

A Rope over an Abyss

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Man is a rope, tied between beast and overman—a rope over an abyss. A dangerous across, a dangerous on-the-way, a dangerous looking back, a dangerous shuddering and stopping.
—Nietzsche, *Also sprach Zarathustra*¹

Normally we take for granted the persistence of human civilization. The general order of society and culture is part of the stable framework within which our lives take place. We human beings will transmit our civilization from generation to generation to generation. We accept that this will be so, just as we accept that a night will follow the day, and then a new day will follow the night, and just as we accept that each year the seasons will return in the customary sequence.

When we pause to think about our expectations for the human future, we realize that the implicit picture requires some qualifications. For one thing, the ongoing process of human history is more complex, more fragile, and less certain of continuance than the predictable regularities of days or seasons. Moreover, human life will perhaps not last as far into the future as either the alternation of day and night or the round of the seasons. But then, neither will the latter phenomena last absolutely forever. Even after giving the matter some thought, we might still feel confident that humanity, and our civilization, more or less as we know them, will exist for a long time to come, for thousands of years, maybe tens or hundreds of thousands of years. Maybe for millions of years. Possibly even longer. Who knows?

A qualification of more practical relevance is the admission that the persistence of civilization is compatible with significant changes in its content and character. We hear so much, and we read so much, about the magnitude and pace of changes during the last century or so. Anyone old enough to remember the last forty years can testify from memory to differences between then and now. The differences include both technological innovations, and social and cultural modifications. In some cases one might even speak of revolutionary changes. In some areas of life, even the *rate* of change is increasing.

Nonetheless, the experience of being human remains basically the same as it always has been. By reading history and literature, and by looking at artifacts made and used by people in different times and places, we understand that the others were and are like us. Emotions and motivations are the same. Fears and hopes are the same. The distance from birth to death is sometimes longer, and sometimes shorter, but everyone walks the same path to the end or until taken from the journey en route. Robert M. Sapolsky has written, “. . . what is surprising is how little these changes have changed us. No matter how long we can expect to live, we still must die . . . and we will still feel like our loved ones were taken from us too soon.”² Sapolsky was surveying the totality of the past existence of the human species, which is of course far longer than the time span of civilization. His remarks seem applicable even to our human ancestors in that distant past, and they certainly hold true for the last few thousand years.

According to some thinkers, all this is about to change. We human beings are within a few decades, or maybe a century or so at most, of something called “The Singularity”. *Time* magazine in a cover story on the subject, defined the term this way: “The moment when technological change becomes so rapid and profound, it represents a rupture in the fabric of human history.”³

If this idea of the Singularity is unsettling, we must brace ourselves for concepts and hypotheses which are far more disturbing. The dreadful counterpoint to the concept of the Singularity is the notion of impending existential catastrophe. Before turning to that, I want to emphasize that many people who discuss the Singularity regard its advent as a very great good. Thus, they are Singularitarians⁴ in the sense of being people who advocate that the Singularity should occur and who act to bring it about. This is clearly different from merely believing that the Singularity is a describable state-of-affairs with a distinct future probability.

Transhumanism presents a set of ideas related to those involved in the Singularity hypothesis and Singularitarianism. According to Wikipedia, transhumanism is “an international cultural and intellectual movement with an eventual goal of fundamentally transforming the human condition by developing and making widely available technologies to greatly enhance human intellectual, physical, and psychological capacities.”⁵ While the Singularity hypothesis emphasizes an abrupt transition to a posthuman state-of-affairs, transhumanism focuses on the outcome rather than on the sudden or gradual character of the transition. A second difference is that transhumanism by definition envisages a very good end state, while formulations of the Singularity hypothesis often describe the post-Singularity situation as unfathomable.

As I mentioned a short while ago, there are also thinkers who believe they can foresee substantial probability for large-scale catastrophes, up to and including the extinction of humanity. Needless to say, none of the pessimists wants any such thing to happen. There are no pessimistic counterparts to Singularitarians. The reason to paint dark pictures of what possibly could happen is to enable humanity to mobilize in order to avoid the dangers and to advance into a more promising future.

