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HERE'S THE THING!

There's something fishy in the state of Denmark . . . or perhaps it's Sweden, from whence Greta hails. CO_2 is demonized and a carbon neutral world is being advanced as the solution to all the ills of mankind.

"All the ills of mankind, all the tragic misfortunes that fill the history books, all the political blunders, all the failures of the great leaders have arisen merely from a lack of skill at dancing."

- Molière

RESPONSIBLE INVESTING: TAKE 2 "BEYOND ROCKET SCIENCE"

In our last issue of the *QUAERO JOURNAL* we talked about ESG[i] (Environmental, Social and Governance) INTEGRATION, an approach to Responsible Investing that doesn't necessarily exclude poor ESG stocks but instead underweights them in favour of stocks with better ESG ratings. Numerous studies argue that by using this methodology, you can create a well-diversified ESG portfolio, free of negative risk-return characteristics. Moreover, if you are prepared to sacrifice optimal portfolio risk-return characteristics in favor of specific ESG values, you can do that too! How cool is that? Now we can blend our concerns for the world with our need to meet specified investment objectives!

But the real world, much to my dismay, doesn't see it that way. The debate around ESG investment policies habitually devolves into concerns about climate change, the evils of CO2 emissions and the need to DIVEST of fossil fuel companies – a simple solution to a problem that unfortunately is multi-disciplinary and complex to the point of eluding simple solutions. This is not rocket science . . . this is "*BEYOND ROCKET SCIENCE!*".

Yet, if we are to agree on ESG policies that serve all stakeholders responsibly, it befits us to try at least, to understand something of the science of climate change. Here is the story of my recent search for truth pertaining to CO2, climate change a sensible ESG investment policy framework.

WHERE I BEGAN:

The first interesting, and understandable piece I came across was produced by the National Aeronautics and Space Administration (NASA). The following captures information from the NASA paper that, consistent with most everything I have read on the subject, yielded more questions than answers.

Solar Irradiance

Humans have increased atmospheric CO2 concentration by more than a third since the Industrial Revolution began. This is the most important long-lived "forcing" of climate change.

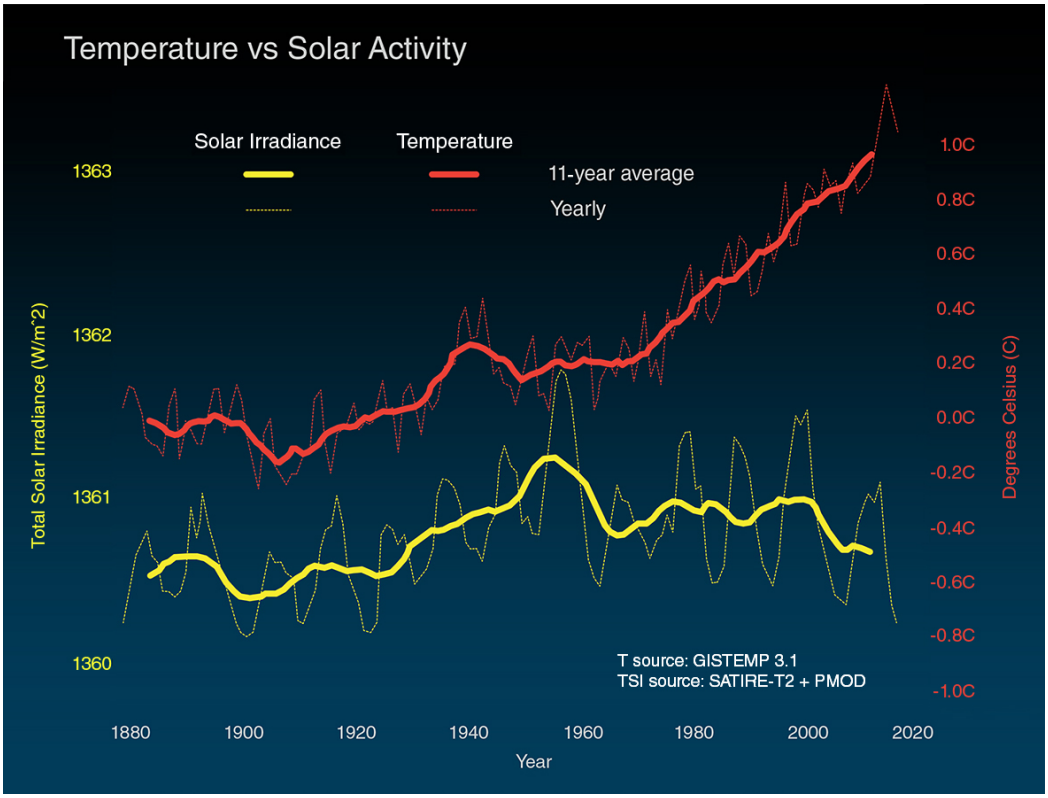

Chart 1: Reference Endnote [ii]

