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An Overview on Pre and Post COVID 19 Electrical Energy Requirement, Consumption and Generation in India and Present Situation

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Abstract: ***India's electrical energy situation has been diverse always. From conventional electrical energy use to non-conventional electrical energy use, from renewable electrical energy use to non-renewable electrical energy use, India has used its potential in every from of electrical energy sector, and tries to generate more electrical energy to satisfy the required demand. From 2019 to 2020, there was a sudden discontinuation in electrical energy generation in India because of the worldwide Covid 19 pandemic situation that resulted in lockdown and closing of schools, colleges, factories, transport and many other sectors that requires electricity. This reduced demand resulted in reduced electrical energy generation. This paper provide an overview over the electrical energy situation in 2019, 2020 pandemic situation, its recovery after 2020 and current electrical energy situation.***

Keywords: ***Covid 19, Electrical Energy Crisis, Electrical Energy Demand, Non-Conventional Electrical Energy, Post Covid, Pre Covid, Renewable Electrical Energy.***

1. INTRODUCTION

India is the largest democratic country in the world, with the population of 141.68 crores according to 2023 census. [1] People live in urban areas as well as in city areas. Some people still do not have the facility to access to electricity. Their sources of electrical energy is bio mass fuel or fuel wood or crop residue. Rest of the people, who have access to electricity, use it in all possible ways, in town, city, villages, metropolitan. The various application is seen in household, factories, plants, educational sector, health sector etc. coal based thermal power, nuclear thermal power, hydroelectric power, gas turbine power, diesel engine power are some of the few sources of electricity. There is also solar power, wind power. India has used all possible variations of electrical energy to its use, renewable and non-renewable sources, as well as conventional and non-conventional sources.

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India under Covid 19

Data of exact electrical energy requirements of 2018-2019, and electrical energy wise percentage In December of 2019, the entire world saw the SARS-COVID-2 virus outbreak. India was no exception. Covid 19 virus caused an incurable pneumonia, and it developed so quickly among the people, especially aged people or people with weak immunity, the virus started taking lives. Covid 19 was declared a pandemic worldwide, millions of people lost their lives. The data from WHO shows the horrific figures of lives lost in this pandemic. There has been a total of 6887000 deaths in the world, as of 23rd march, 2023. If we consider only our country, India alone has seen 530808 deaths. [2]

Corona virus originated in Wuhan, China, but it reached every corner of the world. This highly contagious virus had to be stopped. The world leaders decided to implement strict lockdown in most of the countries. From 25th march 2020 to 31st may 2020, India was under full lockdown, to minimalize human contact and spreading of the virus, making social distancing compulsory. Schools, colleges, factories, small workshops, malls, cinema halls, every single place was shut down. Works were done online, and from home. This new system of work made a huge and abrupt change in India'selectrical energy requirements. The paralysis of education, work and commercial sector caused a huge drop in demand in electricity sector.

Electrical Energy Scenario of India during Covid 19

Reduction in demand & Reduction in GDP

Between March and April of 2020, there is a shocking reduction of electrical energy demand in India, around 25%, compared to the previous year. [3] If we check the worldwide electrical energy reduction data, we will see, electricity demand during the period of March to July 2020, was 15% less than the electrical energy demand seen in the period of March to July, 2019. The electrical power supply of all coal based thermal power plants in India combined, was reduced by 26%. Not only India, other countries has also seen this reduction, in the range of 15% to 18%. Following figure shows the drop in consumption of electrical energy during pandemic.

