

Effect on Indian Energy Sector Throughout Lockdown Owing to Covid-19 Epidemic

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ABSTRACT

Today's globe is infected with the corona virus which is known as COVID-19 and as a result WHO proclaims world fitness emergency. Many countries, including India, declare shutdown to safeguard people's lives while also aiming to stop transmission chain of corona virus disease. However, the shutdown has a negative impact on the province's sectors of the economy including nation. One of them is energy authorities, and such Generation, transmission and distribution system of the Indian electricity sector has seen the significant impact of this during the shutdown announcement. The load curve of electricity requests has taken on a new pattern in corona virus-infected areas of the nation like India, implying significant reductions. This study investigated the circumstances and the effect of corona virus on the Indian electrical energy market and part of the economy, as well as a discussion to aid in analyzing poor results and preparing the best power quarter for future.

KEYWORDS: Covid-19 virus (Novel Corona Virus), Pollutants, National electricity region, Economy

INTRODUCTION

Corona infection disease (COVID 19) is a contagious infection caused by a newly discovered corona virus. Patients infected with the Corona virus will experience symptoms such as fever, throat infection, coughs or sneezes, chest and respiratory issues, and healing will be challenging without the need for a robust innate immunity. The elderly and others with underlying health issues such as chronic lung disease, diabetes, tumors, and cardiovascular disease are more likely to develop extremely serious illnesses. The most effective way to block and/or slow the spread of the COVID-19 disease is to wash hands often with soap or a sanitizing (alcohol-based) on a frequent basis, as well as not to do. Another technique to interrupt the link infectious disease is by social separation. The very first step to reducing and/or stopping the corona virus's chain infection seems to be to shutdown society. [1-4].

The new coronavirus epidemic began in Wuhan, China, and then spread throughout the world. The first incidence of the Novel COVID-19 epidemic in the world's largest second most densely populated republic, India, was recorded on Jan 30th, 2020 in Kerala state, and the number of cases has been steadily increasing since then [2, 4-6]. As a result, on March 22nd, Prime Minister Shree Narendra Modi declared a twenty-one-day nationwide lockdown-1's, which began on March 24th, 2020, and stated that all kinds of industrial facilities, academic institutions, other education programs, educational establishments, company headquarters, wholesaling and retail trade stores, as well as road transport facilities had been closed, Despite the fact that essential services such as supermarkets and pharmacies or drugstore stay open [5].

Nonetheless, as lockdown-1's expiration date approached, country Prime Minister Shree N. D. Modi conducted a meeting with such a number of state Chief Ministers to address the situation of their relevant state Covid-19 infected scenarios, and ultimately refused to end lockdown-1 until May 3rd, 2020, and say lockdown-2 as a constrained operation for a prolonged duration. The end result will be a longer-term loss of massive financial activity. These shutdown recurrence indicators from March and early April are now

reducing the impact of a sudden stop in national economies. As a result of this declaration, all businesses have closed down, resulting in a 26.60 percent drop in maximum energy demand, leaving just home consumption to be met, according to the Power System Operation Corporation Limited's daily report (POSOCO). But at the other hand, day-time peak requirements have fallen by 24.50 percent on average [2, 7]. In every fifteen-day period as well as on the third and fourth May, 2020, Figure 1 depicts the quantity of patients, healed as well as mortality due to novel coronavirus inflammation. [4, 8, 29].

