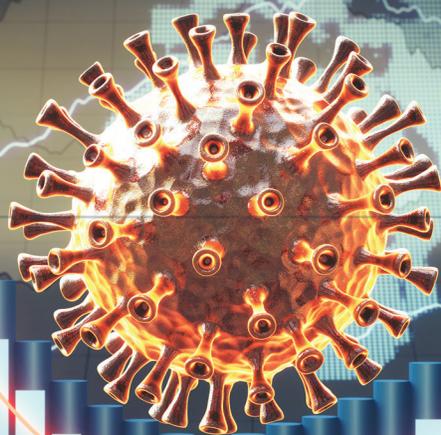


# LEARNING FROM THE COVID-19 PANDEMIC TO ADDRESS CLIMATE CHANGE



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*The COVID-19 pandemic has taught us lessons that can guide key decision makers in both the private and public sectors toward slowing climate change by reducing CO<sub>2</sub> emissions now. Howard Kunreuther and Paul Slovic explain how decision makers can design a risk management strategy that heeds the advice of experts and addresses the cognitive biases which obstruct effective action.*

COVID-19 has dramatically revealed the difficulties society faces in dealing with extreme global events. As of August 7, 2020, in the United States alone, more than 5 million people have contracted the coronavirus and close to 160,000 have died from it.<sup>1</sup> These numbers would have been much lower if public and private sector leaders had:

- Recognized the cognitive biases that obstruct effective decision-making and action
- Heeded the advice of experts
- Designed a risk management strategy that addressed cognitive biases and took the concerns of experts into account

We begin by examining why the United States did not use these strategies during the early stages of COVID-19 and why it imposed social distancing measures only after illness and death from the coronavirus ballooned in mid-March 2020. Using the lessons of the COVID-19 pandemic, we propose ways to implement a risk management strategy that would reduce the damage from climate change in the coming years by significantly reducing carbon emissions.

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## COVID-19: Cognitive Biases and Management Strategies

### *The Impact of Cognitive Biases*

Over the last fifty years, a large body of cognitive psychology and behavioral economics research has revealed that decision makers are often guided by emotional reactions, cognitive biases, and simple rules of thumb rooted in personal experience.<sup>2</sup> These processes are ill-suited to making choices about protective measures against extreme events of which people have limited or no experience. Cognitive biases and heuristics led both the public and leaders at national, state, and local levels to ignore the COVID-19 pandemic in its early stages, when it could most easily have been controlled.

### *Underestimating Exponential Growth*

Foremost among the inherent biases is the failure to grasp the concept of *exponential growth*. William Wagenaar and his colleagues demonstrated this failure more than forty years ago with a series of pioneering psychological experiments. In one study, participants were shown a hypothetical index of air pollution beginning in 1970 with a value of three and rising yearly to seven, twenty, fifty-five and finally, in 1974, to 148. When asked to estimate the value of the index in 1979, many of the respondents gave answers at or below 10 percent of the correct figure of approximately 21,000 (as determined by the underlying equation).<sup>3</sup> Subsequent experiments have revealed similarly dramatic underestimation of exponential growth and shown that participants typically base their erroneous judgments on the straight-line projections of early small increases.

The *Washington Post* conveyed the deceptive nature of exponential

growth in a March 10, 2020 piece on the coronavirus pandemic. Megan McArdle presented a brain teaser about a pond on which the number of lily pads doubles each day.<sup>4</sup> On the second day there are two lily pads, on the third day there are four, on the fourth day there are eight, and so on. If the pond is covered completely by the forty-eighth day, when was it covered halfway? The correct answer is forty-seven days. Almost everyone is surprised to learn that after forty days of exponential growth, you would barely notice the lily pads, as they would cover only 1/256th (0.4 percent) of the pond. It is therefore easy to ignore the steady exponential growth of lily pads for a long time—until they smother the pond.

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One of the reasons that the general public and key decision makers largely ignored the coronavirus in January and February is that they failed to appreciate the looming menace of its exponential growth. It is easy to visualize smooth, linear growth: one person gets the coronavirus today, another tomorrow, a third the next day, and so on, with the cases simply adding up over time. But most of us, including leaders and policymakers, find it difficult to comprehend exponential growth.

