The Climate Crisis and the Green New Deal: The Issue Is the Issue, After All

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Draft: Do not quote

I. Taken for dead

In 2004 two strategy consultants whose clients included major environmental organizations, Michael Shellenberger and Ted Nordhaus, published an article luridly calling for "The Death of Environmentalism."[1] (Shellenberger and Nordhaus, 2004) They hadn't switched sides, or not much or yet at that point, but they had come to believe that the environmental movement, as it was and still is constituted, had reached a dead end.[2] Exhibit A was the failure to generate any meaningful government action on climate change despite the obvious urgency of the problem. What went wrong?, they asked.

Their answer follows from the fundamental belief that, in their words, "Issues only matter to the extent that they are positioned in ways linking them to proposals carrying within them a set of core beliefs, principles, or values. The role of issues and proposals is to activate and sometimes change those deeply held values. And the job of global warming strategists should be to determine which values we need to activate to bring various constituencies into a political majority."

In their view, environmental activism isn't fundamentally different from campaigning for a political party or running a corporation. Getting others to align on your values is the core task, and this means other considerations must be subordinated to enhancing the clarity, reach and consistency of your vision. Environmentalists have come up short by thinking of environmental problems in technical terms and proposing technical solutions, instead of formulating an overarching vision that can galvanize a politically potent constituency. Although they don't quote it, and may have been too young to have lived through those years, this criticism echoes the the New Left slogan "The issue is not the issue."[3]

Applied to the specific question of climate change, Shellenberger and Nordhaus argued that environmentalists were wrong to have centered their campaigns on reforms like fuel efficiency standards and cap-and-trade regulation of carbon emissions, which foreground a technical, mechanistic approach to what is actually a holistic political/cultural/economic tangle of problems.[4] What is needed instead, they wrote, is a vision of social transformation through a massive investment program, one that speaks to the needs of business, labor, minority communities and patriots looking for a renewal of American leadership. Environmentalism as a narrow special interest must die so a broad value-based movement that unites greens and other segments of society can be born.

The reaction to "The Death of Environmentalism" was divided, to put it mildly. In some quarters there was enthusiastic support, but many mainstream environmentalists protested that the announcement of their death was premature. "....unfair, unclear and divisive," complained Carl Pope (2004), Executive Director of the Sierra Club. "....arrogant, self-indulgent, and wrong in blaming perceived failure on those who have sought change, rather than on those who have opposed it," according to environmental lawyer Martin Kaplan (2005). The confrontational language of Shellenberger and Nordhaus seemed to invite this hostility, as if, much as in Freudian

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therapy, resistance itself is validating.

My reaction is divided as well, although, benefitting from hindsight, it has different points to make. First, I believe the past fifteen years have demonstrated that, whatever one might think of the details of their argument, Shellenberger and Nordhaus were correct about the political limitations of traditional environmentalism. In fact, the problem has only grown since "Death" was written in the middle of the George W. Bush administration. (1) A Democratic president and congress in 2009 was unable to pass mild cap-and-trade legislation; the power of the radical right is not the only obstacle climate policy must overcome in America. (2) Policy in Europe has been minimally effective despite support for climate action across most of the political spectrum. Whether the best response is a radicalization of climate-centered activism, as in the Extinction Rebellion, or a revised Shellenberger-Nordhaus shift to comprehensive visioning, as in the Green New Deal, remains to be seen.

Second, there is no question that, even in narrow technical terms, an immense and transformative investment program is an indispensable part of an adequate climate agenda. By its nature, such a program must have profound implications for fiscal policy (a thorough, multi-decade rejection of austerity) and the role of the state in setting objectives and implementing technology policy. A political reversal of this intensity and scope can arise only from a movement that calls for it directly and makes a case on broader ("value") grounds than just climate expediency. This is exactly what Green New Deal advocacy does, and in at least this respect it deserves our support.

