Counterflow
By Steve Huntoon

We're Going to Need a Plan B

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Let me give it to you straight:

#1 - climate change is a global threat;

#2 - humanity isn't going to cut carbon emissions enough to contain it.

Most people agree on #1 so let's focus on #2. There are many reasons for #2, first and foremost it's the ultimate "free rider," aka "tragedy of the commons," aka "negative externality" problem. It boils down to this: Each nation incurring costs to reduce its carbon emissions gets some small percentage of the overall benefit to humanity from doing so. So each nation's cost to *its* citizens and to *its* economy is relatively high, and *its* share of benefit is relatively low.

Given we haven't solved this problem *within* nations, like our states where 60% of emissions come from states without climate goals,[1] it's naïve to think we can solve this problem *among* nations. For all the happy talk at international conferences like COP26, nations are going to continue to pursue their national interests.

Global Reality Check

Asia now represents 74% of world coal electric generation, and it's increasing there with no end in sight.[2] Asia is planning 600 new coal plants.[3]

And consider the developing world where people face personal existential crises every day — do we ask them to forgo fossil fuels that have been, and remain, critical to emerging from poverty?[4] Developing nations face many crises, not just climate change, as Daniel Yergin and others point out.[5]

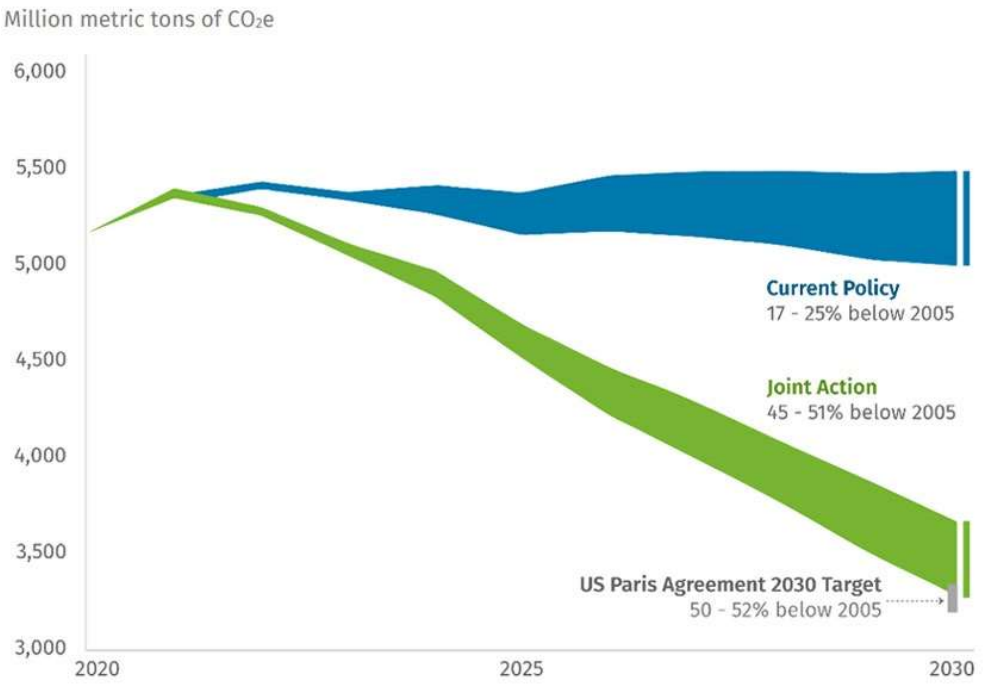
There are strategic resource limitations as well. Current production of strategic minerals for batteries to back up intermittent resources, and to electrify transportation, is a pittance of what is needed, and these minerals tend to be located in problematic nations.[6]

And we haven't untangled the importance of fossil fuels in agriculture (fertilizer), and in plastics, among other essentials of modern life.[7] Did I mention the insane closure of nuclear plants?[8]

And lest we forget, aggressive carbon emission goals by a given nation are a chimera if the consequence is the departure of energy-intensive industries to less-committed nations.[9]

What is the biggest sobering item from the latest Intergovernmental Panel on Climate Change (IPCC) report released April 4? My nomination is: "The report says that to avoid more than 1.5 degrees C of warming, global emissions must peak before 2025 and then fall by 43% before 2030, compared with 2019 levels." [10]

Not happening.



