

Environmental Rejuvenation: A silver lining amidst the disastrous situation of COVID-19

Indranil Chakraborty¹, Arnab Sinha², Chandan Kumar Pal², Prasenjit Maity²

¹ Department of Chemistry, Kharagpur College, Kharagpur 721305, Paschim Medinipur, West Bengal, India.

² Department of Chemistry, Sabang Sajjanikanta Mahavidyalaya, Lutunia, Paschim Midnapore, Pin-721166, West Bengal, India.

Abstract

COVID-19, caused by the novel coronavirus, was first discovered in Wuhan city, China. It has now become a serious global public health concern. In brief, the virus has affected people irrespective of their social and economic status. The pandemic has caused a drop in global economic activity and although this is a major cause of concern, the ramping down of human activity appears to have a positive impact on the environment. The lock down situation has led to almost complete seizure of human activities in different corners of the world, and consequently reduced the overall pollution level in the atmosphere. Clear blue sky, clean beaches, clean rivers and ocean indicated the overall rejuvenation of the global environment. The positive impacts of COVID-19 outbreak in 2020 on global environment have been discussed in the present paper.

Keywords: COVID-19; Environment; Rejuvenation, Pollution; Society

1. Introduction

A novel coronavirus disease, namely COVID-19, was first detected in December 2019 in Wuhan city, China [1]. Spread of the disease in the whole planet has put the entire human population at risk. The World Health Organization (WHO) has declared it as a global public health emergency due to its very fast and widespread transmissibility. Its typical clinical symptoms include fever, dry cough, myalgia, and pneumonia, and may cause progressive respiratory failure due to alveolar damage and death. It has spread globally.

Pollution of the environment is one of the most serious ecological crises in this 21st century [2]. This pollution arises mainly from different man made activities like domestic, agricultural, industrial and life style related activities. These types of activities increase the pollutants like NO_x, SO_x, peroxyacyl nitrate (PAN), several greenhouse gases, toxic metals (Pb, As, Al, Cd etc), chlorofluorochemicals, ethylenedibromide, ethylene oxide, nitrosoamines, polychlorinated biphenyls (PCBs), vinyl chloride etc in atmosphere, hydrosphere and soil.

COVID-19 outbreak is causing global trade to be disrupted, flights are being canceled, and many people are now working on staying at home. Life has changed beyond all respect. But it is also having some interesting positive effects on the environment. The environment is getting benefitted in some interesting and unexpected ways over the last few months. The power plants and industrial facilities halted their production. Also, the use of vehicles decreased considerably, busy industrial and commercial cities have been deserted. All these led to a dramatic reduction in the concentration of Nitrogen Dioxide (NO₂), greenhouse gas and all type toxic chemicals in the environment. It has also been anticipated that, greenhouse gas emissions could drop to proportions never before seen since World

War II. Our studies showed that significant improvement in air quality, clean beaches, clean river water and environmental noise reduction has led to the revival of nature.

2. Reduced air pollution

Air quality of a locality is an indispensable parameter determining the well-being of the inhabitants' health. Less than six months ago, many industrial cities of different countries were gasping for breath as the air quality had reached unbearable levels in those areas. Industrial smoke, vehicular emissions, burning of trash and crop residues, and construction and road dust are the major contributors towards such air pollution. The major air pollutants are PAN, SO₃, NO₂, CO, CO₂ etc. It is estimated that 8% of total deaths in the world every year occur due to air pollution-related diseases.

Governments of different countries implemented strict country wise lockdowns in order to contain the transmission and death toll of COVID-19. This unprecedented mandate decreased activities at factories, and severely reduced car, bus, truck, and airplane traffic. NO₂ produced by car engines, power plants, and other industrial processes causes or aggravate many serious health problems, especially respiratory illnesses like asthma, COPD, bronchitis etc. Due to lock down, several cities throughout the world have been deserted. In northeastern part of USA NO₂ emissions is reduced up to 30% (Figure 1a) [3]. One of the largest drops in the gas has been found in Wuhan city of China, resulting in a 10-30% drop in emissions over the period (Figure 1b and c) [3, 4]. Carbon monoxide emissions have also dropped by somewhere in the region of 50%. Satellite images show that NO₂ emissions in Indian atmosphere have 40-50% decreased due to shutdown (Figure 1d) [4]. Other air pollutants have also been found to decrease significantly. Vehicular emissions and dust from construction sites has been reduced helping

people to breathe in cleaner air. One of the major impacts of the COVID-19 outbreak on environment therefore, has been a significant drop in air pollution in many parts of the globe (Table 1, Figure 2a-d) [3, 4].

