

Figuring toward a Viable Future

David J. LePoire

Environmental Science Division, Argonne National Laboratory

Correspondence | dlepoire@anl.gov

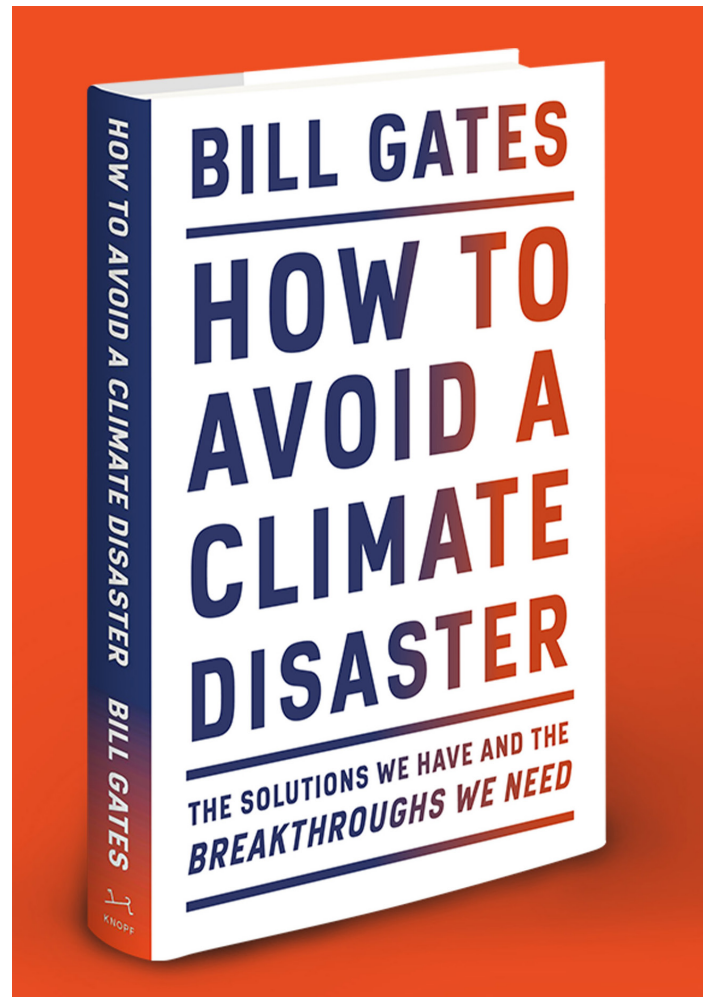
Citation | LePoire, David J. 2022. “Figuring toward a Viable Future.” *Review of How to Avoid a Climate Disaster: The Solutions We Have and the Breakthroughs We Need*, by Bill Gates. *Journal of Big History* 5 (1): 113-115.

DOI | <http://dx.doi.org/10.22339/jbh.v5i1.5170>

Gates, Bill. 2021. *How to Avoid a Climate Disaster: The Solutions We Have and the Breakthroughs We Need*. New York: Alfred A. Knopf.

I first saw this book on the library “hot picks” shelf two months after its initial publishing. I was hesitant at first after seeing many other books and articles about approaches to handle climate change. However, after a brief look, it seemed to be well organized and discussed topics in a more integrated way than I had typically encountered. This book delivered. You may wonder why Bill Gates, a person outside science and government, could present an integrated account of this topic. I think it is because he has vast curiosity and resources to explore and connect with the wide range of groups in science, technology, industry, government, environmental groups, while also being actively involved in deciding where to invest. Some may look at this as an excuse to dismiss parts of this book because of this conflict of interest, but Gates addresses this. He makes it clear where and why he invested (and sometimes failed in the process) but looks at the whole picture. He has assembled quite a team to collect information, develop models, and follow trends in his Breakthrough Energy organization (breakthroughenergy.org).

