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A critique of the apocalyptic climate narrative

Harry DeAngelo[1] | **Judith A. Curry**[2]

[1]Marshall School of Business, University of Southern California, Los Angeles, California, USA

[2]School of Earth and Atmospheric Sciences, Georgia Institute of Technology, Atlanta, Georgia, USA

Correspondence Harry DeAngelo, Marshall School of Business, University of Southern California, Los Angeles, CA, USA.
Email: hdeangelo@marshall.usc.edu

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INTRODUCTION

According to the Apocalyptic climate narrative, humanity faces an existential threat from global warming that can be averted only by aggressive suppression of fossil-fuel use. The narrative has been promoted by environmental activists, prominent politicians, and the United Nations for more than three decades and has been accepted as gospel truth by many citizens of the United States, the United Kingdom, Germany, and other wealthy countries.

Alarming narratives that have an aura of plausibility can be highly effective tools for shaping public opinion and public policies. When such narratives are false or seriously misleading, they can do significant damage because of unintended consequences of their policy prescriptions. For example, an alarming narrative—rooted in a false, but plausible-sounding, analogy between the risks of nuclear power plants and nuclear bombs—helped turn public opinion against nuclear power and thereby induced much greater use of coal over the last 50 or so years.[1] The substitution of coal for nuclear power shortened millions of lives (due to greater air pollution) and led to higher CO_2 emissions than would have otherwise occurred.

These unintended consequences of the anti-nuclear-power narrative should make us think carefully before the United States goes too far down the energy path prescribed by the Apocalyptic climate narrative.

The Apocalyptic climate narrative is a deeply flawed guide for public policies because it:

- focuses on the risks/costs of global warming and ignores any benefits from warming and the myriad benefits to humanity from fossil-fuel use.
- advocates aggressive near-term suppression of fossil-fuel use without considering the huge costs that such suppression would inflict on humans.
- lacks a realistic sense of proportion about the risks/costs from continued global warming, which are manageable, not existential.

This paper details the flaws in the Apocalyptic climate narrative, including why the threat from human-caused climate change is not dire and why urgent suppression of fossil-fuel use would be unwise. We argue that sensible public policies would focus instead on developing a diversified portfolio of energy sources to support greater resilience and flexibility to respond to whatever weather and climate extremes might occur. We identify nine principles for sensible US public policies toward energy and discuss implications of the flaws in the narrative for investors and their agents.

IS GLOBAL WARMING DANGEROUS?

Hypothesized damaging consequences of global warming include: (i) loss of life from greater intensity and frequency of heat waves, hurricanes, floods, droughts, and wildfires, and (ii) economic losses from such extreme-weather events and from sea-level rise due to melting polar ice caps. Assessments of the impact from human-caused warming are complicated by the difficulty of determining the extent to which observed temperature increases are caused by natural climate variability—a difficulty that adds to the uncertainty in estimates of how much human-caused warming to expect over the 21st century.

Warming over the past 120 years

The question of whether global warming is dangerous (whatever its cause) can be addressed by examining the behavior of the

[1] Shellenberger, M. 2020. *Apocalypse Never: Why Environmental Alarmism Hurts Us All*, Chap. 8. New York, NY: Harper Collins.

climate since before the time human activity generated large amounts of greenhouse-gas emissions. Human-caused global warming is typically measured with reference to pre-industrial times; for practical reasons in terms of the availability of data, the usual approach employs a baseline period in the late 19th century. Since the late 19th century, Earth's average temperature has increased by about 1.3°C (2.3°F). During the same period, average global sea level has risen 8–9 inches, and there has been little or no detectable change in most types of extreme weather events when measured against the background of natural weather and climate variability.

Since the late 19th century, with 1.3°C of global warming, humanity has seen unprecedented increases in prosperity and well-being. Global population has increased from about 1.6 billion in 1900 to 8.2 billion people in 2024. In 1900, the global average lifespan was 34 years; in 2024 the global average lifespan more than doubled to 73 years. From 1961 to 2020, global agricultural output nearly quadrupled, with a 53% increase in per capita output despite a 2.6-fold increase in global population.

Since the early 1900s, per capita mortality from hurricanes, floods, droughts, and wildfires has decreased by almost 98%.[2] These favorable trends in weather- and climate-related mortality rates reveal that the world is now much better at preventing deaths from extreme weather and climate events than it was a century ago. The sharp reduction in death rates has been accomplished through greater wealth (driven by energy derived from fossil fuels), which provides better infrastructure, superior advance-warning technologies, and greater capacity to recover from weather-related disasters.