Regardless of what these writers want, and regardless of what we want, the accumulated dangers might be real, all the same. John Leslie, judged the probability of human extinction during the next five centuries as perhaps around thirty per cent at least.^{*6} Martin Rees in 2003 stated, “I think the odds are no better than fifty-fifty that our present civilization on Earth will survive to the end of the present century.”⁷ Less than ten years later Rees added a comment: “I have been surprised by how many of my colleagues thought a catastrophe was even more likely than I did, and so considered me an optimist.”⁸ Only by comparison with estimates as sobering as these can we feel any relief in Nick Bostrom’s number of not less than twenty-five per cent, with no time limit. And Bostrom was weighing the probability, not just of extinction, but of any

* Leslie actually wrote, “I nevertheless feel inclined to say that the probability of the human race avoiding extinction for the next five centuries is encouragingly high, perhaps as high as 70 percent.” Bill Joy and Nick Bostrom cite Leslie’s estimate, but restate it in terms of the probability of extinction.

disaster which would lead to “either the annihilation of Earth-originating intelligent life or the permanent and drastic curtailment of its potential for future desirable development.”⁹

Thus, some writers emphasize the unimaginable wonders which human beings, or successor entities, might experience in the future. Other writers warn of a not insignificant probability that human existence might be irremediably reduced to an undesirable form. Indeed, according to these latter writers, humanity might cease to be, leaving no successors endowed with the precious burden of consciousness, no successors to remember and to try to do better. Although the two scenarios for the human future are polar opposites, they agree on two key points. In both of them, the future will be remarkably unlike the past and the present. Moreover, in both of them, the present is a critical period when the future path will be determined.

To speak of the present as a critical period leads readily to an outlook on the future which conceives the practically available alternatives to be almost exclusively outcomes either unusually good or unusually bad. On this view, a low probability is assigned to the middle ground of business-as-usual. This vision of a stark contrast is compatible with, but not logically required by, the hypothesis that a superlatively good state is significantly probable. Similarly, the stark contrast view is compatible with, but not required by, the hypothesis that existential calamity is significantly probable. Often, however, people who emphasize the opposition between extreme outcomes suggest that they are uncertain as to which side will prevail. What they profess to see is the either/or. They maintain that most of the center will fall away. Here is how the Oxford Martin School of the University of Oxford expresses this vision:

The School was founded with the belief that this century, and specifically the next two decades, is a crucial turning point for humanity. The sheer speed of change means that we now have the power to destroy possibilities for future generations. Equally, we have the potential to dramatically improve the well-being of people across the planet.¹⁰

Some individuals see the chasm between alternatives as much wider. For instance, Fred Hoyle: “Whether or not all the agonies and struggles of the past will emerge into a great future, or will vanish into nothing at all, is likely to be decided in the next few tens of human generations.”¹¹ And Martin Rees: “What happens here on Earth, in this century, could conceivably make the difference between a near eternity filled with ever more complex and subtle forms of life and one filled with nothing but base matter.”¹²

Common sense tells us to dismiss assessments and predictions that are as out-of-the-ordinary as these appear to be. Many changes in human affairs are on record, but nothing that comes close to being either species-transcendence or extinction. Furthermore, we know enough about human nature to see why some people are motivated to advance extravagant claims, or uncritically to embrace such claims, although the assertions lack adequate support. Nearly all human beings like to feel they are special. One might be special as an individual, or one might be special by virtue of belonging to a special country or a special group. Perhaps one lives in a distinctive era, in an era of remarkable promise, or in an era of remarkable danger. “It was the best of times, it was the worst of times” Perhaps one lives at a moment in history when critical choices must be made. Because of the human psychological makeup, people are inclined to believe so, whether or not they have good reasons for the belief. Thus, we must be cautious

and skeptical as we examine claims that our lives right now are set in an unusual period and that an even more unusual future might soon overtake us.

The Current Situation

Many ideas are on the table. Some of them conflict with others: they cannot all be right. In order to sort things out, I suggest that we begin by thinking about the hypothesis that the present is a critical epoch in the history of humanity. In this context, “the present” is defined as a century at most, and probably not more than a few decades. Is civilization really poised between a much better future and a very bad one? I believe we can argue convincingly that it is.

Either it will be the best of times, *or* it will be the worst of times. This is the conclusion I need to establish. The argument examines the two cases, but in reverse order. Thus, we first review the possibility of global catastrophe and then, secondly, we look at the possibility of extraordinary improvement in the human condition. This latter alternative includes, but does not require, change which might amount to a kind of transcendence of humanity. The argument ends with a third part. I have to show that these are the only two likely alternatives. The continuation of business-as-usual and life-as-usual is no longer a viable option. The middle ground has fallen away. Although the first two parts of the argument are not trivial, it is the third which is the most difficult and the most important.

