bokaro – Dhamra Pipeline Project (JHBDPL) & Barauni- Guwahati Pipeline project (BGPL)

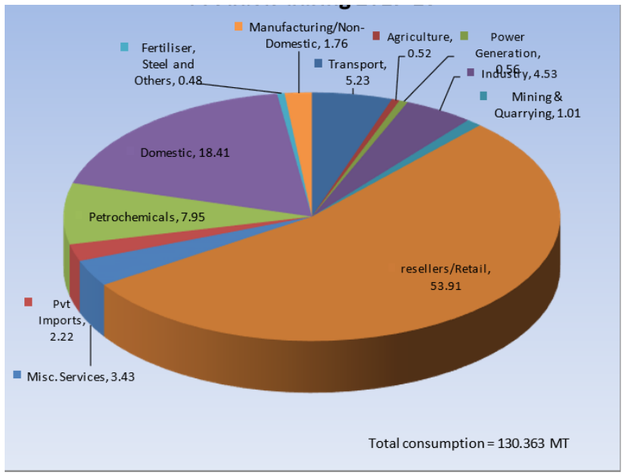
2. North East Region (NER) Gas Grid

3. Kochi-Koottanad- Bangalore-Mangalore (Ph-II) Pipeline Project (KKBMPL)

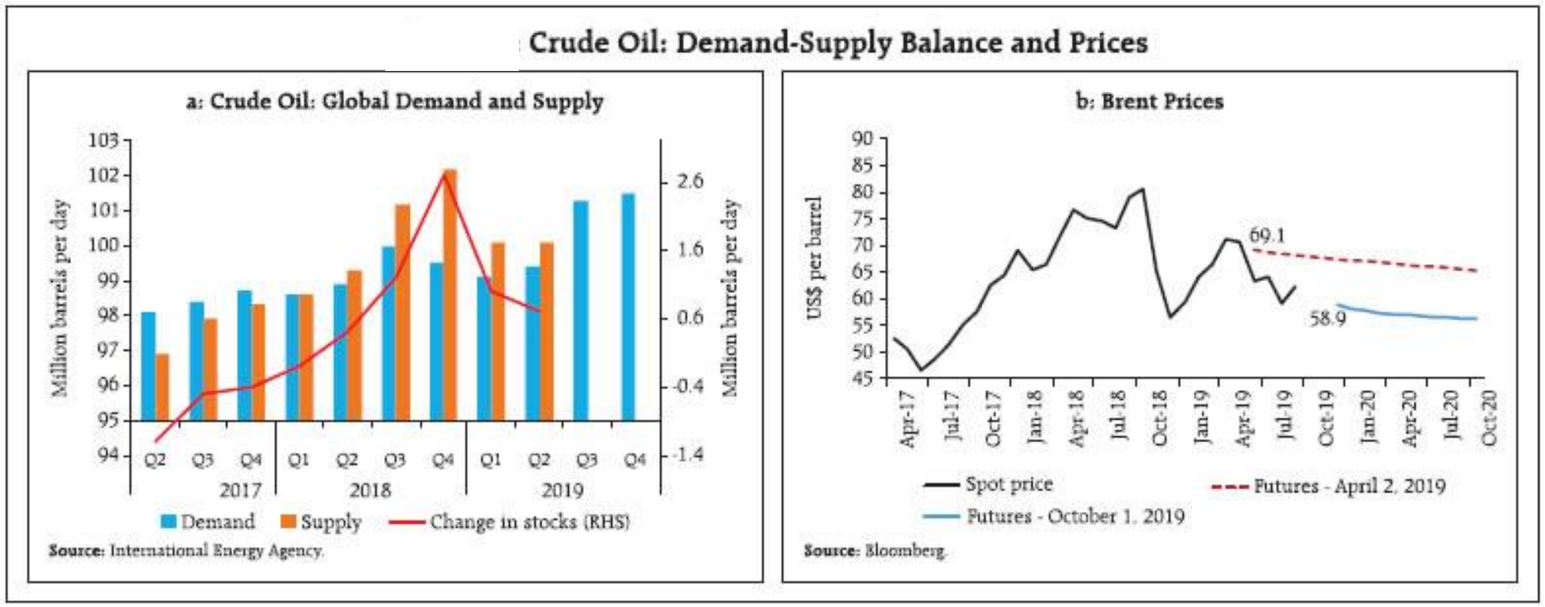
4. Thiruvallur-Bangalore-Nagapattinum– Madurai – Tuticorin Natural gas pipeline (ETBNMTPL):