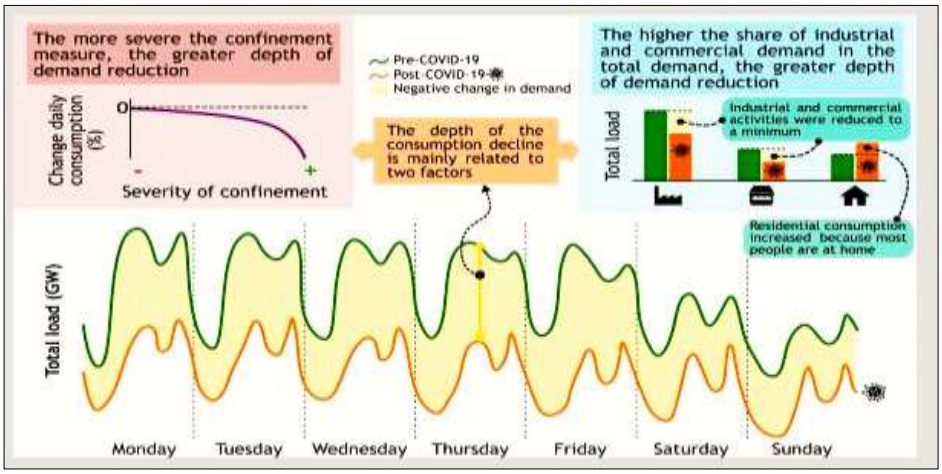

Fig 1. Weekly Load Variation in Pre Covid and Post Covid Situation and the Negative Change in Demand

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Fig 1 shows Weekly Load Variation in Pre Covid and Post Covid Situation and the Negative Change in Demand, with the noticeable drop in load variation between pre and post Covid scenario. In places, with severe confinement zones, greater depth or slope reduction of daily electrical energy consumption is seen.

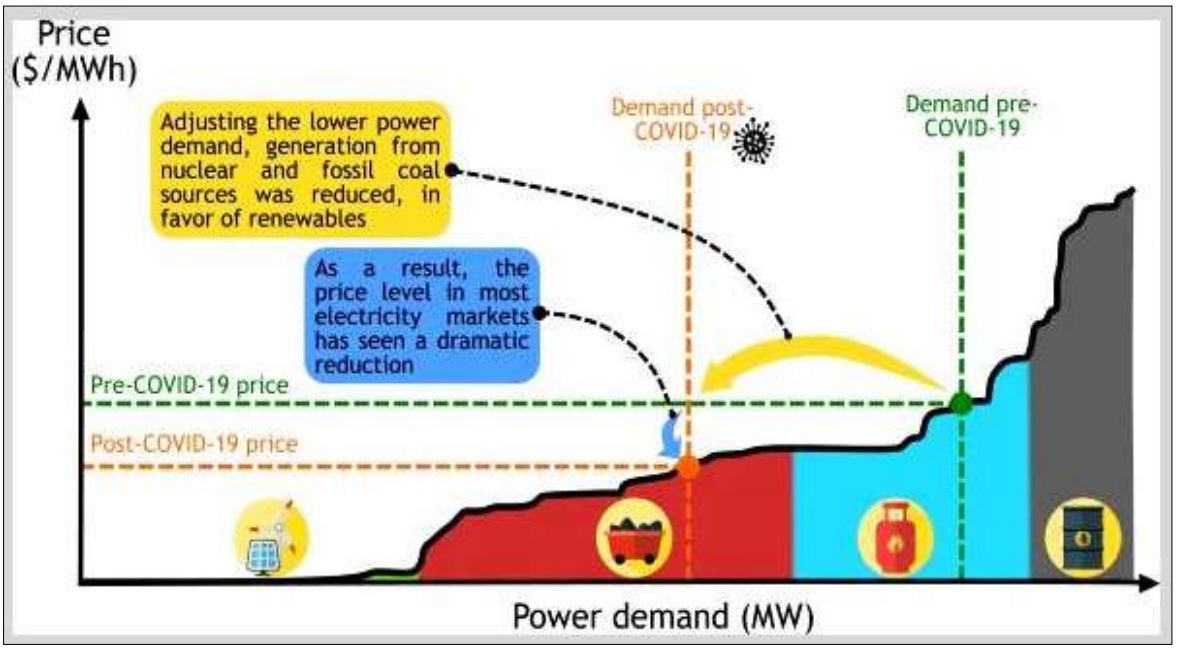

Fig 2. Price of ElectricalenergyVs Power Demand in Pre Covid and Post Covid Situation