(1) To understand how the worst of times might come upon us, we begin with the obvious truth that disasters happen. It is the next step in the argument which requires some thought. We have to give appropriate weight to the novel factors inherent in the circumstances of the contemporary world. A global catastrophe of civilization is more likely to happen now than it was in the past. One novel factor is the scale of human activities. Never before have so many people lived on the earth at the same time. More important than population size per se is the scale of many industrial processes. By historical standards, people are dealing with enormous amounts of matter and energy. The concerns about, for instance, climate change and species extinction indicate that humanity is in some respects a force of geological significance. Then there is the factor of globalization. The human species now conducts much of its business (literally and figuratively) as one connected global enterprise. This has many obvious benefits, but it carries the downside risk that distance is no longer such an obstacle to the spreading of threats, such as contagious diseases. Probably the most important novel factor is complexity. Whether on a global scale or in more localized activities, our lives depend on very complex systems, both technological and social. The complexities are one reason that the systems function as they do, and so deliver the services required of them. But the risks are serious. The more complex a system is, the more liable it is to failure in some part. Also with complex systems, if something does go wrong, the initial malfunction could quickly lead to other failures, and together the problems could cascade into a catastrophe. Moreover, complex systems are generally harder to repair when disrupted. There are reasons to be worried.

(2) By contrast, positive scenarios are also genuinely possible. We might come into the best of times. In order to understand this possibility, we need to combine mentally three facts.

One is the fact that some people conceive, predict, or advocate radical transformation of the human condition. Among these are, of course, transhumanists, advocates of the Singularity hypothesis, and Singularitarians.¹³

The second of the three relevant facts involves a judgment that the laws of nature permit the changes transhumanists and similar thinkers envisage, at least to a large extent. I do dissent from the more extreme claims. No amount of life extension will amount to immortality. Immortality is deathlessness, everlasting or eternal life (of some sort). A life span of two hundred years does not amount to that, nor does an allotment of five hundred, six hundred, or a thousand years. A Methuselah of the future would not be even virtually immortal or nearly immortal. Nonetheless, from a practical standpoint, this obvious objection is a quibble. If the goal is fundamental transformation of the human condition, looking forward within one's life to a hundred and fifty or two hundred years would achieve that. We need to remember that transhumanists aim not only to add to the years of life but also greatly to augment the capacities available during life, however long it may be. Surely, superhuman longevity (by current standards) plus enhancement would fulfill a promise of radical transformation. With respect to enhancement, as with life extension, we need not accept everything that is claimed. I doubt that I shall find in any contemporary book "The Secret of Human Thought Revealed".¹⁴ But I have much reason to believe that computer scientists and others will continue to devise instruments that assist, simulate, and improve thinking. For transformation of the human condition, that will be good enough.

The third fact which we should contemplate along with vision and natural possibility is the application of systematic research. Conceptions of a radically different, and better, human future are now something more than ideas propounded by individual thinkers. Such proposals and hypotheses have become items on the agenda of research and development organizations. The most publicized of these futuristic enterprises might well be the Calico company at Google. The purpose of Calico is to find ways to overcome the processes of aging and to extend the human lifespan. It is not clear how far Larry Page and Sergey Brin, Google's co-founders, think they can go with this effort. It is clear that they, and many of their friends and associates, want to go as far as they can. It is also clear that Google has \$54 billion in cash.¹⁵ That is enough to fund much research over many years. A valuable source for information on connections among business, research, and futurism is the Web site of Singularity University.¹⁶ Founded in 2008 by Peter Diamandis and Ray Kurzweil, the university's original corporate sponsors include Google (of course), Genetech, Nokia, and Cisco.

(3) We come then to the third part of the argument. How is it that the likelihood of business-as-usual and life-as-usual is melting away? The argument on this point begins with the fact we just noticed, namely, the symbiosis of money, expertise, and lofty purpose. The research programs with some sort of transformationist inspiration or goal will someday somehow come to an end. Perhaps they will end because they will have attained their goals of life extension, human betterment, and superintelligence. In that case, we shall be in the alternative which will be the best of times. If we try to understand other ways in which such research might stop or be stopped, we cannot realistically suppose that the promoters, advocates, and researchers will lose

