Averting a Deadly Crisis While Restoring Climate Stability

Hugh Ross, PhD

Debate over climate change continues to rage among political leaders around the globe. Conflicting data and competing claims have been fueling the controversy, and needlessly so. Initial research overlooked one simple fact: temperature measurements are complicated by significant disparities in Earth's surface features.

As anyone who has lived or gone hiking at high altitude knows, temperature and temperature variability correlate closely with elevation above sea level. Temperature tends to drop—and to grow less stable—with increasing altitude as both air pressure and atmospheric moisture decline. Also, differences in the color and texture of ground cover impacts the degree to which

sunlight is absorbed into the ground or reflected away. The difference in rate of reflection ranges from as low as 5% to as high as 60%.

New Temperature Reconstruction Record

To eliminate these sources of confusion about the history of Earth's global mean temperature, a team of seven geologists, climatologists, and atmospheric physicists, led by Matthew Osman, focused solely on marine surface temperature measurements. They used temperature data from marine stations around the globe located 100 kilometers or more from any landmasses to assemble the world's largest (to date) database of marine temperature proxy measurements.[1]

Thanks to Osman's team, researchers can now see a detailed record of the global mean surface temperature all the way back to the last glacial maximum 24,000 years ago. This record, which revealed some amazing surprises, is shown in the figure below. It shows that beginning about 9,000 years ago, Earth's global mean surface temperature stabilized to a remarkable degree. Over this time period, it varied by only ±0.15°C, four times more stable than any previous studies had indicated.

Throughout nearly all of Earth's history, climate instability has been the norm, all the more so since the beginning of the ice age cycle some 2.58 million years ago. The extreme climate stability observed over the past 9,000 years is unprecedented. Without doubt it contributed significantly to humanity's ability to launch the neolithic revolution and sustain it all the way to the development of a high-technology, large-population civilization.

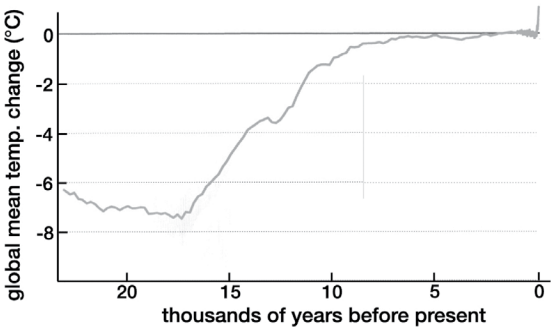

FIGURE 1: GLOBAL MEAN SURFACE TEMPERATURE OVER THE PAST 24,000 YEARS

The y-axis zero point in both diagrams is the average global mean surface temperature from 1000–1850 AD

Adapted from figure 2 of Osman et al., Nature 599 (2021): 241 and from figure 1 of Marcott and Shakun, Nature 599 (2021): 208.

The global mean climate remained even more extremely stable between 900 to 1900 AD. The following figure reveals just how stable it remained. During this millennium, the global mean temperature varied by no more than ±0.06°C! Such remarkable stability correlates with a period of phenomenal advances in human civilization and technology. It also indicates that the Medieval Warm Period and the Little Ice Age were local events, limited to the European continental landmasses.

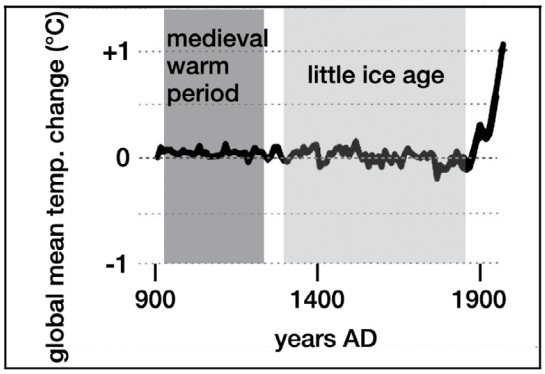

FIGURE 2: GLOBAL MARINE SURFACE TEMPERATURE 900 AD TO PRESENT

Adapted from figure 2 of Osman et al., Nature 599 (2021): 241, and from figure 1 of Marcott and Shakun, Nature 599 (2021): 208

Evidence of Recent Global Warming

The previous figure removes doubt about the reality of the past century's increase in global mean temperature, which is now 1.10°C above the pre-industrial mean temperature. Because this warming has been steady rather than dramatically variable, our technology and economy have barely noticed. However, research teams around the world are all but unanimous in pointing out that another 1°C increase in the global mean temperature will prove deleterious to the economic vitality of every nation on the planet.

