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From climate science to climate action

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Intelligence Briefing

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Abstract

Non-technical summary. Despite 50 years of good science showing the urgency for action on remedying climate change, the business and political worlds have been exceedingly slow in actualizing climate solutions. Now excess climate-related deaths have mounted to more than 5 million people per year. In this Intelligence Briefing, we identify a few targeted driving actions through economic taxation, ending subsidies, and pursuit of legal cases for climate homicide, among many others. Scientists can play a vital role in providing supporting scientific evidence for policies and prosecutions, and model climate behaviors in their personal and professional lives.

Technical summary. Based on our analysis of the current global situation regarding carbon (CO_2) in the atmosphere, we note that the earth has reached a dangerous 420 ppm, compared to staying under the 350 ppm necessary for human sustainability; and carbon concentration in the atmosphere is still climbing, as fossil fuel firms are continuing to delay and dilute regulatory efforts. This paper suggests action on several fronts. Governments can impose improved taxation regimes that involve unitary, windfall, and luxury taxes on carbon and the consumption of natural assets. Cutting subsidies to fossil fuel firms via COP actions can reduce carbon, by making renewable energy more competitive. We suggest recognizing the excess deaths by carbon pollution as homicide and charging responsible companies as was done in the case of asbestos and tobacco. If timely action is not taken, we caution about the potential rise of climate violence of emerging 'new politics' and increased global population displacement. Science, government, and business sectors need to collaborate in transdisciplinary ways to produce further actionable knowledge. Scientists can lead by example by reducing their own carbon footprints.

Social media summary. Fund climate action by taxing billionaires, eliminating subsidies, and suing fossil companies for climate homicide. The science community is focused on and committed to systems changes – seeking both natural systems, and social and economic systems to be sustainable. Yet systems that are in-place now producing carbon dioxide (herein aka carbon), are not taking adequate scientifically recommended actions; or worse, they are changing in the wrong directions. How can we move from producing more scientific knowledge to science-based actions, and what can scientists do to support such actions? In this Intelligence Briefing, we suggest some pathways for action.

1. Science is urging action now

Science is telling us that more carbon is being emitted into the atmosphere each year. In 2015 when the Paris Climate Agreement was signed, there was 410 ppm (parts per million) of carbon dioxide (CO_2) concentrations in the earth's atmosphere, and by February 2023 that number had risen to 420 ppm, despite the 2-year global economic slow-down caused by the Covid-19 pandemic. Depending on which IPCC climate model predictions one follows, the carbon in earth's atmosphere could rise by 2050 up to 480 to 1,000 ppm. For 800,000 years, the carbon in earth atmosphere has remained between 170 and 300 ppm. To remain within 1.5 °C degrees global temperature rise (goal of the Paris Agreement), carbon needs to be limited to below 350 ppm. Science is telling us that we not only need to reduce global carbon emissions from human activities, but we also need to remove existing carbon from the atmosphere to reduce its concentration (Royal Academy of Engineering, 2018). We should question why after so many years of scientific research on climate change, the global systems responsible for them and climate outcomes are getting worse. Why after so much science pointing to the dire need for action, is there so little investment in preventing and adapting to climate change or global heating?

One answer to this question lies in the rising economic inequality and concentration of wealth, which has placed much of the economic decision power in the hands of a few people. Less than 1% of the world's population now owns over 50% of the world's wealth (Oxfam, 2022; Piketty, 2015). Over the last century, this wealth concentration has created a small but powerful billionaire class, and a larger group of enablers, who actively thwart the

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investments needed for reducing carbon. A few American technology billionaires have proposed climate action plans based on free-market solutions and technological innovation (Gates, 2021). However, overall, they are letting Big Oil dominate the global policy agenda. The oil industry is fighting fiercely to weaken and delay carbon reduction policies. Most other companies are sitting on the sidelines rather than aggressively responding to them. There are over 2,500 billionaires worldwide, and most of them employ thousands of multi-millionaires who do their bidding in controlling existing systems (especially economic systems), including buying-off politicians, media, university expertise, and other levers of social influence and control (Franta, 2022).