3. Clean river water

Inorganic (Pb, As, Cd, Hg etc.) and organic (chlorinated aromatic hydrocarbons, phenols, dyes, solvents, fibres, acids etc) toxic agents present in effluents from breweries, dying textiles, paper and pulp mills, steel industries, mining operations etc are largely responsible for water pollution. The chemical fertilizers and the pesticides used in agricultural disease control also contribute a lot towards water pollution. They can cause injury leading to death of living organisms. The COVID-19 pandemic has a great impact on our planet. Lockdown due to the COVID-19 outbreak, seems to have a positive impact on rivers in the world. With the industrial units shut, agricultural works seized, river water has become cleaner than ever. According to the report of Indian Central Pollution Control Board, the river water that during pre-Lock-down period was considered unhealthy for bathing until it drains properly after a few weeks of lockdown period, has become suitable for bathing and propagation of wildlife and fisheries. Due to reduced human activity and shutting down of industrial units, pollutants are not flowing in the rivers, resulting in the fact that the water pollution levels in the Ganga River in India, have dropped by 40 to 50 percent in the last 2 months. After Ganga River, the water quality of Yamuna River, in India has also considerably improved (Figure 3). Crystal clear water in the canals of Venice, Italy was seen due to dramatic falls in pollution levels. This type of improvement of water quality of rivers during the lockdown period occurred all over the world.

4. Clean Sea and Ocean water

Oceans are used for navigation, fisheries, aquaculture, mining, naval and military exercises as well as for the discharge and removal of variety of wastes. Apart from the yearly contribution to global economy worth \$2.5 trillion, an ocean feed more than 3 billion people, is home to more than half the world's species, satisfy 50% of the Earth's oxygen demand and absorb nearly one fourth of global emissions of carbon dioxide. From ancient times Oceans were considered vast and inexhaustible, but this treasure in peril, is being exploited in ways that were believed to be unconceivable even a few decades ago. Uncontrolled fishing, excessive plastic pollution, ocean warming, acidification, spillage of different types of effluents are alarmingly declining the ability of oceans to reinforce well-being of humans and life on the Earth. For the sake of survival of lives the world cannot afford to endure this existing trajectory. Human beings all over the world in their effort to stop exploiting the ocean have taken different measures from time to time. But in the present-day containment period, most of the people are confined inside their home resulting minimum plastic disposal to the oceans. Fishing in the seas and oceans has decreased considerably, movements of ships have mostly ceased, non-functioning of most of the industries have resulted nearly zero industrial waste emission. These unintended happenings have been favorably improving the quality of water in the Oceans (Figure 4). But a new pathway is desirable, one where profitability and sustainability operate together to the benefit and health of people and the seas and Oceans.

5. Reduction of environmental noise level

Noise is considered as a potential menace to health and communication. Environmental noise refers to the undesirable sound

generated out of different activities such as industrial works, transports, loud-speaker, domestic and construction work, crowded markets, atomic explosions etc. Regular and prolonged exposure to noise pollution might lead to several adverse physical and mental health hazards, such as sleep disorder, annoyance, cardiovascular effects, brain problems, gynecological complications, hearing impairment etc. Due to the lockdown, people are staying at home, industries are shut, mass gatherings have been restricted, flights have been detained, and public transportation has decreased significantly (Table 2). A combined effect of all these things has decreased global noise pollution by 50-70% during the lockdown. Noise level from shipping traffic disturbing sea life, has significantly decreased due to putting restriction on movement of ships (excepting those carrying oil and other essential goods). Birds have reclaimed most of their lost terrains during this prolonged lockdown period. In most of the cities the sight and sounds of birds have replaced vehicular horns and other annoying noise.

