Financial Bailout Spending Would Have Almost Paid for Thirty Years of Global Green New Deal Climate: Triage, Regeneration, and Mitigation

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(Edited version of this forthcoming in *Review of Radical Political Economics* 2020)

Abstract

Human induced climate crisis is destroying the capacity of our planet to support our species and other life at an unprecedented rate. The most urgent of climate crisis tipping points is Arctic warming and sea-ice loss. It is estimated that Arctic summer sea-ice loss, that could based on current trends occur in one or two decades, would cause an abrupt 0.5 Watts per square meter of radiative forcing above pre-industrial levels that would be roughly equivalent to the effect of more than 17 years of "Green House Gas" (GHG) emissions if it occurred today. A “Global Green New Deal” (GGND) will require at least three phases and three funding sources. The three overlapping phases are: a) short-run climate restoration or triage, b) medium-term soil carbon sponge and water cycle adaptation or regeneration, and c) long-run “Green House Gas” (GHG) drawdown or mitigation. The three funding sources are: a) utilizing the sovereign of the U.S. government and Federal Reserve to create dollars, b) taxing GHG emissions and c) taxing wealthy and high-income individuals with a particular focus on rentiers. The ex-nihilo financial support offered by the Fed to bail-out the global financial system from 2008-2011 would have been almost sufficient to fund a 2020-2050 comprehensive GGND that includes all of the components above.

Keywords:

financial instability and fragility, climate change, political economy, environment, endogenous money and finance.

1. Introduction

Human induced climate crisis is destroying the capacity of our planet to support our species and other life at an unprecedented rate (Woodward 2019). In addition to climate *mitigation* and *adaptation*, climate triage, or climate *restoration* of already passed or about to pass tipping points is now essential to avoid disaster (Fiekowsky, Douglas, and Lee 2019).

The most urgent of these is Arctic warming and sea ice loss that is causing a wavering and slowing Jet stream, and permafrost methane release, so that the arctic for the first time may be a net carbon emitter rather than absorber, *triggering a long-feared feedback loop of warming causing accelerated warming* (Freedman 2019). Arctic summer sea ice will disappear within the next two or three decades if current trends continue (Stroeve 2019).

Arctic summer sea ice loss would dramatically increase already extreme polar warming due to open ocean heat absorption causing more Greenland ice sheet melting and a shifting jet stream and increased severe weather events (Harvey 2016). Due to its impact in reducing solar reflectivity, it is estimated that such a loss would cause an abrupt 0.5 Watts per square meter increase in radiative forcing, or global warming from the sun, above pre-industrial, roughly equivalent to the effect of more than 17 years of GHG emissions if it occurred today (Pistone et al. 2019).[1]

In this paper, I argue that a global "Global Green New Deal" (GGND) would require at least three phases and three funding sources. The three overlapping phases are: a) short-run climate restoration or triage, b) medium-term soil carbon sponge and water cycle regeneration or adaptation, and c) long-run "Green House Gas" (GHG) drawdown or mitigation. The three funding sources are: a) utilizing the sovereign power of the US government and Federal Reserve to create dollars as Modern Monetary Theory (MMT) theorists have pointed out, b) taxing GHG emissions and c) taxing wealthy and high-income individuals with a particular focus on rentiers. With the caveats that receipts from b) should be partially or wholly redistributed to low income and low wealth households and countries to offset the burden of these taxes on them, and that receipts from b) and c) do not, at least initially, need to cover GGND expenditures due to a). We need to deploy all available options in confronting this looming existential crisis before it is too late.