One reason why billionaires and many other wealthy people do not want to change is because they are convinced that they can escape the worse consequences of climate collapse. Rushkoff's recent book (Rushkoff, 2022) – *Survival of the Richest: Escape Fantasies of the Tech Billionaires* – explains this 'mindset'. Already in many parts of the world, rich people are building fire-proof homes installed with technical gadgets to purify their air and their water and assure their supply of electricity. They travel around in secure air conditioned and air-purified cars and private jets. A few billionaire visionaries are investing heavily in creating space travel technologies. They seem to believe in the adaptation strategy of technologies that would allow a few humans to literally escape the earth to other planets. But such technologies do not help billions of humans and other species facing life-threatening climate conditions.

We acknowledge that resistance to changing our lifestyles to more carbon-friendly ones is not just from millionaires. Even the middle-class and low-income people are reluctant to change their lifestyles. One non-economic reason for 'why so little action?' lies at least partially in the psychology of human decision making and role of climate change anxiety among various human populations (Clayton & Karazsia, 2020). The fears associated with climate change sometimes result in defensive reactions which might appear to be *apathy*, but they are a form of action paralysis. Inaction may also result from some 'hedonic adaptation' to be useful, meaning that emotional responses may be *significant* but not very enduring enough to result in action (Mertens, 2023).

Taking political action that makes peoples' lives more expensive or less comfortable is unpopular with a significant portion of the population. Several schemes involving carbon tax on corporations and dividend to public have been attempted with limited success (Fremstad & Paul, 2018). For carbon taxation to become politically acceptable to most people, it must be designed with fairness and in ways that shield the economically vulnerable from additional burdens. Green (2021) suggests that simply closing current offshore corporate tax-loopholes and reusing those tax revenues for climate improvements could be an effective way of financing climate action.

Scientists are rarely billionaires, but scientists in industrialized high-income countries do live privileged lives at least as compared to middle classes in low-income countries. Some scientists are among the 1% (80 million people) earning over $100,000 a year. A recent survey by Insider magazine of 26 scientific fields in the US showed the median annual salary of $88,400 (postsecondary biological science teachers) to $154,400 (physicists). It is not an exaggeration to say that some scientists behave like or aspire to be among the rich elite. The credibility of scientists and their science results would be more compelling if scientists show personal responsibilities to make sustainable lifestyle choices in the homes where they live, in their modes of transportation, in their own diet, their modes of entertainment, etc. (Starik & Kanashiro, 2021). Of course, we recognize that we live within urban ecosystems over which we do not have direct control. But as scientists we can try to influence system designs and operations toward sustainability in our own organizations and communities. Through such efforts in their real societal life, scientists can even improve the premises, assumptions, and parameters of their analysis and predictive models. The main point here is that scientists should not take responsibility only for producing knowledge while abandoning responsibility for using it in our own lives.

2. Economic action on climate

Action on climate now boils down to economic actions, especially on investing in carbon emissions reduction and in carbon sequestration. For example, the US Federal Government passed the Inflation Reduction Act in November 2022, which includes $370 billion for climate-related investments over a decade. A month later, The State of California committed another $56 billion for climate action. These are good starting points, but much more needs to be done urgently. Where could funding for climate action come from?

The Club of Rome 2022 report *Earth for All* suggests governments should tax wealth to further invest in climate action now. One avenue for immediate action is taxing the assets of the ultra-wealthy no matter where this wealth is held, including tax havens, and making this possible by developing and sharing national registries of assets held in different forms. In addition to taxing wealth of the richest people, there is opportunity to progressively tax corporate incomes, including income from capital gains (Gaffney, 2023).

Current tax laws allow many international companies to pay little or no taxes at all.

The Institute on Tax and Economic Policy reports that many major companies have legally not paid any federal taxes for many years. Corporations should be taxed fairly by applying a minimum global tax on companies close to the global average rate of 25%; and by making multinational corporations subject to the same tax rates as domestic companies. A unitary tax of global profits can be based on the individual countries' shares of sales, employment and assets held.