The above graph compares global surface temperature changes (red line) and the Sun's energy received by the Earth (yellow line) in watts (units of energy) per square meter since 1880. The lighter/thinner lines show the yearly levels while the heavier/thicker lines show the 11-year average trends. Eleven-year averages are used to reduce the year-to-year natural noise in the data, making the underlying trends more obvious.

> The amount of solar energy received by the Earth has followed the Sun's natural 11-year cycle of small ups and downs with no net increase since the 1950s. Over the same period, global temperature has risen markedly. It is therefore extremely unlikely that the Sun has caused the observed global temperature warming trend over the past half-century. Credit: NASA/JPL-Caltech

You can read more about that by accessing the NASA Website **HERE** or at https://climate.nasa.gov/causes/. The arguments are clear and the conclusions impressive, but I wondered as follows:

1. The paper claims that:
    a. "Humans have increased atmospheric CO2 concentration by more than a third since the Industrial Revolution began" and that
    b. "increased atmospheric CO2 concentration is the most important long-lived 'forcing' of climate change."

    Let's accept a. as a measured quantity, whether or not entirely human induced. But I wondered how, in the absence of a scientific proof statement, we leap to the conclusion in b.
2. The paper also claims, with the support of convincing data in chart form, that "It is extremely unlikely that the Sun has caused the observed global temperature warming trend over the past half-century." I took note of the uncertainty reflected in the words "extremely unlikely" but wondered mostly about the implied conclusion that if the Sun didn't cause the observed global temperature warming, the culprit must be CO2.

And it is with the wondering that my journey began in fact. As we say, "mine eyes were opened" unto a whole new world – a world at war over the causes of climate change. Armed with ideas, many sound, well-researched and based in science, many others *misguided or intentionally deceiving* to protect vested interests in profit, power and politics, the internet is packed with a million posts, articles, papers, whatever, about climate change, that will support any position that suits your fancy. And I read them all! No, seriously though, I read enough to become unsettled, even distracted, by the idea of the prevalence of misinformation running through our society. In my distracted state I read a book that I count as an important part of my research effort, by the American investigative journalist Jane Mayer entitled **Dark Money: The Hidden History of the Billionaires Behind the Rise of the Radical Right** which served to further heighten my skeptical nature about climate change claims and everything else.

BUT I DIGRESS!

Let's move on. I want to tackle my two curiosities in reverse order. **FIRST**, the effects of the Sun on global temperature warming. And let me be clear that the science relating to this issue is way over my head. That being said, countering NASA's conclusion, I grabbed this quote from **Oscillations of the baseline of solar magnetic field and solar irradiance on a millennial timescale** by V. V. Zharkova, S. J. Shepherd, S. I. Zharkov & E. Popova, the full article available **HERE** or at:

https://www.nature.com/articles/s41598-019-45584-3.

> However, Hays et al.[iii] have shown that small planetary influences on the solar magnetism seen from the Earth can have long-term effects on the Earth's climate. As established by Milankovich[iv] (see also https://en.wikipedia.org/wiki/Milankovitch_cycles) there are various aspects of the Earth movements in the solar system, which can affect the terrestrial climate changes over many thousand years. For example, the Earth axis tilt is shown to affect the terrestrial temperature variations with season and their durations, while the Earth orbit eccentricity and different type of precession define long-term variations of the terrestrial temperature on a scale of 20, 40 and 100 thousand years as derived from the Antarctic glaciers.[v, vi, vii]

Wow! Could it be that the culprit is not the Sun and not CO2, but the Earth itself, i.e., the Earth axis tilt, or the Earth orbit eccentricity? There's an awesome thought! And if so, what are we going to do about that?

