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# The COVID-19 crisis and its consequences for global warming and climate change

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## 1 Introduction

In late 2019, Chinese doctors and health researchers announced that they were facing a new virus, the dimensions of which were mysteries to them. The first cases of the virus were recognized on November 17th and people became infected with the virus every day. By December 17, the number of people infected with the virus reached 27. Five days later, 60 people fell ill. On December 27, Zhang Jixian, a doctor from Hubei Provincial Hospital of Integrated Chinese and Western Medicine, announced that the cause of these illnesses was a new coronavirus.<sup>1</sup> Coronaviruses are a family of viruses that, according to research, can cause diseases ranging from as mild as a common cold to more dangerous conditions such as mild Middle East Respiratory Syndrome (MERS) or even the deadlier severe acute respiratory syndrome (SARS).<sup>2</sup> In 2019 and by early 2020, the pandemic rapidly spread to people in all world regions.<sup>3</sup>

Governments have imposed shelter-in-place orders to counteract the spread of the disease. Most industries stopped operating, and movement, transportation systems, and traffic declined. The demand for petroleum and several other fossil fuels has decreased. Economic challenges have emerged in most countries. Global lockdowns have drastically changed the energy demand pattern, leading to a recession.<sup>4</sup>

According to the Asian Development Bank, the coronavirus pandemic could cost the global economy as much as \$8.8 trillion (£7 trillion) in losses or 9.7% of global gross domestic product.<sup>5</sup> COVID-19 may have had positive, indirect effects on our environment.<sup>6</sup> Global warming is driven by the concentrations of CO<sub>2</sub> and other greenhouse gases in the atmosphere, which is a consequence of anthropogenic emissions of these chemicals. Human activity has accelerated global warming and has led to changing climates around the world. The reduction of air pollution is a good thing, and reducing greenhouse gas emissions can help mitigate warming and slow climate change. Although the epidemic has helped to reduce greenhouse gas emissions, for the time being, the consequent death of hundreds of thousands of people was a steep and unacceptable cost for achieving the desired goal. Climate researchers and activists see no success in reducing environmental impacts at the expense of human lives and health; it is an anathema to their destinations. The threat of this disease may be only temporary, but global warming, climate change, and extreme weather events will challenge societies for years to come. Human health cannot be separated from the health of global natural systems and the environment.<sup>7</sup> Although the consequences of the coronavirus crisis are enormous, the climate change crisis cannot be ignored.<sup>8</sup> There have been many studies on the impact of the coronavirus crisis on the environment, global warming, and climate change. Helm<sup>9</sup> studied the environmental effects of the coronavirus crisis, and Lidskog et al.<sup>10</sup> showed the Corona as an opportunity to re-implement climate change policies, and Ching and Kajino<sup>11</sup> led the battle against COVID-19 to bring short-lived, long-lasting, and positive and negative impacts on the warming climate. Fishedick and Schneidewind<sup>12</sup> simultaneously examined the coronavirus crisis and climate protection.

If governments have been able to undertake measures to control COVID-19 transmission, they are undoubtedly capable of changing the sources of energy production and energy consumption habits.<sup>13</sup> For decades, scientists have been calling for severe commitments to activities that will reduce the rate of global warming. As oil prices fall, governments have opportunities to implement carbon-emission reduction policies, make direct investments in renewable energy production, and promote a transition to cleaner energy. Coronavirus pandemic's impact on the oil industry have reduced greenhouse gases to some extent. However, reducing employment by destroying industries has never been the preferred approach for reducing CO<sub>2</sub> emissions and global warming. The most cost-effective ways to deal with carbon emissions are to maintain vegetation and soil biological resources, use conservation, improved efficiencies, and renewable energy, and reduce energy demand. Global warming has caused a great deal of concern worldwide, and clean energy must be used to solve this problem.<sup>14</sup> If investments in the low-carbon economy increased after the corona crisis, economic progress could be put back on track.<sup>8</sup> According to previous studies, the cost of counter-measures will be lower if the principle of prevention against climate change is implemented, such as the prevention of coronavirus.<sup>15</sup>

The purpose of this study is to review the evidence and effects of the COVID-19 crisis on air pollution, global warming, climate change, and a transition to a low-carbon economy. Numerous reports, analytical notes, and news sites on global warming, climate change, and Coronavirus are reviewed.