2. Funding

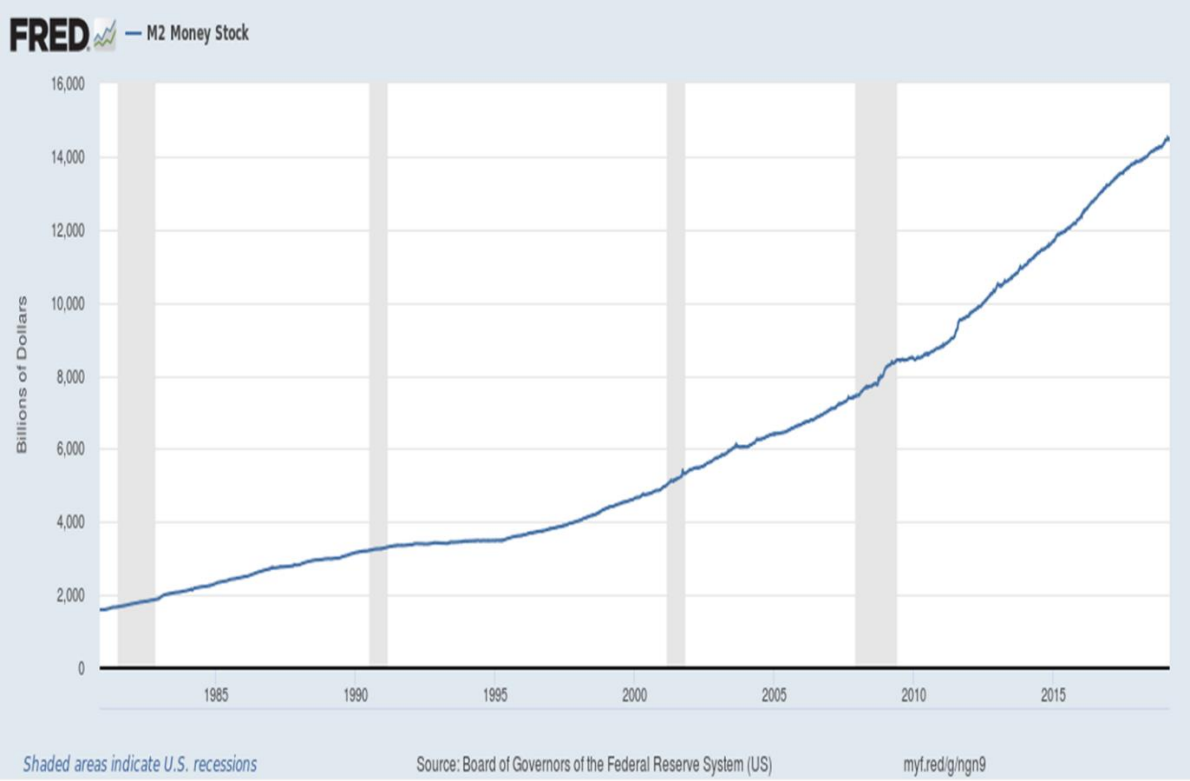
A detailed "Modern Monetary Theory" (MMT)[2] rationale for monetization of US public spending can be found in (Mitchell et al. 2019). In practice, though direct monetization through

[1] Pistone et. al. (2019) estimate 25 years but this is for the impact since 1979 based on 2016 atmospheric CO2 levels. The paper also notes that the 0.5 Watts per square meter increase in radiative forcing estimate is in the ball park of three earlier estimates using different data and methodologies, and that observed arctic sea ice retreat per degree of global temperature increase is occurring more rapidly than the predictions of any of a suite of recent climate models and 2.1 times faster than the average of these models.

[2] Here I am strictly referring to monetization, not other policies that are often included as part of MMT like guaranteed employment (that I agree with) and free trade (that I don't agree with). For the record I would consider myself a "Neo-Rentierist" MMTer in the broad sense--see text below.

Federal Reserve purchase of Treasury Bills is not currently authorized, this restraint has been lifted in the past and there is no reason why it could not be lifted again, especially after the Fed has recently created trillions of dollars ex-nihilo on "Quantitative Easing" (QE) "open market" purchases of Treasuries, and Freddie, Fannie, and Ginnie mortgage backed securities (Garbade 2014). Moreover, whether direct or not, when the Fed increases its securities portfolio, it is effectively pumping "high-powered" money into the economy. In fact, M2 money supply has expanded more than three times as fast in the last 9 years from the end of the financial crash in June 2009 to June 2019 (roughly $6.3 trillion) than it had in the 27 years from November 1980 to November 2007 prior to the crash (roughly $ 5.8 trillion), see figure 1 below.