You can get a whole lot more insight into this Solar issue by reference to **Pathway to a better understanding of the upcoming Grand Solar Minimum,** a concise 2-pager by Gerald Ratzer, Professor Emeritus, McGill University. The paper provides links to numerous other academic papers for those interested in digging a little deeper and you can access it HERE, ON OUR QUAERO WEBSITE. And you can learn more from Professor Ratzer, in his slideshow **The Sun and the Earth's Temperature** that, on the last page includes a biography on himself, and is accessible **HERE**, or at:
https://www.dropbox.com/s/kgh7pamajnz5rs0/The%20Sun%20and%20Earths%20temperature%20Handout%20of%20PowerPoint%20Jan2020.pdf?dl=0

Now to our **SECOND** curiosity, Nasa's claim that "CO2 concentration is the most important long-lived 'forcing' of climate change." Consider **Chart 2** on the following page, extracted from the United Nations Report, **IPCC, 2014: Climate Change 2014: Synthesis Report.**

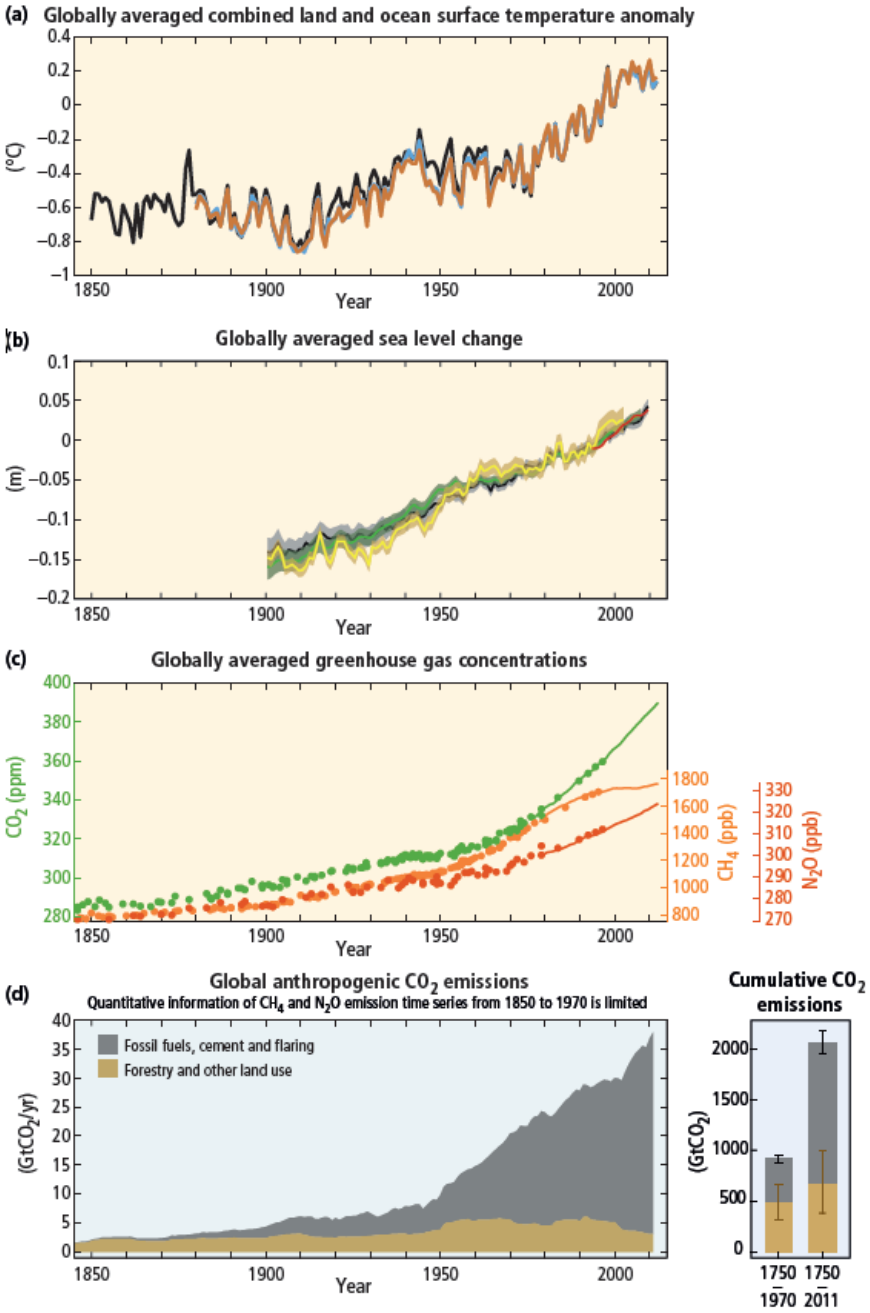

Figure SPM.1 | The complex relationship between the observations (panels a, b, c, yellow background) and the emissions (panel d, light blue background) is addressed in Section 1.2 and Topic 1. Observations and other indicators of a changing global climate system. Observations: **(a)** Annually and globally averaged combined land and ocean surface temperature anomalies relative to the average over the period 1986 to 2005. Colours indicate different data sets. **(b)** Annually and globally averaged sea level change relative to the average over the period 1986 to 2005 in the longest-running dataset. Colours indicate different data sets. All datasets are aligned to have the same value in 1993, the first year of satellite altimetry data (red). Where assessed, uncertainties are indicated by coloured shading. **(c)** Atmospheric