Governments should also tax true windfall profits in all sectors. Corporations are known to make 'excessive' or above annual normal profits, during periods of scarcity, uncertainty, and speculation when the rest of the world is becoming worse off (ISRICT, 2022). The Covid pandemic allowed pharma companies to make USD billions in profits. Pfizer alone made a net profit of nearly $22bn in 2021, up from $9.1bn in 2020. It increased its 2022 estimate for Covid vaccine sales to $32bn and expects Paxlovid (a Covid treatment drug) to contribute $22bn in sales. The Ukraine war created uncertainty in the oil and energy sector allowing US oil companies to make windfall profits of over $200 billion in 2022. In a world of interconnected and cascading poly crises, there are frequent windfall profits in one sector or another. Tax gain from such extra profits can be used for climate actions.

Another opportunity to fund climate action is by taxing 'luxury carbon' and biosphere consumption. There is egregious, unconscionable carbon and luxury natural resources consumption among the super-wealthy. Examples include personal jet and yacht travel, big game hunting, ivory and rhino horn trading, export of exotic birds and butterflies, despite the legal ban on

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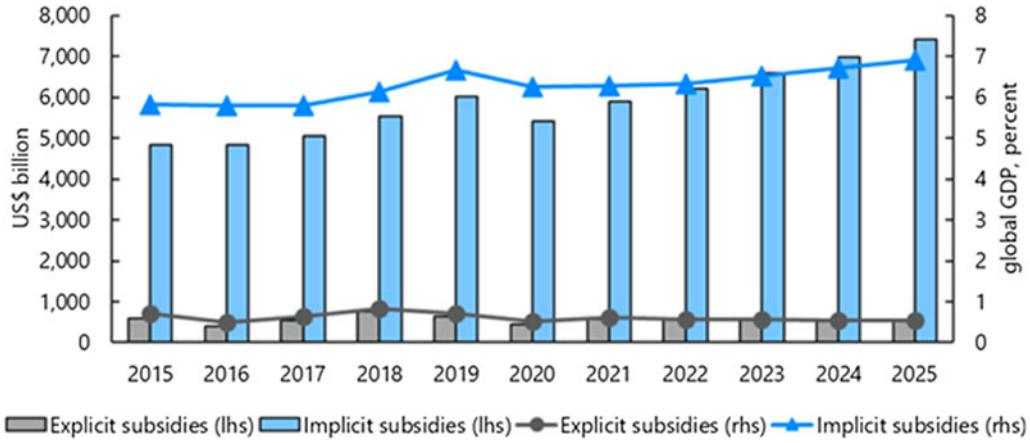


Figure 1. Subsidies to fossil fuel industry.

some of these activities in some countries. Studies show the top 1% wealthiest people were responsible for cumulative emissions of 15% of carbon (Chancel, 2021; Gore, 2021). A review of public records of emissions from the private yachts, planes, helicopters, and mansions of 20 billionaires in 2018 suggested they were responsible for on average 8,194 tons of CO_2e emissions (Barros & Wilk, 2021; Fassler, 2023). Compare this to the poorest one billion people who consume 1.4 tons of carbon per person per year (Chancel, 2021). Private jet tracking data show that some billionaires are emitting more CO_2e in a few minutes, than most people will emit in a year (Millman & Witherspoon, 2022). Given democratic rules and values in different parts of the world, outright unilateral bans on such consumption may not be possible. However, such luxury consumption could be taxed heavily for a fair climate policy (Dixon-Decleve et al., 2022; Oswald et al., 2023).

3. Phase-out for all fossil fuels subsidies and tax incentives

Today the cost of producing renewable energy is lower than the full cost of fossil-based energy (IRENA, 2021). The fossil fuel industry is supported by huge subsidies and incentives globally. IMF chart below shows both implicit and explicit subsidies over the past several years. Total global fossil fuel subsidies were $5.9 trillion (6.8% of GDP) in 2020 and in 2025 they are expected to increase to $7 trillion (7.4% of GDP). These subsidies are greater than the total estimated cost of averting climate heating of $4–$5 trillion per year (Figure 1).

