

AUTHORS' PREFACE

Civilization may well be facing the biggest crises in its ten-thousand year history: global warming, and the related problems of pollution and mass extinction of species, all related to large increases in the human population.

With a myriad of books available on climate change, why do we need another? Notably, it is because our book has a stronger emphasis on the social sciences and the free-riding problems. It explains not only the earth science, atmospheric science, and engineering challenges, but also the political and economic obstacles confronting any serious attempts to solve the crises we face. And just as some technical engineering is impossible today (like **nuclear fusion power** for infinite clean energy), so it is with some social engineering.

Perhaps the best way to illustrate our perspective is with a simple analogy. Advocating that the world should stop burning fossil fuels and emitting greenhouse gases is like advocating that the world should stop spending on its armed forces. Even though we agree that disarmament would be wonderful from a collective point of view, it's simply not going to happen. This is because countries have primarily their own interests at heart, not the world's. It is the same with fighting climate change. It is not worth it for each of the world's 195 countries to make large sacrifices that benefit the other 194 countries more than themselves. Worse, benefits and harms are unevenly distributed across countries, and expensive sacrifices over many decades will yield noticeable benefits only in future decades.

One may retort that there are politicians who have been signing treaties that are against their own self-interests. However, we believe this perception is illusory. If they or their successors were ever to attempt to execute and enforce measures that would result in meaningful reductions in living standards, they would be quickly replaced by politicians who would offer higher local living standards sooner.

Climate change is also not a problem that the West could solve *even if* it had an iron will (and it does not). If the United States and Western Europe

miraculously emitted no more greenhouse gases tomorrow, the rest of the world would still pump the equivalent of 30 Gigatonnes of CO₂ (GtCO₂e) rather than 40 GtCO₂e into the atmosphere every year. (See Figure 2.3 on page 1.) And within five years, world emissions would likely be back to 40 GtCO₂e. The central emission problem today can no longer be solved alone by the one billion people in rich countries (or the 0.1 billion wealthier people therein). It is a problem that also needs to be tackled by the seven (soon to be eight) billion people in poorer countries who aspire to higher standards of living. They won't accept delay.

Even most economic approaches to climate change have been distracted by arguments over globally optimal responses. Yet whether it is globally optimal to stop arming or to stop emitting greenhouse gases is unimportant. The fact is that countries will do neither. As social scientists, we need to think about what environmentalism can accomplish when faced with the tough realities of the world. Environmentalists should be aware of what they can and cannot achieve. Reality denial is as unproductive as climate-change denial.

TODAY'S ACTIVISM

In our view, much climate-change activism today seems performative — akin to a “personal wellness approach to climate change” — more feel-good than effective. The evidence is in the air, and it suggests that most climate-change activism to date has been wasted energy. Earth would probably be in roughly the same spot now if climate-change activism had never occurred in the first place.

Naïve environmentalists have been committing two sins that, sadly, don't cancel out each other — they have been thinking too big, and they have been thinking too small.

Thinking too big, too many analysts (including many economists) have focused on advocating for coordinated global action. We also would love to see this happen, but as we just explained, debating how to achieve such a goal is like arguing about how many angels can dance on the head of a pin. The fact is that there is no global government that could enforce global coordinated action. Treaties are no substitutes, either. In the real world, treaties only have a reasonable chance of success if they are in the signers' self-interests or at least not greatly against them. They do not succeed when

they demand large sacrifices today and will show tangible results only after decades. Most of humanity is too poor to afford large payments for the common good, and the remainder would never be willing to pay for all of humanity in order to avoid a climate disaster in fifty years. (For perspective, think of the cost as approximately the equivalent of 1 to 3 months' rent per year; we explain this yardstick later in the book). Whether you personally believe civilization should or should not take on large sacrifices doesn't matter. It simply won't happen.

