

The current revision of this manuscript clarifies earlier arguments of the authors Garrett et al and adds support to my previous recommendation for proceeding with publication. I summarize their main argument and revisit its implications in order to reinforce that recommendation.

The key result is the claim that the future behavior of the human-technological “world-system” (civilization, global society, technosphere...) is strongly constrained by a single quantity, W , a measure of the accumulated products of its past consumption of energy. The reason that significant aspects of the behavior of something as complex as the world-system can be subjugated to a seemingly simple quantity like W is that complex systems are directly describable at a given scale (here the global scale) only by concepts and constructs native to that scale. Considered in its relation to global consumption of energy, W appears to be such a construct.

Garrett et al appeal to economic data to argue that over time energy consumption E by the world-system is proportional to W . This relationship has the alarming and perhaps puzzling consequence that the rate of energy consumption by the world-system today seems to be wired into its past history of production through a simple dependence on W . The authors illustrate their resolution of the puzzle through various analogies showing how energy use by diverse systems (for example a tree) reflects their cumulative productive history, even if past production does not remain metabolically active (e.g., the dead heartwood of the tree). The significant point is not just that consequences of prior human behavior, in the form of past production, still influence human actions today, since of course the present is contingent on the past, but rather that the rate at which society uses energy seems to be determined by the value of W . Humanity appears destined to experience the consequences of continuing increases in energy use given that acceleration is the source of new productivity which in turn adds to the value of W . If all human endeavor, as far as energy use today is concerned, is indeed wrapped up in the quantity W , the latitude for human action to shape the future of civilization would seem to be severely limited.

The Garrett et al argument is formulated within a physical framework that focuses on the underlying condition that drives essentially every global Anthropocene crisis from climate change to occurrence of pandemics to spread of mass surveillance, namely, the chronic acceleration of energy use. The ideas and connections discussed are interesting, provocative, and, in my view, well-defended, and they open many new avenues for thought and research. The authors' conclusions should be more widely known, not because the issues are settled, but to open them to wider consideration and debate.

In preparing this review I composed several more pages of commentary. However, on reflection that seemed to be overkill, so rather than continuing I stop here. As part of the review process, however, I would be happy to respond to any remarks or questions by the ESD community.