Although the role of higher temperatures and atmospheric CO_2 concentrations in these favorable changes in mortality rates is open to debate, two aspects of the increases are unambiguously beneficial. First, satellite observations since the 1980s indicate widespread greening of the planet. The satellite data show that, over the last two decades, Earth has increased its green leaf area by approximately 5%. This greening reflects increased CO_2 fertilization, warmer temperatures, and more rainfall.[3]

The second aspect relates to heat and cold extremes. An unambiguous consequence of global warming is more frequent heat extremes, coupled with less frequent cold extremes. It is well known that mortality is substantially greater (almost a factor of 10) for extreme cold than for extreme heat.[4] Consequently, rising temperatures are associated with a *net saving of lives* owing to the reduction of mortality from extreme cold events. Heat-related mortality is also declining over time, owing to general improvements in health care systems, increasing prevalence of residential air conditioning, and behavioral changes—factors that have dominated any impact of a warmer planet on the risk of heat-related death.[5]

Although the dollar value of damages from extreme weather events is now greater than it was many decades ago, this increase is the result of increasing vulnerability and exposure associated with greater population and concentration of wealth in coastal and other disaster-prone regions. A recent analysis summarizing many studies finds no evidence to support claims that any part of the overall increase in global economic losses from weather and climate disasters can be attributed to global warming.[6]

Prospective warming over the 21st century

What about warming over the rest of the 21st century? Is there reason to expect dire consequences for humanity going forward in time?

The Apocalyptic climate narrative and the most extreme impacts are driven by extreme emissions scenarios, with 4–5°C of warming by 2100 (above a baseline in the late 19th century). However, since 2021, the UN's climate negotiators have abandoned extreme emissions scenarios as unrealistic for two reasons. First, they make unrealistic assumptions, especially about coal use. Second, actual emissions have been tracking well below their most extreme emission scenario, and indeed slightly below their medium emissions scenario. The UN is now working with an estimated year 2100 warming of 2.5°C,[7] while the IEA Roadmap to NetZero projects 2.4°C of warming by 2100.[8] When plausible scenarios of natural climate variability and values of climate sensitivity on the lower end of the UN's IPCC likely range are considered, the expected warming could be significantly lower.[9]

If we work with 2.5°C projected warming by 2100, more than half (1.3°C) of the predicted increase in temperature has already occurred. There are good reasons to expect continued advances in prosperity and well-being over the remainder of the 21st century—and ample reasons such as AI to expect such advances to accelerate. Moreover, the so-called threshold of danger of 2°C warming since pre-industrial times is not an objective threshold of danger. Rather, 2°C is a politically negotiated target designed to motivate broad-based actions to reduce emissions.[10]

Importantly, there is no credible case that missing the 2°C target would pose an existential risk to humanity. Humans have

[2] Koonin, S. 2021. *Unsettled: What Climate Science Tells Us, What It Doesn't, and Why It Matters*, 170. Dallas, TX: Ben Bella.

[3] Chen, X., T. Chen, B. He, S. Liu, S. Zhou, and T. Shi. 2024. "The Global Greening Continues Despite Increased Drought Stress Since 2000." *Global Ecology and Conservation* 49: e02791. https://www.sciencedirect.com/science/article/pii/S2351989423004262

[4] Zhao, Q., Y. Guo, T. Ye, A. Gasparrini, S. Tong, A. Overcenco, A. Urban, et al. 2021. "Global, Regional, and National Burden of Mortality Associated With Non-Optimal Ambient Temperatures From 2000 to 2019: A Three-Stage Modelling Study." *The Lancet Planetary Health* 5(7, July): E415–25. https://doi.org/10.1016/s2542-5196(21)00081-4.

[5] O'Neill, B., et al. 2021. "Key Risks Across Sectors and Regions." In *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, 2411–538. Geneva, CH: IPCC.

[6] Pielke, R. 2020. "Economic 'Normalisation' of Disaster Losses 1998–2020: A Literature Review and Assessment." *Environmental Hazards* 20(2, May): 93–111. https://doi.org/10.1080/17477891.2020.1800440; and Pielke, R. 2023. "Climate Change and Disaster Losses: A Fresh Update to an Overwhelming Scientific Consensus." https://rogerpielkejr.substack.com/p/climate-change-and-disaster-losses

[7] UNFCCC. 2022. "COP27 Reaches Breakthrough Agreement on New 'Loss and Damage' Fund for Vulnerable Countries." November 20, https://unfccc.int/news/cop27-reaches-breakthrough-agreement-on-new-loss-and-damage-fund-for-vulnerable-countries.

