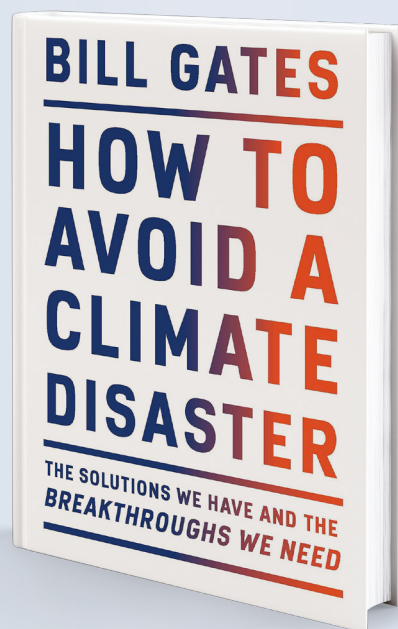


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How to Avoid a Climate Disaster

The Solutions We Have and the Breakthroughs We Need

By Bill Gates

Bill Gates is a technologist, business leader, and philanthropist. In 1975, he cofounded Microsoft with his childhood friend Paul Allen; today he is cochair of the Bill & Melinda Gates Foundation. He also launched Breakthrough Energy, an effort to commercialize clean energy and other climate-related technologies.

How the World Can Avoid a Climate Catastrophe

The world typically adds approximately 52 billion tons of greenhouse gases into the world each year. Following the reports and suggestions of experts in the field, Bill Gates, in his book, *How to Avoid Climate Disaster: The Solutions We Have and the Breakthroughs We Need*, lays out what the world needs to do in order to reduce that number to zero by the year 2050. In his book, he takes into account both the current energy needs of the world, the projected needs in the future, both current and hopefully forthcoming technological advances, and the need of the developing world to increase their energy usage. Gates says, “The only solution I could imagine was to make clean energy so cheap that every country would choose it over fossil fuels.” He does not envision or desire a world in which less energy is used; rather, he desires a world in which more energy is used but that that energy is carbon free. Gates acknowledges the difficulties inherent in getting the world to net zero carbon emissions, but he remains hopeful throughout the book that it can be achieved.

In Gates’s estimation, continuing to release carbon into the atmosphere will result in an inevitably hotter planet and that this heat will make it more difficult for people to thrive. Because the world is so reliant on fossil fuels for certain processes, he does not believe it will be possible to get to a point where humans are not emitting some carbon. Instead, he thinks the path to net zero emissions will require humanity to figure out ways to remove the carbon that is released. When he refers to net-negative emissions, he is referring to the concept that at one point humanity will have to start removing some of the gases from the atmosphere that have already been emitted.

Gates gives a basic explanation of greenhouse gases and how they impact the environment. In short, “they absorb heat and trap it in the atmosphere. They work the same way a greenhouse works.” As an example most people are familiar with, he explains how a car’s windshield allows heat in and then traps some of it in there, making a car sitting in the sun quite hot. Gates states that the temperature has raised about 1 degree celsius since pre-industrial times and would likely raise another 1.5 -3 degrees Celsius by mid-century and 4-8 degrees celsius by the end of

the century. While not everyone will suffer equally from these changes, he predicts stronger storms, more severe droughts, more and worsening wildfires, and rising sea levels. In order to stop or mitigate these disasters, human beings can adapt to the changes that have already occurred by trying to minimize their impacts, and they can mitigate these changes by stopping the emission of more greenhouse gases to the atmosphere.

Gates explains that fossil fuels are “so pervasive that it can be hard to grasp all the ways in which they - and other sources of greenhouse gases - touch our lives.” One main reason for this is that fossil fuels are very inexpensive. This is because they are “abundant and easy to move.” Gates makes the claim, however, that their purchase price does not take into account all the damage they cause. The demand for these fuels will rise as people in the developing world advance their energy use to be more on par with that of the developed world. Gates does not believe it is moral to ask those in the developing world to consume less energy than those in the developed world do; therefore, humanity needs to find a way for poor people to use energy while avoiding making climate change worse.

Gates goes on to mention certain considerations to take into account when someone discusses greenhouse gases. First, he suggests converting the amount into a percentage of the 52 million that needs to be eliminated. Next he suggests people consider more than just electricity use because electricity use accounts for just 26% of the problem. These gases are also emitted from making things, growing things, getting around, and keeping warm and cool. Finally, cost needs to be considered. Here he discusses Green Premiums or the added cost that these carbon-free emissions cost. He suggests considering whether green premiums are low enough for middle-income countries.

He then goes on to say that “figuring out how to get all the benefits of cheap, reliable electricity without emitting greenhouse gases is the single most important thing we must do to avoid a climate disaster.” In terms of electricity, he believes that only a modest Green Premium would be required to actually eliminate emissions from electricity. In the United States and Europe, he believes that rates would go about 15 and 20% respectively. In the rest of the world, however, this low premium may not be possible because they do not have the same breadth of natural renewable resources that the US does in varying parts of the country. One of the problems, however, with the use of natural resources is they are intermittent. The sun does not shine all the time and the wind does not always blow. Therefore, in order to make these massive parts of the electrical supply, people will need to develop a method to store this energy from times when it is plentiful to times when it is lacking. This is both difficult and expensive on a large scale. Gates believes these energy sources can play an important role in helping humanity get to net-zero emissions, but they will need to be supplemented by other sources. Gates then goes on to explain nuclear fission as a possible way to get more electricity. This is cheap, reliable, and carbon-free. It is, however, expensive and can be dangerous. Nuclear fusion is another option. This option is cheap and plentiful but is still at least ten years away from feasibility. Offshore wind is a third option that has fewer intermittency problems

and is becoming more usable as prices come down. Finally, he mentions geothermal energy as another possible source of electricity. This requires digging up to a mile down into the Earth to get hot rocks that are capable of generating electricity. The downfall of this approach is that it is not energy dense, meaning that there is not a lot of energy per square meter. Also, experts are incapable of determining where to dig the wells because they do not know where the needed heat is.