But the passage of time has not been kind to other Shellenberger-Nordhaus claims. (1) They presented the New Apollo Project of 2003 as an example of the forward-looking, vision-based politics needed to meet the climate challenge, but Apollo failed to lift off. Perhaps its lack of a particular centering issue, relying instead on a more diffuse call for energy development and progress, was at fault; this is the implication I draw from the relatively greater initial success of the Green New Deal—augmented by greater public awareness of the imminence and devastating effects of climate change. (2) The failure to curtail climate emissions over the past 15 years has rendered an investment-only, or even an investmentment-mainly, approach radically insufficient to achieve acceptable climate stabilization targets. This constitutes a conflict between political convenience and biophysical reality. Saleability can't be the only criterion.

Let's look a little more closely at the problem of reality constraints. "The Death of Environmentalism" takes note of the fact that opponents of policies to limit carbon emissions, such as carbon taxes and various permit (or cap-and-trade) schemes, emphasize their economic costs: they will make energy more expensive and eliminate jobs. Environmentalists typically replied by saying that energy costs would rise only a little, and only few jobs were at risk. (This latter claim is often accompanied by data showing how few Americans still work in coal mines.) *Wrong response!* say Shellenberger and Nordhaus; don't accept the framing put forward by business opponents and the far right. Instead redirect attention to all the new jobs that will be created by investments in energy efficiency and renewables: "Talking about the millions of jobs that will be created by accelerating our transition to a clean energy economy offers more than a good defense against industry attacks: it's a frame that moves the environmental movement away from apocalyptic global warming scenarios that tend to create feelings of helplessness and isolation among would-be supporters."

Unfortunately, the Reality Principle doesn't go along with the marketing. As I will argue shortly in more detail, serious action to forestall a climate catastrophe *will* raise energy prices and eliminate jobs—lots of them. It will be a difficult transition, and unfortunately for the marketing-centered

approach, this fact is obvious to reasonably well-informed voters. Claims that swift decarbonization will usher in an era of green prosperity are simply not credible. This doesn't mean that environmentalists must reject a broader social vision, just that the only viable visions are those that comport with reality. Moreover, the goal is not just to increase polling numbers or incorporate more interest groups; real environmental and economic constraints can't be ignored because they interfere with political expediency. There is no way to address climate stabilization and protect living standards without facing the challenge honestly, so protective measures can be proactive and well-designed.

II. From the Death of Environmentalism to a Green New Deal

Why spend so much time with a fifteen year-old dustup in a paper that claims to be about today's politics? Because Shellenberger and Nordhaus were explicit about the strategic basis of their call for a radical change in environmental advocacy and not just its component elements. This makes it easier to see how the pieces fit together and evaluate climate politics holistically. In what follows I will apply this wide-angle perspective to the Green New Deal (GND).

The GND is still more a slogan than a set of proposals. It takes various forms in activist and political contexts, as well as between the United States and Europe.[5] In some versions it is essentially a wish list, a set of objectives detached from specific ways to achieve them. In a rather vague (non-operational) way, some formulations of the GND do specify criteria, although even here there is little guidance to balancing the competing goals that might be pursued or how possible costs can be assessed against them.[6] Thus any characterization of this strategy must be somewhat provisional. I do not make any claim for the accuracy of mine or its applicability to the GND as it may evolve in the future.

Shorn of the inclination to include business in its circle of allies and the rather strident technical "modernism" that characterized the Breakthrough Institute, the GND can be seen as its direct offspring. It has these elements in common:

- It prioritizes the promulgation of an encompassing vision, one that embraces a variety of issues and constituencies but appeals to core values shared by a large portion of the general public—in this case solidarity, a respect for diversity, and support for greater economic and political democracy.

- It downplays the specifically ecological component of its program. The GND *is* seen as a way to mitigate climate change, but this goal is not emphasized at the expense of the others, like racial justice and full employment.

- It seeks a diverse constituency whose members are not defined as or at least not limited to "environmentalists".

- Its centerpiece is an investment program. This is seen as a positive approach, compared to the negative, thou-shalt-not regulatory fixations of traditional environmentalism, and one that can win a much greater degree of public support. It counters the claim that action against climate change is expensive not by minimizing the costs but trumpeting the benefits.