## 2 Results and discussion

### 2.1 Reduction of air pollution and greenhouse gases

The global response to the COVID-19 pandemic has led to a sudden reduction in greenhouse gas (GHG) emissions and air pollutants<sup>16</sup>, the most vexing global environmental issue faced by the planet along with the global build-up of GHGs. GHGs warm the surface and the atmosphere with significant implications.<sup>17</sup>

Air pollution is usually the emission of pollutants from internal combustion engines, factories, and other natural and human activities. According to the WHO, air pollution kills 7 million people annually worldwide. A typical engine combustion reaction (fuel + air (nitrogen (N<sub>2</sub>) + oxygen (O<sub>2</sub>))) may emit the following gases: carbon monoxide (CO), ozone (O<sub>3</sub>), nitrogen oxides (NO<sub>x</sub>) (including nitrogen dioxide (NO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O) and nitric oxide (NO)), and volatile organic compounds, which may be toxic to human respiratory systems or serve as precursors to toxins (such as O<sub>3</sub>). Carbon dioxide (CO<sub>2</sub>), emitted from engines and all other combustion processes, and N<sub>2</sub>O and methane (CH<sub>4</sub>) are gaseous pollutants that contribute to global warming. Also emitted from engines are respirable particulate matter.<sup>18</sup> Sulfur dioxide (SO<sub>2</sub>), another widespread air pollution problem that, along with NO<sub>2</sub>, contributes to acid rain, is usually released from processes that require combustion of coal combustion.

The life of every child born today is affected by changes in contemporary climate induced by global warming. The climate crisis is not a virus, but manifests itself in other extreme atmospheric phenomena such as floods and droughts, and intensifies and complicates other issues, such as air pollution. A consequence of the coronavirus pandemic was a sharp drop in atmospheric emissions due to the cessation of industrial activities and reduced use of transportation modes (automobiles, trucks, buses, airplanes, ships, and trains). The data indicate that the coronavirus lockdown may have saved the lives of 4000 children under the age of 5 and 73,000 adults over 70 in China alone by reducing pollution.<sup>19</sup>

In Iran, following the COVID-19 outbreak, social distancing was implemented and people were informed not to go on Nowruz (Iranian New Year) trips or to visit the National Headquarters of the Coronavirus Administration. The governors-general were told that the facilities available in past years should not be used this year. Many tourists, leisure, and religious centers have been closed. Schools and universities were closed. The government's guidance was well received by the public. Train travel was reduced by 94%, bus travel by 75%, and air travel by 70%. About 80% of Nowruz's trips were forgone in the first week of the New Year.

The Air quality index in Iran decreased during sequestration (March 5 to April 3, 2020), as indicated by data provided by the Iranian National Air Quality Monitoring System.<sup>20</sup> A similar observation was reported by Asna-ashary et al.<sup>21</sup> Data describing the concentrations of several air pollutants in the air quality index archive of INAQMS<sup>20</sup> from February 2 to April 8, 2020, were analyzed (Fig.1), revealing that the trend curve changed whenever social rules and quarantine requirements were not met. Limiting the outbreak of Corona in Canada through lockdown led to a reduction in NO<sub>2</sub> emissions in southern Ontario and an average reduction of 40% in Toronto.<sup>22</sup>

One of the highest rates of decline in pollutant concentration was observed in Wuhan, China, which began a city-wide quarantine in late January 2020. Nitrogen dioxide (NO<sub>2</sub>) concentrations dropped significantly in China as