U.S. net GHG emissions trajectory, 2020-2030 | *Rhodium Group*

On the Home Front

The American people aren't going to stand for big electricity cost increases, degradation of electric reliability or NIMBY siting issues. We already are seeing pushback on electric rate increases in California.[11] We were reminded by Texas last year that the populace will not tolerate outages. And we have huge NIMBY siting issues, not just for large transmission projects,[12] but also for large wind and solar projects.[13]

Not to mention our "own goals," like the solar panel antidumping investigation.[14] And the new NEPA rules,[15] exacerbating the existing ones,[16] which will sabotage many more renewable projects than fossil fuel projects.[17]

Lord, help us. Because we can't help ourselves.

The Coffee

So where are we? We need to wake up and smell the coffee: Plan A ain't happening.

We need a Plan B: Solar geoengineering. This is adding particles, like calcium carbonate (think white sands of Hawaii), to the stratosphere that would reflect more sunlight and thus reduce global warming. It wouldn't take much extra reflection, as the IPCC stated in last month's report: "Simple calculations and climate modelling studies show that about 2% extra solar irradiance reflected away from Earth … would suffice to offset global mean warming from a doubling of the CO_2 concentration." [18] Doubling is much less than the actual increase in CO_2 concentration from the pre-industrial period to now.[19]

Bottom line according to the IPCC? "Modelling studies suggest that it is conceptually possible to achieve multiple climate policy goals by optimally designed SRM [geoengineering] strategies." [20]

Last year a blue-ribbon committee of the National Academies of Sciences, Engineering and Medicine recommended that the U.S. spend about $100 million to $200 million

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researching this over the next five years.[21] If you look at only one of the footnoted materials for this column, please make it this National Academies report.

The reaction in some quarters has been outrage. The most organized opposition is from those who oppose even research, making three main arguments: (1) the risks are poorly understood and can never be fully known; (2) Plan B would delay/discourage Plan A ("moral hazard"); and (3) the "global governance system" is unfit to develop and implement the necessary agreements for deployment.[22]

Let's take these up. Regarding objection #1, the uncertainty of the risks, that's of course a reason *to do* research. This just in, we humans have been meddling with Earth for about 150,000 years without understanding the risks, much less *fully* understanding the risks. And could the risks of geoengineering be bigger than climate catastrophe?

Regarding objection #2, the moral hazard argument, this is akin to opposing *adaptations* to climate change (*e.g.*, seawalls) because their sheer existence reduces the urgency of cutting carbon emissions. Or opposing seat belts because people drive faster. Or opposing COVID vaccine research because it would discourage mask wearing. And, again, we need to recognize that nations' individual decisions are not going to be determined by whether geoengineering might or might not work.

Regarding objection #3, the alleged unfitness of the "global governance system" to deploy geoengineering, this begs the question doesn't it? If nations can't get it together for geoengineering at a cost of $250 billion to $2.5 trillion through 2100 (depending on the scenario chosen),[23] how on Earth could these same nations get it together to transform virtually everything at a ballpark cost of $275 trillion through 2050?[24]

Those who support research on geoengineering acknowledge that maybe we're just buying needed time for technology, mitigation and adaptation to catch up.[25] Or maybe it's a permanent offset to carbon emissions that can be managed effectively. Nobody knows.

Instead, some environmentalists went into overdrive to stop — not just geoengineering itself — but any research into it.

What About a Plan C?

There is no realistic Plan C. As *The Atlantic* just said: We have two impossible paths to avoid the worst of climate change.[26]

The Atlantic identifies two impossible paths: (1) a collapse in global energy usage, and (2) massive carbon removal from the atmosphere. Regarding energy usage reduction, it gives an example with vehicles where instead of world-wide vehicles increasing from 1.3 billion now to 2.2 billion by 2050, they would actually decline to 0.85 billion by 2050. Not a chance.