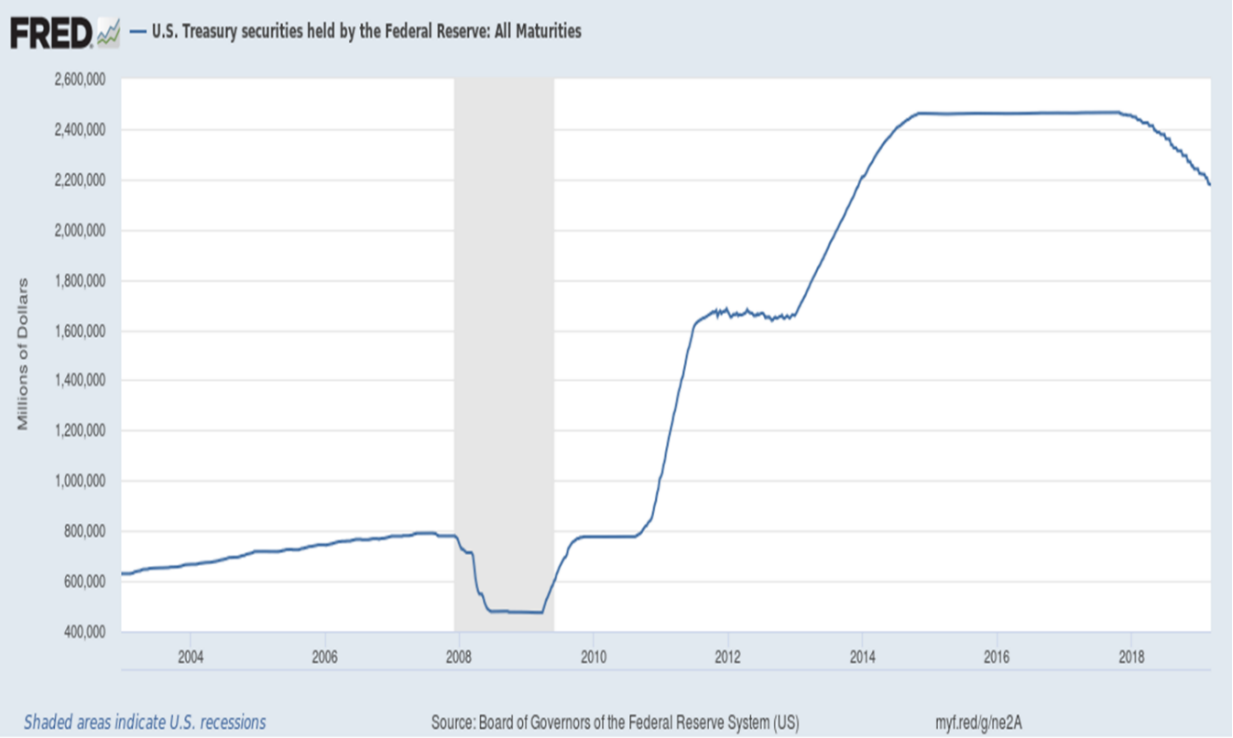
Figure 1: M2 Money Stock 2008-2019



Source: FRED, M2 Money Stock, downloaded 12/17: https://fred.stlouisfed.org/series/M2

Roughly $ 2.8 trillion ($ 1.7 trillion Treasuries and $ 1.3 trillion Fannie, Freddie, and Ginnie securities) or 44 percent of this $ 6.3 trillion expansion has been directly created by the Fed via the financial bailout and QE over this period, see figures 2 and 3 below.

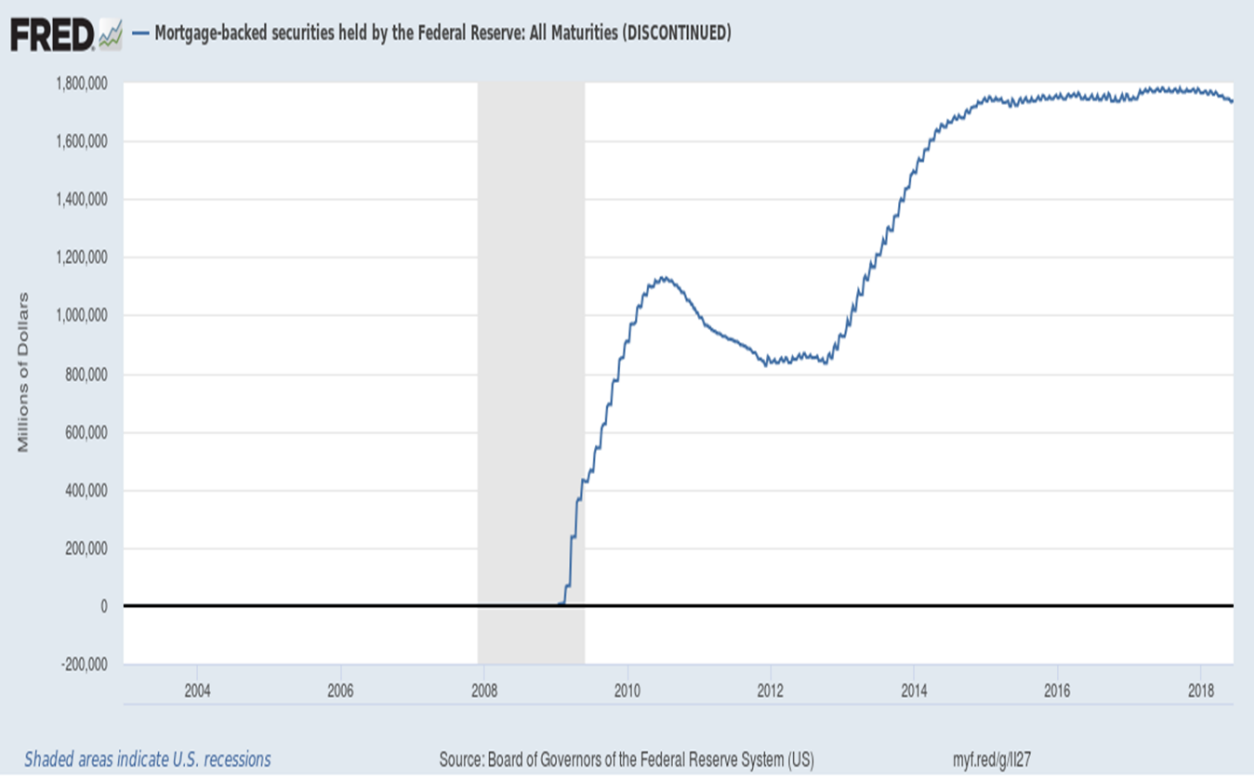
Figure 2: Fed Purchases of Treasuries 2008-2019



Source: FRED, Fed US Treasuries stock, downloaded 12/17: https://fred.stlouisfed.org/series/TREAST .