CURRENT ENERGY SCENARIO IN INDIA: Oil

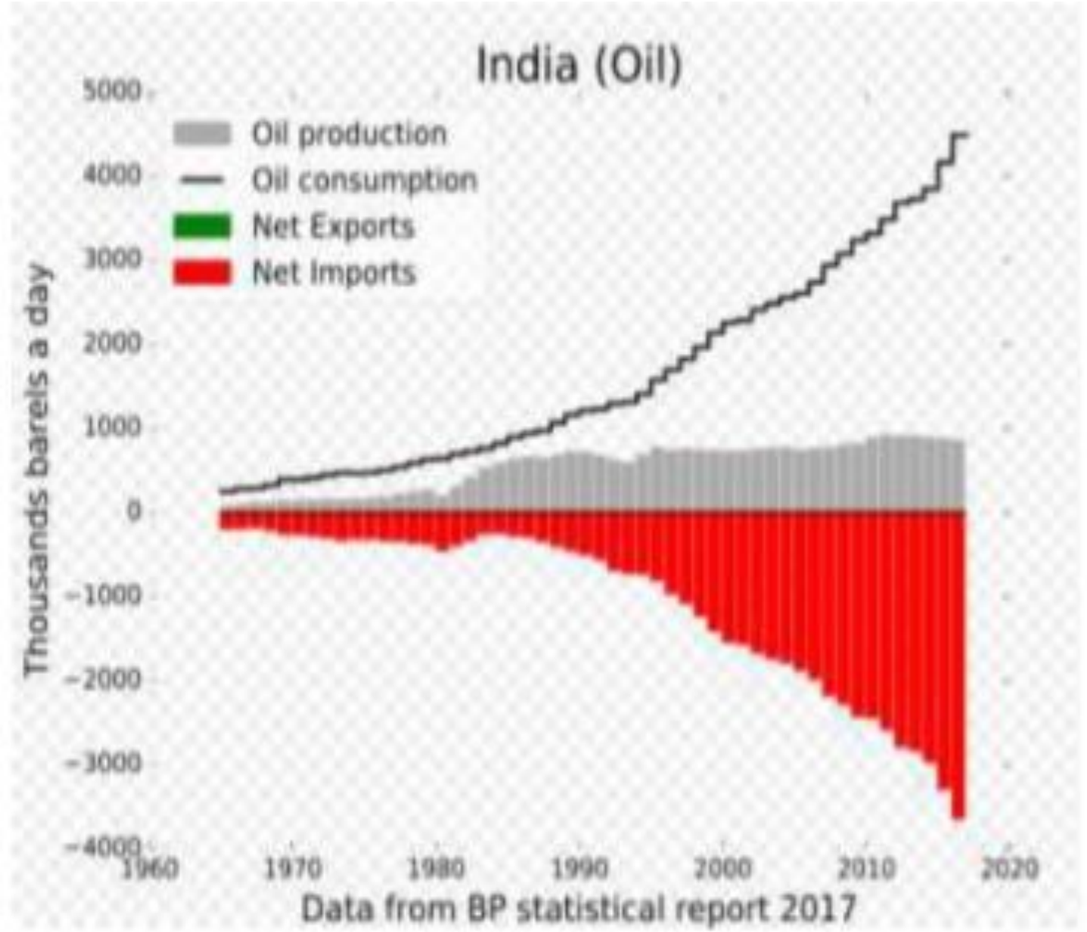
- India **ranks third** in oil consumption after China and US
- **India's** current refining capacity stands at 249 MMTPA, comprising **of** 23 **refineries**—18 under public sector, 3 under private sector and 2 in a joint venture. **Indian Oil** Corporation (IOC) is the largest domestic refiner with a capacity **of** 80.7 MMTPA.
- The refining capacity of the country was 22.36 Million Tonnes in 2020 which is 2% higher than 2019
- The Refinery production (crude throughput) achievement was 31092.30 TMT during April- May 2020 .
- Indian Oil Corporation(IOC), the state owned corporation had highest refining capacity of 80.7 MMTPA.
- Top three companies – IOC, Bharat **Petroleum** Corporation (BPCL) and Reliance Industries (RIL) - contribute around 66.7% of **India's** total refining production from FY 2018 - 19.