6. Clean beaches

In many countries, beaches are some of the most important natural capital assets available, providing services to local residents, domestic tourists and international tourists. Marine garbage (solid waste materials) and waste (discarded man-made objects) together with micro-plastics spread everywhere in the oceans and beaches, damagingly affect the economy, wildlife and human health all over the world. Indirect consequences of global climate change and pollution worsen this situation. Beach cleaning operations are the main tool for ensuring litter free beaches, and these are often mandatory and costly.

In order to restrict COVID-19 transmission many countries have shut down schools, workplaces, industries, transport, airports, seaports, beaches, restaurants and forced people to stay home (Table 1). Due to this situation, local residents, domestic tourists and international tourists are not visiting the beaches. As a result, a remarkable change in the appearance of many beaches has taken place in the world (Figure 5). It is just one of the possibly beneficial effects of the COVID-19 pandemic on the environment.

7. Reduced thermal pollution

Thermal pollution is a real and persistent problem in our modern society. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers. Other causes of thermal pollution are domestic sewage, soil erosion and deforestation. The effects of thermal pollution are diverse, but in short, thermal pollution damages water ecosystems and reduces animal populations [5]. But in current situation across the world, the factories have shut down. So thermal pollution has somewhat decreased. The largest power station in India, the Vindhyachal Super Thermal Power Station, shows about 15% reduction in emission due to this COVID-19 lock down. With the modeled scenario, prepared in an early impact assessment of COVID-19 on European power and carbon markets, the European power sector emissions are expected to decrease by about 87.6 million tons (12.7%) due to the pandemic related effects (Figure 6). Similar kind of situation is prevailing in almost all the COVID stricken countries throughout the world, resulting in a huge drop of thermal pollution level.

8. Reduced greenhouse gases

Increasing levels of greenhouse gases is largely responsible in changing the climate of the planet. Heat trapping greenhouse gases in the atmosphere are at highest levels. According to the report of

Table 1: NO₂ emissions data of different regions of the world

Place	Time	Reduction (%)	Satellite	Source
India	April 2019 to April 2020	40-50	Sentinel-5P	ESA, 2020
China	1 st January 2019 to 25 February 2020	20-30	Sentinel-5P	ESA, 2020
Wuhan	1 st January 2020 to 25 February 2020	30	Aura	NASA, 2020
USA	Mar 2015-19 to Mar 2020	25-30	Aura	NASA, 2020
Europe	1 st March 2019 to 13 April 2020	45-50	Sentinel-5P	ESA, 2020
France	March 2019 to March 2020	20-30	Sentinel-5P	ESA, 2020
Italy	March 2019 to 25 March 2020	20-30	Sentinel-5P	ESA, 2020
Spain	March 2019 to 25 March 2020	20-30	Sentinel-5P	ESA, 2020