[8] IEA. 2023. "Net Zero Roadmap: A Global Pathway to Keep the 1.5°C Goal in Reach – Analysis." *International Energy Agency*, September https://www.iea.org/reports/net-zero-roadmap-a-global-pathway-to-keep-the-15-0c-goal-in-reach.

[9] Lee, J. et al. 2021. "Future Global Climate: Scenario-Based Projections and Near-Term Information." In *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, 553–672. Geneva, CH: IPCC.

[10] Curry, J. 2023. *Climate Uncertainty and Risk: Rethinking Our Response*. New York, NY: Anthem Press.

adapted to (and thrived in) climates extremes far worse than in the pessimistic extreme scenario, as summertime residents of Phoenix and wintertime residents of Minneapolis demonstrate every year.

Two other risk-related points are relevant here. First, a basic assumption in the socioeconomic scenarios used in formulating the UN climate-assessment reports is that vulnerability to weather and climate extremes decreases with greater wealth and economic development, as adaptive capacity increases. All of the Shared Socioeconomic Pathways (SSPs) scenarios constructed for the most recent UN climate assessment entail dramatic growth, with global GDP in 2100 between four and ten times larger than in 2010.[11] These scenarios do not imply any futures for humanity that are worse than today.

Second, risks from human-caused global warming are difficult to separate credibly from natural weather and climate variability and the risks to a large degree reflect the vulnerabilities of less-developed countries and poorer populations generally. Increasing wealth and productivity will continue to reduce humanity's vulnerability to weather- and climate-related risks.

Tipping points and surprises

Uncertainty about the impact on humans of continued use of fossil fuels is dominated by the difficulties of estimating the likelihood of catastrophic outcomes from climate tipping points that could cause severe and possibly irreversible damage.

Climate tipping points are defined as abrupt or nonlinear transitions to a different climate state, which are hypothesized to occur once some threshold has been crossed, with regional or global consequences that are largely uncontrollable and beyond our management. In other words, tipping points are points of no return, at least on the century timescale. In recent geologic history, abrupt climate change has been caused by changes in ocean circulation patterns and ice-sheet dynamics, including (i) the Younger Dryas (12,900–11,700 years ago) when global temperatures dropped by up to 15°C in some regions, (ii) an unnamed sudden cooling event that occurred around 8200 years ago and that lasted about 150 years, and (iii) the Dansgaard-Oeschger Events (115,000–11,500 years ago) with a series of abrupt warmings and cooling during the last Ice Age with temperature shifts of 5–10°C occurring within decades.

The IPCC Assessment Reports have considered a number of potential tipping points associated with global warming, including ice-sheet collapse, collapse of the Atlantic Overturning Circulation, carbon release from permafrost thawing, and destruction of the Amazon rainforest and coral reefs. There are some preliminary climate model simulations for some of these conjectured tipping points. However, climate models do not include the appropriate physical, chemical, and biological processes to adequately simulate such events. Hence, these hypothesized climate tipping points have been based largely upon the consideration of imperfect analogues from the geologic past, process models, and physically based storylines.

The likelihood of any of the above types of hypothesized tipping points occurring in the 21st century under the medium emissions scenario is generally regarded as low, although there is also low confidence in any conclusions surrounding possible tipping points owing to deep (Knightian) uncertainties in our understanding of the complex climate system.

Could something genuinely catastrophic happen to the climate on the timescale of the 21st century? Yes, although continued use of fossil fuels is not the only possible cause. For example, a climate catastrophe could also be caused by nuclear war, a series of explosive volcanic eruptions, natural shifts in ocean circulation patterns, and/or shifts in ice-sheet dynamics driven by geologic processes.

It is impossible to remove all sources of climate-related risk, and it would be unwise to attempt to try to avert low probability climate catastrophes with policy actions that would themselves surely impose massive near-term costs on humanity. There is no doubt that aggressive near-term suppression of fossil-fuel use would impose significant costs on humans until such time as viable replacements for fossil fuels were found for the roles they play in the production of food, steel, cement, and plastics.