interest and then turn to other things. It is also implausible to suppose that the natural limits on technology are much tighter than they seem to be. If we be so deeply mistaken about the laws of nature, then it will be impossible in practice to extend the human lifespan by more than a decade or two longer than what it now is in the most developed countries. Also, on the hypothesis of grave error on our part, computer technology, including robotics and nanotechnology, has progressed about as far as it can. But there are few signs that human ingenuity and enterprise are about to run into limits so close to where we now are. Innovation will not stop for that reason. So, if enough people with means will want to continue and if nature contains additional potentialities to explore and to put to good use, there is only one other end point short of success. If the research stops without having reached something close to the desired goals, that will only happen because the research programs are forced to stop. And the only likely cause for a forced termination would seem to be one or more of the civilization-wide catastrophes we earlier discussed. Therefore, it will be the best of times—unless the worst of times intervenes. Our familiar business-as-usual and life-as-usual have little chance for a future.

There is one additional element in this terrestrial-scale quasi-Manichean picture. The negative tendencies are somewhat more likely to prevail than the positive ones. There are several reasons to think this. For one thing, a beneficial outcome requires that many factors work together in order for the result to be achieved, but an undesirable outcome can occur if only one necessary ingredient is missing.¹⁷ Applying this contrast to temporally extended processes, we find that a desirable situation often takes time to construct and, if damaged, time to repair, but a single event can bring about ruin. Another reason is that we have empirical evidence that grave problems, such as species extinctions, resource depletion, and climate change, not to mention increasing inequities and other social ills, are happening right now. By contrast, hoped-for transformations of the human condition, though not implausible as expectations, are not here yet.

In a general way, then, Nietzsche's metaphor of a rope over an abyss is an apt image for our times. Obviously, we are not today starting from prehuman times. Just as obviously, the end state might not be as remote from our experience as Nietzsche's overman (or Kurzweil's Singularity) would be. Nonetheless, we need to avoid disaster as we move toward hope.

What Should Humanity Do Now?

Evidently humanity is at a turning point. "It may not be absurd hyperbole—indeed, it may not even be an overstatement—to assert that the most critical location in space and time (apart from the big bang itself) could be here and now."¹⁸ If this is so, the inescapable question is what humanity should do. In my view, three strategic principles are essential.

First, avoidance of a negative outcome must take priority over the production of a positive outcome. One of my reasons for this I have already stated: potentialities for general ruin appear to be more likely than potentialities for desirable advancement. Thus, additional effort is needed to reduce the likelihood of disaster. There are also two reasons which hold independently of this assessment of the relative strengths of the contending forces. For one thing, the evil inherent in an existential disaster is so enormous that we ought to strive to avoid it,

even if the odds of its occurring are quite small. And then also, many projects for human betterment are underway. Given sufficient time, the viable ones will come to fruition. What they need, more than they need assistance, is protection from external threats that could destroy them before they reach maturity.

The second strategic principle is that we can rely only on human character and motivations as we now find them, and we can rely only on normal improvements in technology. In other words, the solution of current human problems does not lie with transhumanism or with the Singularity or with anything of that sort. Why not? Obviously, a desirable posthuman condition might never come about. This observation is, however, the weakest of the reasons for doubting the relevance of an appeal to transhumanist solutions. A stronger reason is the fact that technology takes time to develop and deploy. Consequently, a transformation which ultimately will be enormously beneficial can be destabilizing during its implementation. For example, extending the life span to two hundred or three hundred years would be beneficial, if people in general could expect to live that long. However, while technology for life extension is being introduced, it is likely that only a few very wealthy people will be able to afford it. For decades (probably) life extension will appear to those excluded as one more advantage of the privileged. This perception, accurate or not, can only increase social tension and social conflict. The strongest reason is that transhumanism, if it comes at all, will come too late. Environmental and resource problems, and social problems along with them, are a gathering storm. They will not wait until 2045 (the approximate date Kurzweil has predicted for the Singularity).¹⁹ Humanity must solve humanity's problems, or there will never be any transhumanity.

The third strategic principle is to select carefully the problems to attack. There are too many serious problems for all of them to receive equally serious attention all at once. Tentatively, I would suggest that climate change be taken as the top priority on the global human agenda. I have several reasons for this selection. The evidence of the problem is massive. The consequences will be severe, and are even now beginning.²⁰ Moreover, the issue is already fairly well-known as part of humanity's collective and institutional agenda. But, for most individuals and most institutions, it is not a priority. It is regarded as a problem to be addressed at some future time. I have two additional and less obvious reasons for this selection. First, I do not believe that we can solve the problem of climate change without also making progress on many other natural and social problems that humanity faces. This is because wasteful and inefficient uses of energy are embedded in current economic structures, and the former cannot be reduced without modifying the latter. Therefore, working on climate change leverages our efforts so as to work on several problems concurrently. The second not-so-obvious advantage is that a global effort focused on one serious problem (i.e., climate change) will put in place both institutional structures and habits of mind that will be required for many other tasks in the coming decades.