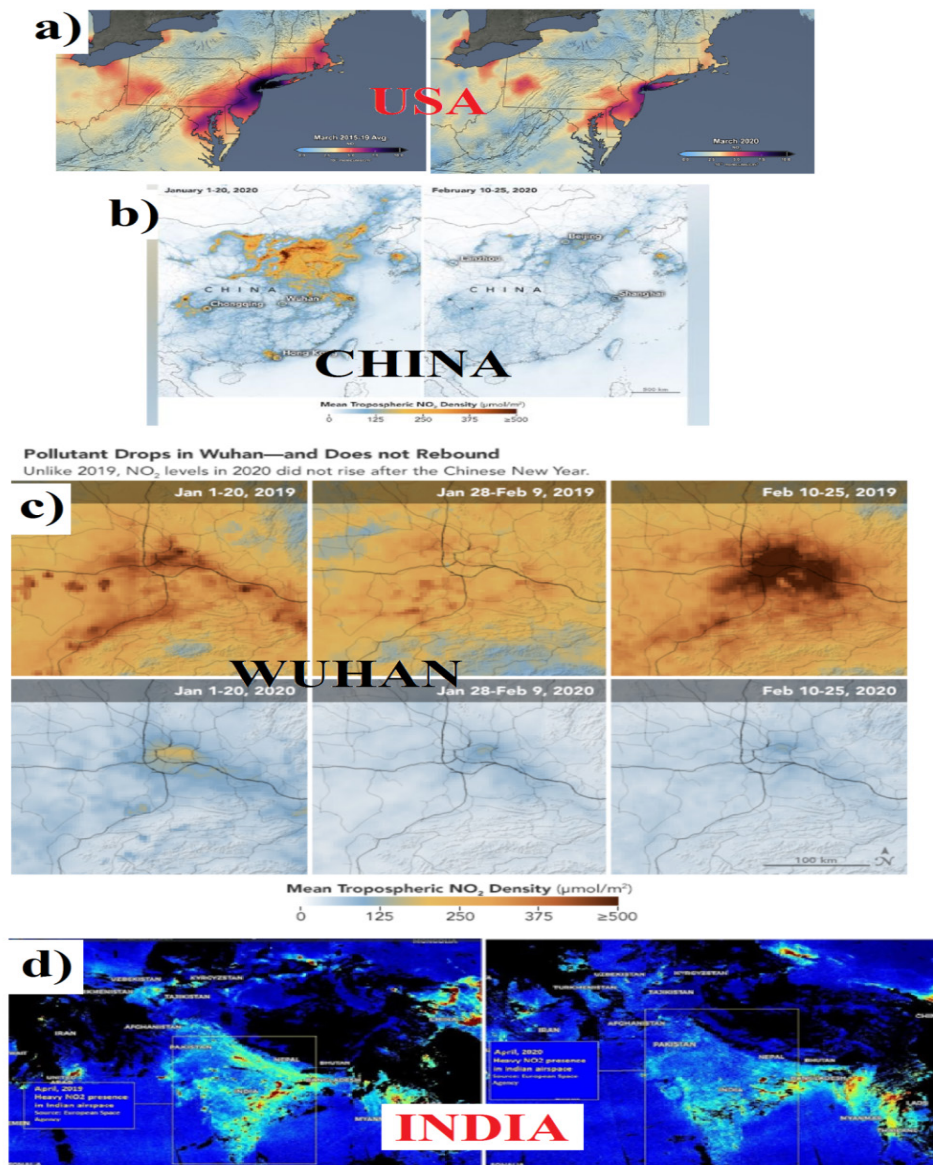


Fig. 1. (a) NO₂ emissions in northeastern USA before (2015-2019) and after (2020) lockdown, (Source: NASA, 2020). (b) NO₂ emissions in China before and after lockdown, (Source: ESA, 2020) (c) NO₂ emissions in Wuhan during 2019 and 2020, (Source: NASA, 2020). (d) NO₂ emissions in India before and after lockdown. (Source: ESA, 2020).