Nearly all climatology research teams have pointed to atmospheric greenhouse gases as the primary contributor to this warming. These gases include methane, nitrous oxides, chlorofluorocarbons, hydrofluorocarbons, and carbon dioxide. Carbon dioxide is the dominant component. Since 1800, Earth's atmospheric carbon dioxide level has risen from 275 parts per million to 423 parts per million.[2]

Looming Health and Economic Crises

At 400 parts per million in Earth's atmosphere, carbon dioxide begins to hinder the respiration of humans and terrestrial animals. At 900 parts per million, the hindrance becomes severe.

Aquatic animals stand to suffer even more than terrestrial animals. Already, atmospheric carbon dioxide is acidifying Earth's oceans, lakes, and rivers.[3] Fish stocks drop noticeably when atmospheric carbon dioxide surpasses 500 parts per million. At 600 parts per million, several economically valuable fish stocks become severely affected. At 950 parts per million, the declines end in extinctions. Many species of marine corals, echinoderms, mollusks, crustaceans, and fish will disappear from the earth if atmospheric carbon dioxide levels attain that level.

Regardless of what one thinks about links between greenhouse gases and global warming, it is critical for the sake of human and animal life that atmospheric carbon dioxide be prevented from rising much above its present level. According to an abundance of scientific literature, the maximum allowable level for avoidance of medical and economic crises is likely no greater than about 500 parts per million. At the same time, however, a more specific and destructive crisis looms.

Imminent Health Crisis

By far, the most damaging—and yet preventable—health crisis has been brought on by particulate air pollution. Today, this foe is already ravaging most of the Asian continent. According to recent satellite data, India, now the world's most populous nation, ranks highest (worst) in particulate air pollution, and India's capital, Delhi, with a metropolitan population of over 29,000,000, is suffering, literally, to death.[4]

Since 1998, an array of satellites has been tracking particulate global air pollution levels. From 1998 to 2021, the average increase in such pollution over India, alone, measured 67.7%. Between 2013 and 2021, India was responsible for 59.1% of the global increase in particulate air pollution.

Can this alarming trend, which now extends far beyond Delhi, India, be checked or even reversed? Clearly, it can be, and in a way that holds the potential to enhance, rather than cripple, the global economy. First, though, the scope of the challenge must be made clear.

Pollutants Identified

Researchers with the World Health Organization (WHO) have identified two categories of particulate pollution: inhalable particles between 2.5 and 10 micrometers in diameter, and inhalable particles less than 2.5 micrometers in diameter. The latter type, referred to as PM2.5, proves most damaging to health. Both types of particulate air pollution are comprised of black carbon soot, mineral dust, sulfates, nitrates, ammonia, and sodium chloride (salt).

In 2021, PM2.5 air pollution over India averaged 58.7 micrograms per cubic meter ($\mu g/m^3$), an increase of 4.4% over the previous year. The measure in that same year for Delhi reached 126.5 $\mu g/m^3$, an increase of 18.2% and a level that exceeds by more than 25 times what the World Health Organization considers the maximum tolerable level for humans (5 $\mu g/m^3$). Meanwhile, ground-based instruments indicate that the city of Darbhanga in northeast India may have had an even higher PM2.5 level that year, as much as 35 times the WHO limit.[5]

Right behind India in dangerously high levels of PM2.5 pollution are eastern China and virtually all other nations of Southeast Asia. In China, PM2.5 air pollution takes 2.5 years off the life expectancy of the average resident and even more from those living in the largest cities.[6] In Bangladesh, Nepal, and Pakistan, the effect of PM2.5 is worse yet, shortening average life expectancy by five years.[7] The average decrease in life expectancy attributable to particulate pollution across all of Asia amounts to 3.3 years.[8]

Other Health Consequences

Anyone who has warmed up near an open fire that's billowing smoke has experienced the respiratory distress that comes from inhaling carbon particulates. When the fire starts to irritate lungs and nasal passages, people instinctively back away. Only in an open area is backing away an option. Elsewhere, it is not.

Inhalable particulates from a campfire or other open fire tend to be larger than 2.5 micrometers, typically closer to 10 micrometers in diameter. Even these larger particles can penetrate deep into lungs and, from there, into the bloodstream, potentially harming one's health. However, the

smaller PM2.5 particles pose the greatest health risks: decreased lung function, fibrosis, aggravated asthma, COPD, irregular heartbeat, heart attacks, lung cancer, and premature death in people with heart or lung disease.[9] Children and older adults are at the greatest risk from exposure.