The question of what humanity should do is inescapable, and it is important. All the same, it is not the question which it is most appropriate *for me* to ask. Humanity cannot receive or act upon advice, because humanity does not have a unified consciousness or a unified will, in the way that human individuals possess these capacities, nor even in the attenuated way that organizations may be said to have a consciousness and a will. More to the point, I am not in a

position to give humanity advice or to change the course of history. It makes more sense for me to ask what I can do. My acts might fit into a larger pattern or they may remain gestures, but at least they will be concrete.

But What Can I Do About It?

So at last we reach a question which has been in my mind as I worked through the preceding material. This question would probably occur to most people in any discussion of this sort. Amidst many grand questions, it is a humble question. Any proposed answer must necessarily specify measures too small to impact the problems. The compensating virtue of the question is that it brings my thinking into the concrete reality around me. Grand solutions, whatever they may be for others, remain only fantasies for me.

The best I can do is to imagine that today I received a message. Whether from a dear friend or from an anonymous stranger, does not matter. The message most likely came by e-mail. The message reads somewhat as follows:

What I have to say is unusual, and it may appear even strange. I ask, however, that you please take a little time to consider these thoughts.

From what I have been hearing and reading lately, I have become increasingly concerned about the world in which our children and grandchildren will have to live. I note, for example, in a recent issue of *Scientific American* the warning about a climate crisis in the near future.²¹ More generally, looking at some other topics, I have studied materials on the Web site of the Centre for the Study of Existential Risk at the University of Cambridge.²² Perhaps you are familiar with other sources that would cast light, one way or another, on the prospects our children and grandchildren face.

After due consideration, you may come to believe, as I do, that here are problems which demand both personal commitment and changes in public policy. At a personal level, I have decided to begin by reducing my travel by automobile. Rather than specifying details, I shall simply add that my longer-term goal is to reach a point where automobile travel is only for a few special occasions or emergencies. In addition, I intend to make my house more energy efficient.

At the level of public policy, I have been persuaded²³ of the importance of two steps. The first is changing the market prices of energy supplies so that those prices include the real-world costs of those commodities. The second is encouraging efficiency in order to decrease energy use or at least to slow the rate of increase. I am aware that there are technical difficulties in implementing these policy changes. I am acutely aware that both of them, especially the first, mean higher monetary prices for energy, and that the prices will be paid by industries and consumers in developed nations. Nonetheless, I advocate these steps. I am prepared to bring them to the attention of policy makers, just as I now mention them to you.

I would appreciate suggestions either for implementing or for improving these ideas. We all share the goal of a better world for those who come after us.

If you believe the foregoing ideas have merit, then I ask that you forward them to others. If you believe that the ideas must be modified in the service of our common goal, then I ask you to do that before you send them on. In deciding to whom the message should be sent, please try to include those who are socially positioned to have the most influence (that you know of) in implementing these changes. Or, if an intended recipient might perhaps lack such influence in his or her own right, then the goals can still be advanced by reaching out to a recipient with second-hand or third-hand associations with persons more influential on policy matters like this.

Finally, I would ask that you include in your message some wording similar to the immediately foregoing request to advance the dialogue with people more likely to have the means to implement necessary political, social, and economic change.

Thank you for your attention. I look forward to your thoughtful response.

As I said, asking myself what I can do, I find it useful to imagine that I received a message like this. I wonder how I would respond. My first inclination would be to delete it. Maybe, however, I would recall the image with which we began, the image of the rope over the abyss. Fortunately, if I must be part of that rope, I am required to be only a tiny fraction of inch. There will be many other strands, and all of us together might not have to reach much farther to get to the post on the other side. When I suppose myself thinking this way, I conclude that I would read the message carefully, study it, make some changes, and send it on. I also conclude that then I would stand up and do what I can.

