Dr. Lars Schernikau • Switzerland

Attn:

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cc. World Coal Association, IEA, IEEJ, ASEAN Center for Energy, Clean Coal Center, VDKI, and various other energy and commodity institutions

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IMF: Working Paper - The Great Carbon Arbitrage

Online available at: https://www.imf.org/en/Publications/WP/Issues/2022/05/31/The-Great-Carbon-Arbitrage-518464

Dear Sirs,

Thank you for releasing the IMF Working paper "*The Great Carbon Arbitrage*" from 31 May 2022 in which you explicitly seek comments and encourage debate. Lars Schernikau, the initiator and main author of this reply letter is an independent energy economist, commodity trader, and entrepreneur educated in the US (NYU), France (INSEAD), and Germany (TU Berlin). This reply is endorsed by a number of science and energy economic experts in the energy, commodity, and atmospheric physics fields who have chosen to co-sign this letter.

The prime author of this reply, Lars Schernikau, has worked in the energy and bulk commodity industry with significant but not exclusive exposure to coal for the past 20 years. All signatories are also closely associated to various fields of energy. The author and signatories have no financial or political interest in writing this response and received no financial support for the statements or work referenced herein.

For the record, we agree that

1) The world has on average warmed during the past 150 years, after a cooling period of the Little Ice Age, from ~1300 to ~1800 AD, not mentioning earlier climatic shifts.
2) CO2 and CH4 are green-house gases and have contributed, along with other climate forcings, to the measured global temperature increase during the past 150 years
3) Humans contribute to this measured warming, inc. but not limited due to the increase GHG concentration in the atmosphere (namely CO2 and CH4), which appear to be largely of anthropogenic origin over the past 150 years.

4) Most importantly, we are certain that you will agree – and if not we ask you to please reply which point you do not agree with and why – with our view that humankind should
   a) Minimizing the environmental impact of our energy systems along the entire value chain and life-cycle, environmental impact include emissions and non-emissions (please see Figure 1)
   b) Increase material efficiency of energy systems (use less raw materials for each unit of energy produced),
   c) Increase net-energy efficiency of our energy systems (use less input energy for each unit of energy produced)
   d) Increase efficiency of energy consumption (get the maximum result from the least energy consumed)

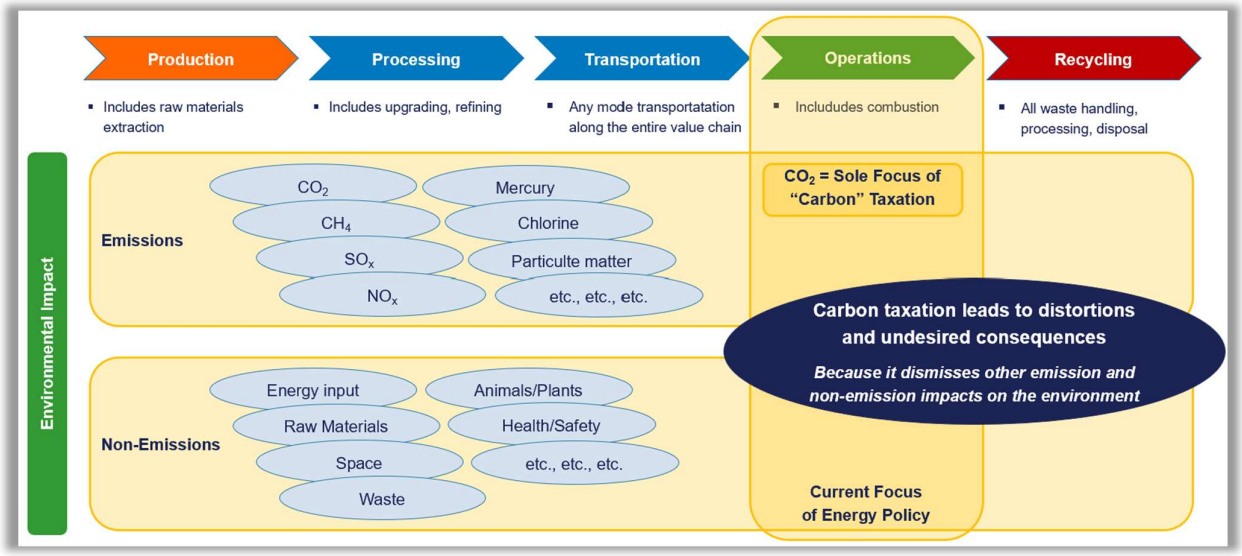

Figure 1: Environmental impact of energy systems and why "carbon" taxation leads to distortions and undesired consequences (Schernikau et al. 2022[1])

The purpose of this response is not to discuss the causes of the past 150-200-years of global warming, nor the impact that global warming may have, though it does play into your working paper's reason. For this purpose, we refer you to the book Unsettled[2] by Prof Koonin which provides a fair and independent summary of the current state of "climate science".