What's worse, the PM2.5 pollution in India shows elevated levels of arsenic, tin, and lead.[10] Long-term exposure to these elements is known to cause cancer and organ failure. By all indications, this pollution is a slow, stealthy killer.

Impact on Life Expectancy in India

For India as a whole, PM2.5 air pollution shortens residents' life expectancy by 5.3 years.[11] According to the latest Quality of Life Index, the average person living in the vicinity of Delhi would live 11.9 years longer if the PM2.5 level there were reduced to 5 $\mu g/m^3$ or less.[12]

India's northern plains dwellers, 546 million people who constitute 39% of India's total population, are currently on track to lose 8 years of life expectancy due to PM2.5 air pollution.[13] Clearly, exposure to PM2.5 air pollution ranks as the greatest threat to life expectancy in India, ahead of cardiovascular diseases, high systolic blood pressure, and tobacco—all of which have received serious attention in recent years. All the while, however, particulate pollution has continued to increase.

Environmental Damage

In addition to its damaging effects on human health and life expectancy, PM2.5 severely reduces atmospheric visibility (see figures below) and increases the acidity of lakes, streams, estuaries, seas, and oceans. In addition, it melts snow and ice, significantly contributing to global warming by decreasing the reflectivity of Earth's surface. The deposition of black carbon particulates from power plants in southern and eastern Asia via wind flow patterns onto the snow and ice in northern Canada explains why Canada is warming faster than any other nation in the world. Additionally, PM2.5 depletes soil nutrients and damages vegetation, including food crops, fruit trees, and forests. It even degrades buildings, bridges, monuments, and statues.

FIGURE 3: LOW VISIBILITY DUE TO PM2.5 AT THE NEW DELHI RAILWAY STATION

Note that the railway building a half of a kilometer away is nearly invisible.

Sumita Roy Dutta, Creative Commons Attribution

FIGURE 4: AIR POLLUTION IN NEW DELHI SIGNIFICANTLY BLOCKS SUNLIGHT
Sumitmpsd, Creative Commons Attribution

Proposal for Potential Remediation

Nearly all of India's PM2.5 air pollution comes from the burning of coal (the major contributor), wood, biomass, diesel, oil, and gasoline.[14] Replacing these fuel sources with natural gas would eliminate the majority of India's PM2.5 pollution, leaving only the small contribution from dusty roads and construction. This replacement would offer the added benefit of immediately reducing India's carbon greenhouse gas emissions by nearly half.

To ban the burning of *all* fossil fuels would represent an enormous mistake, endangering not only life and health but the environment and economy as well. Natural gas, or methane (CH_4), is a "clean" fuel, one that releases no particulates into the atmosphere as it burns. The end products of its burning are water vapor and carbon dioxide. Although both water vapor and carbon dioxide are greenhouse gases, only carbon dioxide would contribute significantly to global warming. Most of the water vapor would simply condense as rain, dew, mist, snow, hail, or frost.

In North America, natural gas is a more economical source of fuel than coal, wood, diesel, oil, and gasoline. For this reason, natural gas is used widely for heating as well as for generating electricity. When truck and car engines are converted to run on natural gas, the fuel cost for these vehicles is cut in half. For most North Americans and Western Europeans, exposure to PM2.5 air pollution poses no significant health risk.

By switching from coal to natural gas to generate heat and electricity, Canada, the United States, and western Europe experienced a more dramatic drop in greenhouse gas emissions than did all other nations of the world. In fact, these Western nations stand alone, globally, in cutting greenhouse gas emissions.

Barriers to Potential Remediation

Natural gas is abundant and accessible in North America and, thus, relatively inexpensive to obtain. The North American supply is of such a quantity that if it were made available it would eliminate the world's dependency on coal, wood, diesel, oil, and gasoline fuels—and for less than these nations/regions currently spend for fuel.

To make this resource available to the rest of the world, it would require that North America scale up its capacity to export liquefied natural gas. When gas is cooled to liquid form, it can be easily and safely stored and transported. Liquefied natural gas takes

up only 1/600th the volume of natural gas at standard temperature and pressure. A large tanker ship can transport the equivalent of 162 million cubic meters of natural gas to any port in the world.