Figure 3: Fed Purchases of Fannie, Freddie, and Ginnie Securities[3]

[3] Fed stock of mortgage backed securities, downloaded 12/17: https://fred.stlouisfed.org/series/MBST .



Source: Fed mortgage backed securities stock, downloaded 12/17: https://fred.stlouisfed.org/series/MBST

This has caused real estate (up 28 percent)[4] and Dow Jones (up 276 percent)[5] to rise along with non-financial private debt (up 31 percent).[6] But real economic growth for this expansion has been slower than prior periods of positive annual GDP growth: 2010-2018 average annual 2.3 percent, 1992-2007 3.3 percent, 1983-1990 4.1 percent, and inflation, or prices for produced goods and services (as opposed to existing assets), has been very low: with annual CPI average increases of 1.5 percent, versus 2.5 percent and 3.9 percent, for these same periods.

The fact that MMT monetization of government spending is not particularly novel or original misses the important political effect of highlighting this possibility. his is critical as it shifts the discussion of financing a Green New Deal and Marshall Plan (GGND) to the *really important* issues of *real economic resource use* instead of the irrelevant "how do we pay it?" question. Thinking about the problem this way directs planning toward how to create enough *real* slack in the economy to accommodate the enormous amount of new government spending on investment and employment that such a program would require. As in WWII, such an expansion of real economic resource use would require offsetting reductions in consumer and

[4] FRED US Real residential property price index increased by 27.6 percent from 102.16 in 2010 Q1 to 130.32 by 2019 Q3 (FRED Real Property Price Index 2019).
[5] Dow Jones stock index increased by 275.6 percent from 10,191.90 in May 2009 to 28,086.49 in Jan. 2020 (Macrotrends 2020).
[6] Credit to the US private non-financial sector from all sectors at market value in increased by 30.99 percent from $ 24,587.332 billion at end of 2009 Q1 to $ 32,206.566 billion end of 2019 Q (BIS 2020).

other investment spending and production, and probably direct rationing and price controls (as in WWII) to prevent unforeseen bottlenecks from leading to inflation instead of real resource reallocation. This means for example that simply taxing *extreme* income, wealth, and luxury production would not be adequate as it would be necessary to tax *a sizable enough share of upper income households and luxury goods* so as to achieve sufficient real reductions in production and use of these kinds of goods and services to accommodate public GNDMP spending and investment. However, it makes no sense to assume that an artificial equivalency between the public funds that can be raised through taxing and borrowing, and the funding needed for a GGND.

MMT critics frequently point out, the power to monetize government spending is not unlimited. This includes left critics who are in full agreement with the goal of expanding public provision and spending (Paley 2018) (Wolff 2019) (Henwood 2019) (Sawicky 2019). However, as documented above, the ship of using monetized public spending to prop up Finance, Insurance, and Real Estate (FIRE) and maintain tepid GDP growth has already sailed in the United States and elsewhere since the crash, and probably will keep on sailing during the next recession (Buiter 2019). It is true that history is replete with examples of monetized public spending leading to runaway inflation and MMT critics have rightly expressed skepticism that governments can be trusted to use this power responsibly over the long term. However, Central banks also are incapable or unwilling to use their power to create money responsibly as was evident after the financial crash when the Fed other Central Banks monetized private debt to bail out FIRE instead of homeowners and the real economy, (Hudson 2012), and the eventual overexuberance of private finance has been a regular feature of capitalism throughout its history (Minsky 1986) (Keen 2017). In this respect the main difference between public monetization and private debt leveraging has been what these powers are used *for*. I see no reason why, when we are faced with an existential crisis that is unquestionably greater than any crisis humanity has never before faced in its history, we should not use the public power of fiat money creation, and especially the unique global monetary power of the US dollar, to address it. If this eventually causes inflation so be it. As in war time we need to act.

Public monetization is also necessary to reduce the debilitating macroeconomic and income extraction role of money creation through ever increasing private debt in the absence of periodic debt cancellation or "Jubilee" as practiced in ancient civilizations. As "Neo-Rentierists" (who broadly include themselves in the MMT camp) have argued, judicious public money creation can be a used to offset this burden of private debt without generating similarly burdensome public debt obligations (Keen 2017) (Hudson 2012) (Baiman 2020).[7]

However, it is true that even for a currency as strong as the US dollar, public monetization involves trust. Therefore, raising public revenue through taxing is important and not just in order to prevent inflation, or reduce concentrated economic power and social inequity, but also to

[7] Recently Keen has produced a withering critique of the leading economic climate impact models and estimates produced by Neoclassical economist William Nordhaus (and followers). Nordhaus' estimates have influenced the IPCC's choice of 1.5 C and 2.0 C "guardrails" that are clearly too optimistic as Arctic sea ice is melting at the current 1.1 C warming (Keen 2019) (Nordhaus 2018) (Arent et al. 2014).

signal to the world that the government is not on an unrestrained course of currency debasement. This also suggests a strategy of monetizing without acknowledging it, as the Fed and other Central Banks have been doing for over a decade now.