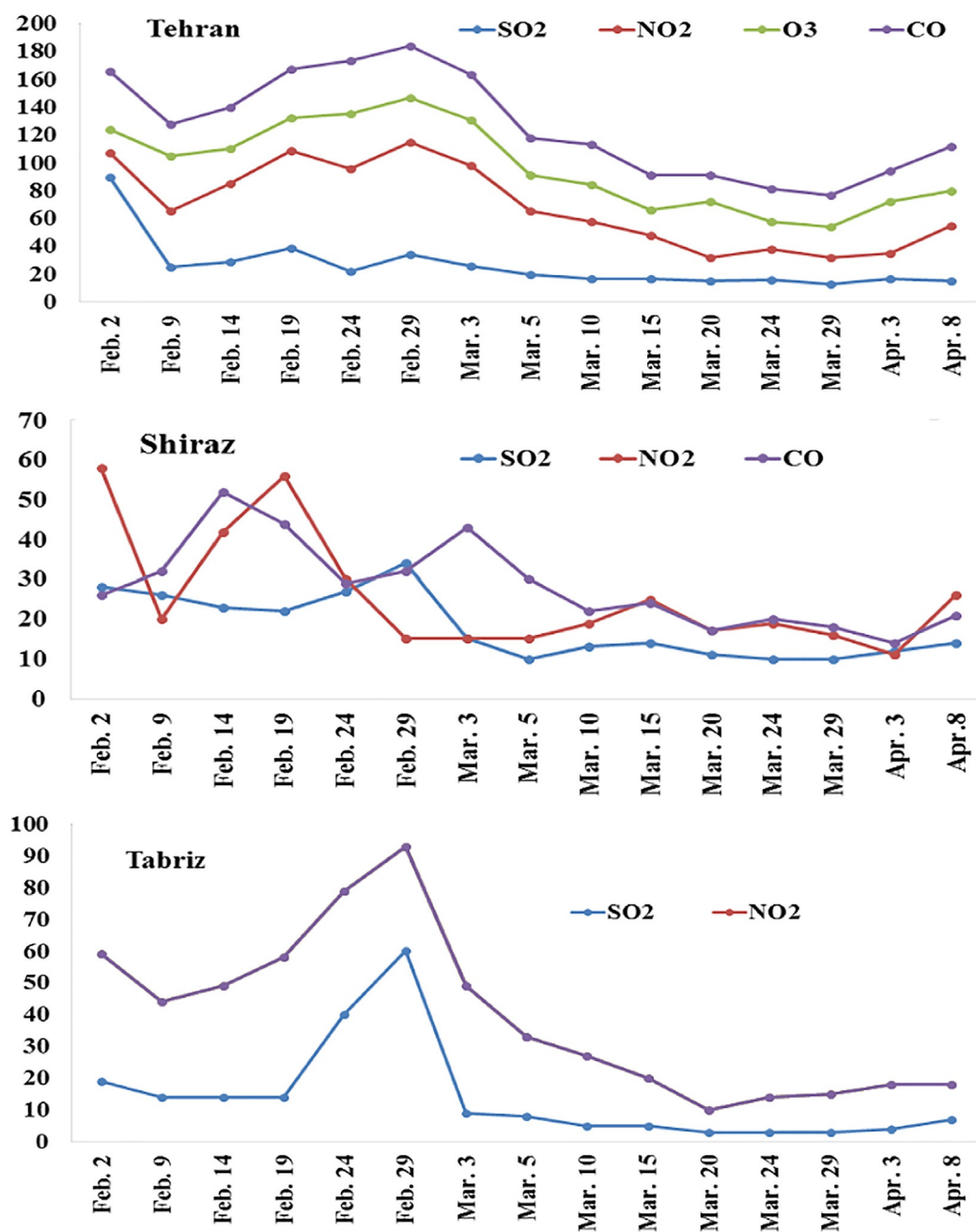


FIG. 1 Air pollutants (NO<sub>2</sub>, CO: (ppm), O<sub>3</sub>, SO<sub>2</sub>: (ppb)) in three Iranian cities during the period of February 2 to April 8, 2020. Social distancing was from March 5 to 3 April 2020. Data source: INAQMS (Iran National Air Quality Monitoring System). 2020, <http://aqms.doe.ir/>.

quarantine continued (10–February 25, 2020). The decline began in Wuhan and spread to other cities with active responses to squelch the spread of the virus.<sup>23</sup>

In a study of 44 cities in northern China, mobility was reduced by 69.85% after the government banned travel, air quality index and five air pollutants (i.e., SO<sub>2</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, NO<sub>2</sub>, and CO) decreased.<sup>24</sup> According to the Copernicus Atmosphere Monitoring Service, air pollution concentrations in China fell by approximately 20% to 30% in February 2020.<sup>25</sup> A study in eastern China based on National Aeronautics and Space Administration (NASA) data found that NO<sub>2</sub> decreased during lock-down (February 1 to February 14, 2020). At the start of 2020 were between 1/3 and 1/6 of the normal pollution levels in Wuhan, Shanghai, Beijing, and other cities.<sup>26</sup> Closures of highways, factories, and commercial centers in many countries (China, Italy, Great Britain, Germany, and others) have generated temporary 40%

reductions in CO<sub>2</sub> and NO<sub>2</sub>.<sup>27</sup> Since Italy shut down on March 9, NO<sub>2</sub> levels in Milan and other northern regions have dropped by approximately 40%.<sup>28</sup> In 2020, NO<sub>2</sub> concentrations were significantly lower (from 10% to 30% lower) than in the previous year.<sup>23</sup> Sentinel-5 satellite data show how air quality improved in Wuhan, China, compared to a similar period in 2019. Recent data released by NASA and European Space Agency (ESA) indicate that pollution in some of the epicenters of COVID-19, such as Wuhan, Italy, Spain, and the USA, has been reduced by up to 30%.<sup>29</sup> Compared to the same period in 2017–2019, the daily O<sub>3</sub> mean concentrations increased at urban stations by 24% in Nice, 14% in Rome, 27% in Turin, and 2.4% in Valencia during the lockdown in 2020.<sup>30</sup>