As second-generation post-environmentalism, the GND shares its main virtues. It is clearly galvanizing across a range of communities and interests that extends far beyond the traditional

environmental constituency. In building a broader movement, it has the potential to achieve ancillary goals like greater housing equity, resurrection of the labor movement, and lifting the austerity-mandated shackles on fiscal expansion. To these I would add perhaps the most compelling point in its favor to someone for whom climate change is an overriding issue: the GND investment program really is a necessary component of adaptation to both likely climate impacts and the impacts imposed on us by serious carbon policy. We will need energy retrofitting throughout the housing stock, a new, more capable electrical grid, vastly improved mass transit, and of course a crash program to expand renewable energy. Much has been written about this, and I have nothing to add beyond one more endorsement.

Unfortunately, the GND also shares most of the downsides of its post-environmental forebear. This comes next.

III. The return of the reality principle: renewables, fossil fuels and carbon targets[7]

If the investment program at the heart of the GND were sufficient to achieve defensible carbon goals, there would be little to criticize, but this is not the case. It *might* have been enough three decades ago, when global warming first appeared as a pressing public issue but it isn't possible today.[8] To see why, it's necessary to dip into the arithmetic of atmospheric carbon accumulation as a product primarily of the burning of fossil fuels.[9]

Until last year, the consensus stabilization target adopted by the Intergovernmental Panel on Climate Change (IPCC) was 450 parts per million (ppm) CO_2, which it assesses as giving us a 2/3 chance of keeping global warming in this century at 2º C or less. Since then it has promoted an even more stringent standard under which we would strive to restrict warming to 1.5º. Since the current level of CO_2 already exceeds 410 ppm, this more stringent standard is simply unattainable unless radical measures to curtail carbon emissions from burning fossil fuels are combined with other activities, like reforestation and sequestration of carbon from crops, and even then it may be out of reach. To keep matters as simple and plausible as possible, I will assume we are aiming for the 450 ppm target.[10]

Let's do a numerical exercise that begins with the global carbon budget estimated by the IPCC, 1000 gigatonnes of CO_2, which, if we emit only this amount, should give us an atmosphere of 450 ppm. The reference year for this budget is 2011: that's when their clock began ticking. Global CO_2 emissions for 2010 were about 32 gigatonnes, and they were 36.3 in 2016, the most recent year for which we have data.[11] Suppose an effective global carbon policy is put in place beginning in 2020—a very optimistic scenario, of course. Question: if the policy somehow imposes a constant rate of emissions reductions, what does it need to be in order to keep to the IPCC budget constraint?

The first step is to calculate the emissions between 2011 and 2020 and deduct their total from the budget, since we've already used up this portion of our carbon space. Cumulative emissions for the years 2011-2016 come to 215 Gt, and if the rate of emissions increase between 2010-2016 (1.3%) persists, another 112 Gt will be accounted for by years 2017-2019. That leaves 674 Gt for—well, the end of the century. Again our question: what constant rate of global emissions reduction is consistent with staying within the 1000 Gt budget over the period 2020-2100?

The answer is slightly more than 5%, so we can take this as a rough indicator of what a serious effort to forestall a climate catastrophe would look like. While there isn't a rule that emissions reductions have to follow a straight-line decline, this is the simplest way to translate a budget

constraint into year-to-year terms. As a caveat, it should be clear that any numerical exercise like this is going to be highly inexact and rely on choices that could be made in multiple ways. What to include and exclude in emissions, how to project their future trajectory and the timing of carbon policy, and even the IPCC budget itself (which comes with an error band)—all of this is uncertain. Our 5% solution should not be taken as gospel, but only as a loose guide to the extent of emissions reductions we should be aiming for, especially if we want to take the safest road and apply non-fossil fuel strategies, like planting trees and implementing carbon-scrubbing technologies, to attaining warming targets *below* 2º.