The book is concise and includes relatable numbers and stories. He develops a “thought experiment” to bound the cost of mitigating climate change by estimating the cost of constructing and operating a carbon capture and storage device (with near future technology, although still uncertain viability). The cost of reaching zero emissions, with technology that processes a ton of carbon for about \$100, is about 6% of the world’s current economy. He then develops estimates of “Green Premiums”, i.e., the additional costs for making carbon-free products, processes, or energy. Throughout the book estimates of the Green Premi-



ums are made for both current technology or with potential advanced technologies in each of the five major activities contributing to greenhouse gases: making things (5), electricity (4) agriculture (3), transportation (2), and heating and cooling (1). (The numbers in parentheses are the relative amount of greenhouse gas

contributions by the activity.) He discusses both why these are large contributors and the possible technologies that are being pursued to mitigate them.

Before a deep dive into these areas, a framework of questions is developed to cover the scales of emissions, power, land required, and cost. The emissions are measured relative to the current global emissions of 51 billion tons (equivalent) per year. Power generation is relative to the current global use of 5,000 GW in factors of 1,000 from the 20% (1,000 GW) for the U.S., 1 GW for a mid-size city, 1 MW for a town, and 1 kW for a house. Land requirements vary over four orders of magnitude from over 1,000 square meters to support a typical house with wood to the 1/10th of a square meter needed for fossil fuels. Cost is measured based on the Green Premiums and the 6% global economic cost from the thought experiment.

You might wonder how this relates to big history. I would like to address this in a couple of paragraphs concerning topics that are outside the scope of the book. Many see the development of life (and human civilization in particular) leading to a major crisis or inflection point. Future scenarios often include a business-as-usual scenario in which fossil fuels continue to play a leading role in energy and production. This could lead to a climate with an unsustainable quality of life; a muddling-through scenario, where efforts are made to mitigate and adapt to climate change, but the actions are too little and too late to circumvent many societal and climatic impacts; and the optimists' scenario that the combination of technology breakthroughs, sufficient investment, government policy, and political will leads to a world that not only develops economic and environmental sustainability but also offers greater equity through global collaboration and participation.

In fact, this problem of environmental crisis near the globalization of the economy is being fervently researched through modeling techniques. In the related field of astrobiology, the question is whether any planet in the habitable zone around a star, which develops civilization, might also experience such an environmental crisis. The early results suggest that such

a crisis might be common and act as a "Great Filter" determining whether advanced civilization continues to thrive after addressing this issue.

Throughout the book various perspectives are discussed and integrated to demonstrate the difficulty and challenge of the issue. Some history of energy use is relayed through the author's discussions with the well-known energy expert Vaclav Smil, who has written extensively about the history of energy use and our situation today. Gates has also interviewed leaders or participated in United Nations (UN) climate summits with them and traveled to developing countries to understand their predicaments (also as a part of his larger health campaign). As mentioned, he sees many innovators and relates to his own story of working with start-up funding and government policies.

This book reminds me of the initiative advocated by the late Richard Smalley, Nobel Prize winner for his breakthroughs in nanotechnology, almost twenty years ago. Soon after the terrorist attack on the World Trade Center on September 11, 2001, Smalley went around the world from his base at Rice University to advocate for a global collaboration in developing inexpensive energy solutions. One of his main points at the time was that with relatively inexpensive clean energy, many problems can be more easily addressed. For example, with enough clean electricity, water shortages evaporate as fresh water can be distilled from ocean water. Unfortunately, his message did not gather enough support.

In the end, Gates calls for a collaboration of innovators, markets, and governments to develop incentives that can solve this issue in time and yet leave the world in a better condition in terms of both economic functionality and social equality. While this conclusion is not surprising, the details and organization of the possibilities and complexity of the issues leaves the reader with insights to apply to choices in activities, markets, investments, and government. One of the warnings is that while a goal of zero emissions might be a final goal, the intermediate goal of partially reducing emissions by 2030 might be counterproductive. This is due in part to the long-range investments that must be

made in the near-term. For example, currently replacing a coal-powered plant by one based on natural gas might reduce emissions in 2030 but still require another investment in 2050 to reduce the emissions to zero.