The critical implication: In terms of rational risk management, there is no case for policies that would suppress fossil-fuel use aggressively simply because something bad might happen. For such suppression to be rational, we should have good reason to think that the low probability climate catastrophe we would avoid would be far worse than the catastrophe we would surely induce by moving aggressively to net zero. We have yet to see anyone provide credible support for the latter argument.

FOSSIL-FUEL SUPPRESSION: SHOOTING OURSELVES IN THE FOOT

The Apocalyptic climate narrative incorrectly portrays CO_2 emissions as inherently and unequivocally dangerous and an economic "bad," that is, a purely negative externality. This portrayal ignores the fact that CO_2 yields direct benefits (e.g., it is plant food) and the inarguable technological reality that fossil fuels are currently *irreplaceable* inputs for producing food (via ammonia-based fertilizer), steel, cement, and plastics,[12] which are central features of modern life.

The last 150 years have seen an enormous increase in human welfare that occurred to a large degree because of the use of fossil fuels for electricity, transportation, agriculture, and the material inputs for manufacturing and infrastructure construction. Fossil fuels have enabled huge advances in medicine, food production, communications, computing, ground and air travel, and much more. They have enabled billions of people to have lives of much higher quality, longer length, and generally greater material abundance than our ancestors—most of whom lived on the Malthusian margin of survival.

The 2015 Paris climate agreement set a goal of "net-zero" global emissions (a balance between greenhouse-gas emissions and offsetting emission removals) by 2050, which as a practical matter

[11] Dellink, R., J. Chateau, E. Lanzi, B. Magné. 2017. "Long-Term Economic Growth Projections in the Shared Socioeconomic Pathways." *Global Environmental Change* 42(January): 200–14. https://doi.org/10.1016/j.gloenvcha.2015.06.004.

[12] Smil, V. 2022. Chapter 3 of *How the World Really Works: A Scientist's Guide to Our Past, Present, and Future*. London, UK: Viking; and Gates, B. 2022. Chapter 3 of *How to Avoid a Climate Disaster*. New York, NY: Penguin Random House.

targets a drastic reduction in fossil-fuel use over the next 25 years. By 2024, 107 countries had adopted net-zero pledges. The United States entered the agreement under President Obama, exited under President Trump, re-entered under President Biden, and is in the process of exiting again under President Trump's second administration.

The problem with the Paris agreement is its urgent timeline for abandoning fossil fuels before we have viable replacements for the energy they provide and the myriad other roles they play in creating products that benefit humanity. As Vaclav Smil put it bluntly in 2020:

> Designing hypothetical roadmaps outlining complete elimination of fossil carbon from the global energy supply by 2050 is nothing but an exercise in wishful thinking that ignores fundamental physical realities.[13]

Failure of net-zero policies

After the Paris agreement, atmospheric CO_2 concentrations increased 5.0% from 401 ppm in 2015 to 421 ppm in 2023. Global emissions from burning fossil fuels increased 6.6% from 34.7 billion metric tons in 2015 to 37 billion metric tons in 2023. Today, the world is far from reaching the net-zero emissions target and the post-Paris emissions trend is away from target.

In recent years, the world has spent enormous amounts on clean energy in the hope of curtailing fossil-fuel use. In every year since 2015, outlays on clean energy have been $1 trillion or more, with outlays for 2024 on track to reach $2 trillion.[14] These efforts have succeeded in slightly lowering the percent of global energy from fossil fuels, but they have done so by expanding other sources of energy—notably solar and wind—and *not by reducing fossil-fuel use*. Today, the world gets 81% of its energy from fossil fuels, down slightly from 82.8% in 2010 and 81.2% in 2000. In absolute terms, global use of oil, natural gas, and coal have all increased. Although a decade of government subsidies of electric vehicles has led to less oil usage than would otherwise have occurred, absolute consumption of gasoline is now at a record high.

In public discourse, capitalism and democracy are sometimes unfairly blamed for increasing emissions and the failure of net-zero policies. China has strong elements of a government-planned rather than capitalist economy and no reasonable observer would mistake it for a democracy. Yet China is the world's largest greenhouse-gas emitter.

Fossil-fuel firms are also portrayed as the root cause of global warming. If humans did not desire the products made with fossil fuels, there would be no firms producing such products. Consumption demand by individual human beings is the root cause of fossil-fuel use and greenhouse-gas emissions. Net-zero policies are failing because they do not deal with this fundamental reality.