Gates then moves on to examine greenhouse gas emissions involved in how things are made. He reiterates his belief that progress is a good thing and that it is good that people are getting more benefits from energy. He believes, however, that we have to eliminate these gases to net-zero in order to stop catastrophic effects. In his section on making things, Gates goes into detail about just how much carbon dioxide is released in the making of steel, cement, and plastics. Gates provides several avenues for mitigating these emissions. One of these is to use carbon-free electricity in the processes used to make these materials. Another is to create public policies that encourage the greening of these industries. Carbon capture will also play a role in eliminating the carbon that is still released.

Gates then discusses how things are grown and the impact this has on carbon emissions. Part of the problem with food production is that people eat more calories as they get richer. Meat and dairy require more resources because for each pound of meat produced two pounds of grain are required. As the world becomes richer, demand for these meat products will increase. Another problem regarding how things are grown is that as there is a push to increase energy coming from plants, those plants will compete with plants grown for human consumption.

In regards to farming, animal poop is actually one of the biggest problems because as it decomposes, it creates greenhouse gases. Gates believes this can be partly mitigated by using better breeds of animals who do not produce as many gases. New techniques can be improved, as well, for getting rid of manure with fewer emissions. Another partial solution to the problem of meat production is for people to eat plant based meats instead of real meat that comes from animals. In addition, meat can also be produced in a plant. This is actual meat, albeit artificially made, rather than plants that have been prepared to taste like meat.

Moving on to transportation, Bill Gates mentions two crucial facts about gas: it is cheap and it is powerful. Transportation does not count for the largest amount of emissions in the world, but it does count for the largest number of emissions in the United States. Gates suggests one possible alternative to gas is to use cars that run on carbon already in the air rather than on fossil fuels. Electric vehicles are also another option, and Gates believes the Green Premium on these vehicles will be nonexistent by the year 2030. The downfall to electronic vehicles is that their price is good relative to the price of gas. Also, it takes longer periods of time to charge a vehicle than it does to fill up with gas. Another alternative is the use of biofuels that get their energy either from plants or from combining “the hydrogen in water with the carbon in carbon dioxide.” These are called hydrocarbon fuels. The situation



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is different with cargo trucks as it is not feasible to electrify them. Therefore, in order to reduce their emissions, electro-fuels and biofuels may be required although as of today, they have a hefty Green Premium. To reduce the Green Premiums for all forms of transportation a combination of government policies, green electricity, possible nuclear powered ships, and advanced biofuels and electrofuels will be needed.

Gates next discusses heating and cooling. He proposes that simply purchasing greener appliances can make an impact. One of the reasons people do not already do this, he claims, is that the information on energy efficiency is not readily available enough for consumers. Furnaces and water heaters are generally run on fossil fuels rather than on electricity. For this reason, greening the electricity will not provide any improvement. In regards to heating and cooling, Gates recommends electrifying anything that can be and creating better fuels for anything that cannot. One way he proposes to do this is with heat pumps.

In regards to all of the categories he previously discussed, Gates boils it down to three main points. The first is that the situation is complex as we use greenhouse producing products in almost every aspect of life. The second is that we already have some of what we need to make the situation better. The third point is that we do not yet have everything we need, and in particular, we need to reduce Green Premiums.

Gates then explores adaptations people make and can make in order to adapt to a warmer world. He notes that the people who will be most affected by climate change are the poorest people in the poorest parts of the world. He says that adaptation occurs in three stages:

Reducing risks posed by climate change

“Preparing for and responding to emergencies”

Helping in the recovery period after a disaster.

Gates believes humanity should be preparing for the worst case scenario. Part of this involves studying and debating geoengineering. These are processes of last hope as they raise numerous issues. These approaches could involve shooting particles into the atmosphere which would scatter sunlight or brightening clouds which could scatter sunlight.

Gates emphasizes the need for policy in making some of these changes possible. Part of this involves governments investing in innovation. Another is by raising the prices of fossil fuels so that they truly reflect their overall cost; this would help lower Green Premiums. Gates provides numerous other ways policy can help including by mitigating the cost that some will occur as society

moves away from fossil fuels and making codes up to date so new technologies can be used.

When evaluating how close a country is getting to net-zero emissions, Gates encourages the reader to not just look at the current level but at what the country is doing to make it to zero by 2050 as sometimes some effective long-term policies take some time to make a difference. Using the idea of supply and demand, Gates says an increase in the supply of innovations is necessary alongside an increase in demand. He claims that governments need to expand investment in research and development, take bigger risks on R&D projects, match research with our greatest needs, and work with industry. He insists that all levels of government must be involved because they all have power over making different types of decisions. Gates ends his discussion with an analysis of what individual people can do to make a difference. This involves using their political voice, reducing home CO2 emissions, and using electric vehicles among other changes.

Bill Gates, in his book, does not oversimplify the problem of increased carbon emissions and the problems they can cause to our planet and the people who reside on it. He is insistent, throughout, that the poorest in our world need to be protected. After all, they are the ones releasing the least amount of carbon while being most greatly affected by it. Gates examines multiple different options to get to net-zero emissions by the year 2050. While he acknowledges that humanity does not currently have all of the technology necessary today, he remains optimistic that pursuing multiple avenues and greening different facets of society in ways most effective to that society, that we can, indeed, get to net-zero emissions by the year 2050.