Mahato et al.<sup>31</sup> indicated that NO<sub>2</sub>, CO, PM<sub>10</sub>, and PM<sub>2.5</sub>, were lower than pre-lockdown levels in Delhi, India. Compared to the five-year monthly mean concentrations, the three pollutant concentrations decreased in the urban areas of the state of São Paulo, Brazil. NO was reduced by 3.73%, NO<sub>2</sub> diminished by 4.54%, and CO decreased by 64.8%.<sup>32</sup> The average concentrations of atmospheric PM<sub>2.5</sub>, PM<sub>10</sub>, and SO<sub>2</sub> in the three cities (Central China) in 2020 were 46.1, 50.8, and 2.56, 30.1%, 40.5%, and 33.4% lower than the levels in February 2017–2019.<sup>33</sup> Agriculture is one of the sources of GHG emissions. Research has shown that agriculture is a significant source of NO<sub>x</sub> pollution in California.<sup>34</sup> Approximately 60% of global NO emissions, 39% of methane, and 1% of global NO<sub>2</sub> emissions are related to agriculture.<sup>35</sup> The results of Sadeghi et al.<sup>36</sup> showed that carbon, methane, and nitrous oxide footprints of economic sectors in Iran were 646 million tons, 51,000 tons, and 12,000 tons, respectively. Meanwhile, the share of the agricultural industry was 10.2%, 10.5%, and 17%.

Although the outbreak of the disease has caused significant economic damage to agriculture,<sup>37</sup> the result could be a reduction in greenhouse gases reduced consumption, and production of chemical fertilizers.

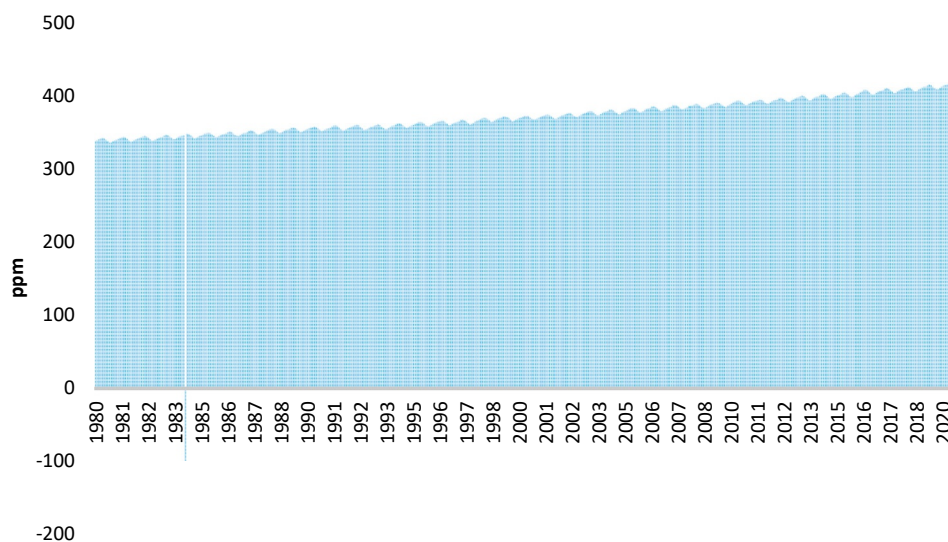
Coronavirus has improved air quality in many regions and has reduced the risk of lung and heart disease. The World Health Organization has described NO<sub>2</sub> as being toxic to humans. NO<sub>2</sub> concentrations above 200 mg m<sup>-3</sup> cause severe inflammation in the respiratory tract.<sup>38</sup> Ogen<sup>39</sup> found a correlation between death rates and NO<sub>2</sub> concentrations with death rates from coronavirus been higher in areas that have experienced prolonged exposure to high NO<sub>2</sub> concentrations.

If industrial and transportation activities resume sooner or at an accelerated rate, air pollution will quickly return. Forster et al.<sup>16</sup> estimate that the pandemic-driven response's direct effect will be negligible, with cooling off around 0.01 ± 0.005°C by 2030 compared to a baseline scenario that follows current national policies. In contrast, with green economic and fossil fuel investments reduction, it is possible to avoid future warming of 0.3°C by 2050.

## 2.2 Reduction of carbon emissions

The Keeling Curve, which charts the systematic measurement of CO<sub>2</sub> concentration in the atmosphere at a Hawaii site since 1958, shows that CO<sub>2</sub> concentrations have risen steadily for 61 years with no apparent interruption (Fig. 2). Also, a similar trend is observed in the global carbon dioxide emissions (Fig. 3).