Thinking too small, many environmentalists have advocated slogans such as “every little bit counts,” “we have to start somewhere,” “we must do our fair share,” “we must set an example,” or “we must reduce our personal carbon footprints.” These approaches will not change the CO₂ concentration in the atmosphere, either. When solutions do not have a dynamic that will make them scale to billions of people, they will never **move the needle** in any meaningful way. If the goal is to truly bring down the CO₂ concentration in the atmosphere, the equivalent of New Year Resolutions simply won't make a difference. It is important to have the appropriate perspective: not only does your own carbon footprint not matter, but even the entire United States' carbon footprint is no longer what matters most. Eliminating the emissions of all 0.3 billion Americans is of much less importance now than reducing the emissions of the remaining 7.5 billion people.

Environmentalists also need to be not just *against* but also *for* some big policies, even painful ones. The requirement of zero environmental harm on every dimension cannot possibly change the world for the better. It only empowers the status quo when many environmentalists are against fossil fuels, **nuclear power, hydroelectric dams, geothermal plants, lithium mining, solar cells, windmills, new electric transmission lines, and tree felling**. What compromises is environmentalism really ready for? Activists who want to change the world should be able to articulate alternatives, explain who will *realistically* pay for them, be clear as to what difference the results will make and how they can be cost-effective. Environmentalist alternatives must also assure that poor countries can develop their economies and that reliable energy is continuously provided — or the affected people will not accept them. Our book limits its recommendations to alternatives widely considered to be viable and effective — even though our alternatives are also imperfect.

We are not against feel-good activism — unless it saps the energy from environmentalism that can really make the world better. Rearranging the deck chairs on the Titanic is fine, but only if it does not distract from readying the rescue boats.

VIABLE APPROACHES

Despite the enormous magnitude of the problem, we remain cautiously optimistic. Yes, change will be difficult in an era of pandemics, global poverty, wealth inequality,¹ economic stagnation, high taxes and tax evasion, political, cultural and religious strife, and many oppressive and corrupt governments. These are all serious problems — but many of them are **not as bad today** as they have been in the past. We do face novel challenges, though: our much larger human population, a bad head-start on environmental degradation, and more pervasive misinformation and effective propaganda.

The solutions to the world's climate problem will have to be based on human ingenuity. And fortunately the rapidly declining prices of cleaner technologies are now giving civilization the ability to solve many of its environmental problems. As environmentalists, we suggest that countries and individuals should work on accelerating these solutions. We can nudge the big ship that is Earth — with all of humanity that it contains — in the right direction, even if the ship turns more slowly than we would wish. Prodding, pushing, and nudging — smart environmentalism can move good but imperfect solutions forward and can do so now. We wrote this book partly to explain how.

Because we think it is irrelevant, we do not need to get involved in the debate about exactly how bad the situation is. We can take it as given that it is bad enough to warrant reductions in fossil fuel use. From a social perspective, humanity today is burning too much fossil fuel (resulting in millions of deaths every year), and it will almost surely burn more *very soon*. We can thus dispense with the most heated arguments among politicians and climate scientists over how aggressively and quickly humanity must wean itself off fossil fuels to stem global warming — 10 years, 30 years, or

¹Fair contributions are not just a problem across rich and poor countries, and across rich and poor within the same country. Depending on the country and cutoff, the rich in poor countries are often **much richer** than the poor in rich countries.

100 years, with carbon taxes of \$50 or \$500 per ton of CO₂. Frankly, this debate is as divisive as it is irrelevant.

Instead, we think everyone should be focusing on how we can immediately move more aggressively in the right direction. What actions can countries and individuals take to *move the needle* now? Fortunately, there are many that are cheap and locally advantageous enough to be worthwhile, feasibly adoptable, and possible to accelerate at modest cost. We will cover many promising approaches in Chapter 12.²

Of course, many readers will think we are going too far, and many others will think that we are not going far enough. We expect only a small minority of readers to like everything we write. At some points, we will offend many climate-change activists, at other points many climate-change skeptics. We consider no cow sacred. However, we hope that all our readers will appreciate the honesty of our presentation and analysis, whether they agree with us or not.