At the 2021 COP26 meetings, countries agreed to accelerate phasing-out fossil fuel subsidies. But a year later, at the COP27 in Egypt, there was no mention of reducing fossil subsidies, or even reducing carbon emissions further. Governments acknowledge that much more investments and access to finances are needed, particularly in poor countries to help them cut greenhouse gas emissions and cope with the impacts of extreme weather. In 2009, poor countries were promised climate financing of $100bn a year from 2020 to 2025. Several mechanisms exist for accomplishing this, including debt forgiveness for climate expenses, direct investment under UNFCC financing mechanisms, and more recently John Kerry's suggestion of de-risked capital underwritten by rich country governments. The pledged finances are behind schedule and expected to reach $100 billion in 2023. The actual disbursal of finances lags further behind with majority of financing being in the form of loans and not grants (Oxfam, 2020). Moreover, some of the financing is not new money but rather a renaming of existing development funds by donor countries.

The above tax and subsidy arrangements can succeed only if governments in solidarity close international tax loopholes and end perverse subsidies and taxation structures. Resulting tax revenues could be invested in decarbonization of the global economy, social programs, women's empowerment, and the transformation of energy and food systems that meet people's needs.

4. Climate homicide and legal action

Human-made climate change is killing in excess of 5 million people each year worldwide (Zhao et al., 2021). Fossil fuel companies are responsible for emitting most of the carbon that causes climate change or global heating. They are continuing to invest in fossil extraction and production and denying the need for urgent climate action. Exxon Mobil developed accurate climate models in the 1970s and has known the harmful climate impacts of their activities for over three decades (Supran & Oreskes, 2017). Climate science over the past three decades has also documented the accelerating deterioration of a stable climate, and expects disastrous climate tipping point consequences on lives and livelihoods (IPCC, 2023; McKay et al., 2022). Some corporations have responded to climate action by developing ESG (Environment, Social, and Governance) practices (Financial Services Agency, 2021). The investment industry now depicts almost 50% of funds as being invested under emerging ESG protocols. But studies show that many organizations are hiring ESG experts with limited knowledge on climate science or experience in the tasks they are conducting, leading to greenwashing (Schumacher, 2020; Whelap, 2021).

The harm caused by fossil fuel companies has led to a renewed focus on holding these companies accountable. Some legal analysts are making the case for climate deaths being legally treated as homicides. Arkush and Braman (2024, forthcoming) suggest that when companies purposely (to defend their profitability and prevent regulation of their operations) obfuscate harm caused by their products and do not inform the public and curtail their harmful operations, they are engaged in lethal conduct. Many big fossil fuel companies did worse. They financed public relations and political campaigns that cast doubt on climate science.

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They gave false information to shareholders about climate risks. They confused consumers and lawmakers on the effects of using fossil fuels. In the US, they financed campaigns to elect or appoint sympathetic local officials, legislators, and even judges who would side with them. Experienced attorneys like Arkush and Braman (2024, forthcoming) have argued that this extreme lethality of fossil fuel corporations' conduct, and their awareness of risks, qualifies for charging them with homicide.

Criminal law in some countries is developed sufficiently with doctrines and precedents of mass tort or injury cases to deal with this massive scale global harm caused by fossil fuels.

Such prosecutions may offer the most prompt and effective remedy. However, as seen in past product injuries lawsuits, such as Asbestos (Johns Mansville), the Bhopal Disaster (Union Carbide), and Tobacco companies, tort case settlements take a long time, remedies often don't reach real victims' needs due to attrition and movement, lawyers tend to make outsize fees, and companies themselves may be bought out and cease to exist (Shrivastava, 1992). Furthermore, in the case of climate harm, identifying victims who may be dispersed around the world adds an extra level of complexity in securing just remedy.