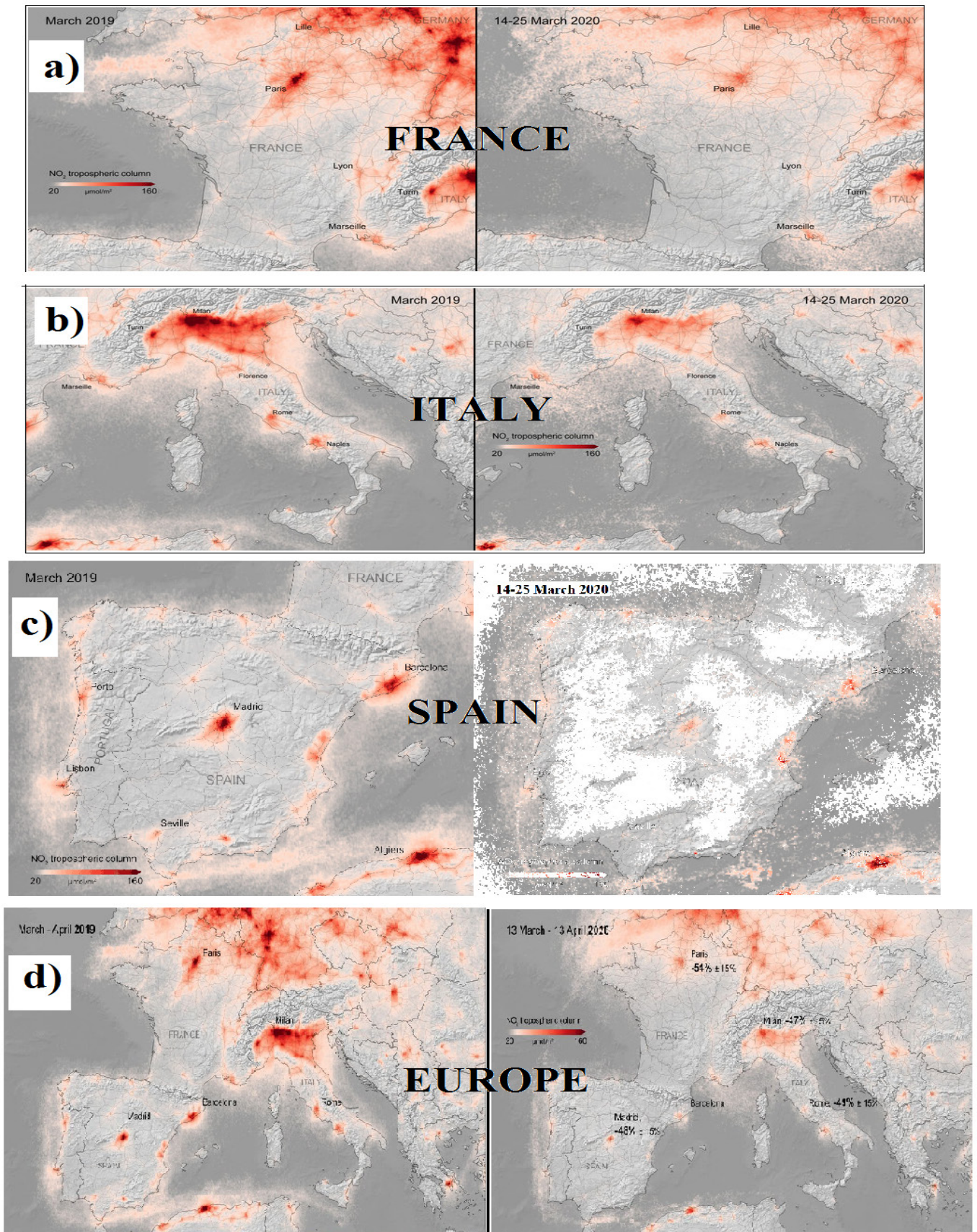


Fig. 2. (a) NO₂ emissions in France before and after lockdown, (Source: ESA, 2020); (b) NO₂ emissions in Italy before and after lockdown, (Source: ESA, 2020); (c) NO₂ emissions in Spain before and after lockdown, (Source: ESA, 2020); (d) NO₂ emissions in Europe before and after lockdown, (Source: ESA, 2020).



Fig. 3. After and before lockdown Yamuna River in India (Source: <https://www.insider.com/before-after-photos-show-less-air-pollution-during-pandemic-lockdown>).



Fig. 4. Coronavirus lockdown cleans up Arabian Sea in Mumbai, India (Source: <https://timesofindia.indiatimes.com/travel/destinations/videos-of-dolphin-playing-in-mumbai-sea-amid-covid-19-lockdown-are-going-viral/as74787988.cms>).

Table 2: Mobility index report based on Google tracking (<https://www.google.com/covid19/mobility/>, date: 11.04.2020).

Location	Transport (%)	Grocery and pharmacy (%)	Retail and recreation (%)	Work place (%)	Parks (%)	Residential (%)
India	-69	-55	-80	-64	-52	+30
USA	-49	-7	-45	-38	-16	+14
Spain	-84	-44	-92	-63	-85	+26
Italy	-78	-42	-86	-62	-83	+26
France	-79	-39	-86	-55	-74	+23
Germany	-48	+0	-56	-29	+35	+10
New Zealand	-82	-33	-88	-58	-75	+24
Iraq	-58	-37	-60	-38	-40	+17



Fig. 5. Before and after photos of Rio de Janeiro's bustling beaches during the coronavirus pandemic.