Figure 1a depicts the exponential growth of COVID-19 in the United

States from the first case, noted on January 21, through March 31, 2020. By February 29 only seventy people had tested positive for COVID-19. Yet by the end of March, 188,049 people had been diagnosed. Focusing on the period between January 21 and February 29 in Figure 1b, we can again see the exponential growth in COVID-19 infections.

We tend to underestimate the probability of a threat if we have not recently experienced a significant loss. Even when the threat becomes salient, we focus on its consequences rather than its likelihood.

### Misperception of Risk

Another factor that delayed the U.S. response is the *availability* bias, in which we perceive the likelihood of an event occurring according to its salience and memorability.<sup>6</sup> We tend to underestimate the probability of a threat if we have not recently experienced a significant loss.<sup>7</sup> Even when the threat becomes salient, we focus on its consequences rather than its likelihood. Few people in the U.S. experienced severe illness from SARS or the H1N1 virus. As a result, the public was largely not worried about contracting the coronavirus in January and February 2020, when few illnesses were reported. Early comparisons to the seasonal flu also contributed to this complacency.

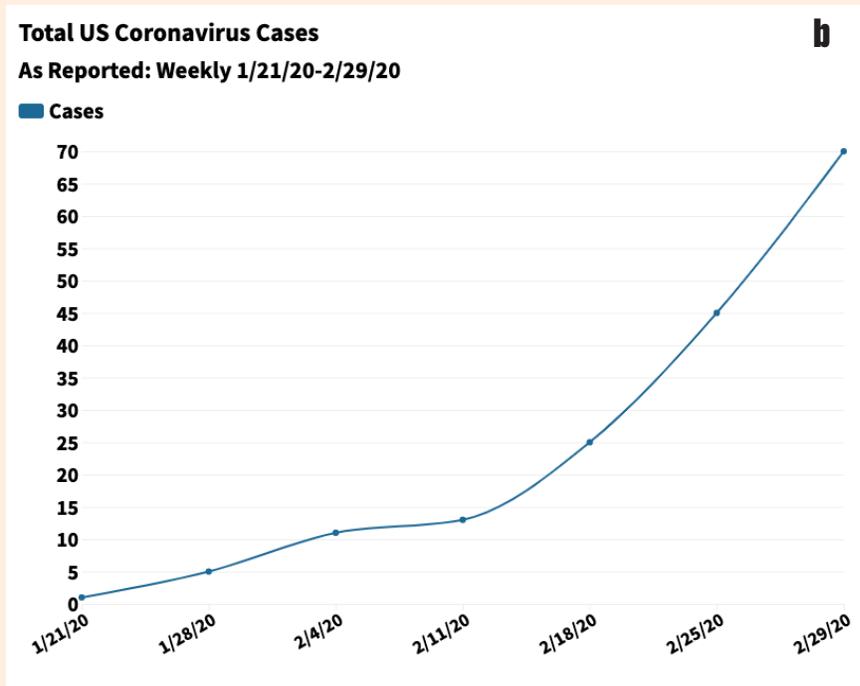
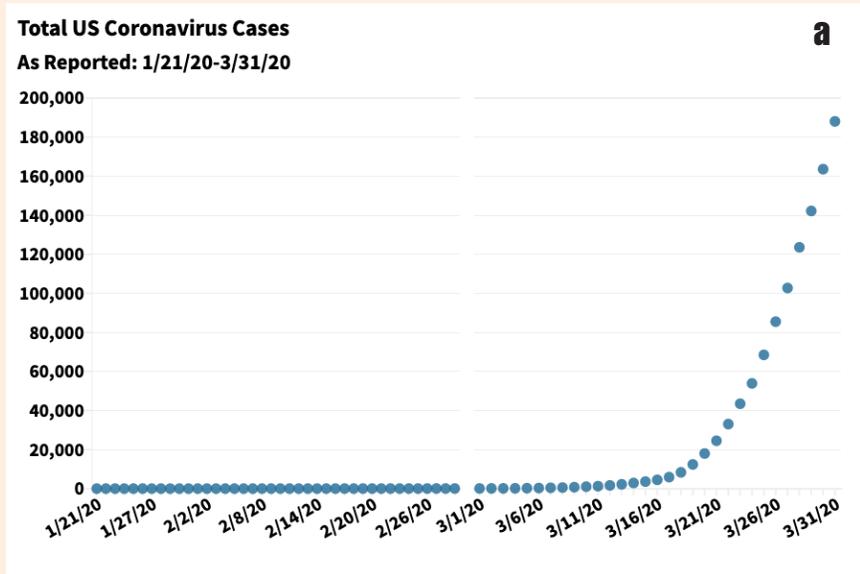
Only when the number of illnesses and fatalities skyrocketed in mid-March (as shown in Figure 1a) did Americans begin to focus on the effects that COVID-19 could have on them. They then perceived the risk of contracting the virus to be high because they *dreaded* its