As we know from basic earth sciences, there is only one atmosphere, one water system, and one biosphere that is essentially shared by all life on earth. Furthermore, these natural elements have limits and boundaries for humans to live safely – planetary boundaries (Rockström et al., 2023; Steffen et al., 2015). So, earth should not be polluted and destroyed or treated as a free and unlimited dumpsite by some industries for the benefit of a few shareholders. The 2180 law suits in 65 jurisdictions by youth, children, women, Indigenous peoples, and activists (such as Julianna *v* USA case and Held *v.* State of Montana) are arguing that the Federal and State governments have a constitutional duty to maintain a climate system capable of sustaining human life (UNEP, 2023). The carbon debt of most fossil fuel companies to posterity is so great that paying it off at reasonable social cost of carbon ($190/ton) (EPA, 2022; Rennert et al., 2022) would bankrupt virtually all firms in the fossil fuel industry. Systematic efforts to structure fossil companies to maintain legal defenses through 'plausible deniability' assertions are blatant efforts to provide top management teams with 'hear no evil, see no evil' protections. The Directors and Officers insurance industry may be complicit in such arrangements. Property and Casualty insurance industry will also need to continue adjusting rates and coverage of increasing carbon risks. Florida and California's regulatory frameworks have led several insurance firms to stop writing Property and Casualty insurance in these states.

Going beyond traditional risk management strategies and protracted legal battles with companies, a more socially responsible and practical approach would be converting fossil fuel companies into public benefit corporations. As public benefit companies, they can be weaned away from fossil fuels toward renewable energy (Arkush & Braman, 2024, forthcoming). Profits from their operations could be used to fund carbon mitigation globally. A consequence for investors will be that the company would survive its mounting carbon/climate liability. In this model, shareholders and management could prioritize the public benefit mission over maximizing shareholder returns. California is an early adopter of this model, with the passage of AB 361 (Public Benefit Corporations), which requires that such companies consider the impact of their activities on society and the environment and publicize those considerations in their annual report (California Benefit Corporation, 2012).

A few fossil fuel companies have started to consider steps toward social and climate responsibility. In 2019, Royal Dutch Shell announced it would link executive pay to carbon emissions reductions, and in 2020, BP pledged to become carbon-neutral by 2050 (Storrow, 2020). While these are positive steps, they are still a long way from conversion to a public benefit corporation. Moreover, such initiatives require a change in mindset from fossil fuel companies and their stakeholders, to prioritize the public benefit mission over maximizing shareholder returns (Noor, 2023).

Kohei Saito's (2020) book *Capital in the Anthropocene* makes a case for global economic degrowth in the longer run. While his more radical Marxist version of degrowth seems impractical in today's world, the French version of selective degrowth 'decroissance' and South American version 'buen vivir' of pursuing a modest good life are being usefully applied in some economies (Schmelzer et al., 2022). Degrowth is not a generic solution for the entire world, since almost 2 billion people still live in multidimensional poverty. However, such actions can be instrumental in transforming our global economic systems.

5. Peaceful transformation now or climate chaos and violence later

The window of opportunity for climate action is now, and it is closing fast. Within a decade, many climate feedback loops will become self-reinforcing putting us on an irreversible path to climate chaos. This chaos is already taking shape as reported by the *National Geographic*. By 2050, Bangladesh alone is likely to lose 17% of its land to rising seas making 20 million people climate refugees. The Intergovernmental Panel on Climate Change (IPCC) predicts that sea levels will rise a total of up to 0.6 meters (two feet) by 2100. The Institute for Economics and Peace suggests that by 2050, globally 1.2 billion people are risk of being displaced due to climate change. No doubt some maritime engineers, lawyers, builders, and accountants will benefit from threats and losses associated with sea-level rise (Funk, 2015), so fossil fuel firms are not the only parties who may be indifferent to global heating.

Frustrations with climate inaction are giving rise to a 'new politics of violence' (Anfinson, 2022; Solnit, 2014; Wagstyl et al., 2021). There have always been voices favoring rebellion against the status quo, and violent defense of the earth that were silenced by governments, corporate influences, and civic norms (Best & Nocella, 2006). Koubi (2019) provides an extensive review of prior literature at the nexus of climate and conflict, with emphases on intervening variables, e.g., institutional structures, natural resource diversity and histories of violence. The direct and indirect pathways between climate change and various forms of violence toward humans and other assets remain uncertain in timing and extent. Actions to mitigate the rate of environmental changes and to improve communities' resilience capabilities can serve to reduce both physical and psychological stresses. With the widespread availability of low-cost drones, optical detection sensors, satellite detectors linked to the web in real-time (e.g. MethaneSAT; Bylsma et al., 2023), and explosives, it is easy to imagine how violent responses to the wanton burning of fossil fuels can get actualized.