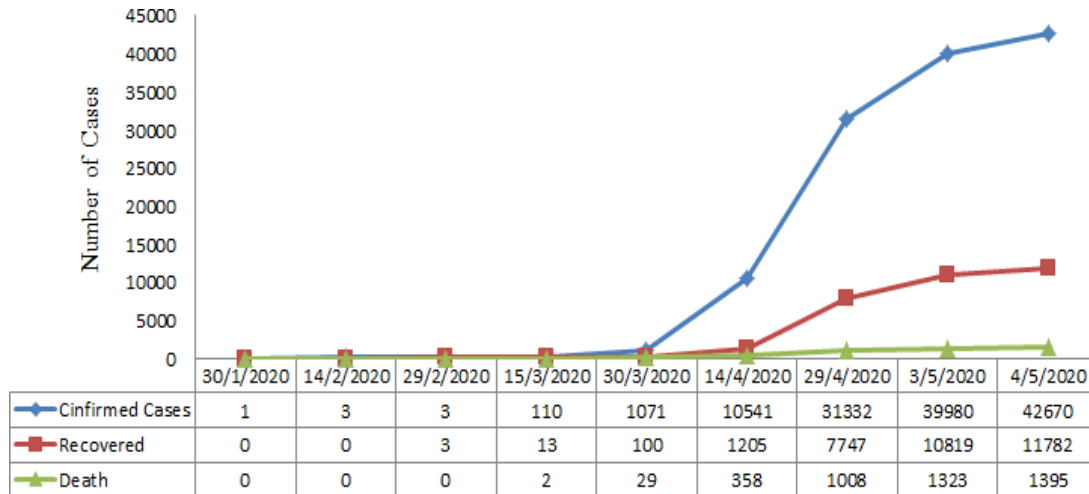


Fig. 1: Incidence of COVID-19 in India are outlined [4, 8, 29]

Each situation has two aspects, and the same is true in this, with several bad consequences as a result of the world's largest shutdown, which includes emerging nation such as India. This means that all workshops, enterprises, market stalls, religious sites, school systems, academic institutions (university/colleges), and all kinds of road transport are currently shut down, as the Indian government requests of its citizens. But just don't neglect about the beneficial impacts of the shutdown in India, like as lesser polluted air, which leads to the increase in the Quality of Air Index (AQI), cleaner river and lake water than it has ever been, and citizens seeing the nation's and the world's oneness in the battle against the Covid-19 virus. [9-10].

The dramatic impact of pollution in India, data shows that even the most heavily contaminated metropolitan areas are showing much lower levels of harmful small particulate matter known as fine Particulate Matter PM 2.5, as well as NO₂, which would be released from autos and power plants. According to data gathered from the Centre for Research on Energy and Clean Air (CREA) of Ministry of Environment in India, officially known as the Central Pollution Control Board (CPCB), NO₂ levels had decreased by seventy-one 71 percent from 52 per m³ to 15 in the same time frame. Air pollution has also decreased in Mumbai, Chennai, Kolkata, Bengaluru, and Ahmedabad. Fig. 2 depicts the air quality index of the most polluted cities. [9-11].

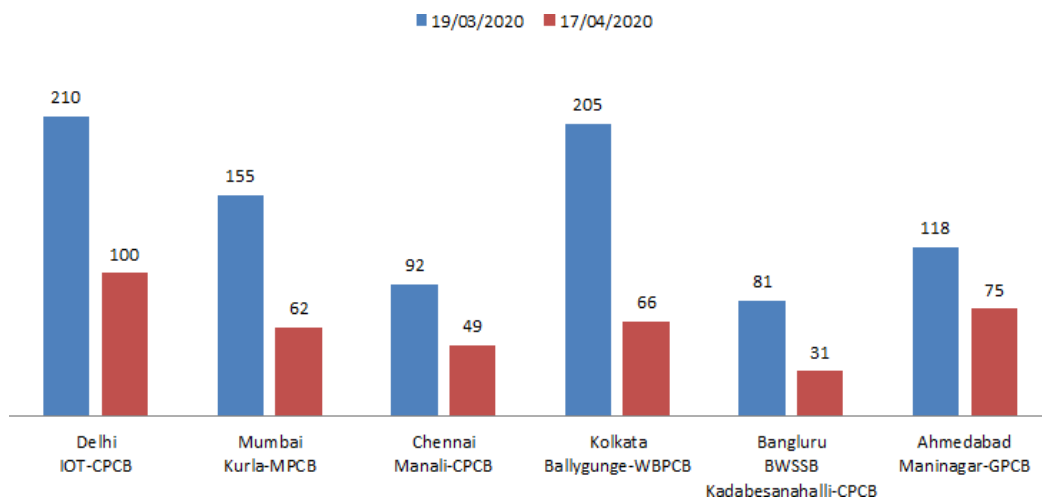


Fig. 2: Major polluted cities' AQI [10]

The purpose of this overview study is to deliver information regarding the COVID-19, as well as the influence of the COVID-19 shutdown on environment, the Electricity segment of Indian and the National economy.