FIG. 2 The trend of increasing carbon dioxide emissions from 1980 to 2020 at the Mona Loa station. Data source: Tans P. Trends in Atmospheric Carbon Dioxide, NOAA/GML and Dr. Ralph Keeling, Scripps Institution of Oceanography 2020. <https://scrippsco2.ucsd.edu/>; <https://www.esrl.noaa.gov/gmd/ccgg/trends/data.html>.





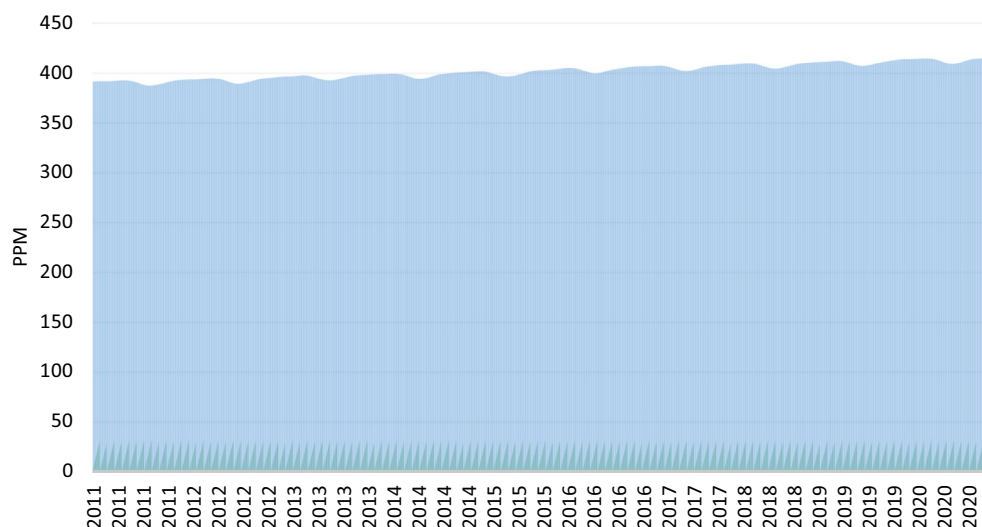


FIG. 3 The trend of daily global carbon dioxide emissions from 2011 to 2020. Data source: Dlugokencky E, Tans P. Trends in Atmospheric Carbon Dioxide. NOAA/GML 2020. [https://www.esrl.noaa.gov/gmd/ccgg/trends/gl\\_data.html](https://www.esrl.noaa.gov/gmd/ccgg/trends/gl_data.html).

With the outbreak of COVID-19 and reduced fossil fuel use, for the first time, we see that a crisis has been manifested in CO<sub>2</sub> measurements. Recent data show a 10% reduction in CO<sub>2</sub> emissions from fossil fuels, which will undoubtedly bend the curve, which is the highest rate of emissions reduction since World War II. Carbon emissions fell 1.4% for the first time during the 2008 financial crisis,<sup>40</sup> but emissions in 2020 are expected to decrease by approximately 5% (2.5 billion). The trends of changes in global CO<sub>2</sub> emissions growth in 2000–2009, 2010–2018, and 2019–2020 were +3, +0.9, and +0.6%, respectively. The reasons for this slow increase in the demand for coal and, most recently, the coronavirus pandemic consequences.<sup>40</sup>

In 2018, the United States was the second-largest producer of fossil fuels, according to data from The Global Carbon Atlas 2018, but CO<sub>2</sub> emissions are projected to fall by 7.5%. China's combustion of less coal in February 2020, a reduction equivalent to the amount used over an entire year in a small European country, is sufficient to prevent growth in this year's emissions.<sup>26</sup> It is estimated that continental Europe will produce 390 million tons of CO<sub>2</sub> by 2020.<sup>27</sup> The Breakthrough Institute in California also predicted that global greenhouse gas emissions would be 0.5 to 2.2% lower.<sup>40</sup>

The First-quarter 2020 global daily CO<sub>2</sub> emissions from surface transport, power, and industry fell by 36%, 7.4%, and 19%, respectively, relative to the annual mean daily emissions in 2019. CO<sub>2</sub> emissions from surface transport, power, and industry accounted for 86% of the total global reductions in CO<sub>2</sub> emissions. The sum of daily CO<sub>2</sub> emissions in 2020 corresponded to the levels of emissions in 2006.<sup>41</sup>

Much of the oil demand comes from the aviation industry. Typically, 99,700 flights flies per day worldwide, but this has been reduced to only one-fourth of the number to prevent COVID-19 outbreaks. Air travel is responsible for 5.2% of the carbon emissions and 2.5% of the greenhouse gas emissions. Analysis of Flightradar24 data showed that CO<sub>2</sub> emissions from aircraft decreased by 31% (equivalent to 28 million tons). In the UK, Hong Kong, and Switzerland, air traffic has fallen by more than 90% since last year.