deadly potential and because it was a new risk. Psychometric studies in a number of countries have shown that these qualities strongly increase our fear of health and safety risks.<sup>8</sup>

### Myopia, Optimism, and Herding

When the general public and key decision makers chose to ignore the potential consequences of the coronavirus pandemic, several other biases played their part.

**Figure 1a and 1b.** Exponential growth in the number of reported cases of COVID-19 in the United States<sup>5</sup>



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If the country had begun imposing social distancing measures on March 1 rather than delaying for two weeks, an estimated 54,054 fewer people would have died by early May.

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People tend to be *myopic*, failing to see the value of taking immediate action to reduce predicted severe future consequences. People are unduly *optimistic* about whether adverse events will occur, and we tend to *follow the herd*, allowing our choices to be influenced by other people's behavior, especially when we feel uncertain.<sup>9</sup> All of these reasons predisposed people to go about their normal social activities during the first two months of 2020 and to go on interacting with friends and co-workers during the early part of March. A study by researchers at Columbia University estimated that if the country had begun imposing social distancing measures on March 1 rather than delaying for two weeks, an estimated 54,054 fewer people would have died by early May.<sup>10</sup>

### **Failure to Listen to Experts**

Lulled by these cognitive biases, the general public and most decision makers at the national, state, and local levels in the United States were not concerned with COVID-19 during the first two months of 2020 nor did they give much thought to the possibility of a pandemic. Although 11,950 people in China had contracted the virus and 259 of them had died by January 31, few people in the U.S. felt alarmed. But epidemiologists did.

After scrutinizing its trajectory in China, epidemiologists

understood that COVID-19 was a new and potent virus that was likely to spread globally. By mid-February they were urgently warning national leaders that the coronavirus was likely to infect and kill many people around the world. They knew that it would soon be classified as a pandemic and that it was important to take immediate steps to contain its spread. Yet government leaders in the U.S. failed to heed these warnings, making no effort to obtain sufficient test kits or determine who was infected during the early stages of the virus's spread within the United States even though such measures would have allowed them to enact contact tracing and quarantine measures.<sup>11</sup>

In early March, both the general public and business leaders continued their normal behavior because they had failed to appreciate the exponential spread of COVID-19. Americans across the country kept going to the office, meeting with friends, and shaking hands. By March 11, over 1,000 people in the United States had contracted the coronavirus, ten times more than in the previous week. On that same date, the World Health Organization declared COVID-19 a pandemic.<sup>12</sup> Only then did the U.S. begin to recognize that steps would have to be taken to prevent a catastrophic increase in illness and fatalities from the coronavirus.

### **Designing a Risk Management Strategy for COVID-19**

To effectively curtail the pandemic, epidemiologists advocated a risk management strategy comprised of three elements:

- Sufficient tests to locate those infected with COVID-19;
- Isolation or quarantine of those who had tested positive;
- Temporary closure of non-essential businesses and requiring citizens to shelter-in-place

until the virus could be brought under control.

The United States would have done well to emulate South Korea in enacting the above strategy. After COVID-19 emerged in China, the Korea Centers for Disease Control and Prevention (KCDC) quickly cooperated with diagnostic manufacturers to develop commercial test kits. The country soon had the broadest and best-organized testing program in the world, as well as extensive efforts to isolate infected people and to trace and quarantine their contacts. By mid-March, South Korea had tested more than 270,000 people—over 5,200 tests for every million residents in the country. At the same time, the U.S. performed only seventy-four tests per million residents according to data from the U.S. Centers for Disease Control and Prevention and the KCDC.<sup>13</sup>

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### **Dealing with Climate Change**

The same cognitive biases and failure to heed experts that exacerbated the coronavirus pandemic also drive our inaction in the face of looming catastrophes due to climate change. In particular, our failure to appreciate the exponential growth of climate-destroying processes has caused political leaders to resist acting to reduce carbon dioxide (CO<sub>2</sub>) emissions.