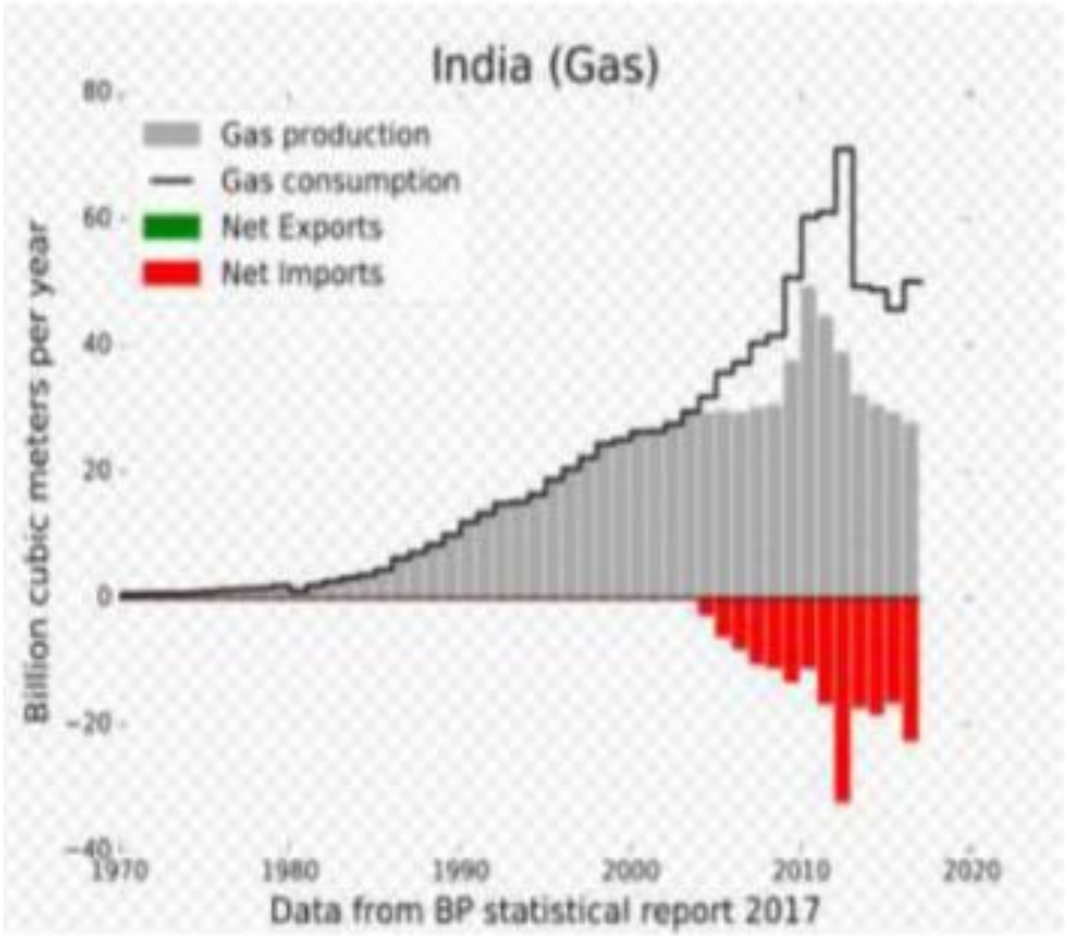
Sector-wise Consumption of Petroleum products during 2018-19