INDIAN ENERGY SEGMENT

Evolution of Indian Energy Segment

India is ranked third in the world in terms of both electricity generation and client satisfaction. On the 31st of March, 2020, the country's installed capacity was 370.106×10^3 MW. In the 2018-19 fiscal year, per capita electricity consumption was 1,181 kwh. As per the government's 2018 Central Electricity Proposal, the nation will have no nonrenewable power production requirements in the service sector only till 2027, thanks to the planning and construction of a 50.025×10^3 MW coal-fired station currently being built and a total 275×10^3 MW renewable power capability after stepping down to around 48×10^3 MW old mining power stations [12].

Over the last 3 years, India's total electrical energy production from grid-connected various renewable power production has grown from 1308.146×10^3 million unit (MU) in 2017-2018 to 1376.095×10^3 million unit in 2018-2019 and 1390.467×10^3 million unit in 2019-2020. In the previous year, conventional power generation grew by 2.59 percent, hydro power generation declined by 15.62 percent, nuclear power energy production climbed by 22.66 percent, and electricity produced by renewable sources improved by 8.75 percent. The total rate of electrical power production progress in 2019-2020 is estimated to be 1.04 percent. [13].

The 15th of June, 2003 was a watershed moment in the National power industry since the Electricity Regulation of 2003 was approved and the competitive power marketplace was launched. The impartial job is to declare race, defend consumer welfare, and provide electrical power to everyone. This Regulation was altered in response to two events: (1) the Electricity Act of 2003 was amended; and (2) The Electricity Act of 2007 was amended. The major aim of this Law is to raise the sector onto a path of total industrialization and to encourage the federal government and the provinces to act in tandem. Following the restructure of the electricity system, all energy producing investors have the opportunity to produce and deliver electric energy, as well as trade it without a permission, and there are strong penalties for robbing electrical energy, as indicated in figs. 3 and 4 as on 17th December, 2020 [14-15].

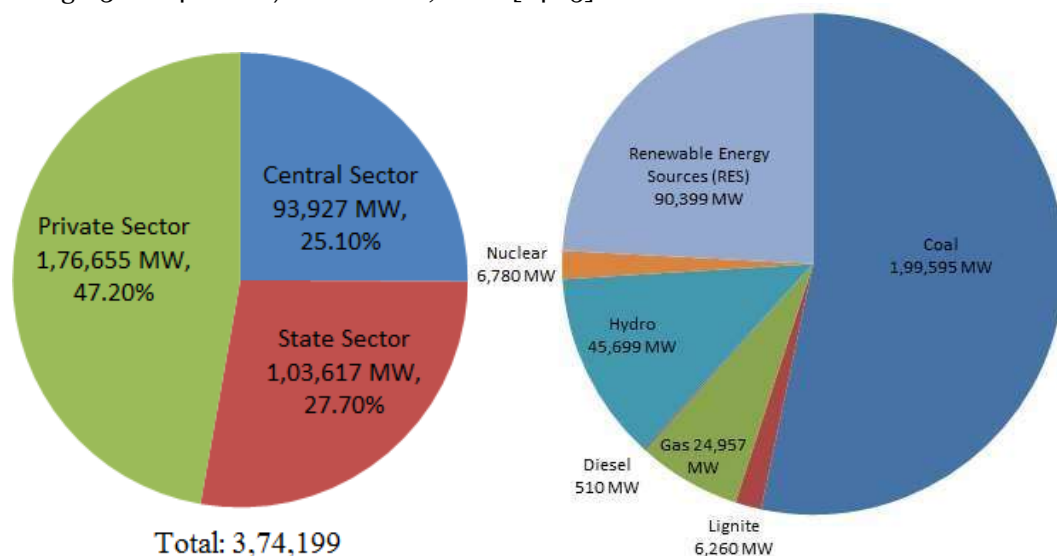


Fig. 3: Total installed capacity-Sector wise [14] Fig. 4: Total installed capacity-Fuwise [14]