Figure 2 shows the price vs power demand graph, where post Covid price is less than pre Covid price of the power demand. As the electrical power demand kept on decreasing with time during the lockdown period, the price of consumable electrical energy ($/MWh)also reduced, causing a huge loss in international market. To manage this financial growth drop, most of the organizations decided to fire their employees, or reduce the salary to half. No new people were recruited in this frozen economic state. The employment scenario was shaken as well, in only renewable sectors, 300000 people were at risk of being fired from their jobs, or in some cased, salary was reduced to half. [4]

Indian Electrical Energy Scenario Post Covid 19

Fastest recovery was seen in agriculture, health, internet communication and animal husbandry sector. The paralysis or stand still situation took time to be in motion, or rather to say, to get back to normal situation. The electrical energy demand recovery was mainly managed by renewable sources, mainly solar electrical energy, wind electrical energy and hydroelectric electrical energy. The reduction in use of coal electrical energy reduced the CO2emission, as well the air pollution. Many places in India, saw clear sky and breathed fresh air, for the first time during lockdown. The SPM present in air was also lessened due to very less vehicles running. [5]

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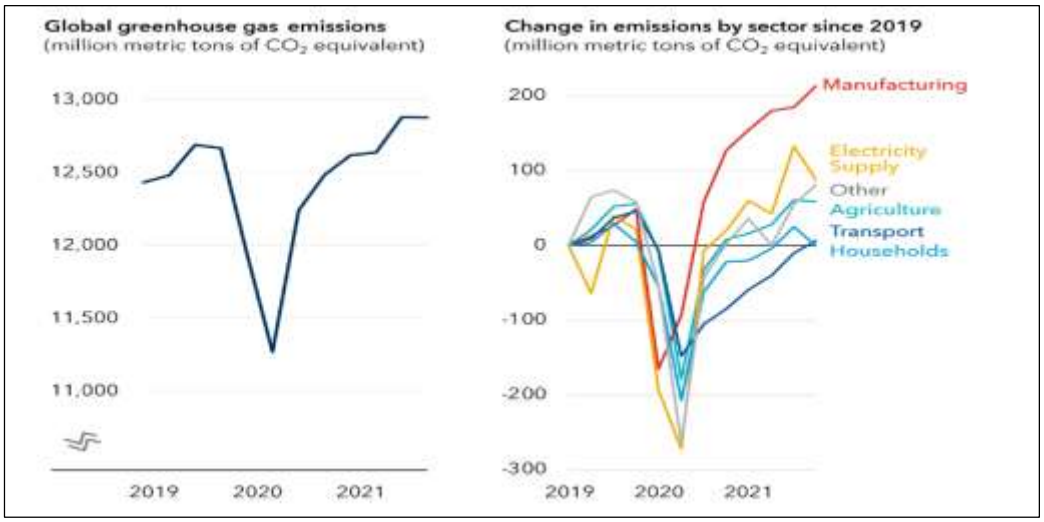

Fig 3. Green House Gas Emissions over the Years

During lockdown and in the time after that, India has seen a growth in renewable electrical energy sectors. To be exact, according to the data given by Central Electricity Authority (CEA)in January 2020, total electrical power generation by renewable and non-conventional method grew from 2.65 BU to 113.20 BU. [5]From figure 3 the sudden drop in greenhouse gas emission is seen during 2019-2020 all over the world, due to lockdown, minimal transport, or any activity producing emission. [9]

Table 1.1: Electricity Generation (Both Conventional and Non-Conventional Sources)

Jan 2020			**Jan 2019**		
Generation from conventional sources in (BU)	Generation from renewable sources in (BU)	Total in (BU)	Generation from conventional sources in (BU)	Generation from renewable sources in (BU)	Total in (BU)
102.88	10.325	113.20	100.85	9.433	110.280

Table 1.2: Electricity Generation (Both Conventional and Non-Conventional Sources)

% Growth		
Growth in conventional sources in (%)	Growth in renewable sources in (%)	Growth in total generation in (%)
2.01	9.45	2.65

The renewable and non-conventional energies included solar electrical energy, wind electrical energy, small hydro electrical energy, biomass electrical energy and biogas electrical energy.