CURRENT ENERGY SCENARIO IN INDIA: Oil and Gas



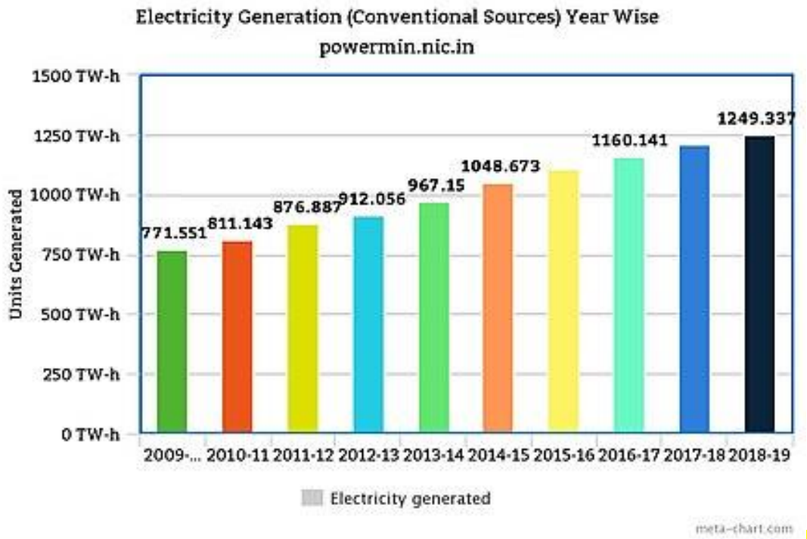
OIL CONSUMPTION IN INDIA



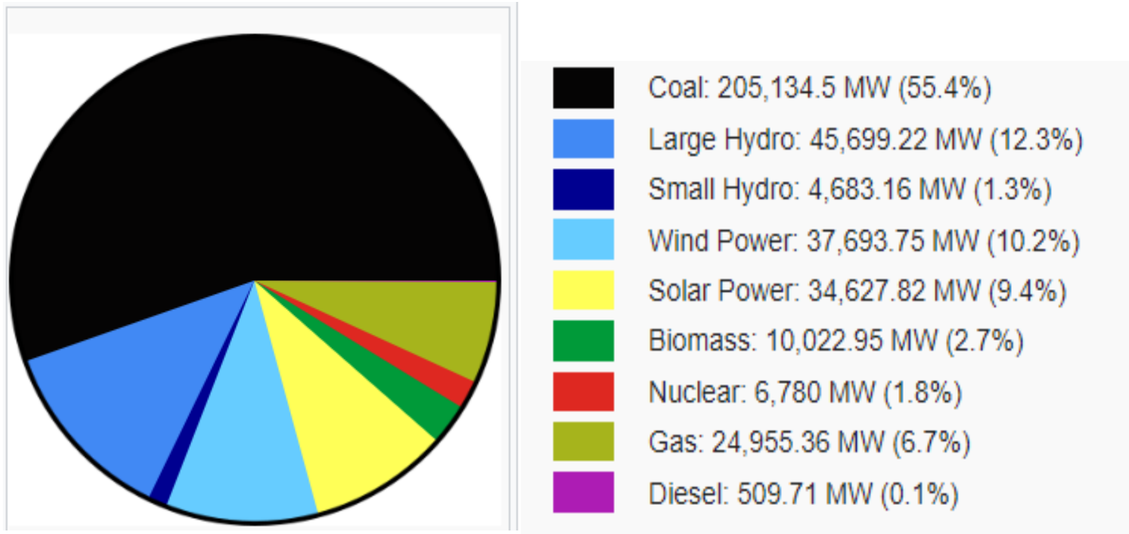
GAS CONSUMPTION IN INDIA

CURRENT ENERGY SCENARIO IN INDIA: Electricity

- India is the world's third largest producer and third largest consumer of electricity.
- The national electric grid in India has an installed capacity of 370.106 GW as of 31 March 2020
- During the 2018-19, the gross electricity generated by utilities in India was 1,372 TWh and the total electricity generation (utilities and non utilities) in the country was 1,547 TWh.
- The gross electricity consumption in 2018-19 was 1,181 kWh per capita
- Renewable power plants, which also include large hydroelectric plants, constitute 35.86% of India's total installed capacity



Installed capacity by source in India as on 31 March 2020



CURRENT ENERGY SCENARIO IN INDIA: Electricity

Electricity	Total	India per capita	Compared to Europe per capita
Own consumption	1,048.00 bn kWh	782.57 kWh	5,437.14 kWh
Production	1,289.00 bn kWh	962.53 kWh	5,848.09 kWh
Import	5.24 bn kWh	3.92 kWh	729.45 kWh
Export	5.15 bn kWh	3.85 kWh	708.25 kWh