In addition to raising revenue and preventing inflation, the key objective for taxing rentiers would be to reduce the parasitic burden that they place on especially lower income and wealth households and real production, in order to eliminate or at least reduce the sacrifices in access to goods and services that these households and production may have to make in a GGND transition toward a more equitable and democratic economy and society.[8] Broad improvements in distributional equity and production efficiency would for obvious reasons make a GNDMP transition less painful, more feasible, and more equitable. Taxing high income and wealth individuals would also mitigate their disproportionate GHG emissions from consumption (Guardian 2015). Similarly, the purpose of taxing GHG emissions would obviously be to reduce them. This can be done with rebates to low wealth and low-income, households and countries, to avoid unfair burdens and perverse incentives (Rajan 2019).

3. Short-Run Climate Restoration or Triage

As noted above, passing a tipping point like Arctic sea ice loss is likely to have a dramatic impact on other tipping points like Atlantic circulation and Jet stream slowing and location shifting, and accelerated Greenland ice sheet shifting and melting, and possibly catastrophic permafrost methane release. The likely shifting of the Atlantic circulation and Jet stream if Greenland replaces the Arctic as the central pole of low temperature (until the Greenland ice sheet melts) would have severe impacts on regional climates throughout the globe, possibly transforming Spain and areas in northern Mexico and the southwest United States into unlivable desserts, as is already occurring in parts of Africa and Asia where a combination of extreme heat and humidity is making human respiration and cooling, and thus outdoor non-air conditioned habitation impossible.[9] We are in an emergency situation that calls for emergency responses.

One of the more intriguing possibilities would mimic the way in which large scale volcanic eruptions temporarily cool the planet by suffer into the atmosphere. Solar Geoengineering would mimic this by similarly releasing solar (or some other agent) into the upper atmosphere to cool the planet, and especially the polar regions, until more lasting solutions like soil and plant regeneration and carbon drawdown are put in place.

Prominent among these proposals has been that of David Keith, a professor of applied physics at Harvard, who has developed a detailed plan of action that, based on multiple state of the art climate models, would achieve an about 1.5 degree Celsius average cooling across the planet relative to scenarios with 2xCO2 (that would increase average temperature by about 2.5 degrees Celsius in these models) with no average change in precipitation, and reduced variation, and

[8] Not because of "crowding out" private access to available financial savings, but to reduce real production constraints.

[9] See for example this 12/13/2019 summary of "Our DIRE Climate Emergency" at COP25 in Madrid Spain by Dr. Peter Wadhams, Dr, Peter Carter, Paul Beckwith, and Regina Valdez https://youtu.be/Bje8JMuaDp4 .

maximum, global temperatures and precipitation levels. More specifically, models have indicated that this proposal would reduce: 1) variations in water availability, 2) extreme precipitation, 3) tropical cyclones, and 4) extreme temperatures. Keith's proposal is to inject 1.5 million tons of sulfur per year into the stratosphere (the eruption of Mt. Pinatubo released 8 million tons in 1991) at an estimated cost of only $ 5 billion to build 100 customized aircraft that would make about 120,000 flights per year to do this (commercial flights per year are about 40 million) (Keith 2019).

A whole range of other potentially promising triage technologies including: "Carbon Negative Cement" and "Permaculture Arrays with Upwelling" that could make a real immediate difference in reducing the impact of global warming have been estimated to cost $ 1.25 trillion over 5 years, and $ 3.2 trillion over 10 years in a recent "The Foundation for Climate Restoration" white paper (FCR) (Fiekowsky, Douglas, and Lee 2019).

4. Medium-Term Soil and Water Cycle Climate Regeneration or Adaptation

There is no question that we need to rebalance our climate by reducing global warming and that increased GHG emission has been, since at least the late 20th century, a key driver of the increased net planetary heat absorption that is causing our climate crisis. Less well known, is that until the early 20th century human agriculture was the largest emitter of CO2 (Skuce 2015).

We have to stop increasing and start drawing down GHG emissions. However, even getting to net zero would not stop existing calamitous climate change trends, it would just prevent them from getting even more catastrophic. Reversing the enormous damage to our environment that we have already caused through GHG drawdown alone could take centuries. Are there other things that we can do to more immediately cool and stabilize our climate by regenerating our soil and hydrology, and at the same time drawdown carbon emissions?

Walter Jehne, former CSIRO Climate Scientist and Microbiologist, founder of "Healthy Soils Australia" (HSA), is a leading advocate of this approach (Jehne 2017). In an HSA white paper, Jehne points out that hydrology is responsible for 95 percent of planetary cooling and that "high input" agriculture including: "…excessive use of fire, cultivation, fertilizers, bio-cides, irrigation and fallowing all of which oxidize carbon." has led to declining levels of carbon in most agricultural soils over the past 100 years from about 5 percent to less than 1 percent in many places (Jehne 2017: 2).

Jehne concludes (2017: 3):

"After over 50 years of warnings and 30 years of global policy denial and delay, it is now too late for reductions in future CO_2 emissions to adequately slow down its rise or its greenhouse effects. It is now too late even for the drawdown of carbon to zero or negative net emissions, by itself, to prevent accelerating the dangerous hydrological feedbacks and climate extremes."