## Recognize the Impact of Cognitive Biases

According to a 2019 survey undertaken by the Yale Program on Climate Change Communication, a majority of Americans are now worried about climate change.<sup>14</sup> Nonetheless, their concern does not drive most of the general public to take positive action because, although the perceived future consequences, such as extreme weather events, may be harmful, they are familiar and not perceived as controllable. Like the inattention that led us to ignore COVID-19 during the first two months of 2020, our inaction with respect to climate change is a product of our cognitive biases.

Relatively few homeowners, for example, have voluntarily invested in energy-saving technologies, often because of *myopia*. However, if homeowners focus on the future, they are likely to see that the expected long-term benefits exceed the upfront costs. In many areas of the country, the initial cost of adopting these measures is considerably less than the projected savings in energy costs over time.

People are also reluctant to alter their current behavior due to the *inertia* bias. This tendency is reinforced by the *herding* bias, in which people interact with friends and neighbors who feel as they do, and by the *prominence effect*, in which they are unwilling to give up existing comforts and conveniences like their accustomed level of heating and air conditioning.

Our failure to adequately address climate change is also a result of the way we process information: statistical data characterizing future risks do not evoke feelings of concern. Instead we experience *psychic numbing*, in which numerical projections of CO<sub>2</sub> concentrations fail to stimulate the emotional reactions necessary to motivate action. Our lack of concern is

exacerbated by *pseudoinefficacy*, which makes us feel that any personal contributions we make towards reducing a catastrophic threat will be insignificant and thus ineffective.<sup>15</sup>

As with COVID-19, it is important that political leaders and decision makers in the private and public sectors recognize these cognitive biases and turn to experts for advice on climate change.

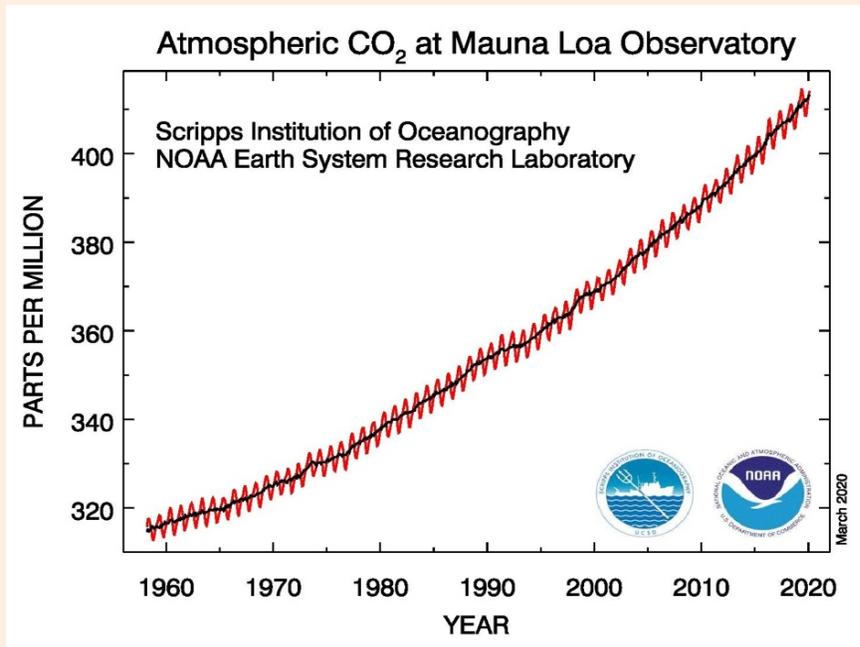
### Listen to Experts<sup>16</sup>

As with COVID-19, it is important that political leaders and decision makers in the private and public sectors recognize these cognitive biases and turn to experts for

advice on climate change. Climate scientists have long recognized that CO<sub>2</sub> emissions and their effects are increasing exponentially. Figure 2 shows the monthly average CO<sub>2</sub> concentration at Mauna Loa Observatory in Hawaii—the longest record of direct measurements of CO<sub>2</sub> in the atmosphere. The volume of CO<sub>2</sub> was 315 parts per million (ppm) in 1958, when it was first measured; by the end of February 2020, it had risen by 31 percent to 414 ppm.