Effective and timely mitigation and adaptation strategies must be pursued in parallel with concerted efforts to provide for human security in order to reduce the risks of increasing violent conflict and to promote peace (Future Earth, 2022; Martin et al., 2022).

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Peaceful transformation is still possible. It will require new investments and cancelling old investments (subsidies and some debts) and bringing legal pressure on fossil fuel companies to change. Climate inaction is sometimes defended by conservatives with the argument that climate action overly constrains personal freedoms (Lane, 2014). However, science tells us that some freedoms are already being lost in some places as climate change continues uncontrolled. So any voluntary limitation of freedom today could serve to protect freedoms in the future. Conservatives also ignore that we face the choice between peaceful transition now and violence later. These trade-offs between current and future freedoms and peaceful *vs* violent changes deserve more discussion in the science community (Sovacool & Linner, 2016). In all these actions, sciences can be supportive by supplying vital evidence. If we do not act now promptly, there is high likelihood that the chaos of climate displacement will result in riots and violence. As Boyd (2023) notes '… (aggressive transition) needs to not be impossible as soon as possible' (p. 250). From a military perspective on potential for violence, see Boulton (2022) 'Plan E for entangled security and hyperthreats' including those from global heating.

Science and scientists can play vital roles in supporting climate actions. Economic policies and legal action both are critically dependent on good scientific evidence, data, and analysis. Researchers with relevant expertise should engage in the policy processes at local and regional levels by providing testimonies at official public hearings, analyses to support local municipal and city climate planning, raising awareness among public by writing 'Letters to Editor' in news media, and public communications via blogs, podcasts, and social media. They can counter climate denialism and the discourses of climate delay (Lamb et al., 2020). A second suggestion for action by researchers is for them to reconsider their traditional siloed disciplinary scientific research. While this is important, it is often read by a very small group of experts in the field. Scientists need to engage transdisciplinary integrated evidence combining natural science, social science, and humanities to make compelling policies and legal arguments that will change resource allocations at sufficient scale and speed (Shrivastava et al., 2020). Third, there is opportunity for institutional and collective action as is being promoted by Future Earth and some universities and academic associations (Future Earth, The Earth League and WCRP, 2022). Future Earth initiated 'Knowledge Action Networks' (groups of academic researchers, policy makers, corporate managers, and activists) in the Global Research Networks, to encourage transdisciplinary solutions research. Future Earth's Science-Based Pathways initiative and TERRA School attempt to promote transdisciplinary research. It is true that past attempts at transdisciplinary research have had limited success, and such works have their own set of limitations. Major progress is still possible if concerted action is taken by funding agencies to promote solutions-oriented work, and reward systems at universities explicitly recognize and reward transdisciplinary engagement.

Finally, transdisciplinarity offers a unique opportunity to reimagine self-identity or personhood as transdisciplinary researchers. That implies broadening our researcher identity beyond the traditional purist notion of the 'objective scientist', and accepting responsibility for community engagement, advocacy of scientific solutions, and science-based activism. Scientists have a social and professional responsibility as human beings and citizens to engage in climate action. We acknowledge that this may not be a common view in the traditional scientific system. There are still many researchers who believe that scientific analysis and political evaluation and action *must be separated*. Some fear that their scientific credibility may get compromised if they engage in political activism. Transdisciplinarity embraces a whole-person view of being scientists. It expects scientists as humans and as community members to legitimately engage in action, activism, and advocacy. Clearly, this suggestion needs much more debate within the scientific community. It also assumes that skills and training will be necessary to prevent scientists from diluting their rigorous objective scientific research, from social and political compromises that are often needed for pragmatic real-world solutions.

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