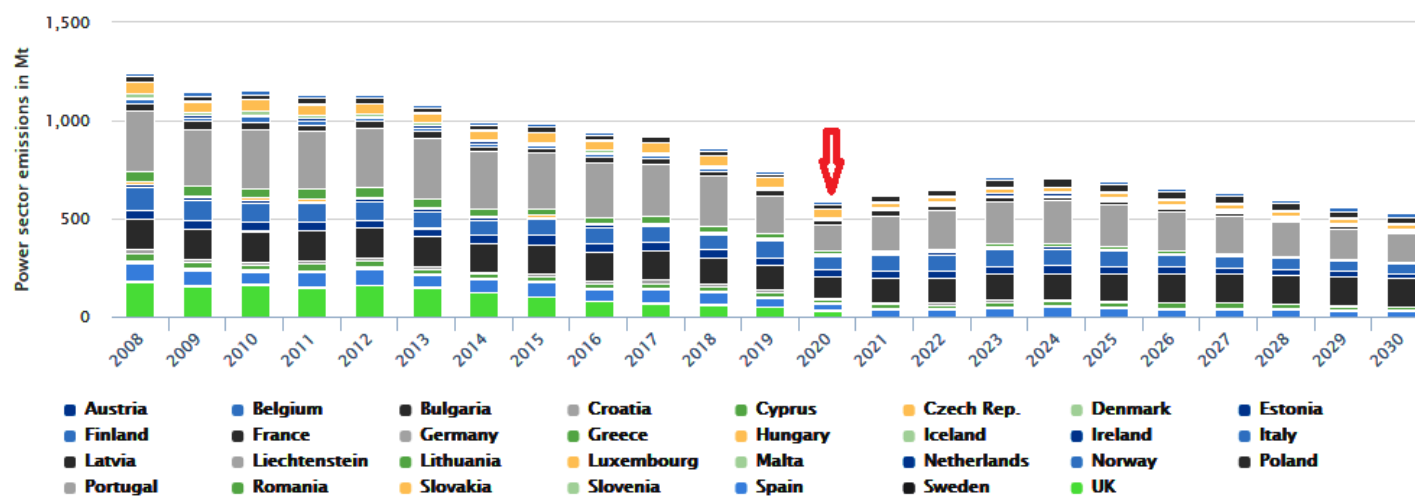


Fig. 6. Power sector emissions by different country (in million tons)

(<https://www.icis.com/explore/resources/news/2020/03/27/10487371/european-power-and-carbon-markets-affected-by-covid-19-an-early-impact-assessment>)

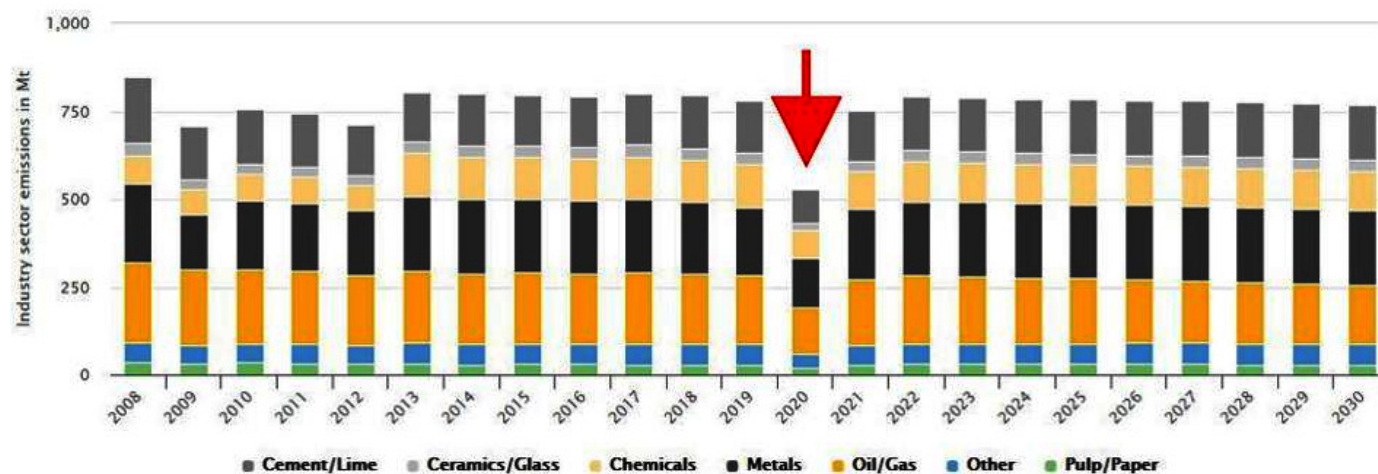


Fig. 7. EU ETS industry emissions by sector (in million tons)

(<https://www.icis.com/explore/resources/news/2020/03/27/10487371/european-power-and-carbon-markets-affected-by-covid-19-an-early-impact-assessment>).