The demand for gasoline and diesel has fallen by an average of 9.4% per year with fewer cars on the road. As a result, oil demand in road transport lessened by an average of 2.6 million barrels per day in 2020. Gasoline sales at U.S. gas stations fell 46.6% in the week to March 28, according to IHS Marketing,<sup>42</sup> and the government's weekly figures show that gasoline supplies have fallen to their lowest level since 1994. Gasoline demand in Spain fell by 83% yearly from the week to March 29. The British Gasoline Dealers' Union also said that gasoline sales lessened by 66% in late March compared to an average of 2 months earlier. Road traffic in the UK has dropped by 70%<sup>27</sup> and data from the US Traffic Transportation Center show that traffic volume has fallen by 4%.<sup>42</sup>

In Iran, gasoline consumption at 75 million liters per day in February 2020 dropped to 65 million liters/day in the first half of March 2020. Daily consumption is now below 50 million liters, less than half 5 months ago. During social distancing (5 March to 3 April 2020), fuel consumption decreased by 30%–72%, and traffic on different provinces' roads decreased by 41%–80% (Table 1).

The International Energy Agency estimates that the coronavirus crisis's shock will significantly reduce total global oil consumption by 2020. The COVID-19 crisis has affected several energy markets, including coal, natural gas, and renewable energy, but its impact on the oil market has been severe. This was most apparent in China because it

TABLE 1 Reduce fuel consumption and traffic in different provinces of Iran during social distancing (5 March to 3 April 2020).