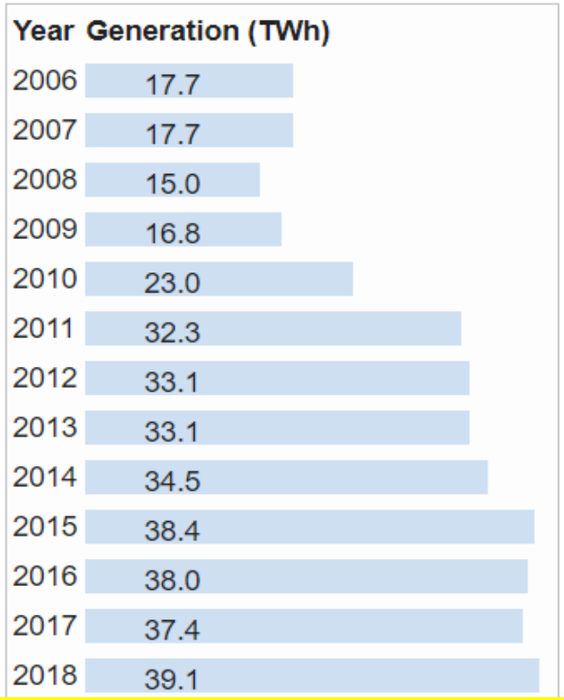
Electricity consumption (demand) in the country will grow at7.1% (CAGR) between FY17 and FY22and then slow to 6% in the subsequent five years, according to the Central Electricity Authority (CEA). Electrical energy requirement in the next 10 years is expected to grow by 79%.The country will need 1,743 billion units (BU)of energy in theFY27. Energy requirement in FY17 was close to 1,142 BU. The report noted that energy efficiency schemes and aggressive demand side management would lead to savings of 206 BU in FY22 and 273 BU in FY27

CURRENT ENERGY SCENARIO IN INDIA: Nuclear Energy

- Nuclear power is the fifth-largest source of electricity in India after coal, gas, hydroelectricity and wind power. As of March 2018, India has 22 nuclear reactors in operation in 7 nuclear power plants, having a total installed capacity of 6,780 MW. Nuclear power produced a total of 35 TWh and supplied 3.22% of Indian electricity in 2017. Six more reactors are under construction with a combined generation capacity of 4,300 MW.

- India has been making advances in the field of thorium-based fuels, working to design and develop a prototype for an atomic reactor using thorium and low-enriched uranium, a key part of India's three stage nuclear power programme. The country has also recently re-initiated its involvement in the LENR research activities, in addition to supporting work done in the fusion power area through the ITER initiative

Fiscal Year	Total nuclear electricity generation	Capacity factor
2008–09	14,921 GW·h	50%
2009–10	18,798 GW·h	61%
2010–11	26,472 GW·h	71%
2011–12	32,455 GW·h	79%
2012–13	32,863 GW·h	80%
2013-14	35,333 GW·h	83%
2014-15	37,835 GW·h	82%
2015-16	37,456 GW·h	75%
2016-17	37,674 GW·h	80%
2017-18	38,336 GW·h	70%
2018-19	37,813 GW·h	70%
2019-20 (Mar-Sep)	24,026 GW·h	86%