However, on January 26, 2024, the executive branch of the U.S. government decided to delay construction of new liquefied natural gas terminals—and any consideration of such construction. The stated rationale for this decision: to cut greenhouse gas emissions. Ironically, the decision leads to the opposite. In effect, it leaves India, China, and Southeast Asia with no option but to continue their dependence on coal, wood, diesel, oil, and gasoline.

This refusal to supply Asian nations with a more affordable fuel source proves crippling to their economies. At the same time, it hinders ours by cutting off a major source of export income. Worse by far, it perpetuates the ill health and untimely death of over a billion human beings. For humanitarian reasons, alone, we have a responsibility to act—and to do so immediately, not later.

Limitations of Wind and Solar Power Generation

The goal of eliminating all greenhouse gas emissions through the development of wind, water, and solar power generation is laudable. This goal, however, will take considerable time to achieve—an estimated two decades, at least.

Meanwhile, to say that wind, water, and solar power generation have little or no environmental and economic consequences is patently false. Ecosystems are negatively impacted. The availability of needed agricultural land is reduced. And, by contrast with hydropower, electricity generation from wind and solar is undependable because wind and sunshine are highly variable.

The construction and maintenance of wind power generators is expensive, and to date, the implementation of solar power to generate electricity has required generous government subsidies at taxpayers' expense. The recycling of no-longer-functional solar panels remains a problem without an available solution at present.

Although these issues and others may be solved eventually, developing and implementing solutions will require time. Even over the long term, it remains to be determined whether wind and solar generators can adequately meet all the world's energy needs.

In the short term, natural gas can be used to supplement power generation by wind, water, and solar, and, at the same time, to dramatically lower greenhouse gas emissions. Then, within the next decade or two, thorium nuclear reactors could be developed to deliver power more cheaply, abundantly, and safely than any other energy source, greatly reducing and possibly eliminating dependence on fossil fuels.

Thorium Nuclear Power Generation

Not only are the governments of the West wrongheaded in their attempt to ban all fossil fuels, they are also unwise in banning all nuclear power generation options. The strong public reaction against nuclear power generation is justifiable in the context of uranium-based reactors, but their

inherent dangers do not apply to thorium reactors.

Thorium nuclear reactors pose no meltdown risks. Furthermore, the manufacture of nuclear weapons from the operation of thorium nuclear plants is not an issue, given that nearly everyone involved in attempting such manufacture would be killed in the process.

Compared to uranium nuclear reactors, thorium reactors generate a thousand times less radioactive waste. Further, while uranium reactors' waste remains dangerous for 50,000 years, the waste from thorium reactors remains dangerous for no more than about 200 years. Workers mining thorium or managing thorium reactors need no special protective clothing and are at no greater risk of radiation exposure than the rest of the human population.

Thorium is three times as abundant in Earth's crust as uranium. Per ton, it is much cheaper to mine and process. One ton of thorium yields the energy equivalent of 200 tons of uranium or 3,500,000 tons of coal. Earth holds enough thorium to provide 100% of humanity's foreseeable energy needs for at least the next thousand years.

Nuclear fusion power generation represents an attempt to copy the physics of the Sun's furnace, fusing hydrogen into helium or, more realistically, deuterium into tritium to generate electricity. However, after spending billions of dollars and millions of research hours, nuclear fusion research teams have yet to find an economically feasible way to generate usable electricity from nuclear fusion reactors.

Meanwhile, thorium nuclear power generation is a proven technology, known since the 1960s (see figure below). The primary challenge to the use of thorium reactors to supply humanity's energy needs is to determine what size reactor delivers the most energy for the least construction cost. Realistically, thorium nuclear reactors could provide nearly all the energy needs of humanity within the next 12–15 years if allowed to go forward. As realistically the cheapest source of electricity by far, they would be the biggest boost to world economy.

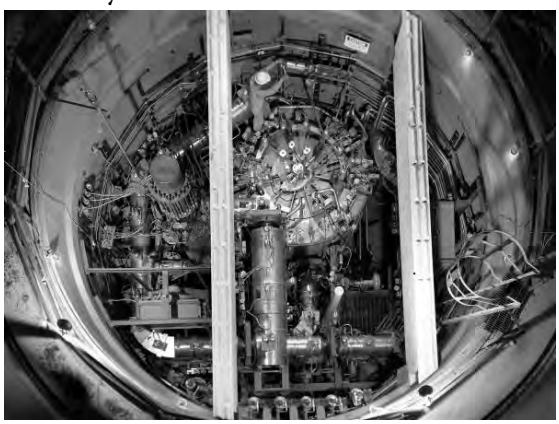

FIGURE 5: THORIUM NUCLEAR REACTOR AT OAK RIDGE NATIONAL LABORATORY (OAK RIDGE, TN)
Oak Ridge National Laboratory

A Way Forward

A strategic plan to develop use of natural gas first and thorium nuclear power second would seem the fastest and most effective way to mitigate global warming, address a human health crisis, stabilize the global climate, and prevent a global environmental catastrophe. Such a plan requires no punitive laws or tax increases. It demands no long-term or far-reaching economic sacrifices. By contrast, it promises to boost the

economies of all nations.