Province	Reduce traffic (%)	Reference	Reduce fuel consumption (%)	Reference
East Azarbaijan	48	<a href="http://www.irna.ir/news/83761577">www.irna.ir/news/83761577</a>	44	<a href="http://www.irna.ir/news/83739833">www.irna.ir/news/83739833</a>
West Azarbaijan	63	<a href="http://www.irna.ir/news/83740167">www.irna.ir/news/83740167</a>	47	<a href="http://www.mehrnews.com/news/4891691">www.mehrnews.com/news/4891691</a>
Ardabil	72	<a href="http://www.irna.ir/news/83743250">www.irna.ir/news/83743250</a>	48	<a href="http://www.mehrnews.com/news/4890425">www.mehrnews.com/news/4890425</a>
Esfahan	66	<a href="http://www.isna.ir/news/99011607552">www.isna.ir/news/99011607552</a>	54	<a href="http://www.irna.ir/news/83736243">www.irna.ir/news/83736243</a>
Alborz	50	<a href="http://www.irna.ir/news/83729736">www.irna.ir/news/83729736</a>	31	<a href="http://www.irna.ir/news/83737879">www.irna.ir/news/83737879</a>
Ilam	41	<a href="http://www.mehrnews.com/news/4904784">www.mehrnews.com/news/4904784</a>	50	<a href="http://www.yjc.ir/fa/news/7308523">www.yjc.ir/fa/news/7308523</a>
Bushehr	68	<a href="http://www.irna.ir/news/83741809">www.irna.ir/news/83741809</a>	55	<a href="http://www.irna.ir/news/83739210">www.irna.ir/news/83739210</a>
Tehran	73	<a href="http://www.tasnimnews.com/fa/news/2232032">www.tasnimnews.com/fa/news/2232032</a>	50	<a href="http://www.donya-e-eqtesad.com/fa/tiny/news-3640864">www.donya-e-eqtesad.com/fa/tiny/news-3640864</a>
Chaharmahal va Bakhtiari	52	<a href="http://www.irna.ir/news/83738591">www.irna.ir/news/83738591</a>	50	<a href="http://www.yjc.ir/fa/news/7296689">www.yjc.ir/fa/news/7296689</a>
South Khorasan	70	<a href="http://www.irna.ir/news/83735441">www.irna.ir/news/83735441</a>	39	<a href="http://www.iribnews.ir/fa/news/2678936">www.iribnews.ir/fa/news/2678936</a>
Khorasan Razavi	–	–	50	<a href="http://www.yjc.ir/fa/news/7278560">www.yjc.ir/fa/news/7278560</a>
North Khorasan	69	<a href="http://www.qudsonline.ir/news/699706">www.qudsonline.ir/news/699706</a>	49	<a href="http://www.irna.ir/news/83732859">www.irna.ir/news/83732859</a>
Khuzestan	48	<a href="http://www.iribnews.ir/fa/news/2674242">www.iribnews.ir/fa/news/2674242</a>	40	<a href="http://www.irna.ir/news/83731166">www.irna.ir/news/83731166</a>
Zanjan	50	<a href="http://www.isna.ir/news/99012413237">www.isna.ir/news/99012413237</a>	57	<a href="http://www.isna.ir/news/990119102225cg70t">www.isna.ir/news/990119102225cg70t</a>
Semnan	46	<a href="http://www.iribnews.ir/fa/news/2687016">www.iribnews.ir/fa/news/2687016</a>	72	<a href="http://www.irna.ir/news/83727911">www.irna.ir/news/83727911</a>
Sistan and Baluchestan	47	<a href="http://www.irna.ir/news/83731598">www.irna.ir/news/83731598</a>	45	<a href="http://www.irna.ir/news/83739562">www.irna.ir/news/83739562</a>
Fars	65	<a href="http://www.irna.ir/news/83738250">www.irna.ir/news/83738250</a>	32	<a href="http://www.iribnews.ir/fa/news/2677616">www.iribnews.ir/fa/news/2677616</a>
Qazvin	64	<a href="http://www.irna.ir/news/83731844">www.irna.ir/news/83731844</a>	41	<a href="http://www.yjc.ir/fa/news/7293497">www.yjc.ir/fa/news/7293497</a>
Qom	70	<a href="http://www.mehrnews.com/news/4889434">www.mehrnews.com/news/4889434</a>	65	<a href="http://www.yjc.ir/fa/news/7299833">www.yjc.ir/fa/news/7299833</a>
Kurdistan	67	<a href="http://www.isna.ir/news/99011406760">www.isna.ir/news/99011406760</a>	43	<a href="http://www.isna.ir/news/99011206025">www.isna.ir/news/99011206025</a>
Kerman	52	<a href="http://www.isna.ir/news/99011809477">www.isna.ir/news/99011809477</a>	30	<a href="http://www.irna.ir/news/83732058">www.irna.ir/news/83732058</a>
Kermanshah	40	<a href="http://www.iribnews.ir/fa/news/2679676">www.iribnews.ir/fa/news/2679676</a>	50	<a href="http://www.mehrnews.com/news/4888872">www.mehrnews.com/news/4888872</a>
Kohgiluyeh and Boyer-Ahmad	50	<a href="http://www.tasnimnews.com/fa/news/2250241">www.tasnimnews.com/fa/news/2250241</a>	51	<a href="http://www.isna.ir/news/99011708955">www.isna.ir/news/99011708955</a>
Golestan	62	<a href="http://www.yjc.ir/fa/news/7310679">www.yjc.ir/fa/news/7310679</a>	–	–
Gilan	80	<a href="http://www.iribnews.ir/fa/news/2680051">www.iribnews.ir/fa/news/2680051</a>	34	<a href="http://www.isna.ir/news/98122619792">www.isna.ir/news/98122619792</a>
Lorestan	49	<a href="http://www.isna.ir/news/99011809907">www.isna.ir/news/99011809907</a>	50	<a href="http://www.isna.ir/news/99010803969">www.isna.ir/news/99010803969</a>
Mazandaran	70	<a href="http://www.iribnews.ir/fa/news/2686259">www.iribnews.ir/fa/news/2686259</a>	40	<a href="http://www.irna.ir/news/83721000">www.irna.ir/news/83721000</a>
Markazi	68	<a href="http://www.irna.ir/news/83737059">www.irna.ir/news/83737059</a>	55	<a href="http://www.irna.ir/news/83734939">www.irna.ir/news/83734939</a>
Hormozgan	–	–	–	–
Hamedan	58	<a href="http://www.irna.ir/news/83734339">www.irna.ir/news/83734339</a>	51	<a href="http://www.mehrnews.com/news/4895832">www.mehrnews.com/news/4895832</a>
Yazd	26	<a href="http://www.iribnews.ir/fa/news/2683922">www.iribnews.ir/fa/news/2683922</a>	30	<a href="http://www.yazdeemrooz.ir">www.yazdeemrooz.ir</a>

accounted for 80% of the world's energy demand growth in 2019.<sup>43</sup> The EIA estimates that COVID-19 will reduce the demand for oil and other liquid fuels in China by an average of 190,000 barrels per day. China bought about 200,000 barrels of oil per day from the United States, while US oil exports were 8.5 million barrels per day. A few weeks after the outbreak in China, oil consumption fell by 20%, impacting a considerable number of oil companies. Fifty million people in China's Hubei Province no longer consume oil. The corresponding drop in oil prices will reduce the profits of producers such as Saudi Arabia and Iraq by 10%.<sup>44</sup>

Most automakers and parts manufacturers have suspended production and orders due to declining demand and non-favoring government policies. Eighty percent of automakers quotes that the coronavirus will have a direct impact on 2020 revenues. In January, the sales of Chinese cars fell by 18%. At least 1.2 million jobs in Europe are directly dependent on car production, which are now in jeopardy in the wake of factory closures. The sale of approximately 729,400 units of light trucks in the United States in March 2020 was more than one million units less than sales in March 2019.