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Table 2: Energy generation in India during 2018-2019

All India generation from renewables				**All figures are in MU**	
SL NO	**Source wise all India generation from renewables**	**For the month of**		**Cumulative for the period**	
		Dec-2019	Dec-2018	April 19 to Dec 19	April 18 to Dec 18
1	Wind	3943.01	2789.24	54396.21	53124.09
2	Solar	3932.61	3182.12	34798.64	27794.92
3	Biomass	238.09	247.01	2072.84	2035.81
4	Bagasse	1801.17	2311.49	5778.21	7451.18
5	Small hydro	702.83	516.72	7694.14	7410.48
6	others	29.61	36.69	276.31	318.58
total		10647.32	9083.27	105016.35	98135.06

By 2022, the expected solar power capacity and wind power capacity of India will hopefully be 100GW and 60 GW respectively. [6][7]

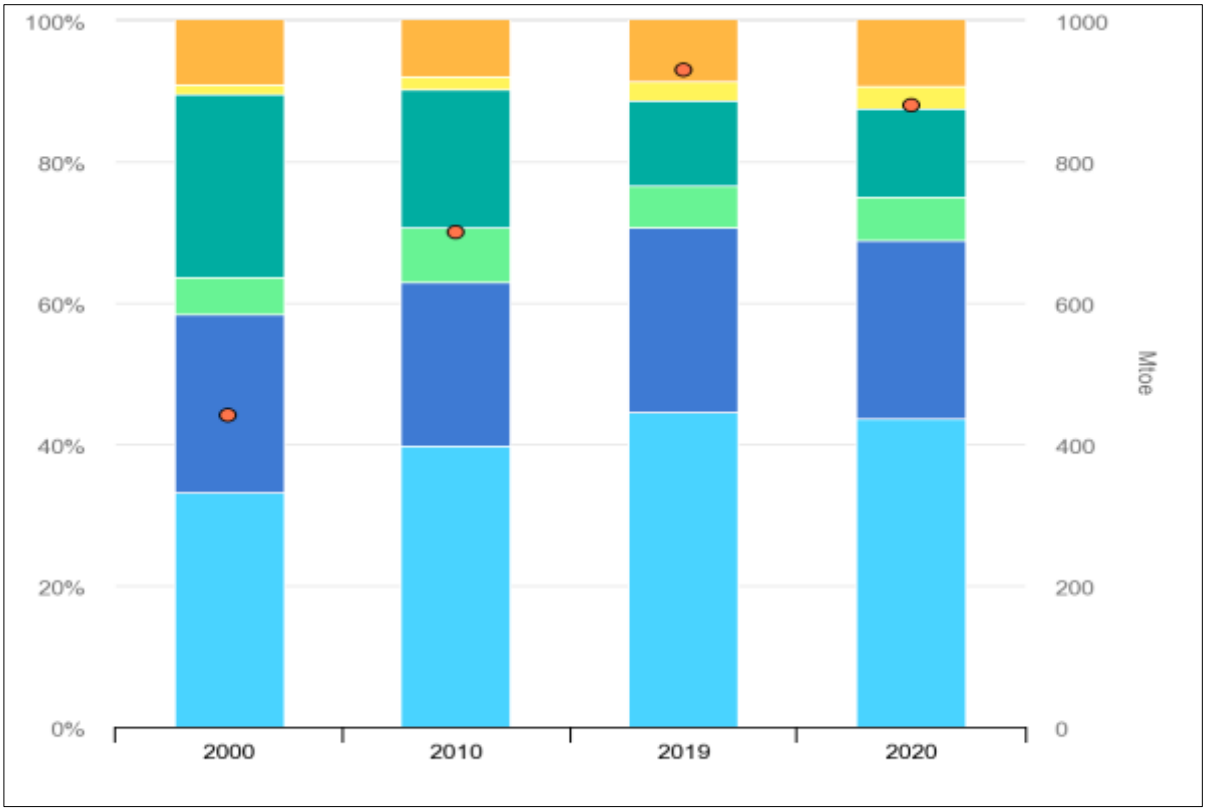

Fig 4. Primaryelectrical energy demand in India in 2000-2020

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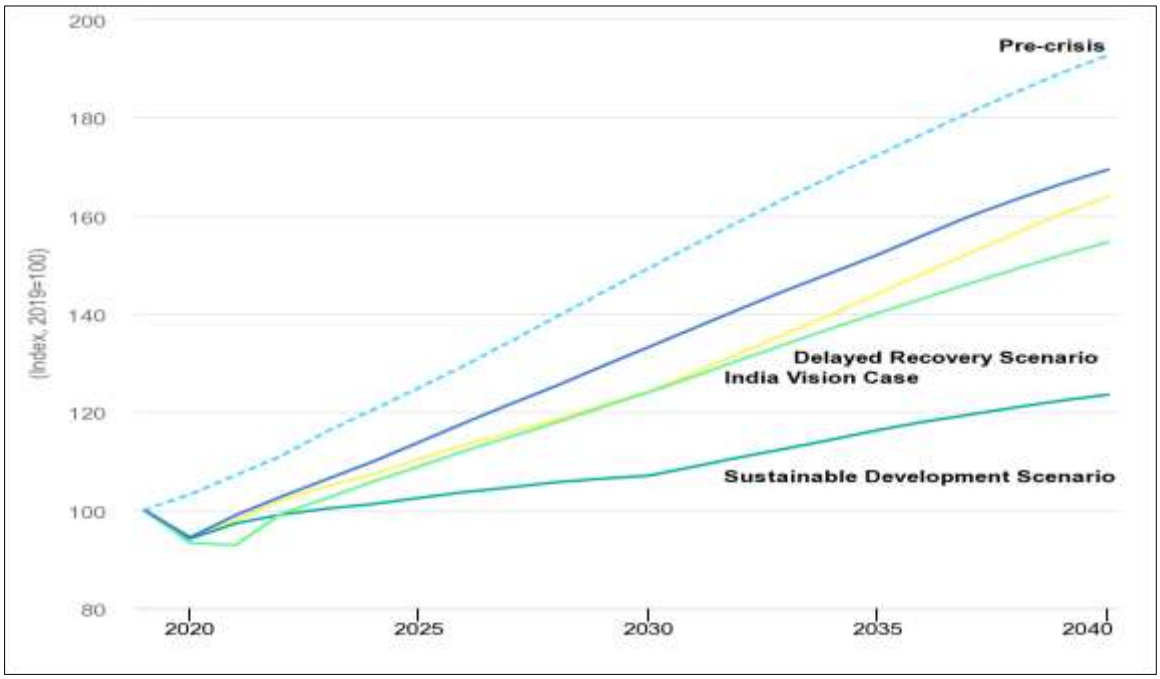