concentrations of the greenhouse gases carbon dioxide (CO_2, green), methane (CH_4, orange) and nitrous oxide (N_2O, red) determined from ice core data (dots) and from direct atmospheric measurements (lines). Indicators: **(d)** Global anthropogenic CO_2 emissions from forestry and other land use as well as from burning of fossil fuel, cement production and flaring. Cumulative emissions of CO_2 from these sources and their uncertainties are shown as bars and whiskers, respectively, on the right hand side. The global effects of the accumulation of CH_4 and N_2O emissions are shown in panel c. Greenhouse gas emission data from 1970 to 2010 are shown in Figure SPM.2. *(Figures 1.1, 1.3, 1.5)*

Chart 2 Reference Endnote [viii]

We can forgive readers who, from **Chart 2**, excitedly conclude that CO2 embodies the devil. Panels a and b depict all the bad news of rising global temperatures and sea levels while panels c and d highlight the interestingly correlated rise in Greenhouse Gas (GHG) emissions with particular focus on CO2 emissions. But we know that "**correlation does not imply causation**" and conclusions drawn from correlation analysis alone are simply bad science. Hence the need to persist in our search for more science . . . and I did.

I started with **Chart 3**, below, from **Atmospheric Carbon Dioxide and Aerosols: Effects of Large Increases on Global Climate**[ix] by S. I. RASOOL and S. H. SCHNEIDER, two highly respected scientists.

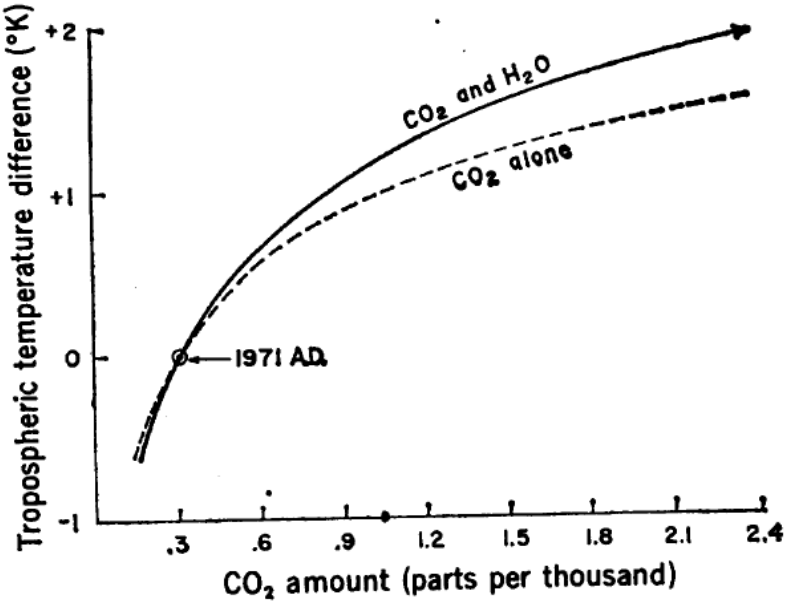

Fig. 1. Change in tropospheric temperature as a function of the amount of CO_2 in the atmosphere. The dashed curve is computed for constant surface *absolute* humidity, and the solid curve is for the case in which surface *relative* humidity is maintained constant. Note that the rate of temperature increase diminishes with increasing CO_2 in the atmosphere.