It requires only that politicians prioritize the greater good, popular or not, supporting rather than blocking fulfillment of a viable plan for the good of all people, all ecosystems, and all countries. We know the way forward. We know the necessary steps toward alleviating the Asian health crisis, averting other global crises, and enhancing the health and well-being of all people and animals. Let nothing stand in the way.

Hugh Ross, PhD is a founder, president and senior scholar at Reasons to Believe.

ENDNOTES

1 Matthew B. Osman et al., "Globally Resolved Surface Temperatures Since the Last Glacial Maximum," *Nature* 599 (November 11, 2021): 239–244, doi:10.1038/s41586-021-03984-4.

2 CO2-Earth, DailyCO2, accessed October 28, 2024, https://www.co2.earth/daily-co2.

3 Astrid C. Wittmann and Hans-O. Pörtner, "Sensitivities of Extant Animal Taxa to Ocean Acidification," *Nature Climate Change* 3 (August 25, 2013): 995–1001, doi:10.1038/nclimate1982.

4 Michael Greenstone and Christa Hasenkopf, "Air Quality Life Index 2023: Annual Update" (August 2023), https://aqli.epic.uchicago.edu/wp-content/uploads/2023/08/AQLI_2023_Report-Global.pdf; "Air Quality Life Index, India Fact Sheet" (2023), https://aqli.epic.uchicago.edu/wp-content/uploads/2023/08/India-FactSheet-2023_Final.pdf.

5 IQ*Air*, "World's Most Polluted Cities: Most Polluted City Ranking Based on Annual Average PM2.5 Concentration (µg/m3)" (2017–2022), https://www.iqair.com/us/world-most-polluted-cities.

6 Greenstone and Hasenkopf, "Air Quality Life Index 2023."

7 Greenstone and Hasenkopf.

8 Greenstone and Hasenkopf.

9 Lukasz Zareba et al., "The Relationship between Fine Particle Matter (PM2.5) Exposure and Upper Respiratory Tract Diseases," *Journal of Personalized Medicine* 14, no. 1 (January 16, 2024): id. 98, doi:10.3390/jpm14010098; Dayong Yue et al., "Diesel Exhaust PM2.5 Greatly Deteriorates Fibrosis Process in Pre-Existing Pulmonary Fibrosis Via Ferroptosis," *Environment International* 171 (January 2023): id. 107706, doi:10.1016/j.envint.2022.107706; Yonghui Yang et al., "Continuous Exposure of PM2.5 Exacerbates Ovalbumin-Induced Asthma in Mouse Lung Via a JAK-STAT6 Signaling Pathway," *Advances in Clinical Experimental Medicine* 29, no. 7 (July 2020): 825–832, doi:10.17219/acem/121009; Ruyi Li, Rui Zhou, and Jiange Zhang, "Function of PM2.5 in the Pathogenesis of Lung Cancer and Chronic Airway Inflammatory Diseases (Review)," *Oncology Letters* 15, no. 5 (May 2018): 7506–7514, doi:10.3892/ol.2018.8355.

10 Pallavi Pant et al., "Characterization of Ambient PM2.5 at a Pollution Hotspot in New Delhi, India and Inference of Sources," *Atmospheric Environment* 109 (May 2015): 178–189, doi:10.1016/j.atmosenv.2015.02.074.

11 "Air Quality Life Index, India Fact Sheet."

12 "Air Quality Life Index, India Fact Sheet."

13 "Air Quality Life Index, India Fact Sheet."

14 Abhinandan Ghosh et al., "A District-Level Emission Inventory of Anthropogenic PM2.5 from the Primary Sources Over the Indian Indo Gangetic Plain: Identification of the Emission Hotspots," *Science of the Total Environment* 914 (March 1, 2024): id. 169865, doi:10.1016/j.sciotenv.2023.169865; Pant et al., "Characterization of Ambient PM2.5."