But there is a further consideration. 5% reduction per year is a global benchmark, but some countries can and should reduce more per year while others reduce less. Specifically, it would be a gross violation of global justice to require poorer, less developed countries to cut emissions at the same rate as North America, Japan and the EU. India, Indonesia, Ethiopia and many other countries have both fewer resources to deploy and far more pressing needs to increase energy consumption in the course of battling poverty. Moreover, countries like the US have incurred a climate debt, so to speak, for having used up far more than their share of the world's carbon space in the process of their own development; it would be arrogant for them to now shut the door they themselves had walked through. Just how much more than the global average the US should reduce its emissions is a matter for debate, but clearly it needs to be significantly more, raising the annual rate reduction to something like 6-7% if not even greater.

With this benchmark for "adequate carbon policy" in mind, let's turn to the actual numbers. By how much, if at all, is the world now reducing its use of fossil fuels? And how is fossil fuel use affected by increases in renewable energy?

But first one more pause to take note of an important fact: the amount of energy used in societies, nationally and globally, is not fixed. On the contrary, total energy use has risen dramatically over past centuries; it is central to the notion of industrial revolution and "modernization", in all its positive and not-so-positive respects. It seems unnecessary to point this out, except that in much of the discussion of climate policy—and especially GND proposals—increases in renewable energy are assumed to correspond one-for-one with decreases in the carbon kind: every wind turbine means that much less coal, oil or natural gas. But as we will see, that's not the way it works.

Consider the following table, assembled from the British Petroleum Review of World Energy, 2019:

Table 1: Global Primary Energy Consumption in Million Tonnes of Oil Equivalents, 2017-2018

Fuel	2017	2018	Change
Oil	4,607.0	4,662.1	55.1
Natural gas	3,141.9	3,309.4	167.5
Coal	3,718.4	3,772.1	53.7
Fossil fuel total	11,467.3	11,743.6	276.3
Renewables	490.2	561.3	71.1
Nuclear	597.1	611.3	14.2

Hydro	919.9	948.8	28.9
Non-fossil total	2,007.2	2,121.4	114.2
Combined total	**13,474.5**	**13,865**	**390.5**

Source: *BP Statistical Review of World Energy, 2019*

Energy consumption is measured in this table in units of oil equivalents, how much oil it would take to produce the same amount of energy from other sources. This doesn't correspond to climate impacts, but it does give us a useful sense of the tradeoff between fossil and non-fossil energy supplies. While two years also doesn't begin to tell the full story of the ups and downs (or more accurately, the ups and more ups) of energy use over recent decades, it's enough to illustrate the extent to which different sources compete with or simply add on to each other. I have lumped all non-fossil sources together for simplicity, although there are important differences in the environmental and other impacts of renewable fuels, nuclear and hydroelectric power. (Renewables constitute about a quarter of non-fossil energy supplies over this brief period but account for 62% of the growth of this sector.)

Non-fossil energy use increased by 5.7% between 2017 and 2018; how good was that? It's much faster than fossil energy growth, 2.9%, but it's adding to a lower base, since non-fossil sources made up only about 15% of total supply in 2017. The result is that, while oil, natural gas and coal grew at a lower rate, their absolute growth (in oil equivalents) was almost two and a half times renewables, nuclear and hydro combined. Now imagine for a moment we adhered to a rule that keeps energy use constant: if we had the same growth in non-fossil energy under this regime, fossil sources would have declined by nearly 1% instead of increasing by almost 3%. While that would be far too small in relation to what we need to accomplish, at least it would be in the right direction. I suspect this is the effect many people assume when they hear about expansion in renewable and other forms of non-fossil energy supply: more of the "good" energy means that much less of the "bad" variety. Of course, in the real world there is no fixed-energy mandate, and an interesting question is, how large an increase in non-fossil energy would it take to actually get the same 1% reduction in fossil supplies at the current rate of energy growth? The disturbing answer is 25%: at the current size and composition of global energy supply and at the current growth rate of that supply, to cut fossil fuels by 1% would require a 25% growth rate in all the other energy sources. And yet what we need is approximately a 5% cut year after year at a global level and significantly more than that in countries like the US. In other words, *in a world of expanding energy demand, no feasible amount of investment in renewable or other noncarbon energy sources can sufficiently reduce the use of fossil fuels unless action is also taken to suppress those fuels directly.*