This exponential increase indicates that CO<sub>2</sub> emissions and concentrations will be considerably higher in the coming years unless we take strong measures now to reduce them. If we do not, our climate will be driven to extremes that look nothing like a linear extrapolation of recent history. We will suffer blistering heat waves, severe droughts, accelerating rise in sea levels, unprecedented rainstorms and flooding.

**Figure 2.** Mean carbon dioxide (CO<sub>2</sub>) measured at Mauna Loa Observatory, Hawaii.<sup>17</sup>



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Consider the damage that climate change-related flooding, combined with population growth in hazard-prone areas, could cause. A 2013 analysis of 136 major coastal cities around the world revealed that sea level rise (SLR) of an optimistic 20 cm (7.9 inches) by 2050 will cause the average annual flood losses in those cities to increase to \$1.2 trillion in that year, compared to \$52 billion in 2005. A more pessimistic scenario in which SLR reaches 40 cm (15.7 inches) by 2050 would bring average annual flood losses of \$1.6 trillion. Houston was among the twenty most vulnerable coastal cities in the study. Its average annual damage according to the optimistic scenario would increase by 78 percent, from \$5.1 billion in 2005 to \$9.1 billion in 2050.<sup>18</sup>

And people are actually moving *into* harm's way, not considering the severe damage climate change might inflict upon them in the coming years. From 1980 to 2018, the population of Florida's hurricane-prone counties increased by 163 percent from 3.7 million people to 9.8 million. The population of the United States as a whole rose by only 61 percent during the same period. These Florida residents seem oblivious to the fact that climate change will probably cause them to suffer the damage from increasingly intense hurricanes coupled with rising sea levels.<sup>19</sup>

If CO<sub>2</sub> emissions continue to grow exponentially, most of the United States could see twenty to thirty more days each year with maximum temperatures above 90 degrees Fahrenheit, and the Southeast could see forty to fifty more such days.<sup>20</sup> Such extreme heat poses serious health risks, especially for the very young and the very old as well as construction and agricultural workers, and those living in urban cores. A study by researchers at the Earth Institute

of Columbia University has found that, over the next forty years, the rising temperatures associated with climate change could cause wildfires in California to continue to grow exponentially.<sup>21</sup>

The 2015 Paris Agreement, signed by nearly every country in the world, requested that the scientists at the Intergovernmental Panel on Climate Change (IPCC) produce a comprehensive analysis of the effects on humanity if global warming were to reach 1.5°C. The panel produced the 2017 Fourth National Climate Assessment, based on a plethora of peer-reviewed studies. Its primary finding was that CO<sub>2</sub> emissions are already causing severe economic damage and must be significantly reduced immediately if we are to avoid even more serious losses.<sup>22</sup>

In October 2018, the IPCC published a special report highlighting the importance of limiting global warming to 1.5°C above the preindustrial (1850-1900) average temperature relative to a 2°C increase, and describing the resulting benefits to people and ecosystems. The report indicates that to limit global warming to 1.5°C would require humans to reduce their CO<sub>2</sub> emissions from 2010 levels by about 45 percent by 2030, reaching net-zero around 2050. If we are to achieve these objectives we must enact rapid and far-reaching transitions in land, energy, industry, buildings, transport, and cities. A follow-up to the IPCC report by Climainfo detailed some of the measures we will need to undertake.<sup>23</sup>

### **A Risk Management Strategy for Climate Change**

If we are to design a strategy to combat climate change, we must recognize that cognitive biases render both the general public and key decision makers hesitant

to act to reduce CO<sub>2</sub> emissions or invest in adaptations against future disasters. Concerns about reelection make political leaders reluctant to support legislation or global accords like the 2015 Paris Agreement if their constituencies do not seem concerned with climate change. By calling attention to the severe effects that might otherwise occur, the coronavirus pandemic represents an opportunity to encourage leaders to implement CO<sub>2</sub> reducing measures now. A risk management strategy offers ways to address this challenge.