Effect on Indian Energy Segment due to Current Pandemic

Owing to the widespread of the novel coronavirus, the first internal advice to working population in terms of sanitization and social distancing measures was provided on March 13th, 2020. However, these settings are unable to restrict the corona disease's transmission cycle. To combat this virus, Country's PM, Shri Narendra Modi, issued a 'Janta curfew' in India on March 22nd, 2020. After the imposition of the 'Rastriya janta curfew' on March 22nd, 2020 (Sunday), electricity consumption is expected to reduce dramatically compared to March 15th, 2020 (earlier Sunday) for different hours. Following that, a twenty-one days shutdown was proclaimed until the 24th of April 2020, and then expanded to the 3rd of May, 2020. As a result, substantial parts of the country are in shutdown, with power consumption dropping [16].

In India, the Central Electricity Regulatory Commission (CERC) ruled on April 1st, 2020 that the Electricity power industry could be run as a real-time market, although this would not begin until June owing to the COVID-19 epidemic. Because of the lockout, there is a considerable drop in electricity generation, which has a significant impact on electricity purchasing and selling rates. As a result, the electricity industry saw a sharp drop in Market Clearing Volume (MCV) and Market Clearing Price (MCP), as seen in figs. 5 and 6 [17-18]. During this historical moment, the MCV was 97.05×10^3 MWhr and the MCP was 2195.480 Rs/MWhr,

compared to 107.98×10^3 MWh and 2816.00 Rs/ MWhr that same day the year before. During the lockdown period, from March 25th - April 1st, 2020, the entire MCV was 104.27×10^3 MWhr, relative to 130.24×10^3 MWhr that same day previous year. Similarly, MCP was 2155.930 Rs/MWhr this year, compared to 3371.025 Rs/MWhr on the same day previous year. [17-18].

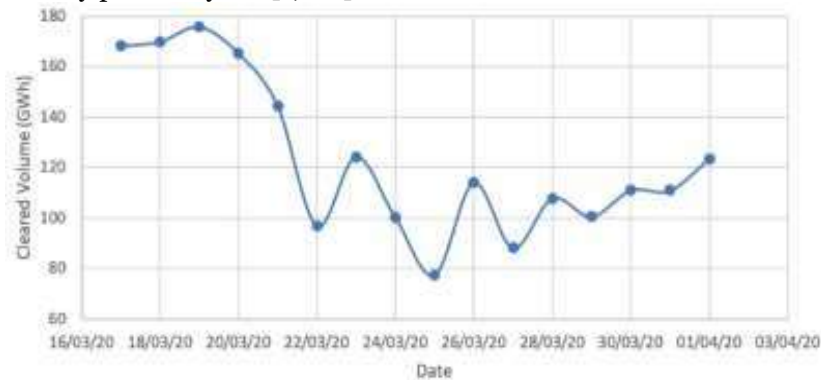


Fig. 5: IEX-Market Clearing Volume (MCV) [17]