To see the same logic at a national level, consider the energy transition (Energiewende) taking place in Germany. Initiated at the federal level in 2011, the goal is to completely transform the country's energy consumption by 2040, with targets for electrical generation, home heating, transportation and general energy usage.[12] Due to Germany's consensus-based system of economic organization, with powerful industry associations, unions, public financial institutions, and integration of education and research with all of the above, it has an exceptional capacity to re-engineer itself. And in fact the increase in renewable energy sources as a proportion of total energy use has risen dramatically, as shown in Table 2.

Table 2: Renewable Energy Sources and Coal as Percent of Total Consumption, Germany, 2005-2016

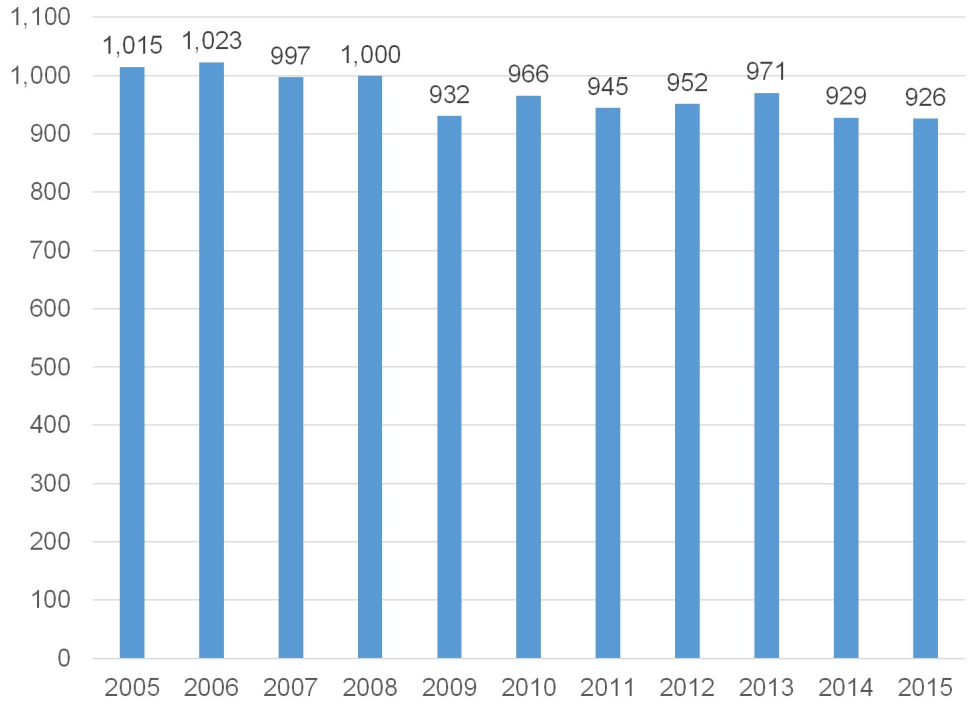
	2005	2006	2005	2008	2009	2010	2011	2012	2013	2014	2015	2016
% Coal*	24.0	24.5	25.8	23.8	22.8	23.7	24.8	25.3	25.1	25.4	25.3	24.3
% Renewables	5.0	5.9	7.1	6.9	7.7	8.3	9.3	10.1	10.3	11.3	12.2	12.3

*Includes both hard and brown coal.[13]
Source: European Commission (2018)

Renewables have more than doubled their share of total energy use over this period, and their inroads into electrical generation have been even more impressive, accounting for nearly 30% of the total for 2016. (European Commission, 2018) Ambitious plans are in the works to build a virtual forest of offshore wind turbines in the coastal region of the North Sea, with massive transmission lines to convey the energy to population centers in the south. The German housing stock, already well insulated by global standards, is being systematically retrofitted for maximum savings in heating requirements. These and similar measures have justifiably attracted worldwide attention.