Our comments to your working paper are as follows. Please accept, for brevity, that (a) we focus on three main points with which we do not agree and (b) that – if included and considered – our points would significantly change the outcome of your analysis. We cannot comment on every single point/disagreement/inconsistency. We are of the opinion, that ***some of the key assumptions made in your paper do not correspond to undisputed scientific knowledge available to us in regard to energy economics, physics, and climate***. Unfortunately, your working paper for download did not include page numbers, so we refer to the page number in the PDF document downloaded from the link given above.

The following are our main points of concerns

1. Social "cost of carbon" is not consistent with life-cycle analysis and a macro view to the environment

Your statements with regards to the social cost of carbon, an example: "*As such the SCC is a measure that is conditional on the level of CO_2 in the atmosphere.*" and "*The higher that level the more powerful is the greenhouse effect and therefore the higher are the expected physical damages.*", p1

This and similar statement are misleading and requires clarification

a) Your statements are contrary to the conclusions of NASA and ESA Earth Observing System data from 1982 to 2015, and subsequent measurements. Real measurements show the planet to be greening due primarily to CO_2. Plants absorb CO2 in order to live, grow and reproduce. That knowledge is entirely missing and is the 'other side of the equation'.

b) Please clarify in your writing on climate sensitivity, that (a) it is scientifically accepted that any warming impact from GHGs logarithmically declines with higher GHG concentrations and (b) that there is significant dispute amongst climate models about climate sensitivity itself (McKitrick 2021[3] and Dayaratna et al. 2022[4]).

c) Please clarify in your writing that physical damage from climate related disasters has been constant, and on a per capita or per GDP basis decreased substantially. Refer to the EMDAT database which are referenced in Alimonti et al. 2022[5] and Pielke 2022[6]

d) Please clarify in your writing that climate scenarios assume, unrealistically, no adaptation to climate change (Lomborg 2020[7])

e) Please clarify, which scenario and which climate model you assume to be correct when making your various statement in regard to SCC. Please note that RCP8.5-SSP5, which is most often used (not clarified in your paper), is not a projection of the future but a highly unrealistic scenario where coal consumption per capita increase 6x by 2100 from today's levels (Pielke Richie 2021[8])

2. Your choice to focus on coal is misleading and incorrect

The statement: "*The focus on coal is natural given that coal emits roughly 2 times as much carbon into the atmosphere per unit of energy production as natural gas, and roughly 1.5 times as much as oil*", p1

This and similar statements and assumptions made in your paper are incorrect and misleading because it focuses solely on CO2 and disregards other known anthropogenic GHGs and other environmental impacts (see 4a) on page 2 herein). In addition, you do not consider, nor do you mention the undisputed positive fertilization effects of additional CO2 in the atmosphere.

a) Carbon is NOT equal to CO2. We assume from your statements that you mean that carbon equals CO2, because ***if you were to include CH4, your statement becomes scientifically wrong***, Schernikau Smith 2022[9]

b) Please include in your judgement and statement that IPCC AR6 (p89) confirms that ***less than half, only "46% [of CO2 emissions] accumulated in the atmosphere***, [the remainder] was taken up by the ocean and was removed by terrestrial ecosystems [in other words was taken up by plant life to create biomass]".

c) Please clarify in your writing that coal and gas have essentially the same climate impact at GWP20 (Global Warming Potential over 20 years). Schernikau Smith 2022[9]

have proven that – assuming IPCC's GWP_{20}, IPCC AR6, and IEA data on methane and CO2 emissions are correct – ***on average LNG is "worse for climate" than any coal and that the average gas is "worse for the climate" than surface mined coal***

d) That being the case and considering that coal and gas alone account for approx. 50% of primary energy and 60% of electricity, please clarify how realistic it is to abandon both coal and gas at the same time, as logically you seem to suggest.

e) McKinsey 2022[10] adopted GWP20, as per the authors information, for the first time in June 2022 *"America's net-zero frontier: A business guide"* but appeared to wrongly not adjust for natural uptake of CO2 by biosphere and oceans

f) Please include in your paper the ***undisputed positive effects of additional CO2 in the biosphere*** as confirmed by WEF[11], NASA[12], and a large number of peer-reviewed scientific papers, such as Taylor Schlinker 2021[13], Harverd et al. 2019[14], and Zhu et al. 2016[15]. Higher CO2 allows plants to prosper in drier climates, in warmer climates, and to grow quickly. Greenhouses routinely raise CO2 levels to 2000 ppm or more to enhance growth.

g) Please repeat what the assumptions are for "Net-Zero" in your referenced scenarios and why you assume that total energy consumption will not grow, but net decline per capita even though the world requires additional energy to reduce poverty. Please also clarify why you do not population adjust your "Net-Zero" scenarios when it comes to future energy requirements.