Fig 5. Electrical energy demand growth in India by from 2019 to 2040

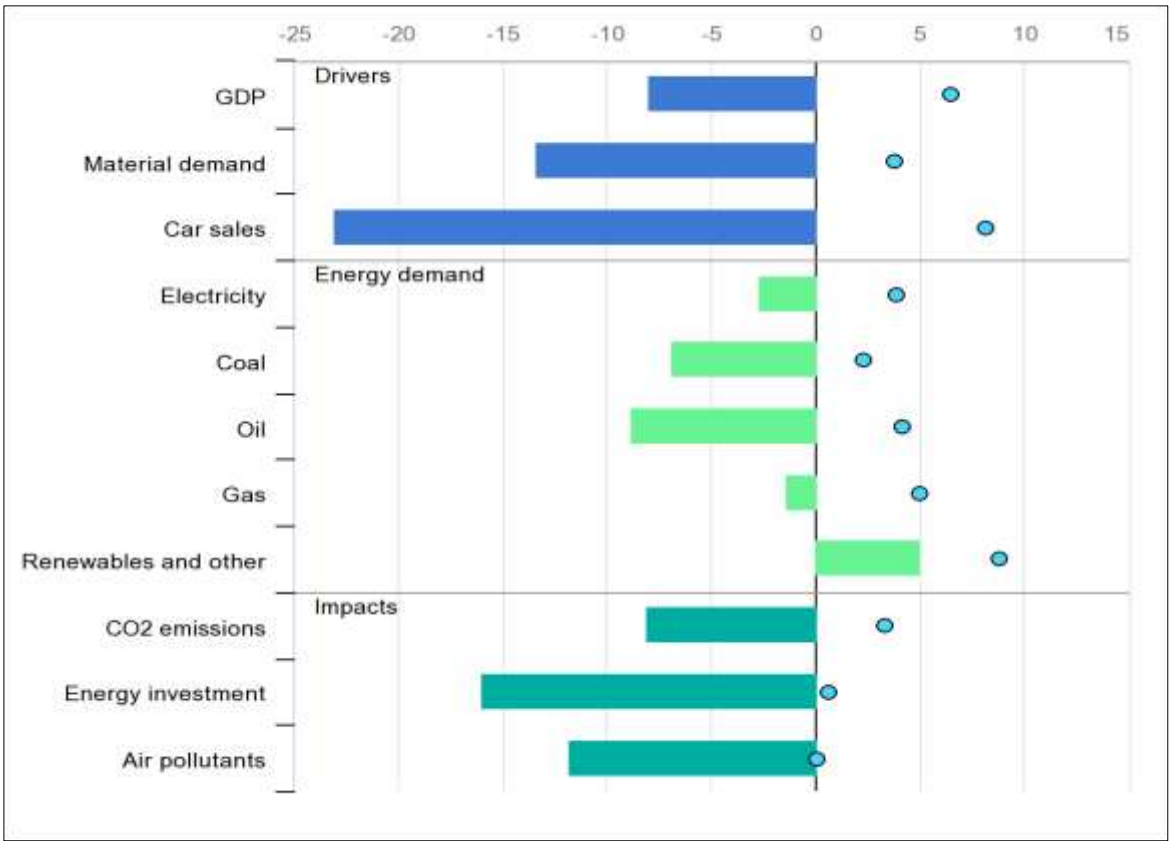

Fig 6. Percentage change in overall electrical energy scenario in India from 2019 to 2020

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India's Electrical Energy Situation In 2023

In 2023, the combined renewable electrical energy sources produce electricity to manage the demand, around 150+ GW, where contribution of different electrical energy sources are considered [8]

Table 3: India's installed generation capacity in 2023 produced by different sectors

SECTOR	Generation in MW	% share of total generation
Central sector	99455	24.2
State sector	104925	25.4
Private sector	207832	50.4
Total	412212	

Table 4: India's installed generation capacity in 2023 produced by different fuels
For Fossil fuel:

Category	Installed capacity in MW	% share of total generation
Coal	204435	49.7
Lignite	6620	1.6
Gas	24824	6.1
Diesel	589	0.1
Total	236469	57.4

Table 5: India's installed generation capacity in 2023 produced by different fuels
For non-fossil fuel:

Category	Installed capacity in MW	% share of total generation
Hydro	46850	11.4
Wind, solar other RE	122113	29.6
Wind	42015	10.2
Solar	64381	15.6
BM power/Cogen	10218	2.5
Waste to energy	523	0.1
Small hydro power	4943	1.2
Nuclear	6780	1.6
Total	175743	42.6

2. CONCLUSION

The Covid pandemic lasted for approximately 2 years. In some countries it lasted even more. The complete shutdown, rather lockdown situation made a huge impact in every sector of society. Health sector, education sector, business, industry, entertainment industry, agriculture, small business and many other crucial parts of the system were reformed to cope up with the new system. So did electrical energy sector; renewable electrical energy sector and non-renewable electrical energy sector, both were very different before and after the Covid situation.After the lockdown was lifted, the world including India recovered from the stand still condition. Conventional electrical energy production was back to normal, but the

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non-conventional, mainly renewable electrical energy production was given more importance. The overview of the electrical energy consumption of India in 2023 is much more diverse.

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