As for carbon removal from the atmosphere, the cost is huge, 6X to 20X the social cost of carbon, comparing the technology's cost estimate range of $300 to $600/metric ton,[27] with the Biden Administration's social cost of carbon of $51/metric ton.[28] The IPCC estimates in one scenario that 6 billion tons would need to be removed from the atmosphere every year to 2050 to meet the 1.5 degree goal,[29] so that translates into $67.5 trillion. If the newly announced Frontier initiative were successful in reducing the cost to $100/ton,[30] it would still take $15 trillion. Nations could pass the hat for that $67.5 trillion, or $15 trillion, but the track record for raising even relatively tiny sums is pathetic.[31]

What about new nuclear? Lazard says new nuclear has a capital cost midpoint of $10.3MM/MW and a levelized energy cost of $167/MWh,[32] more than 3X the social cost of carbon. Vogtle in Georgia is a slow-motion train wreck I wrote about five years ago.[33]

But perhaps smaller, "modular" nuclear? To take an example, TerraPower says its first Natrium 345-MW reactor will cost $4 billion — with taxpayers on the hook for half of that.[34] By the way, $100 billion has been spent over six decades on this "advanced" sodium-cooled nuclear technology, to generate roughly 0 MWh (sodium does not play well with water or air).[35] And the project is now in limbo because the only existing source for the specific nuclear fuel is Russia.[36]

Hope Is Not a Plan

Is it better to bury our heads in the sand instead of getting some answers? To condemn humanity to a global threat by ruling out even research on a Plan B?

"We all have to take a chance. Especially if one is all you have." Capt. James T. Kirk, *Tomorrow Is Yesterday*, 1967.

Let's give geoengineering a chance. ■

[1] https://www.economist.com/united-states/california-wants-to-lead-the-world-on-climate-policy/21808833 ("The Rhodium Group, a consultancy, reckons that 60% of emissions stem from states without climate goals.")

[2] https://www.iea.org/data-and-statistics/charts/asias-share-of-global-coal-power-generation-1990-2019; https://www.reuters.com/business/energy/cop26-aims-banish-coal-asia-is-building-hundreds-power-plants-burn-it-2021-10-29/#:~:text=In%20Asia%2C%20coal's%20share%20of,Statistical%20Review%20of%20World%20Energy.

[3] https://www.reuters.com/world/asia-pacific/asias-new-coal-plant-plans-jeopardise-climate-targets-report-says-2021-06-29/#:~:text=China%2C%20India%2C%20Indonesia%2C%20Japan,of%20more%20than%20300%20gigawatts

[4] https://www.wsj.com/articles/climate-change-life-expectancy-carbon-netural-oil-coal-fossil-fuels-ukraine-war-russia-china-fossil-fuels-carbon-emissions-mining-pollution-electric-car-vehicle-11649258860?mod=Searchresults_pos1&page=1.

[5] https://www.theatlantic.com/international/archive/2021/11/energy-shock-transition/620813/

[6] https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf; https://www.wsj.com/articles/green-energy-makes-inflation-worse-minerals-copper-aluminum-graphite-lithium-commodity-markets-11650205511?mod=Searchresults_pos3&page=1.

[7] https://www.theatlantic.com/international/archive/2021/11/energy-shock-transition/620813/; https://www.wsj.com/articles/fossil-fuels-petroleum-refining-products-plastics-fertilizers-africa-food-shortage-grocery-energy-prices-costs-rising-russia-fracking-biden-climate-change-11649100123?mod=Searchresults_pos2&page=1.

[8] I wrote before February 24: "The Germans are shutting down the rest of their nuclear plants so they can be more dependent on Putin's natural gas. An even worse sin than California's and New York's closures of the Diablo Canyon and Indian Point nuclear plants (which I railed against years ago)."