THE EDUCATIONAL COMPONENT

Our book has a strong educational component. It is designed to be suitable as a course textbook. It is written for interested students at any level — from our teenage children to our political leaders (though sometimes we are not sure which is which). Our readers should come away with a clear understanding of the problems and tradeoffs associated with energy provision, emissions, and climate change. We have tried to keep the book brief and to the point, self-contained, and easy to understand. The target audience would be anyone who enjoys reading a newspaper like the *New York Times* or the *Wall Street Journal*.

One problem in learning about energy, emissions, climate change, economics, and technology is not a lack of information. Instead, there is too much information (often biased and false) all over the Internet. You can probably find everything that we are discussing somewhere else. We are not trying to be original. We are trying to distill the information and remove biases.

²In particular, if the energy storage cost problem (explained in Chapter 9) can be solved, it will be lights out for most uses of fossil fuels.

Our book's first task is thus organizing information into a form that does not miss the forest for the trees. Although many concerned people have read about global warming, most do not fully understand it. (Admittedly, though interested, we did not, either, until we wrote this book.) Most people have glimpsed only **parts of the elephant**. And this elephant is large. It includes the earth-science aspects of the problems (energy, emissions, planetary changes); the social-science aspects (public goods, cost economics, social costs of carbon, coordination); the engineering aspects (the viability of potential technologies, electricity, storage, agriculture, geoengineering); and the overview of feasible large-scale potential solutions. For example, batteries work well for cell phones — but could they really power the daily needs of eight billion people? Where are we right now on the “clean-energy revolution”? And so on.

We want to present information in a fair and unbiased way. Both climate activists and climate skeptics sometimes share a penchant to suppress **inconvenient truths**. Many environmentalists do not like contrary arguments, because they are afraid that their airing could reduce the alarm and poison the determination of the faithful. Many climate-change skeptics are in a worse predicament, because they have to disavow much of the scientific evidence. Moreover, the vitriol and accusations of bad faith on both sides is, at times, stunning. Hired trolls further fan the flames.

Our goal is to air all reasonable and important arguments — even if we disagree with them — and to do so with appropriate respect. We do not want to discourage our readers from forming their own points of view and disagreeing with us. However, we do want our readers to understand why answers may not be as obvious as they might have thought. In many, though not all, cases honest, smart people can come to different conclusions.

ABOUT THE AUTHORS

We are not earth scientists; we are not engineers; we are economists. We are not even among those economists who have dedicated their lives to studying energy provision and climate change. We think that our background offers both advantages and disadvantages. On the positive side, being economists allows us to see more forest than trees and not get lost in too many specific details. As first-time authors on these subjects, we also have no horse in any particular race. We can present what we believe to

be fair and objective perspectives on the evidence. On the negative side, our knowledge is not as deep as that of our fellow scientists. We are not producers, but rather intelligent consumers of the research we present. We have fact-checked the information we are presenting, but we always welcome corrections and clarifications.

As we stated earlier, we are not claiming originality for the many ideas in this book. Our impression is that most good ideas have occurred many times to many people, often independently. Thus, our book should not be viewed as an original research treatise. Its only originality is in the packaging of the information in our own particular way.



We must offer one disclaimer about one bias that we do have. We are not simply uninvolved scientists objectively analyzing an interesting intellectual puzzle. We view ourselves as cool-headed environmentalists, advocating choices that are technically viable, economically affordable, and politically feasible — though rarely ideal. We want humanity to do something about its problems sooner rather than later. We want humanity to *move the needle* now.

***Grant me the serenity to accept the things I cannot change,
the courage to change the things I can, and the wisdom to
know the difference.***

— Serenity Prayer, Reinhold Niebuhr

Conflict of Interest Disclosure: Neither of us has ever been supported by grants or otherwise from lobbies, either environmentalist or fossil-fuel. We are not shills for anyone.

PS: The book contains cartoons (mostly from cartoonstock.com) and jokes. Even if the subject matter is deadly serious, jokes are exactly that — not to be taken seriously much less indicative of our own views.

quote

Ridicule is man's most potent weapon. It is almost impossible to counteract ridicule.
— Saul Alinsky, 1971.