CURRENT ENERGY SCENARIO IN INDIA: Wind Energy

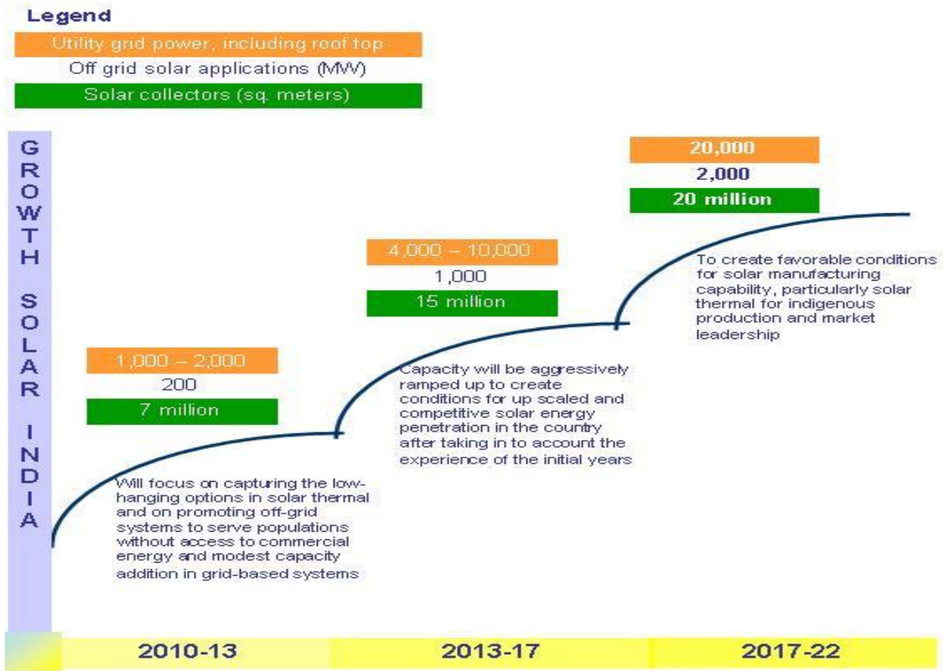
- India has fourth largest **installed wind power capacity** in the world
- Wind power generation capacity in India has significantly increased in recent years. As of the end of Feb 2020 the total installed wind power capacity is 37.669 GW
- India is planning to enter into offshore wind power, with a100 MW demonstration plant located off the Gujarat coast
- Wind power accounts nearly10 % of India . total installed **power generation** capacity and generated 62.03 TWh in the fiscal year 2018-19, which is nearly 4% of total electricity **generation**.
- The National Institute of Wind Energy has announced an estimation of the potential wind resource in India in the range of 49,130 MW to 302,000 MW assessed at100 m hub height. In 2015, the MNRE set the target for Wind Power generation capacity by the year 2022 at 60,000 MW
- Tamil Nadu. The **state** of Tamil Nadu has the highest Installed **wind capacity** by any other **state** of **India**.
- Maharashtra. Maharashtra ranked second in **wind power** installed **capacity**

Installed wind power capacity and generation in India since 2007

Financial year	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19[11]	19-20
Installed capacity (MW)	7,850	9,587	10,925	13,064	16,084	18,421	20,150	22,465	23,447	26,777	32,280	34,046	35,626	37,669
Generation (GWh)									28,214	28,604	46,011	52,666	62,036	64,485

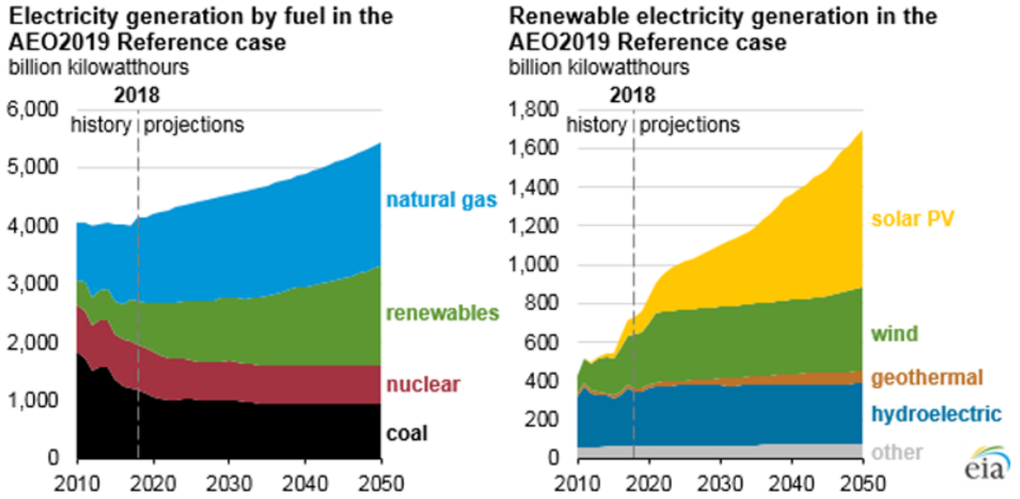
CURRENT ENERGY SCENARIO IN INDIA: Solar Power