A variety of underlying economic and political considerations have played roles in the failure of the net-zero policies embraced by many of the world's governments. Most obviously, government subsidies have induced a greater supply of solar- and wind-generated energy, but a range of technical and political issues have hampered the widespread deployment of these clean-energy sources.

Governments could motivate reductions in fossil fuels by enacting carbon taxes, which would penalize activities in proportion to the emissions they cause. However, proposals to enact such taxes have been very unpopular, especially in the United States, and thus have gained virtually no political traction. Although many people say they are concerned about global warming, there is widespread resistance among the US electorate to paying for climate-related actions.

Voters' resistance to a carbon tax would be especially difficult to overcome once they have a realistic understanding of its limited climate impact. If the United States hypothetically cut its greenhouse-gas emissions to zero today, there would be no reliably detectable effect on Earth's weather or climate over the 21st century. If we accept the climate model projections of 1.2°C or maybe 1.3°C additional warming over the rest of the 21st century, US annual emissions of about 13% of the world's total would contribute less than 0.2°C of warming over the next 75 years.

It would be a very tough sell to convince US voters to incur massively higher tax bills for a small reduction in the warming trend. It would be especially tough to make that sale when China, India, and many other countries are continuing to emit greenhouse gases at prodigious rates.

These problems with clean-energy subsidies and carbon taxes have led the US and European governments to attempt to address global warming through a variety of other tactics such as mandates, quotas, prohibitions, and regulations on specific products and activities because of their carbon footprint.

These tactics include mandating electric-vehicle production through setting caps on total product-line emissions for automobile firms; outlawing the use of gas stoves; controlling the supply of fossil fuels by regulatory restrictions on permits for production; canceling oil and gas pipelines; lobbying pension funds, university endowment funds and other such organizations to divest their investment holdings of fossil-fuel firms; and use of regulatory pressure to discourage banks and other financial institutions from making loans to support investment in fossil-fuel projects, both in the United States around the world.

These tactics have been adopted because of the urge to "do something" about a potential problem and because few people recognize that these actions will have negligible impact on global warming.

Geopolitical concerns about fossil-fuel suppression

Another political impediment to suppression of fossil-fuel use is that it would weaken our national security position by impeding reliable access to large amounts of energy. China, Russia, and Iran may say they will eventually reduce carbon emissions, but their

[13] Smil, V. 2020. "What We Need to Know About the Pace of Decarbonization – Policy Brief." Johnson Shoyama Graduate School. April. https://www.schoolofpublicpolicy.sk.ca/documents/research/policy-briefs/jsgs-policybriefs-pace-of-decarbonization_web.pdf

[14] IEA. 2024. "Investment in Clean Energy This Year Is Set to be Twice the Amount Going to Fossil Fuels." International Energy Agency. June 6. https://www.iea.org/news/investment-in-clean-energy-this-year-is-set-to-be-twice-the-amount-going-to-fossil-fuels; https://www.iea.org/reports/world-energy-investment-2024/overview-and-key-findings

incentives to do otherwise are obvious. All three countries will be stronger in military and economic terms by continuing to exploit their use of fossil fuels.

The lessons of history indicate that we ignore at our peril the national security dimensions of energy policy. Consider, for example, what Daniel Yergin says about World War II in "The Prize," his Pulitzer-prize winning history of oil (with italics added for emphasis):

> "Petroleum was central to the course and outcome of World War II in both the Far East and Europe. The Japanese attacked Pearl Harbor to protect their flank as they grabbed for the petroleum resources of the East Indies. Among Hitler's most important strategic objectives in the invasion of the Soviet Union was the capture of the oil fields in the Caucasus. But *America's predominance in oil proved decisive and by the end of the war German and Japanese fuel tanks were empty*."[15]

Moral concerns about fossil-fuel suppression

Aggressive suppression of fossil-fuel use would be morally unconscionable under any reasonable ethical code, as it would impose costs on the more than 3 billion people who have virtually no access to electricity. This large swath of humanity would like access to abundant, cheap, and reliable fossil-fuel-based energy to help lift themselves out of poverty and to reduce the substantial health risk from long-term exposure to airborne particulate matter caused by indoor burning of dung and wood. There are now more than 6 billion people who would like to live in ways that most of us in wealthy countries take for granted, with abundant and reliable energy that few of us would willingly give up to any degree.