Chart 3 Reference Endnote [x]

The caption below the chart reads: **"Note that the rate of temperature increase diminishes with increasing CO2 in the atmosphere."** And RASOOL and SCHNEIDER go on to say, **"and the increase eventually levels off."** **Really? CO2 is not a primary cause of global warming?** Well maybe, but this particular paper was published in 1971, so I pressed on, wondering if I could find something more recent, addressing my concerns even more specifically. I invested far too much time scanning the "misguided or intentionally deceiving" material that I referenced earlier but the exercise was educational in other ways that helped me discern the legitimacy of published materials. So, I persisted until at last I found a source I *could* trust. And as so often is the case, that source was there, all along, right under my nose.

The abstract to a paper entitled ***Current claims about CO2 and atmospheric temperature are incorrect***, by H. Douglas Lightfoot, Mechanical Engineer, MBA and good friend of many years, reads, in part, as follows:

> **ABSTRACT**
>
> . . . Currently available technology provides records at the same Montreal time at 20 cities, which are representative of the many climates around the Earth. These are atmospheric temperature, relative humidity, CO2 concentration and water vapor concentration. Plotting the concentrations of water vapor and CO2 against atmospheric temperature shows increasing levels of CO2 are associated with lower temperatures rather than higher temperatures. Importantly, water vapor and CO2 act opposite to each other in response to temperature. The concentration of water vapor is an average of approximately 30 times that of CO2 and effectively cancels its warming effect. These are important results because the current concept that increasing CO2 causes dangerous climate change is driving government policies to reduce CO2 emissions by curtailing the use of fossil fuels. These policies can have disastrous consequences on our people. It is the abundant and affordable energy from fossil fuels that make the Earth a safe place for people to live and provide solutions to the eternal problems of food, clothing and shelter.

You can download the full paper **HERE** or at:
https://www.researchgate.net/publication/331632669_Current_assumptions_about_CO2_and_atmospheric_temperature_are_incorrect.

And you can learn more about Doug **HERE** or at:
http://www.geog.mcgill.ca/gec3/wp-content/uploads/2009/02/HD-Lightfoot7.pdf

In a concise, two-page summary of the longer paper, (more lay-person friendly, but still tough going), Doug presents the results of his "20- cities" research in chart form as follows,

showing that the concentrations of CO2 and water vapor act in opposite directions in response to temperature and that the warming effects consequently also act against each other:

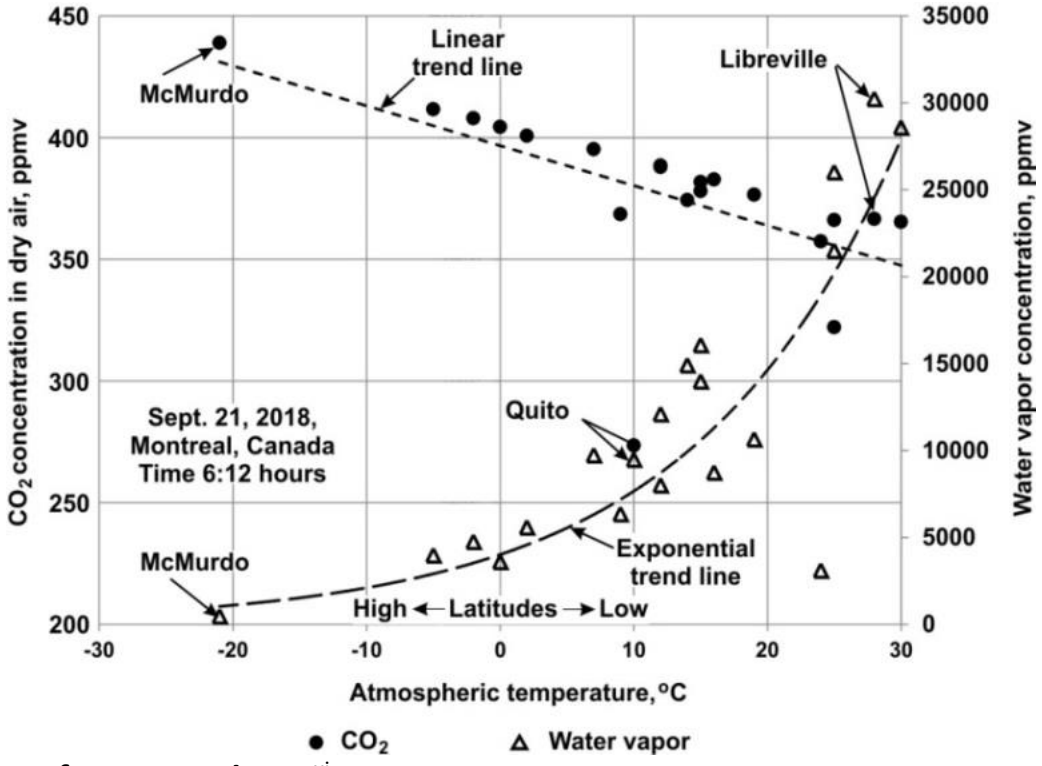

Chart 4 Reference Endnote[xi]

and he comments as follows on the reproducibility of his research:

> Anyone using the method presented here can prove CO2 has no effect on atmospheric temperature. Many people are aware of the Gas Laws from high school science classes. It is only a matter of time before the collapse of the concept that CO2 causes climate change.

I had to revisit the Gas Laws since high school science classes were so very many years ago, but was relieved to find that the Gas Laws (Boyle's Law, Charlie's Law and Avagadro's Law) are quite straightforward; they are a set of rules that explain, quite understandably, the relationship of the pressure, temperature, volume and amount of gases in a given space.

You can access the Lightfoot summary paper HERE, ON OUR QUAERO WEBSITE, or at: https://quaeroinvest.com/2020/02/01/current-claims-about-co2-and-atmospheric-temperature-are-incorrect/.

So, there you have it – science asserting that though climate change may be upon us, CO2 does not contribute meaningfully to global warming and is not a root cause of climate change. And three more papers published last summer support the assertion.[1] What now?

TWO CONCLUSIONS:

1. **Pertaining to the Environment and Climate Change**,
    a. CO2 is not a pollutant.
    b. CO2, water and the Sun work together through the process of photosynthesis to grow all vegetation from crops to shrubs to trees.
    c. Plankton in the oceans also depends on CO2 for their growth. They are at the foot of the marine food chain.
    d. CO2 is confirmed to have a minuscule impact on Climate, that is so small as not to be measurable from the signal noise.
    e. Although CO2 is not a pollutant, continued consumption of fossil fuels is not sustainable for two reasons:
        i. the burning of fossil fuels produces particulate matter emissions that, if not cleaned (witness China and India), EG with electrostatic precipitation and chemical scrubbers, and subjected to strict emission controls testing, dangerously pollutes our global environment, and
        ii. fossil fuels must be preserved; they are a limited, non-renewable resource that, in the absence of effective and sustainable alternatives, will deplete, leaving us without the resource to produce the energy that we need to sustain life on earth.

2. **And therefore, pertaining to ESG investment policies**,
    a. Let's Be Responsible
    Investors should commit to the precepts of Responsible Investing. Responsible Investors are motivated by the need for a clean environment, with social justice

[1] 1) Edwin Berry – Explains why the IPCC Bern Model of CO2 is inaccurate. He shows the residency time for CO2 is about 5 years – not 5 to 200 years. https://edberry.com/blog/climate/climate-physics/human-co2-emissions-have-little-effect-on-atmospheric-co2-discussion/
2) Hermann Harde – comes to the same conclusion. Also, see a 90-minute video with Harde and Murry Salby (advanced material).
http://www.sciencepublishinggroup.com/journal/paperinfo?journalid=161&doi=10.11648/j.earth.20190803.13
3) Dr. Patrick Frank – a new paper which ends with "The unavoidable conclusion is that a temperature signal from anthropogenic CO2 emissions (if any) cannot have been, nor presently can be, evidenced in climate observables." https://www.frontiersin.org/articles/10.3389/feart.2019.00223/full

and sound governance for all. And while the battles rage on in the war of ideas around Climate Change, the importance to all society of securing buy-in from the world's governments, major corporations and financial institutions (where the power resides) to a soundly conceived approach to Responsible (ESG) Investing, is undeniable. So, let's chase those ideals with things that we KNOW about our world and our lives within it. Let's not act impulsively in response to political movements not supported by high probability, scientifically researched findings. And let's invest BIG in serious research to see if we can't resolve the challenges of Climate Change through actions that we KNOW will make a difference. And in the absence of certainty,