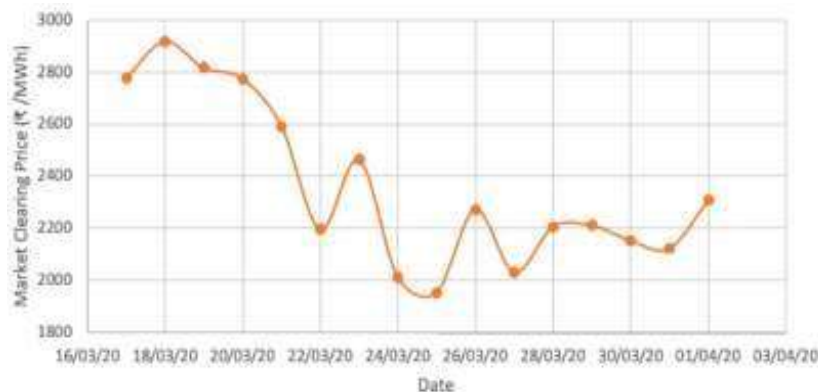


Fig. 6: IEX- Market Clearing Price (MCP) [17]

In April 2020, the electricity costing has been decreased to 2.40 rupees per unit on the Indian Energy Exchange (IEX), day ahead market. In February, the average unit price reached at 2.90 rupees, and the volume cleared was 147×10^3 million, but in next month (March), it was reduced, and the total cleared volume was 77×10^3 million, continuing to fluctuate. Furthermore, the negative impact of distribution networks' money that flows. Below table-1 shows daily electricity needs before and after the lockdown declaration [16, 19].

Table -1 Due to Covid-19: All India Electricity Requirement Outlines From 15/03/2020 - 03/05/2020 [16]

Date	All India Electricity Ingesting in MWh	All India Reduction in Demand w.r.t. 17 th March, 2020	Date	All India Electricity Ingesting in MWh	All India Reduction in Demand w.r.t. 17 th March, 2020
15 th March, 2020	3339×10^3	0.9311%	9 th April, 2020	2695×10^3	0.7515%
16 th March, 2020	3507×10^3	0.9779%	10 th April, 2020	2718×10^3	0.7579%
17 th March, 2020	3586×10^3	0	11 th April, 2020	2801×10^3	0.7810%
18 th March, 2020	3586×10^3	0	12 th April, 2020	2819×10^3	0.7861%
19 th March, 2020	3580×10^3	0.9983%	13 th April, 2020	2913×10^3	0.8123%
20 th March, 2020	3570×10^3	0.9955%	14 th April, 2020	2977×10^3	0.8301%
21 st March, 2020	3510×10^3	0.9788%	15 th April, 2020	2939×10^3	0.8195%
22 nd March, 2020	3035×10^3	0.8468%	16 th April, 2020	2968×10^3	0.8276%
23 rd March, 2020	3133×10^3	0.8736%	17 th April, 2020	2985×10^3	0.8324%
24 th March, 2020	2975×10^3	0.8296%	18 th April, 2020	2908×10^3	0.8109%
25 th March, 2020	2777×10^3	0.7744%	19 th April, 2020	2862×10^3	0.7981%
26 th March, 2020	2652×10^3	0.7395%	20 th April, 2020	2864×10^3	0.7986%
27 th March, 2020	2592×10^3	0.7228%	21 st April, 2020	2789×10^3	0.7777%

28 th March, 2020	2628×10 ³	0.7328%	22 nd April, 2020	2900×10 ³	0.8087%
29 th March, 2020	2639×10 ³	0.7359%	23 rd April, 2020	2919×10 ³	0.8189%
30 th March, 2020	2665×10 ³	0.7431%	24 th April, 2020	2917×10 ³	0.8134%
31 st March, 2020	2705×10 ³	0.7543%	25 th April, 2020	2896×10 ³	0.8075%
1 st April, 2020	2731×10 ³	0.7615%	26 th April, 2020	2741×10 ³	0.7643%
2 nd April, 2020	2787×10 ³	0.7771%	27 th April, 2020	2740×10 ³	0.7640%
3 rd April, 2020	2794×10 ³	0.7791%	28 th April, 2020	2834×10 ³	0.7902%
4 th April, 2020	2791×10 ³	0.7783%	29 th April, 2020	2861×10 ³	0.7978%
4 th April, 2020	2752×10 ³	0.7674%	30 th April, 2020	2955×10 ³	0.8240%
6 th April, 2020	2757×10 ³	0.7688%	1 st May, 2020	2928×10 ³	0.8165%
7 th April, 2020	2727×10 ³	0.7604%	2 nd May, 2020	2997×10 ³	0.8357%
8 th April, 2020	2716×10 ³	0.7573%	3 rd May, 2020	2961×10 ³	0.8257%

