POWER GENERATION AND CARBON FOOTPRINT

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ABSTRACT: *This survey discusses about power generation, carbon emission, climate change and impact on above. The various sectors such as railway, agriculture, and commercial enterprises are the key of economic development which are responsible for the power sector growth. This survey presents emission of carbon dioxide(CO2), nitric oxide (NO2), sulfur dioxide (SO2) from thermal power plant. Global related CO2 emission is around 40% from electricity production and it is expected that the electricity demand increases to two time greater than the current level in 2050. Under the reference of the comparison of electricity or power generation of number of current commercial technologies with the technologies expected to become commercially available within the coming decades and so. In many sector such as residential, work place and leisure are still use large amount of energy and produce large emission of CO2 despite efficiently gains. Also emission of CO2 from renewable energy sources such as nuclear, hydro, wind, bioenergy and solar generating plants were evaluated.*

The carbon footprint of different countries is different depending on technology used. For realizing low carbon economy it is necessary to invest in low carbon power plant, renewable and nuclear energy. It require large amount of investment cost and increasing the power generation projects. The global electricity industry has potential to reduce its carbon footprint of these locally integrated energy sectors together with cost saving benefits compared with existing generation.

KEYWORDS: Electricity generation, carbon emission mitigation potential, environmental policy achieved.

INTRODUCTION:

The recent increase in the power generation and due to this carbon footprint throughout the world is increases. In India 2009-10, 159.26 million tons of crude oil which amounts to 80% of its domestic crude oil consumption and 31% of the country's total imports are oil imports.[1][7] . This survey gives Carbon emission, change and impact in India and trends in global CO2 emission PBL Netherlands Environment Assessment Agency. The enactment of Electricity Act, 2003, over the years the installed capacity of power plants has increased to about 3,02,088 mw as on 31.3.2016 from a meager 1913 mw in 1950. Similarly electricity generation increased from about 5.1 billion units in 1950 to 1,107 BU in the year 2015-16.

Electricity has also increased from 15 kHz in 1950 to about 1,010 kHz in the yea r 2014-15.

MAJOR HIGHLIGHTS:

• India has achieved a total installed capacity of 42,849 MW from Renewable Energy Sources as on 31.03.2016.

• In the 12th plane, capacity of conversion sources will be101,645 MW against a target of 88,537MW.This is about 115% of the target.

• In additional of 17,330MW from Renewable Energy Sources are achieved during 12th plan.

• By various energy saving measures incremental energy saving, during year 2016- 17,2021-22 and 2026-27 are estimated to be 26BU,137BU respectively over the year 2015-16.

• At the end of year 2021-22 the energy requirement is 1,611BU which is around 17% and 15.4% lower than the corresponding projection made by 18th Electric Power Survey Report (EPS).

• The capacity addition from GAS-4,340MW, Hydro 15,330MW, Nuclear-2800MW and RES-1,15,326MW as committed capacity of 50,025MW coal based power project. Thereby total capacity addition during 2017-22 is likely to be 1,87,821MW.

• The non-fossil based install capacity (nuclear +hydro + renewable sources) will increase to 46.85 BY THE END OF 2021-22 and further increase to 56.5 by the end of 2026-27.

• The total coal requirement in the year 2021-22 and 2026-27 has been estimated as 727MT and 901MT due to the coal there is 30% reduction in Hydrogenation due to failure mansion supplemented by coal based supply.

• The total co2 emission for year 2011-22 and 2026-27 is estimated at 983 million tones and 1165 million tones respectively.

• Current co2 emission (2015-1016) is 0.732 kg0co2/kwh (including renewable) it is expected that this co2 may reduce to 0.58 1kg co2\kwh by the and year 2012-22 .

• It is estimated that 6.073 million tones of co2 emission has been avoided during 2015- 16 due to commissioning of super- critical technology based unit under BAU(Business As Usual) Scenario .

• The end of the year 2021-22 , it is estimated that about 268 million will be avoided annually from renewable energy sources.

The primary energy consumption in India is the third biggest after china and USA with 5.5%global share in 2016[5][6]. India ranks 81 positions in overall energy self- sufficiency at 66 % in 2014[3][4].The energy policy of India is largely defined by the country's expanding energy deficit and Increased focus on developing alternative sources of energy[1][2], particularly nuclear, solar, wind energy. The largest power station in the world are depend on the nonrenewable power stations are those that run on coal, fuil oils, nuclear while renewable power station run on fuel sources such as hydro, solar heat, geothermal heat and wind. Thermoelectric power generation is the another method of production of electricity .In this technology, it convert waste heat energy into electrical energy.