b. Let's Hedge Our Bets
   Wise investors always hedge their bets. Listen, if you are CERTAIN that man-made CO2 emissions are at the root of Climate Change and its consequences then, by all means, fossil fuel company divestment becomes one of many realistic investment alternatives. But if, like me, and apparently like much of the world, you don't enjoy the luxury of certainty, then divestment is radical, risky and irresponsible; a carefully considered hedge is, with CERTAINTY, your best bet. ESG INTEGRATION, in pure form or modified to meaningfully reflect your beliefs, is that hedge.
c. Let's Seek Out Opportunities that Reflect Our Beliefs[2]
   Investors who are concerned about planet Earth should invest in companies that:
   i. work on real pollution reduction. In the energy sector this means the equipment to capture particulate matter (PM2.5) with electrostatic precipitation. Also smoke-stack reduction of SOx and NOx with chemical scrubbers.
   ii. practice, or are engaged directly in the business of improved reuse and recycle of paper, cardboard, plastic and metal items.
   iii. practice, or are engaged directly in the business of cleaner motors for cars, trucks and all vehicles, including stricter emission testing - like the UK MOT testing.
   iv. Practice, or are engaged directly in the business of <u>effective and sustainable</u> alternative energy sources.

[2] Special thanks to Professor Ratzer for the thinking reflected in this section 2.c.

AND FINALLY:

I noted in the title of this JOURNAL post, and in my opening remarks, that "This is not rocket science . . . this is BEYOND ROCKET SCIENCE!". Complexity abounds in the multi-disciplinary study of climate change and I do not pretend to understand much of it, nor to possess definitive answers to the many challenges posed by it. This JOURNAL post sets out my current position based on personal observations and research conducted over the past several months. Openly and humbly, I welcome comment and correction from those with superior knowledge of the science of climate change or the art and science of investing. We are all about life-long learning here at QUAERO Investment Solutions and we are clear that in this subject – climate change and Responsible Investing – we have taken the first steps of a very exciting and important, life-long learning journey.

Endnotes

[i] "Environmental, social and governance (ESG) criteria are a set of standards for a company's operations that socially conscious investors use to screen potential investments. Environmental criteria consider how a company performs as a steward of nature. Social criteria examine how it manages relationships with employees, suppliers, customers, and the communities where it operates. Governance deals with a company's leadership, executive pay, audits, internal controls, and shareholder rights." From Investopedia at https://www.investopedia.com/terms/e/environmental-social-and-governance-esg-criteria.asp.

[ii] The Causes of Climate Change; https://climate.nasa.gov/causes/; website produced by the Earth Science Communications Team at NASA's Jet Propulsion Laboratory | California Institute of Technology

[iii] Hays, J. D., Imbrie, J. & Shackelton, N. J. Variations in the Earth's Orbit: Pacemaker of the Ice Ages. science 194, 1121–1126 (1976).

[iv] Milankovich, M. Canon of Insolation and the Ice Age Problem. Belgrade: Zavod za Udzbenike i Nastavna Sredstva, ISBN 86-17-06619-9 (1998).

[v] Abe-Ouchi, A. et al. Insolation-driven 100,000-year glacial cycles and hysteresis of ice-sheet volume. nature 500, 7461– (2013).

[vi] Rial, J. A. Earth's orbital Eccentricity and the rhythm of the Pleistocene ice ages: the concealed pacemaker. Global and Planetary Change 41, 81–93 (2003).

[vii] Akasofu, P. On the recovery from the Little Ice Age. Natural Science 2, 1211–1224 (2010).

[viii] Extract from IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

[ix] Atmospheric Carbon Dioxide and Aerosols: Effects of Large Increases on Global Climate by S. I. RASOOL and S. H. SCHNEIDER. Full article available at: https://pdfs.semanticscholar.org/4db2/1045b17ebcdd6a8c6adeb1f42eb5c2c39270.pdf

[x] From: Atmospheric Carbon Dioxide and Aerosols: Effects of Large Increases on Global Climate by S. I. RASOOL and S. H. SCHNEIDER, Institute for Space Studies, Goddard Space Flight Center, National Aeronautics and Space Administration, New York 10025. Full article available at: https://pdfs.semanticscholar.org/4db2/1045b17ebcdd6a8c6adeb1f42eb5c2c39270.pdf.

[xi] Current claims two-page summary June 6 2019, p. 1; H. Douglas Lightfoot

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