The ostensible urgency of attaining net-zero is seriously hampering progress toward the UN's Sustainable Development goals of no poverty, no hunger, affordable and clean energy, and the development of industry, innovation, and infrastructure. International funds earmarked to aid less developed countries are being directed away from efforts to reduce poverty, and toward emission reductions, particularly in Africa.

Hunger eradication has been made more difficult by climate-mitigation efforts, including (1) restrictions on livestock and fertilizer; (2) impediments to the development of industry and infrastructure that require steel and cement, which currently require fossil fuels for production; and (3) continued emphasis on biofuels (because they are renewable and despite their greenhouse-gas emissions).

Other economic, technological, and social impediments to fossil-fuel suppression

Countries that have taken the lead in the movement toward net-zero have had disappointing track records, which discourages others from following their lead. For example, widespread implementation of government-subsidized solar and wind power has led to increased energy costs in the United Kingdom and Germany, contributing to a domestic industrial decline. In 2022, Sri Lanka experienced a dramatic drop in crop yields and food shortages after the government banned fossil-fuel-based fertilizers, which led to social unrest that was so serious that the president and his wife fled the country.

The broader problem is that many of the technologies needed for net-zero either do not exist or are still in the demonstration or prototype phase. Substantial innovation and investment is needed to scale prototypes to be efficient and affordable for users. For solar and wind, the needs are acute. At present, there is nothing close to viable energy storage (batteries) available at scale to address the fact that these sources provide no power absent sunshine and wind. Also needed are large investments in transmission grids—not just to move power to locations far from rural points of origination, but also to accommodate the asynchronicity of power from wind, solar, and batteries.

These impediments to net-zero are compounded by concerns about the enormous amounts of materials needed for solar, wind, and battery infrastructure changes, along with significant environmental impacts from mining of inputs needed for their production. A closely related impediment is that the huge land requirements for solar and wind farms are fostering conflicts with both environmentalists and residents of rural areas about issues of aesthetics, ecosystem impacts, and competing economic uses for the land.

Bad energy choices

Bad choices about future energy systems are a damaging consequence of the false sense of urgency that the Apocalyptic climate narrative has created about suppressing fossil-fuel use. That urgency effectively dictates that existing technologies like solar and wind must replace fossil fuels. However, overcoming the low power quality, intermittency, and synchronicity problems of solar and wind power remains an ongoing challenge that may not ever be solved in a cost-effective way.

The technological reality is that solar and wind are far inferior to fossil fuels for producing energy at the needed scale and, at present, they are incapable of producing many of the materials that are responsible for the lives of remarkable abundance available to people who live in advanced industrial economies.

The unfortunate result is to distract attention from the potential role of more advanced energy technologies that are under development and that are expected to provide better medium- and long-term solutions than solar and wind. The issue is not if, but when, more advanced energy technologies will emerge as practical and economically viable at scale. Meanwhile, human flourishing today requires enormous amounts of low-cost energy. That energy can come only from the technologies and systems that we know how to build right now, which are mainly fossil-fuel-based. Attempts to suppress fossil-fuel use aggressively are therefore socially destructive in that they would impose significant avoidable costs on humanity.

[15] Yergin, D. 2008. *The Prize: The Epic Quest for Oil, Power, & Money*. New York, NY: Free Press.

Ever-growing demand for energy

All of these impediments to net-zero exist against the backdrop of ever-growing demand for energy. There is huge pent-up demand from developing nations, many of which are mired in energy poverty and whose billions of citizens would like to lead lives with power access that is commonplace in wealthy countries. There is a remarkable degree of self-absorption among net-zero advocates in wealthy nations who personally have ample access to energy and who feel comfortable arguing that people in developed countries should exercise energy and material restraint to slow down global warming when the climate impact of such restraint will almost surely be undetectable.

Greater access to electricity can help reduce our vulnerability to weather and climate through air conditioners, water desalination plants, irrigation, vertical farming operations, water pumps, coastal defenses, and environmental monitoring systems. And ever-growing amounts of electricity will be needed for humans to be able to capture the benefits from innovations in advanced materials, manufacturing, artificial intelligence, robotics, photonics, quantum computing, blockchain, electronics, and other economic arenas that are currently unforeseen or unimagined.

There is good reason to fear a future without cheap, abundant fuel and the continued economic expansion that it fosters far more than to fear planetary warming from the use of fossil fuels. Degrading our energy supply by suppressing fossil fuels and forcing a move to wind and solar will restrict the lifeblood of modern society. Since there is no credible case of an impending Apocalypse from continued use of fossil fuels, we would be shooting ourselves in the foot by urgently suppressing their use.