Lights Switch Off Incident in India on 5th of April, 2020

On third of April 2020 at the time of 21:10, the Honorable PM of India, Shree Narendra Modi, advised the citizens of India to turn off their lights on 5th April 2020 at 21:00 to 21:09, inhabitants were asked to light their candles, Diyas or mobile phone flashlights for night minutes. This event takes place for the honor of all medical staff such as doctors, nurses, hospital staff as well as law enforcement officers, and others who work actively or passively for all of us and safeguard us from a corona virus pandemic in order to save as many people's lives [16].

If the electrical network believes that only lights can be turned off, a considerable range of electrical energy demand (about 12×10³–14×10³) will fall throughout this 9-minute timeframe. Power System Operation Corporation Limited (POSOCO) submitted the report earlier, before the event happens [20]. Maintaining the power system within stable condition was a tough undertaking because the sudden reduction in demand might damage the power network's stability and generate system swings in voltage, which could be damaging to electrical devices and equipment's [21].

Indian Power Ministry, on the other hand, stated that the country power network is resilient and reliable, and that enough precautions and processes have been put in adequate to mitigate with the unexpected increment. As the Prime Minister recently stated that only residential lamps should be turned off, not the lights of needful and case of emergencies facilities such as healthcare, fire departments, city services, police stations, street lamps, and other utility services locations, or domestic appliances such as computer systems, tv sets, fans, fridges, and air conditioners. As a result of this lockdown, the existing electrical energy system is functioning at a reduced generation point and is secure, that is the most significant and hopeful aspect for grid operators' engineers [21].

The day of the occasion, the country's total electricity consumption continued to fall and it was measured at 31.089×10³ MW, while energy requirements went into decline starting 08:45 p.m. and a lesser consumption was reported at 85.799×10³ MW after twenty five minutes at 21:10. Immediately after the incident, power consumption increased by 95.795×10³ MW around 21:15, settling at roughly 114.400×10³ MW by 22:10, with specifics of the rise in electricity consumption shown in table 2 dated on 5th April, 2020 [16, 20].

Table-2 Nation Demand: Change in Power Consumption Region Wise and total during Nine Minutes Incident [20]

Time (Hrs.)	Demand of Various Region in MW						Overall decaying in Electricity Demand
	Northern	Western	Southern	Eastern	North-East	Nation Demand	
20:45	31.791×10 ³	32.474×10 ³	35.012×10 ³	15.815×10 ³	1.796×10 ³	116.887×10 ³	0
20:50	31.339×10 ³	32.113×10 ³	35.109×10 ³	15.452×10 ³	1.761×10 ³	115.775×10 ³	-1.113×10 ³
20:55	30.148×10 ³	31.462×10 ³	35.019×10 ³	14.928×10 ³	1.693×10 ³	113.251×10 ³	-3.637×10 ³
21:00	26.683×10 ³	28.091×10 ³	32.688×10 ³	12.752×10 ³	1.453×10 ³	101.667×10 ³	-15.220×10³
21:10	22.061×10 ³	24.010×10 ³	29.034×10 ³	96.79×10 ³	1.015×10 ³	85.799×10 ³	-31.089×10³
21:15	24.956×10 ³	26.992×10 ³	30.665×10 ³	11.879×10 ³	1.303×10 ³	95.795×10 ³	-21.092×10³
21:30	28.433×10 ³	30.777×10 ³	33.394×10 ³	14.689×10 ³	1.515×10 ³	108.808×10 ³	-8.080×10 ³
21:45	28.633×10 ³	32.403×10 ³	34.096×10 ³	15.140×10 ³	1.523×10 ³	111.796×10 ³	-5.092×10 ³
22:00	28.544×10 ³	32.944×10 ³	34.647×10 ³	15.231×10 ³	1.437×10 ³	112.803×10 ³	-4.084×10 ³

Over that same span of time as the shift in energy requirements, the frequency deviation from the maximum of 50.2560 Hz at 21:08 to the absolute lowest of 49.7070 Hz at 20:49 and ultimately settled around 50.260 Hz and 49.700 Hz, as shown in fig. 7. Dated on 5th April, 2020 [20, 22].