The HSA white paper offers an extensive plan for doing this. These methods are focused on restoring top soil and the "soil carbon sponge" that absorbs and filters water for long durations and incubates the fundamental microbial processes through which plants access nutrients, fix

carbon, and create soil. Most noticeably, Jehne assumes a goal of only 30 percent reduction in carbon emission from fossil fuel use over the next 10 years. He notes that, though based on the accounting above, humanity emits some 10 billion tons of carbon (37 btCO2) annually from burning fossil fuels, this is only 7-8 percent of the 130 btC/an emitted from all sources, and opines that:

"More problematic is that many of the 7.5 billion people now on Earth rely on the energy from fossil fuels to sustain their essential needs, industrial ecology and social stability. Any major cut in its use may lead to global economic and social instability and more ecological exploitation and damage.

Given that it is an imbalance that that we need to fix, there may be ways to do this other than by ceasing all use of a socially critical component and instead altering other components to restore the balance."

Is this a cop out or realism? I'm inclined toward the later given our current track record. The fact that a dominant share of oil production is state owned, and that when countries such as Ecuador offered to not exploit new oil reserves if the international community would refund an equivalent sum to do this, there were no takers (Bremmer 2010) (Goldman 2017). In line with GGND goals it would make sense to first stop private investor driven fossil fuel production and use by forcing losses on wealthy private investors and financial institutions while offering retraining and alternative comparable jobs to fossil fuel workers and communities, but slowing down this transition for developing countries that depend on, often largely nationalized, fossil fuel production for development and growth.

Jehne has worked up a five-year plan with cost estimates for implementing these methods (Jehne 2019). Remarkably he estimates total global costs for this five-year 2020-2025 soil and water cycle climate regeneration plan at only $ 100 million. Though this appears like an exceedingly low estimate, Jehne's methods rely on natural, and often microbiological processes, and assume extensive grass roots community mobilization.

5. Long-Term GHG Drawdown or Mitigation

Project Drawdown (2017) proposes 80 methods for reducing GHG over the next thirty years 2020-2050, and provides net-cost and savings (or dis-savings) estimates for 54 of them.[10] Project Drawdown uses the conventional framing that the most effective way to avoid climate catastrophe is through GHG reduction and eventual drawdown, and there is no doubt that we must do this. Though as noted above, though the climate mitigation effects of this may take centuries to be realized, if we don't do this, we will face increasingly catastrophic climate events no matter how much triage and regeneration we do.

[10] Interestingly, the "refrigerant management" method that would drawdown the most carbon (90 GT or roughly 2 years of current total global emissions) and would be among the least disruptive to the economy, estimated to be only one of three methods with long-terms costs instead of savings, of $ 0.9 trillion (the second most costly of the three). Even so, without "spending" constraints this would no doubt be immediately implemented.

These 54 Project Drawdown methods are estimated to achieve a 544 mtCO2 Eq. GHG drawdown, cost $29.3 trillion and save $ 68.0 trillion over the next 30 years from 2020-2050. From panel b) of figure SPM.1 (IPCC 2018: 6) it appears that 30 years of reducing GHG's by 42x30/2=630 btCO2 Eq. would surpass our ten-year carbon budget but give us a chance of staying below 1.5 C (Hausfather 2018). The 544 btCO2 Eq. reduction from implementing these 54 Project Drawdown methods above would thus achieve 544/630=0.86 or 86 percent of this necessary drawdown.

The most comprehensive estimate of the total amount of monetary "commitments", including revolving cumulative lending, guarantees, and spending made by the Fed over 2008-2011 to bail-out global finance is $ 29 trillion (Felkerson 2011). The Project Drawdown cost estimate above thus has similar net spending, but much greater long-term net savings, and a much longer 30 year "roll-over" period for the spending, than the roughly three year, 2008-2011, period for the $ 29.0 trillion global financial bail-out estimate.[11]

6. Financial Bailout Spending Would Have Almost Paid for Thirty Years of Global Green New Deal Climate: Triage, Regeneration, and Mitigation

Furthermore, adding the costs of potentially effective triage and regeneration methods for the periods indicated in the proposals outlined in Sections 3-5, would increase costs by only $ 1.3 trillion so that overall cost for these triage, regeneration and mitigation methods (with extensive overlap and double counting) would be $ 30.6 T, that would have been 95 percent covered by the $ 29 trillion financial bailout, see table 1 below.