RATIONAL ENERGY POLICY FOR THE 21st CENTURY

Although fossil fuels have played a critical role in generating enormous gains for humanity, there are good reasons for seeking ways to reduce our reliance on them, including geopolitical concerns, environmental degradation, and increasing costs of extraction.

What then makes sense for public policies to foster development of more abundant, secure, inexpensive, and clean energy? The foundation of any reasonable approach should be: First, do no harm. That means abandoning the Apocalyptic climate narrative's prescription of aggressively suppressing fossil-fuel use to attain net-zero CO_2 emissions in the near-term.

We should build on that foundation by (i) recognizing that human flourishing requires abundant and ever-increasing energy, (ii) pursuing research into a broad range of alternatives to fossil fuels as energy sources and as material inputs to production (e.g., as with fertilizer and plastics), (iii) approaching the next 25 years (and perhaps longer) as a learning period grounded in intelligent trial and error, and (iv) evaluating all technologies holistically for abundance, reliability, costs calculated on an "all-in" lifecycle basis, sensible land and resource use, air-quality impact, and environmental impact generally.

Implications for public energy policies

We offer nine principles for operationalizing this approach to US energy policies, with #3, #5, and #6 specifying actions we should take and the remainder highlighting what we should not do.

1. We should *not* inflict costs on US citizens—reduced overall economic prosperity, constrained individual choice, and diminished national security—by adopting public policies intended to mitigate global warming that will not detectably affect Earth's temperature in the short or long run.
2. We should *not* eliminate fossil fuels before we have technologically viable and cost-effective replacements for the critical inputs they provide in the production of food, steel, cement, plastics, and electricity.
3. We should use "carrots" to foster investment in innovation in energy, materials science, and agricultural science, as well as in the ability of humans to adapt to a changing climate.
4. We should *not* use "sticks" to punish consumption that generates greenhouse gasses (e.g., banning gas stoves, jet travel, internal combustion engines, and non-vegan food), while having no material effect on temperatures now or in the long run.
5. We should cultivate clean energy (to reduce air pollution) and energy independence (for national defense and economic security reasons) with a diversified set of reliable energy sources to hedge the risks of adverse "unknown unknowns" in the evolution of our political, economic, and physical environments.
6. We should put major emphasis on the resuscitation (and refined development) of nuclear power, which is at least as safe as solar and wind and far safer than coal and oil (based on comparisons of death rates due to both accidents and air pollution per unit of electricity generated).
7. We should *not* focus narrowly on solar panels, wind turbines, and biofuels. Solar and wind are problematic because of their (i) unreliability and consequent need for a stand-by power system, (ii) low energy density and consequent massive land requirements to deliver energy at scale, and (iii) negative externalities (e.g., from rare-earth mining to produce batteries to address the unreliability problem). Biofuel emissions are at least as bad as gasoline, while biofuel production uses massive amounts of cropland and played a significant role in three major food crises in the last 20 years.
8. We should *not* engage in backdoor regulation of fossil-fuel use by the Federal Reserve (through bank oversight) and the SEC (through ESG empowerment) that will warp the allocation of investment capital.
9. We should *not* use our power to impose credit policies toward developing countries (e.g., by the World Bank) that discourage fossil-fuel-based projects and thereby make it more difficult for world's poorest people to elevate themselves out of poverty.

The three proactive principles (#3, #5, and #6) reflect the physical reality that human flourishing depends critically on the abundant availability of energy and on the currently irreplaceable role that fossil fuels play in the production of food, steel, cement

and plastics. Deterrent principle #7, which cautions against a narrow focus on solar, wind, and biofuels, reflects the strong technological limits of these technologies.

The remaining deterrent principles (#1, #2, #4, #8, and #9) reflect the fact that it makes no sense to mandate or constrain choices that will cause humanity to bear costs when those choices will have no detectable effect on global warming in the short- or long-run. These costs have a *direct* component: Avoidable waste from outlays on unpromising technologies and on consumption goods that simply sound good from a carbon emissions perspective. They also have an *opportunity cost* component in terms of diverting resources from worthwhile causes, including investments to foster greater resilience to weather and climate extremes as well as to help wide swaths of humanity to elevate themselves out of poverty.