[9] The "good" nations theoretically could tax via tariff their imports from "bad" nations in an effort to rebalance the economic incentives, but will they?

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[10] https://www.economist.com/science-and-technology/2022/04/09/the-latest-ipcc-report-argues-that-stabilising-the-climate-will-require-fast-action

[11] https://www.rtoinsider.com/articles/29617-rate-hikes-prompt-concern-california.

[12] https://www.bloomberg.com/graphics/2022-clean-energy-power-lines-transwest-wind-maps-private-property/

[13] According to Columbia University's Sabin Center, more than 200 wind and solar projects face local opposition. https://www.wsj.com/articles/hamptons-opponents-hound-offshore-wind-power-project-11650058015?mod=Searchresults_pos1&page=1

[14] https://www.rtoinsider.com/articles/29967-solar-sector-braces-tariff-probe-impact

[15] https://www.ceqachronicles.com/2022/04/new-nepa-rule-restores-demanding-environmental-review-practices-for-major-federal-projects/

[16] https://www.wsj.com/articles/for-a-clean-energy-future-we-need-deregulation-11645110044?mod=Searchresults_pos1&page=1.

[17] https://www.washingtonpost.com/business/energy/want-green-energy-cutred-tape/2022/04/21/147bbf38-c173-11ec-b5df-1fba61a66c75_story.html ("An analysis last year found that of the projects undergoing NEPA review at the Department of Energy, 42% concerned clean energy, transmission or environmental protection, while just 15% were related to fossil fuels.")

[18] https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report_smaller.pdf. (pdf page 1036).

[19] https://www.carbonbrief.org/met-office-atmospheric-co2-now-hitting-50-higher-than-pre-industrial-levels

[20] IPCC Report (pdf page 1041).

[21] https://nap.nationalacademies.org/download/25762

[22] https://www.solargeoeng.org/non-use-agreement/open-letter/; more detail here, https://wires.onlinelibrary.wiley.com/doi/10.1002/wcc.754.

[23] https://iopscience.iop.org/article/10.1088/1748-9326/aba7e7/pdf

[24] https://www.mckinsey.com/business-functions/sustainability/our-insights/the-economic-transformation-what-would-change-in-the-net-zero-transition.

[25] It should be noted that there are other consequences of carbon emissions that geoengineering would not necessarily address, such as ocean acidification, https://www.annualreviews.org/doi/pdf/10.1146/annurev-environ-012320-083019.

[26] https://www.theatlantic.com/science/archive/2022/04/ipcc-report-climate-change-2050/629691/?utm_source=newsletter&utm_medium=email&utm_campaign=weekly-planet&utm_content=20220427&utm_term=The%20Weekly%20Planet

[27] https://www.economist.com/science-and-technology/2022/04/09/the-latest-ipcc-report-argues-that-stabilising-the-climate-will-require-fast-action

[28] https://www.kirkland.com/publications/blog-post/2022/03/social-cost-of-carbon-fifth-circuit

[29] https://www.scmp.com/business/article/3174001/google-facebook-owners-among-tech-titans-launch-us925-million-initiative

[30] https://frontierclimate.com/.

[31] https://www.nature.com/articles/d41586-021-02846-3

[32] https://www.lazard.com/media/451905/lazards-levelized-cost-of-energy-version-150-vf.pdf.

[33] https://www.energy-counsel.com/docs/The-Devil-Went-Down-to-Georgia-2018-01-23-RTO-Insider.pdf; https://www.energy-counsel.com/docs/Vogtle-the-Law-of-Holes-and-Two-Modest-Proposals.pdf.

[34] https://www.cnbc.com/2021/11/17/bill-gates-terrapower-builds-its-first-nuclear-reactor-in-a-coal-town.html

[35] https://www.foreignaffairs.com/articles/2021-07-08/nuclear-energy-will-not-be-solution-climate-change; https://fissilematerials.org/library/rr08.pdf

[36] https://www.wired.com/story/the-nuclear-reactors-of-the-future-have-a-russia-problem/