Table 1: Additional Cost of Triage and Regeneration Methods

	Cost Annually $ billions	Years	Cummulative Cost $ billions
Solar Geoengineering		5	$ 5.00
Carbon Negative Cement	$ 250.00	5	$ 1,250.00
Permaculture Arrays with Upwelling	$ 0.32	10	$ 3.20
Soil and Water Cycle Climate Regeneration		5	$ 0.10
Total			$ 1,258.30

For direct equity and efficiency reasons, and in order to most effectively reduce demand driven GHG emissions, US (partial) demands for pay-backs for extended GGND credit, should be directed (like Marshall Plan Policies stipulating land reform and break-up of industrial

[11] There is abundant evidence that the Fed's largesse was not just used to bail-out nominally US (with global exposure) financial institutions, but also directly and indirectly through "counter-party" bailouts, "foreign" financial institutions (Hudson 2015).

monopolies) at taxing high income and wealth, and generally unproductive monopolistic rentier sectors like private fossil fuel production and the "Finance, Insurance, and Real Estate" (FIRE).

Finally, as discussed in Section 2, spending alone would not produce a GGND. The increase (or decrease, if net financial savings resulted in job and income losses) in investment, employment, income, and consumption, particularly in developing countries, from GGND spending would need to be offset by taxing the wealthy (to create slack or more jobs) for global equity and so that this spending would result in reallocation and creation of *real* economic capacity to reduce net GHG emissions and not just bottlenecks and unsustainable inflation. The 54 Project Drawdown project methods not only exclude highly ranked methods for which cost and savings estimates are not available, but also family planning and other population growth reduction measures and most importantly other critically important GHG *demand side* reductions from income and wealth *redistribution*.

About half of global GHG emissions come from the consumption of the upper 10 percent of income earners.[12] So that the effectiveness of the GGND would also depend on the extent to which it redistributes most of the benefits of green economic transition toward lower income and wealth households and productive sectors, and places most of the burdens of the transition on the wealthy and rentier sectors. In this sense the GGND would be a complete reversal of the Ne International Monetary, World Bank, and Federal Reserve policies of the last few decades.

The question before us may thus be framed in a nutshell. Are modern civilization and species survival more important than the neoliberal order, and global finance and Neo-rentierism?

[12] See footnote 8.

References

Arent, Douglas J., Richard S.J. Tol, Eberhard Faust, Joseph P. Hella, Surender Kumar, Kenneth M. Strzepek, Ferenc L. Tóth, and Denghua Yan, 2014. Key economic sectors and services. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Mastrandrea and White (eds.). Cambridge University Press, UK: 659-708.

Baiman, Ron. 2020. Shaikh's Classical-Keynesian political economy, unequal exchange, and Facebook. *Review of Radical Political Economics* 52(2): 239-258.

BIS. 2020. United States - Credit to Private non-financial sector from All sectors at Market value - US dollar - Adjusted for breaks in $ US billions. Series: Q:US:P:A:M:USD:A downloaded 6/7/2020. Accessed at: https://www.bis.org/statistics/totcredit.htm

Bremmer, Ian. 2010. The long shadow of the visible hand. *Wall Street Journal.* May 22.

Buiter, Willem. 2019. The Fed will have to be creative to tackle the next recession. *Financial Times.* December 9.

Felkerson, James. 2011. $29,000,000,000,000: A detailed Look at the Fed's bailout by funding facility and recipient. Levy Institute of Bard College Working Paper # 698. December. Accessed at: http://www.levyinstitute.org/pubs/wp_698.pdf

Fiekowsky, Peter, Carole Douglas and Susan Lee. 2019. Restoration solutions to the greatest threat facing humanity and nature today. Los Altos, CA: The Foundation for Climate Restoration. White Paper. September. Accessed at: https://foundationforclimaterestoration.org/wp-content/uploads/2019/09/20190916b_f4cr4_white-paper.pdf

Freedman, Andrew. 2019. The Arctic may have crossed key threshold, emitting billions of tons of carbon into the air, in a long-dreaded climate feedback. *Washington Post.* December 10. Accessed at: https://www.washingtonpost.com/weather/2019/12/10/arctic-may-have-crossed-key-threshold-emitting-billions-tons-carbon-into-air-long-dreaded-climate-feedback/

FRED Real Property Price Index. 2019. Federal Reserve Economic Data. Downloaded 6/7/2020. Accessed at: https://fred.stlouisfed.org/series/QUSR628BIS

Macrotrends. 2020. Dow Jones – DJIA – 100 Years Historical Chart, downloaded 6/7/2020. Accessed at: https://www.macrotrends.net/1319/dow-jones-100-year-historical-chart

Garbade, Kenneth D. 2014. Direct Purchases of U.S. Treasury Securities by Federal Reserve Banks. *Liberty Street Economics*. September 29. Accessed at: https://libertystreeteconomics.newyorkfed.org/2014/09/direct-purchases-of-us-treasury-securities-by-federal-reserve-banks.html

Goldman, Jason G. 2017. Ecuador has begun drilling for oil in the world's richest rainforest. *Vox.* January 14. Accessed at: https://www.vox.com/energy-and-environment/2017/1/14/14265958/ecuador-drilling-oil-rainforest

Guardian. 2015. World's richest 10% produce half of global carbon emissions, says Oxfam. Dec. 2. Accessed at: https://www.theguardian.com/environment/2015/dec/02/worlds-richest-10-produce-half-of-global-carbon-emissions-says-oxfam