- 1 Prologue to the First Part, section 4, translated by Walter Kaufmann in *The Portable Nietzsche* (New York: The Viking Press, 1954), pages 126-127.
- 2 “Super Humanity”, *Scientific American*, 307 (September, 2012), pages 42-43.
- 3 Lev Grossman, “Man and Machine”, *Time*, 177 (February 21, 2011), page 43. See also “Technological singularity”, <http://en.wikipedia.org/wiki/Technological_singularity>. The Wikipedia article refers for its definition to Amnon H. Eden, James H. Moor, Johnny H. Soraker, and Eric Steinhart, editors, *Singularity Hypotheses* (Springer-Verlag, 2012), page 1.
- 4 Ray Kurzweil, *The Singularity Is Near* (New York Viking, 2005), page 370. Wikipedia, “Singularitarianism”, <<http://en.wikipedia.org/wiki/Singularitarianism>>.
- 5 “Transhumanism”, <<http://en.wikipedia.org/wiki/Transhumanism>>. The Wikipedia article cites for this Nick Bostrom, “A History of Transhumanist Thought”, *Journal of Evolution and Technology*, 14 (April, 2005), now available at <<http://www.nickbostrom.com/>>. This specific wording seems not to appear in Bostrom’s article. See also Nick Bostrom, *Superintelligence: Paths, Dangers, Strategies* (Oxford University Press, forthcoming); information on this book at <<http://www.nickbostrom.com/>>.
- 6 *The End of the World* (London: Routledge, 1996), page 146. Cited in Bill Joy, “Why the future doesn’t need us”. [Originally published in *Wired* (2000). Now widely available on the Internet.] Also cited in Nick Bostrom, “The Future of Humanity”, page 10. [For Jan-Kyrrre Berg Olsen and Evan Selinger, editors, *New Waves in Philosophy and Technology* (Palgrave MacMillan, 2007). Reference here is to the version available at Nick Bostrom’s Web site, <<http://www.nickbostrom.com/>>.]
- 7 *Our Final Hour* (New York: Basic Books, 2003), page 8.
- 8 *From Here to Infinity* (New York: W. W. Norton & Company, 2012), page 72.
- 9 “The Future of Humanity”, page 10. Bostrom points out that he first published his estimate in “Existential Risks”, *Journal of Evolution and Technology*, 9 (2002). This paper is also available at <<http://www.nickbostrom.com/>>.
- 10 “About Us” page at the Web site of the Oxford Martin School, <<http://www.oxfordmartin.ox.ac.uk/about>>.
- 11 *Ten Faces of the Universe* (San Francisco: W. H. Freeman & Company, 1977), page 203.
- 12 *Our Final Hour*, page 8. See also page 188.
- 13 See page 2 above.
- 14 Subtitle of Ray Kurzweil’s *How to Create a Mind* (New York: Penguin Books, 2013).
- 15 Harry McCracken and Lev Grossman, “The Audacity of Google”, *Time*, 182 (September 30, 2013), pages 22-30.
- 16 <<http://singularityu.org/>>
- 17 See Jared Diamond, *Guns, Germs, and Steel* (New York: W. W. Norton & Company, 1999), pages 157-175, on the “Anna Karenina principle”. See also the Wikipedia article, “Anna Karenina principle”, <http://en.wikipedia.org/wiki/Anna_Karenina_principle>.
- 18 Martin Rees, *Our Final Hour*, pages 7-8.
- 19 *Time* magazine cover, February 21, 2011; see note 3 above.
- 20 Many sources. E.g., The Worldwatch Institute [Robert Engelman, Michael Renner, and Janet Swain, project directors], *State of the World 2009 Into a Warming World* (New York: W. W. Norton & Company, 2009); John Carey, “Global Warming: Faster Than Expected?” *Scientific American*, 307 (November, 2012), pages 50-55; Michael E. Mann, “False Hope”, *Scientific American*, 310 (April, 2014), pages 78-81. See also Al Gore, *Earth in the Balance* (New York: Plume, 1993). See also Al Gore’s film, “An Inconvenient Truth”, directed by Davis Guggenheim (2006), and the companion book, *An Inconvenient Truth* (New York: Viking, 2007).
- 21 Michael E. Mann, “False Hope”.
- 22 <<http://cser.org/>>
- 23 By Vaclav Smil, “The Long Slow Rise of Solar and Wind”, *Scientific American*, 310 (January, 2014), pages 52-57. See also his *Energy Transitions: History, Requirements, Prospects* (Santa Barbara, California: Praeger, 2010).