Implications for investors and their agents

The flaws in the Apocalyptic climate narrative have three important implications for the risk-management decisions of private investors and for the corporate directors and money managers who work on their behalf.

- The actual risks of fossil-fuel-generated climate change are not nearly as great as portrayed in the drumbeat of worried discussions of global warming in public discourse that the Apocalyptic climate narrative has fostered.
- Those who nonetheless want to do something to help mitigate global warming should realize that the long-run consequences for the planet of the ESG pursuit of a reduced corporate carbon footprint will do little, if anything, to change the climate over the course of the 21st century.
- The Apocalyptic climate narrative is itself an element of investment risk. The narrative has gained such powerful traction—especially in the US and other wealthy countries—that it is significantly affecting the allocation of real resources and the stock-market values of companies.

The latter traction creates upside investment potential and downside risk. The upside, of course, is the potential for profits by responding to the demand for green investments. The downside risk is the possibility that many people will eventually come to realize that the importance of suppressing fossil-fuel use has been blown far out of proportion in public discourse.

From a capital markets perspective, the current green-investment situation accordingly has elements of a stock-price bubble that is supported by a false narrative. One can expect that bubble to sustain or grow provided that many people continue to buy into the premise of an urgent need to transition away from fossil fuels and as governments add more subsidies to renewable-energy projects.

The danger is that the bubble will pop or dissolve as it becomes increasingly clear that the Apocalyptic climate narrative is an extremely effective form of environmentalist propaganda that markedly overstates the risks to humanity of continued global warming.

One might be tempted to take investment positions that effectively "short the bubble" and wait for the gains to come rolling in when the bubble pops or dissolves. The problem with such strategies is that substantial valuation errors in the capital market can take a long time to correct. Consequently, arbitrageurs who have finite capital to invest and who make strong bets against the bubble can be wiped out financially before the asset-pricing errors are corrected.

The upshot is that there is no clear path to a "free lunch" of abnormal investment performance from shorting green investments. The reason is that one simply cannot be sure about whether or when the world will come to broad recognition of the flaws in the narrative.

BOTTOM LINE: SENSIBLE ALTERNATIVES TO NET-ZERO POLICIES

The Apocalyptic climate narrative is a seriously flawed guide for public policy because it (1) radically overstates the risks to humanity of continued global warming, which are manageable, not existential and (2) prescribes large-scale near-term suppression of fossil-fuel use, while failing to recognize the huge costs that such suppression would inflict on humans because fossil fuels are currently irreplaceable inputs for producing food (via ammonia-based fertilizer), steel, cement, and plastics.

The answers to four key questions provide a compact foundation for a far more sensible template for public policies toward global warming and the use of fossil fuels.

What would happen if the US enforced a net-zero emissions policy? In 2100, according to climate-model projections. Earth's average temperature would be lower (than it otherwise would be) by less than 0.2°C, which would be undetectable statistically given normal temperature variation. US consumption and production of goods created with steel, cement, and plastics, and of food grown with ammonia-based fertilizer would immediately plummet because of the essential role fossil fuels play in their creation. A sharp decline in the quality of life would surely ensue.

Is it worth it? Is an undetectable reduction in the warming trend worth a huge sacrifice in the quality of life caused by an urgent move to net-zero? According to the Apocalyptic climate narrative, the answer is yes because humanity (ostensibly) faces an existential threat from global warming. However, there is no credible evidence of an existential threat from global warming. Nor, indeed, is there evidence of warming-related costs that cannot be addressed by humanity's resilience and ability to adapt to extreme climates.

Is an aggressive move to net-zero emissions politically feasible? Public policies that enforce an urgent move to net-zero would be especially hard to sell to the US electorate once voters see the costs they would bear. The resistance would almost surely grow stronger as more voters come to realize that, regardless of their personal quality-of-life sacrifices, global warming is predicted to continue because China, India, Russia, Iran, and many other countries have strong incentives to continue to use fossil fuels.

What then should the US do about global warming? We should encourage investment in efforts to find and improve alternatives to fossil fuels and in adaptation to a changing climate. We should *not* suppress fossil-fuel use because that would impose serious costs while generating no detectable benefits. Such suppression would put the net-zero cart before the horse, which is finding viable alternatives to fossil fuels in the myriad ways they enable humans to live far longer and much higher quality lives than our ancestors did even as recently as 100 years ago.

KEYWORDS
climate change, ESG, fossil fuels, global warming, public energy policy

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