3. Your statement that variable "renewables" will bring economic benefit over coal in misleading and incorrect

Your statements:

"*Shorting coal and going long replacement renewables could then result in a net gain, or a carbon arbitrage*", p2,

"*phasing out coal is not just a matter of urgent necessity to limit global warming to 1.5°C. It is also a source of considerable economic and social gain*", p3

"*PV and wind: (1) have received the most policy support in over 130 countries; (2) are currently the most competitive power generation technologies; and (3) experience a continuing trend of falling cost suggesting the highest potential to dominate most markets (IEA (2021e)",* p22

These and similar statements are wrong and misleading

a) Your use of the variable cost measure LCOE is scientifically incorrect when comparing dispatchable with base load power. When you adjust your analysis for full costs (which you must for a logical economic argument), you will get different results. Some examples below:

   a. IEA confirmed in December 2020 (IEA 2020[16], p14): *"…the system value of variable renewables such as wind and solar decreases as their share in the power supply increases*" and they used VALCOE instead of LCOE

   b. OECD NEA 2018, p39 confirms "*When VREs [variable "renewable" energy] increase the cost of the total system, … , they impose such technical externalities or social costs through increased balancing costs, more costly transport and distribution networks and the need for more costly residual systems to provide security of supply around the clock*" (OECD NEA 2018, p39) and "*From the point of view of economic theory, VREs should be taxed for*

these surplus costs [integration costs above] in order to achieve their economically optimal deployment."

c. The integration cost of VRE logarithmically increases as the VRE share in the energy system increases beyond a certain point (IEEJ 2020[17], p124ff)

b) Schernikau et al. 2022[1] (recently peer-reviewed) discusses full cost of electricity FCOE and net energy returns eROI and proves why the ***switch to variable "renewable" energy will always increase the cost of an energy system*** and have large negative economic and environmental impacts

c) Please include and detail the probability and costs of energy shortages (such as current energy crisis starting in 2021 prior the Russian/Ukrainian conflict) and energy starvation (Schernikau et al. 2022[1]) which will directly result from moving away from conventional energy to variable "renewable" energy that is intermittent, energy inefficient, material inefficient, and requires 100% backup or storage to function.

d) Please mentioned and clarify that the "green" energy transition will reduce global net energy efficiencies, because they require more complex energy systems and increased storage

a. IEA 2022[18] "*Shifting away from centralized thermal power plants as the main providers of electricity makes power systems more complex. Multiple services are needed to maintain secure electricity supply*." And "*In addition to supplying enough energy, these include meeting peak capacity requirements, keeping the power system stable during short-term disturbances, and having enough flexibility to ramp up and down in response to changes in supply or demand.*"

e) Please clarify that ***to date no grid-scale environmentally and economically viable long duration energy storage system exists***. If you believe otherwise, please clarify which solution is today available for long duration energy storage. Hydrogen cannot be the solution because

a. More than half of energy is always lost in producing hydrogen and this lost energy will end up in high-entropy heat that warms our biosphere and always reduces the energy efficiency of the entire energy system.

b. Logically, only excess – otherwise unused – "renewable" energy, such as wind and solar, should be used to produce H2 for the purpose of grid-storage as otherwise it is always more economical to use the "green" or any available energy directly.

c. "*the production of H_2 requires 3-5x more energy than using renewable energy directly*" and hydrogen is precious and should be considered the "*Champagne for Energy Systems*" (Kemfert 2021[19])

f) Please state and clarify in your paper that "climate economics" Noble laureate Prof Nordhaus calculated that "going green" will net cost society as it reduces the GDP available to society in the year 2100 relative to staying "conventional" (Nordhaus 2018[20], Lomborg 2022[7], and various others).

We kindly ask for your written response to Lars Schernikau, email and contact details are given in the email sent. A word version of this letter is available on request for easy answer.

Signatures below

Your sincerely,

Signatories

1) Dr. Lars Schernikau, independent energy economist, commodity trader, and entrepreneur
2) Prof. William Hayden Smith, Prof. of Earth & Planetary Sciences, at Washington University, St. Louis, MO, USA.
3) Prof. Emeritus Rosemary Falcon, retired NRF SARChI Chair of Clean Coal Technology at the University of the Witwatersrand; currently Director of the FFF Carbon Foundation, Johannesburg, South Africa.
4) Prof. Samson Bada, Senior Research Fellow, Associate Professor, DSI/NRF SARChI Chair of Clean Coal Technology, University of the Witwatersrand, Johannesburg, South Africa
5) Prof. Richard Axelbaum, Energy, Environmental and Chemical Engineering, The Stifel & Quinette Jens Professor of Environmental Engineering Science, Washington University in St. Louis, USA
6) John Droz, jr, physicist, founder of Alliance for Wise Energy Decisions, website and network www.wiseenergy.org, USA.
7) Dr-Ing. John A. Shanahan, civil engineer. First career in design and licensing of commercial nuclear power in the United States and Switzerland. Retirement dedicated to public education about the importance of energy from fossil fuels and nuclear power and their by-products for humanity and the environment. Founder-Editor of the website: www.allaboutenergy.net, USA.

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