World Meteorological Organization, last year, two of the most important human made gases driving global warming, were 150% to 250% higher compared to 'pre-industrial times'. Greenhouse gas emissions have dropped by about 6% due to COVID-19 related lockdown in USA. CO₂ emissions in China had also suffered a drop with a reduction of 15 % to 40% in output across key industrial sectors. In an early impact assessment of COVID-19 on European power and carbon markets, a model has been fabricated considering the large drop in electricity demands, assumed industry production cuts and continued travel restrictions. The model anticipated a substantial drop (-24.4%) in overall European Union ETS emissions of 388.8 million tons for 2020 (1,177.4 million tons) compared to pre-COVID environment (1566.2 million tons) (Figure 7). The reduction in greenhouse gases, such as methane, sulphur dioxide, nitrogen dioxide, carbon monoxide, ozone, formaldehyde, and aerosols, was measured using TROPOMI instruments through ESA satellite Sentinel-5P (Table 1).

9. Improvement of the Earth's ozone layer

Ozone (O₃) gas, an important species present in stratosphere acts as a protective shield for life on the earth. It absorbs harmful solar radiation such as ultraviolet (UV) rays, which may cause DNA mutation, develop skin cancer in humans, damage crops & marine ecosystems. For the last few decades altitude and thickness of this protective layer have been regularly and gradually decreasing due to accumulation of Hydrochlorofluorocarbons (HCFCs), methyl bromide, Halon-1211, Halon-1301, chlorofluorocarbons (CFCs) released from refrigerators, air conditioning machines, plastic foam manufacturing and other industries. But due to the lockdown, almost all industries are shut down mostly all over the world. As a result of this, concentrations of ozone depleting substances have considerably decreased in the upper atmosphere. Consequently, the ozone layer altitude and thickness have dramatically improved.

10. Conclusion

Apart from its catastrophic health consequences on the global population, COVID-19 is anticipated to generate terrible social, economic and political crises. Alarming rate of transmissibility and increasing death toll has terrorized the entire human civilization. Many unforeseen effects such as, suppressed economic growth, increased unemployment, unthinkable crisis of food along with many others are awaiting the post COVID world. But amid this unprecedented calamitous cloud of distress and difficulties, revival of global environment is a silver lining. During the last few decades all the human efforts in restoring the nature could hardly bring about any effective change. But during the first quarter of 2020, the consequences of COVID-19 have triggered fairly fruitful recovery of the global environment. Pollution levels in the pandemic stricken countries are decreasing, and the nature is reclaiming itself. Reduced emission of green-house gases and other toxic fumes and suspended particles, calm and quiet oceans and sea beaches, transparent water flowing in the rivers, clear view of blue sky indicates the rejuvenation of the environment. Decrease in pollution of all kind during this short period of time is not permanent at all. Ecologists are afraid that, once the crisis is over, the environment will once again start depreciating from its present state of recovery. This problem could perhaps be reduced if we can adopt certain measures like complete lock downs (that we have been compelled to adopt during the present-day crisis period of the pandemic) for one or two days in every six months, restricting motor vehicles once/twice a month, reduction of plastic use etc. But it is the good will of the governments and the individuals all over the world that can reduce environmental pollution on long

term basis. Certain policies need to be adopted in making the environment greener and healthier. It is just a matter of time for the human civilization to win the battle against COVID-19, but it is a challenge for the human civilization to conserve the much cleaner environment.

Acknowledgements

The authors are thankful to Prof. Syed Sirajul Islam, former Professor, Department of Chemistry and Chemical Technology, Vidyasagar University, West Bengal, India.

References

1. C. Huang, Y. Wang, X. Li, L. Ren, J. Zhao, Y. Hu, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*, 395:497–506. (2020).
2. L. Chen, J. Zhang, & Y. You. Air pollution, environmental perceptions, and citizen satisfaction: A mediation analysis. *Environmental Research* 184,109287 (2020).
3. NASA, 2020. <https://earthobservatory.nasa.gov/images>.
4. ESA, 2020. https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel-5P.
5. C. E. Raptis, J. M. Boucher, & S. Pfister. Assessing the environmental impacts of freshwater thermal pollution from global power generation in LCA. *Science of the Total Environment* 580, 1014–1026 (2017).