The International Energy Agency estimates that the coronavirus crisis's shock will significantly reduce the total global oil consumption by 2020. However, it is unlikely that plummeting oil prices will stimulate demand and increase consumption.<sup>42</sup> Falling oil prices have given countries a chance to cut or eliminate subsidies for fossil fuel consumption. These subsidies can either be directed to promote renewable energy or be forgone to allow the free market to determine the prices of conventional and alternative forms of life.

The effects of these emission reductions are not apparent for several months because they have been released for years. Therefore, government measures and post-crisis economic stimulus will have important influences on future emissions,<sup>41</sup> and countries must adhere to the commitments of Paris. If we return to the previous rate of greenhouse gas emissions after the COVID-19 pause, a small but favorable effect on global temperature will be eliminated.

### 2.3 Reduction of deforestation

Forests cover 31% of the world's land area (4.06 billion). It is estimated that about 420 million hectares of forests have been destroyed for human consumption since 1990 with annual destruction of 10 million hectares of forests from 2015 to 2020.<sup>45</sup>

With deforestation, biodiversity is declining and the risk of animal-to-human transmission is increasing. Viruses such as Ebola, SARS, and COVID-19 are thought to have been transmitted from wild animals to humans in tropical forest areas. A 2019 study found that with a 10% increase in deforestation, the number of malaria cases increased by 3.3%.<sup>46</sup>

Forests play an essential role in reducing global warming by absorbing carbon from the atmosphere and absorbing air pollutants. In Iran, due to the outbreak of the disease and the limited cessation of tourism activities, forests have been preserved to some extent, and other incidents such as fires have not occurred. Forest fires are significant sources of pollution, so reducing fires may improve air quality in the southeastern part of the United States. Fewer fires may have occurred due to economic constraints on the use of forests and the requirements for social distancing in March 2020.<sup>47</sup>

Due to the negative economic consequences of the disease, there is a possibility that investments will be reduced to destroy forests and pastures turning them into residential and agricultural areas. Indirect coronavirus disease has led to a slight reduction in global deforestation, and if this situation continues, it will be useful in reducing global warming.

### 2.4 Reduction of noise pollution

The issue of noise pollution in cities is another pervasive global problem.<sup>48</sup> In addition to damaging the human body and its function, loud noise has adverse psychological effects.<sup>49</sup> There are a variety of sources of noise pollution, but the most important are industries and transportation. A study on noise pollution determined that more than 30% of Europeans were exposed to more than 55 dB during the day and 20% were exposed to more than 65 dB and suffered from sleep disorders.<sup>50</sup> According to the Iranian NAQMS, from March 5, 2020, the average sound level was reduced by 1–2 dB compared to 2 years ago. Due to the Corona situation, The New York Times reported that noise levels in some parts of New York City had dropped by about five decibels.<sup>51</sup>

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## 3 Conclusions

Global challenges do not have national borders. Some think that climate changes occasionally occur on Earth and have nothing to do with them. Currently, practically, no part of the world is immune to COVID-19, and this is also true



of global warming and the prospects for changing climates. COVID-19 has created an opportunity for solidarity among all people that have never been seen before. This is precisely the tool that must be used to deal with climate change. The principle that prevention is better than treatment, a fixed rule in health and medicine, should be adopted to slow global warming and reduce climate change. It will be much easier to challenge the momentum of global warming now, than, it will be to deal with the enormous consequences we face with changing climates. In the post-COVID-19 world, economic redevelopment has become a priority for environmental concerns. The people and governments of the world, by staying at home, forgoing demonstrations, and caring for and protecting each other, have shown that they can unite to prevent disasters and save humanity. The same decisive spirit is needed to deal with climate crises. However, there is a risk that if people abandon public transportation because of the perceived health threat, it poses and returns to their cars, greenhouse gas emissions will be higher than before. Plans should be drawn to encourage people to invest in renewable and low-carbon energy sources. Today's reduced carbon emissions are temporary because there is insufficient infrastructure to migrate to primary reliance on renewable energy; we remain dependent on fossil fuels. We find ourselves (inadvertently) in the world's most massive experiment to reduce, if not halt, the combustion of carbon. However, the oil industry has been the primary engine of technological progress and innovation for decades, and it will be challenging to dispense with it, if not overcome its political power, to achieve clean energy. Clean air and stable climates will only return when we move to make concerted commitments and changes to develop low-carbon economies in the future.

## Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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