Harvey, Chelsea. 2016. Dominoes fall: Vanishing Arctic ice shifts jet stream, which melts Greenland glaciers. *Washington Post*. May 2. Accessed at: https://www.washingtonpost.com/news/energy-environment/wp/2016/05/02/dominoes-fall-vanishing-arctic-ice-shifts-jet-stream-melts-greenland-glaciers/

Hausfather, Jake. 2018. Analysis: Why the IPCC 1.5C report expanded the carbon budget. *Carbon Brief.* Oct. 8. Accessed at: https://www.carbonbrief.org/analysis-why-the-ipcc-1-5c-report-expanded-the-carbon-budget

Henwood, Doug. 2019. Modern Monetary Theory isn't helping. *Jacobin*. February 21. Accessed at: https://www.jacobinmag.com/2019/02/modern-monetary-theory-isnt-helping

Hudson, Michael. 2012. *The Bubble and Beyond.* Dresden: ISLAT-Verlag.

_____. 2015. *Killing the Host.* Dresden: ISLAT-Verlag.

IIPCC. 2018. Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*. Masson-Delmotte, Valerie, Panmao Zhai, Hans-Otto Pörtner, Debra Roberts, Jim Skea, Priyadarshi R. Shukla, Anna Pirani, Wilfran Moufouma-Okia, Clotilde Péan, Roz Pidcock, Sarah Connors, J. B. Robin Matthews, Yang Chen, Xiao Zhou, Melissa I. Gomis, Elisabeth Lonnoy, Tom Maycock, Melinda Tignor, and Tim Waterfield (eds.). World Meteorological Organization, Geneva, Switzerland.

Jehne, Walter. 2017. Regenerate Earth. Dubbo, NSW, Au: Healthy Soils Australia. White Paper. September. Accessed at: http://www.globalcoolingearth.org/wp-content/uploads/2017/09/Regenerate-Earth-Paper-Walter-Jehne.pdf

_____. 2019. Implementation of the Regenerative Earth Initiative to draw down 20 btc/an globally, in time. Regenerate Earth. Dubbo, NSW, Au: Healthy Soils Australia. Draft White Paper. Personal communication 12/12/2019.

Keen, Steve. 2017. *Can We Avoid Another Financial Crisis?* Cambridge, UK; Polity Press.

_____. 2019. Presentation at a September 18 meeting of the OECD NAEC Group, 35:20 to 50:30 in this video. Accessed at: https://oecdtv.webtv-solution.com/5652/or/meeting_of_the_naec_group.html. Power point for this presentation:

https://30e28210-43ef-4e0b-81c7-b722210fbad6.usrfiles.com/ugd/30e282_1b72d2514ff14536ac53b3c77c28ac0a.pdf .

Keith, David. 2019. The Peril and Promise of Solar Engineering. Lecture at Harvard Museum of Natural History. October 30. Accessed at: https://hmnh.harvard.edu/event/peril-and-promise-solar-geoengineering

Minsky, H. P. 1986. *Stabilizing an Unstable Economy*. New Haven: Yale University Press.

Mitchell, William, L. Randal Wray and Martin Watts. 2019. *Macroeconomics*. NY: Macmillan.

Nordhaus, William. 2018. Projections and Uncertainties about Climate Change in an Era of Minimal Climate Policies. *American Economic Journal: Economic Policy* 10(3): 333-360.

Palley, Thomas. 2018. Modern Monetary Theory (MMT) vs. Structural Keynesianism. April 6. Accessed at: https://thomaspalley.com/?p=1145

Pistone, Katrina, Ian Eisenman and Veerabhadran Ramanathan. 2019. Radiative heating of an ice-free arctic ocean. Geophysical Research Letters. July 10.

Project Drawdown. 2017. *Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming*. Ed. Paul Hawken. New York: Penguin Books.

Rajan, Raghuram. 2019. Here's a simple and fair way to tax carbon emissions. *Financial Times.* December 17.

Sawicky, Max. 2019. The best way to argue against Paygo. *In These Times*. January 4. Accessed at: https://inthesetimes.com/article/21659/paygo-modern-monetary-theory-pelosi-keynes

Scuse, Andy. 2015. The history of emissions and the great acceleration. April 1. From personal blog: Critical Angle: Reflections on the refractory problems of climate and energy. Downloaded 6/8/2020. Accessed at: https://critical-angle.net/2015/04/01/emissions-history-and-the-great-acceleration/

Stroeve, Julienne C. 2019. When Will All the Ice in the Arctic Be Gone? A climatologist and ice researcher examines the latest trends and data. Scientific American: August 14. Accessed at: https://www.scientificamerican.com/article/when-will-all-the-ice-in-the-arctic-be-gone/

Wolff, Richard. 2019. The truth about Modern Monetary Theory. May 3. Accessed at: https://www.rdwolff.com/the_truth_about_mmt

Woodward, Aylin. 2019. 18 signs we're in the middle of a 6th mass extinction. *Business Insider*. June 18. Accessed at: https://www.businessinsider.com/signs-of-6th-mass-extinction-2019-3