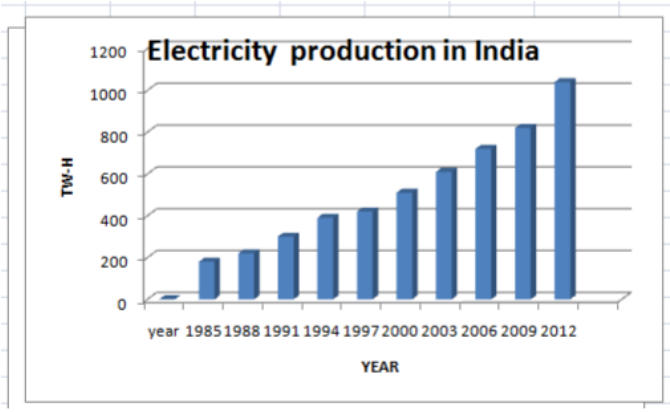


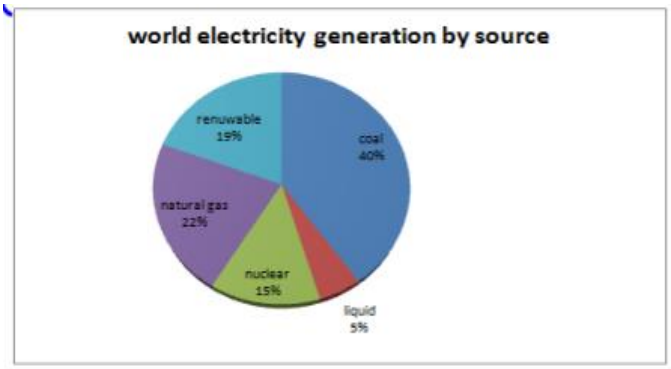
Fig 1 electricity generation in India

World's top ten renewable electricity produces country:

rank	country	year	total renewable(terawatt hr/year)
1	China	2014	1,300
2	United state	2012	549.5
3	Brazil	2014	451.5
4	Canada	2014	397.5
5	India	2014	199.1
6	Germany	2014	168.4
7	Russia	2012	167.9
8	Japan	2014	148.6
9	Norway	2014	139.0
10	Italy	2014	58.0

This electricity is produces by hydropower, wind power, biomass, solar, geothermal. Three Gorges Dam in China currently the largest power station and the power generation of this plant is 22,500MW[8], more than twice the installed capacity of largest nuclear station, the Kashiwazaki-Kariwa(Japan) of capacity 7,965MW. Second rank of power generation station is Itaipu Dam in Brazil Paraguay. Third is Xiluodu in China and fourth is Guri in Venezuela.

As the largest under construction power stations are hydroelectric Baihetan Dam(16,000MW)[9]and Belo Monte Dam(11,233MW)[9]. All power electricity generation technologies are generates high amount of CO2 .



Fig(2):world electricity generation by different sources

CONCEPT OF CARBON FOOTPRINT:

The total amount of CO2 and other greenhouse gases emitted over the full life cycle of product or process from extraction or raw material through to decommissioning .The CO2 and greenhouse gases [CH4] emitted from electricity generation technologies. The term footprint was first developed by planner at the University of British Columbia. The term "carbon footprint" originated from the ecological footprint concept. Carbon footprint is divided into two classes as primary and secondary footprint. Primary is measure of our direct emission of CO2 from burning of fossil fuel and secondary is measure of the indirect measure of the CO2 emission from the whole lifecycle of product.

Calculation of carbon footprint:

Carbon footprint calculation is very important which in not only for manufactures but also consumer of the products .Life cycle assessment (LAC) method is used for calculation of carbon footprint. LCA methods have been developed by International organization for standardization (ISO) [9]and focuses on the quantification of a range of environmental impacts, across the whole life of a product including climate change. Form growing of row materials through product manufacture to use and final disposal. LCA is comprehending structured and internationally standardized method which involve following steps.

- The customer used product described
- Construction of the map diagram of all activity
- Identify equivalent factor of CO2 for combustion of fuels.
- Non combustion related emission factor identify
- The product map drown up balance.