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**Our delayed and costly response to the coronavirus pandemic may have a silver lining: forcing us to recognize that we can no longer delay aggressive action to halt and reverse the more severe climate-related crises to come.**

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### **Learning from Experience**

Our delayed and costly response to the coronavirus pandemic may have a silver lining in forcing us to recognize that we can no longer delay aggressive action to halt and reverse the more severe climate-related crises to come. Some parts of the world have already reached a tipping point, with residents of island nations all too aware that they will have to migrate elsewhere to escape rising sea levels. Given our susceptibility to cognitive biases and misperceptions, as well as our difficulty in dealing with climate change voluntarily, we must develop a risk management strategy which is economically attractive and includes well-enforced regulations at the state and national level.<sup>24</sup>

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## Short-Term Economic Incentives with Well-Enforced Regulations

Consider the reluctance of many homeowners to incur the high initial cost of new energy technologies that reduce carbon emissions. Suppose it costs \$15,000 to install solar panels, yet those panels reduce the household's average annual energy bill by \$3,000. With an annual discount rate of 5 percent or less, the expected savings would exceed the cost in only six years.<sup>25</sup>

As of January 1, 2020, California has highlighted solar energy's long-term economic benefits by requiring that all new single and multifamily residences be constructed with solar panels. The California Energy Commission, which approved the new regulation, estimates that the monthly mortgage payment on a house will increase by \$40 a month but that the owner will save an average \$80 a month on electricity.<sup>26</sup> Because the cost of the solar panels is included in the mortgage, the owner's costs are effectively lowered from the moment they purchase the house. This policy addresses the myopia bias by spreading the cost of solar panels over time, while reducing buyers' budgetary concerns about the financial impact of a new house with solar panels.

At least fifteen states and Puerto Rico have enacted legislation requiring the reduction of greenhouse gas (GHG) emissions. Even more now require agencies to report or inventory GHG emissions. Several have also implemented carbon pricing policies, either independently or through regional agreements. California has a multi-sector GHG cap-and-trade program, while several Northeast and mid-Atlantic states participate in the Regional Greenhouse Gas Initiative, the first binding cap-and-trade program aimed at reducing GHG emissions from

the power sector. Many of these same states are also part of the Transportation and Climate Initiative, committed to developing a cap-and-invest program intended to reduce transportation sector emissions.<sup>27</sup>

One of the most effective ways of encouraging firms to reduce CO<sub>2</sub> emissions is through carbon taxes on the production, distribution, or use of fossil fuels based on how much carbon their combustion emits. By setting a price per ton on carbon, the government is effectively taxing electricity, natural gas, and oil. So far, only two states—Washington and Maine—have considered referenda for such a tax, though public support was insufficient.<sup>28</sup> The challenge for national and state leaders is to design and enact tax programs that will significantly reduce carbon emissions over the coming years.

## Construct Climate Change Scenarios

One way to change people's behavior in concert with economic incentives and regulatory pressures is to present detailed scenarios showing how future catastrophic events could affect their communities. Once they understand the danger, demonstrate that the likelihood and consequences of these disasters could be ameliorated by reducing carbon emissions. Visual images of rising sea levels in Miami or New Orleans or a range of other coastal areas and island nations tend to provoke emotional concern which drives people to support immediate action to reduce CO<sub>2</sub> emissions.

Receptiveness to change is highest after a hurricane, flood, wildfire, or heat wave which causes deaths or severe property damage and interrupts business. The *availability* bias can then lead people to think about global warming during heat waves, wildfires, and severe storms. As these disasters

increase, political leaders may pay closer attention and pass state and federal legislation to reduce carbon emissions.

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## Business leaders can learn from the challenges of the coronavirus pandemic and plan now for the long-term consequences of climate change.

Business leaders can learn from the challenges of the coronavirus pandemic and plan now for the long-term consequences of climate change.<sup>29</sup> These leaders would do well to consider some basic guidelines:

- Reflect on decisions that the firm has made and how they could be improved and applied in creative ways.
- Consider the long-term benefits of various alternatives before deciding on a plan of action.
- Recognize that well-enforced regulations may be needed.

## Conclusion

Right now, everyone's top priority is dealing with the health and economic impacts of COVID-19. But the pandemic's lessons will help us when our attention returns to the serious problem of climate change. Our cognitive biases and failure to appreciate the exponential process by which CO<sub>2</sub> emissions increase make the catastrophic consequences of climate change seem distant and unreal. Yet, they will arrive far sooner than we expect.

If we are to effectively manage this dire global threat, cooperation between scientists (including behavioral experts) and leaders from government and industry is essential. Only then may we succeed in mitigating the consequences of climate change before it is too late. ■

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