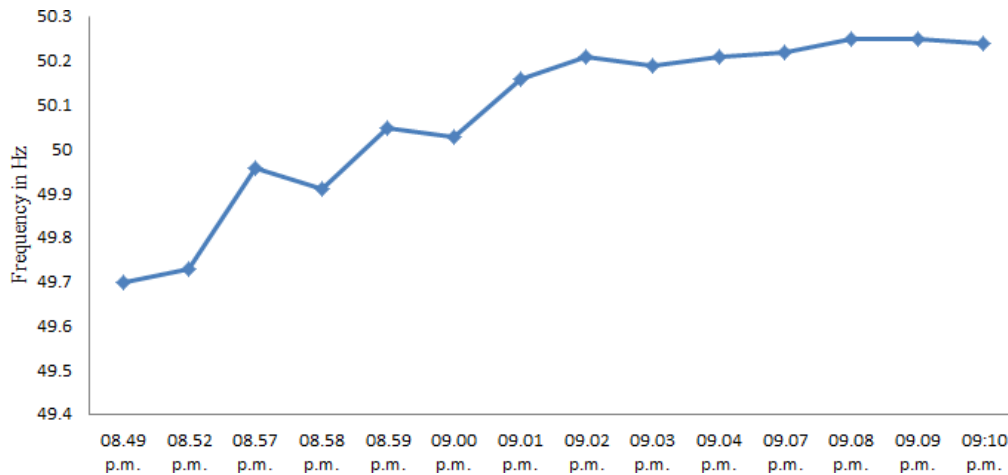


Fig. 7: Nation frequency deviation throughout nine-minute incident [20]

Measures occur to keep the system stable

According to a Power System Operation Corporation Limited (POSOCO) advice, the expected load instability is "unpredictable" and will necessitate the use of hydroelectric and gas electrical stations to help the power system and ensure stability of the grid [23]. When particularly in comparison to coal base plants, hydroelectric and gas power plants can start up quickly. So, the initial move was to tell all hydroelectric power operators across the country to maximize their generation at 20:45, and throughout the incident, this was lowered from 25.559 to 8.016 GW among 20:45 and 21:10. Over the same span of time, production from steam, gas, and renewable energy companies decreased by 6.992 GW, 1.951 GW, and 2.007 GW, correspondingly. Following the nine-minute occurrence, the hydroelectric plant was re-inclined, and generating from

8.016 GW to 19.012 GW began around 21:10 to 21:27 to see the increased demand. [20].

Likewise utilized one more efficient approach that plays a major role, such as shutting down lightly loaded and out of service power lines, keeping all bus reactors and line reactors in service to protect voltage fluctuations, setting HVDC points, charging SVC, STATCOM, and several other safety measures were taken prior to the event to keep voltage level in the bus close to asset value and line load conditions inside acceptable boundaries. The milestone was accomplished in a timely and effective manner, with no unexpected incidents, and electric grid variables were preserved inside acceptable ranges [20].

EFFECT ON NATION ECONOMY

According the International Monitoring Fund's (IMF's) World Economic Outlook (WEO) (Apr. 2020), the global financial system is accelerating downward at quite a rapid speed of -3percentage points in 2020, that is not equivalent to the catastrophic tragedies of 2008-2009. In a current crisis, people have forgotten about the negative financial consequences, however the fact is that taking necessary steps to reduce contamination and protect people is a massive expense in long-term human and economic health. In addition, international strong collaboration with one another is required to overcome the pandemic's effects, particularly providing financial assistance to weaker nations a dual concern such as people's health and finance [24].