- Multiplying equivalent factor of CO2 by quantities of input and output.
- Documentation
- Verifying

Carbon emission from different sources:

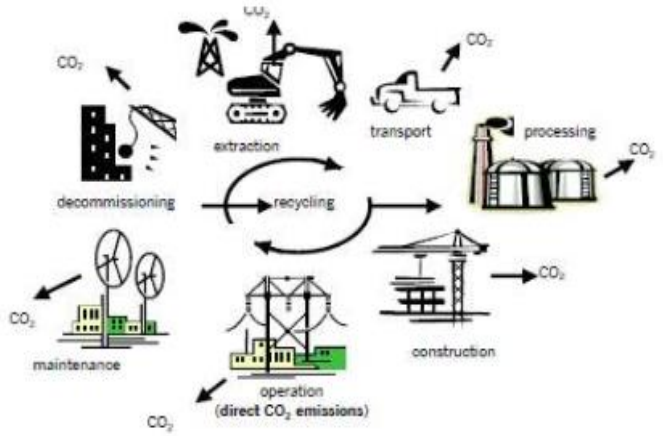


Fig. 3

1. Fossil fuels technologies

Fossil fuelled technologies such as coal, gas, oil have the largest footprint because they burn this fuel during operation. on the other hand, non-fossil fuel based technologies such as wind, hydro, biomass and nuclear are referred to as 'low carbon' because they do not emit carbon dioxide during their operation. The largest carbon footprint of all the electricity generation system analyzed here is coal burning power system. From combustion of coal result in emission of the order of >1,000 gCO2eq/kwh. Carbon capture and storage (CCS) and co-firing with renewable sources have the potential to reduce carbon footprint of coal-firing electricity generation. In contrast to fossil fuelled power generation, feature of renewable and nuclear energy system is that emission of greenhouse gases and other pollutants are 'indirect', that is, they arises from stages of cycle other than power generation.

Reduction of future carbon footprint

In future Carbon Capture and Storage potentially avoid 90% of CO2 emission in atmosphere. However, this technology has not yet been demonstrated within power generation industry.

1. Cofiring fossil fuels and biomass: Cofiring fossil fuel and biomass power plant can also significantly lower carbon footprint. For example At Drax in UK trials of wood co-firing with coal are an going at coal-fired power station. Currently, biomass energy crops are more expensive than coal, although co-firing biomass operators an earn Renewable Obligation Certificates (ROCs) which makes coffering economically viable.

Future carbon footprint reduction from all technologies:

All electricity generation technologies could be further reduced carbon footprint if the manufacturing phase and other phases of their cycles were fuelled by low carbon energy sources. Marine and PV would also lower life cycle CO2 emission. Biomass has the potential to generate power with 'negative' CO2 emission. The survey show that a 'negative emission' of up to -410gCO2/kwh can be achieved. If lower grade uranium ore is used then carbon footprint could increases. As it required more energy to extract to level usable in nuclear reactor. If lower grades of uranium used in future then footprint nuclear will increases. But this footprint will not be as large as the footprint of fossil fuelled system.

ANALYSIS OF CARBON FOOTPRINT EMITTION FROM SOURCES:

Sources	Footprint range	
	Lowest	Highest
1) Biomass	25gCO_2/KWh	237gCO_2/KWh
2) Photo Voltaic	35gCO_2/KWh	58gCO_2/KWh
3) Marine (wave & tidal)	25gCO_2/KWh	50gCO_2/KWh
4) Hydro (small CO2 emitter but CH4 also emitter)	3gCO_2/KWh	10gCO_2/KWh
5) Wind	4.68gCO_2/KWh	5.25gCO_2/KWh
6) Nuclear	3.48gCO_2/KWh	5.05CO_2/KWh

None of the technology are entirely carbon free. Future carbon footprint can be reduced for all electricity generation technologies if the high CO2 emission phases are fuelled by low carbon energy sources.

CONCLUSION

This study may help in development of power generation globly. This survey provides how improved the power generation technology throughout the world. Countries produced the power from different sources from these different technologies very large amount of CO2, SO2 and No2 are emitted. Every day the environmental issues are increases due to increasing the power generation. Now the requirements is to reduce the issues by utilizing the waste source like, noise of various machines which produces vibration and also there is wastage of heat in the thermal power plant can also be used for generation of power. Very suitable and better option for generating the power is

thermo electric technology. For reducing the environmental issues during electricity production this will minimize by using maximum renewable sources which maintain the environmental condition.

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