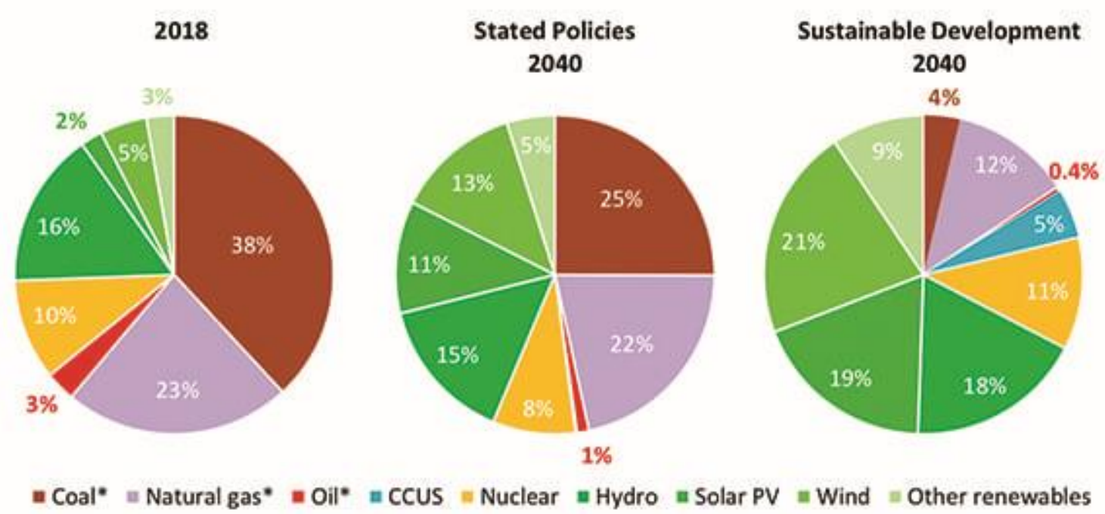
- **Solar power** in **India** is a fast developing industry. The country's **solar installed capacity** reached 37.627 GW as of 31 March 2020
- With about 300 clear and sunny days in a year, the calculated solar energy incidence on India’s land area is about 5000 trillion kWh per year.
- India's initiative to produce 100 GW from solar energy by 2022, with the help of International Solar Alliance (ISA)

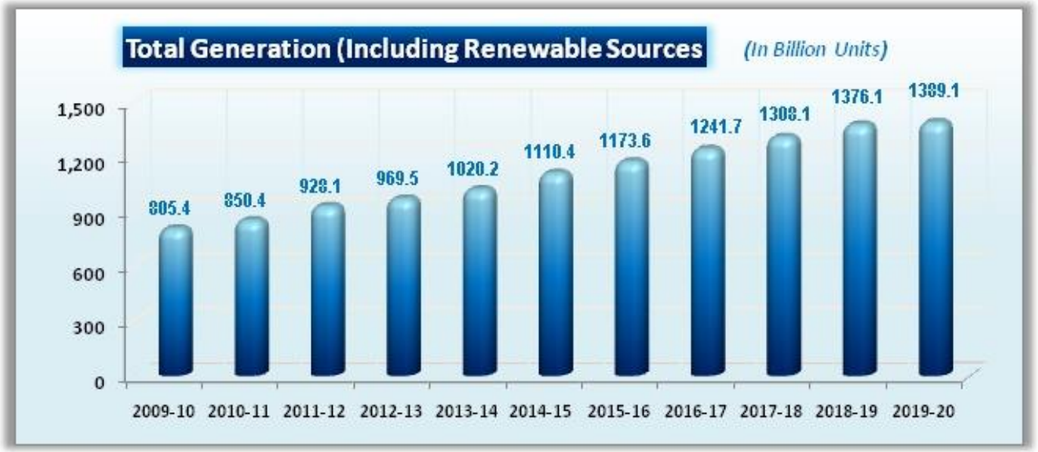


Other sectors
1. Bio mass
2. Hydro energy

CURRENT ENERGY SCENARIO IN INDIA: Electricity







Assignment -2

Q.1. Write short notes on:

a) Availability of Renewable / Non Renewable sources
b) Availability of Coal and Lignite
c) Availability of Natural Gas
d) Availability of Crude Oil and Petroleum Product
e) Availability of Electricity

Q.2 Discuss the Energy Balance in India.

Q.3 Where India Stands in the world in the field on Energy?

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Thank you!