India's economy is also hurting, with interest rates falling. Moody's Investors Service has slashed India's GDP forecast for 2020 from 5.3 percent to 2.5 percent, just 10 days only after government announced a nationwide shutdown to combat the COVID-19 illness. Prime Minister proclamation of a 21-days shutdown would result in a sharp drop in individual income and a reduction in household consumption [25].

In 2019-2020, India's real Gross Domestic Product (GDP) is predicted to grow significantly of 5.0 percent (second Preliminary Forecasts), compared to 6.1 percent (first Updated Forecasts) in 2018-2019. However, with the start of the COVID-19 pandemic, its severity, feast, and duration will now determine if a nation is smart enough to understand its potential and predicted GDP growth. The worsening effects of the corona virus have slowed the rate of economic progress. Goods are shipped, with positive year-over-year progress in Feb'20, although negative year-over-year growth of - 34.6 percent the following month. Likewise, goods imports had positive rate of 2.5 percent year over year in Feb 2020, but negative growth of - 28.7% the later that month, continuing the downward trend in the economy rate in April 2020. [26].

Ultimately, according to the WEO Estimates, highly developed markets are expected to contract 2% in 2020, down from 1.7 percent in 2019, whereas developing markets are projected to decline to 1.9 percent, down from 4.2 percent in India. In the section Emerging Markets and Developing Economies, fig. 8 displays results on three main nations' real GDP during the last 3 years. [26-28].

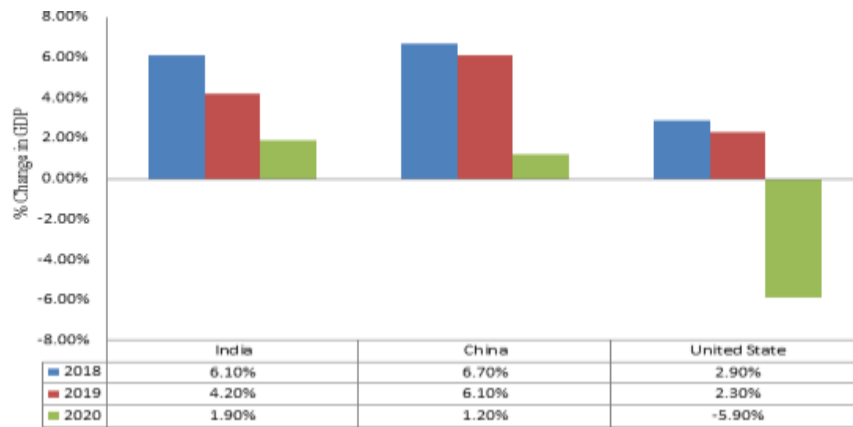


Fig.8: In percent, real GDP growth over the last 3-years [27-28]

CONCLUSION

The country is currently in the early stages of debating the effects of the COVID-19 on the National electricity system and economy. These dreadful times of shutdown and declarations of Work from Home (WFH) and Social Distancing (SD) are causing energy requirement to plummet faster than ever. POSOCO controls the entire scenario extremely well to participation among all RLDC and the assistance of other electric grid institutions such as Genesco, Transco's, and Discos businesses during these critical moments again for entire electricity sector. The day of the light turn off incident, POSOCO and the Power Ministry also managed the Indian electricity grid and successfully finished a demanding task while maintaining stable operation. COVID-19 has a significant effect on the Economy of India, as it has in the past. Just on plus side, due to the effect of the shutdown, the Indian ecosystem greatly enhances and enhances the Air Quality Index (AQI) in some of the most congested city, as well as cleans the river water. Finally, because to the COVID-19 epidemic, the entire world is in a dreadful condition, along with the United States, the United Kingdom, China, Italy, Spain, among others. In nutshell, clarify that the goal of all current pronouncements and efforts made and/or being undertaken by the national government is always to safeguard humanity from deadly corona virus.

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