But greenhouse gas emissions? This part of the story is not as uplifting. As Table 2 also demonstrates, coal has stubbornly retained its importance in Germany's energy portfolio, and cutting back will be difficult since the country has committed itself to shutting down its nuclear industry by 2021. (Nuclear provided 6.9% of all energy consumption in 2016, again according to European Commission, 2018.) The upshot is a decidedly mixed record on the overall carbon front, as we can see in Figure 1.

Figure 1: German Greenhouse Gas Emissions, 2005-2014, in Millions of CO_2 Equivalents



Source: European Commission, 2018

To some extent the rather stable carbon emissions since 2009 reflect the relative strength of the

German economy, which has benefited from robust exports due to the weakness of the euro and continuing demand from China; if Germany had stagnated like most other Eurozone countries its people would be a lot less content, but the climate would be somewhat better off. Indeed, Table 3, which uses 2005 as a base year to index carbon emissions, tells us that Germany progress over the past decade on this front substantially trails the entire 28-member EU taken as a single entity.

Table 3: German and EU-28 Carbon Emission Indexes, 2005 = 100

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EU-28	100	99.9	99.0	96.9	89.9	91.8	89.0	87.8	86.0	82.8	83.3
Germany	100	100.8	98.3	98.5	91.8	95.2	93.2	93.8	95.7	91.5	91.3

Source: European Commission, 2018

The inescapable conclusion, as strange as it seems, is that the Energiewende has hardly had an impact on overall German emissions; to this point Germany has been outperformed by its neighbors. This observation is so surprising it has acquired its own name: the Energiewende Paradox.[14] Increased renewable capacity has *not* been at the expense of fossil fuels—especially coal—and energy conservation in some sectors, like residential heating, has not automatically translated into corresponding reductions in overall demand. The picture is somewhat complicated by energy imports and exports, since surpluses of electricity at times when wind and solar are abundant are shared with other countries on the same grid, but Germany also draws from the grid at other times; a thorough analysis of Energiewende would have to take this factor into account, but we won't.

The German struggle to rein in emissions while sustaining its economy is fascinating and can easily become the subject of its own research program. The reason for bringing it up here is more limited, however: it vividly illustrates the fact that investing in renewable energy is not the same as reducing the use of fossil fuels. There is no law of economics or physics decreeing that German energy consumption must remain fixed, or that its mix of nonrenewable energy sources is not allowed to change. Germany is entirely capable of making very large investments in wind and solar energy as well as energy efficiency technology *and* maintaining an unacceptably large appetite for fossil fuels, especially coal. Energy is not a zero-sum world.

The lessons for a GND-type climate policy should be clear. Large investments in renewable energy sources and energy efficiency are urgently needed, and certainly we will not be able to curtail fossil fuels unless we make them. On their own, however, they simply don't get the job done. Fossil energy is abundant and relatively inexpensive, and people will continue to burn it until we make them stop. And if we want them to stop at a rate that keeps the IPCC target of 450 ppm CO_2 in sight we will have to couple massive increases in clean energy with significant declines in total energy. That's not a statement of what is politically desirable or constitutes a compelling vision that large constituencies will be attracted to; it's just the arithmetic of energy, carbon and climate stabilization. The political question is what this means for the GND as a framework for politics and policy.

IV. The Green New Deal in the real world

The GND promises a wide range of social and economic benefits stemming from a green investment program. We have seen that investment alone, however, does not constitute an adequate climate policy; there is no escaping the need to keep carbon in the ground by

suppressing use of fossil fuels. Can we amend the GND in a way that preserves most of its advantages but takes account of the constraints imposed by the reality principle?

The first point is the most obvious, that there is no intrinsic conflict between a major expansion of public investment for green purposes and a program to suppress fossil fuels; on the contrary, each needs the other. This leaves unaddressed the specific mechanisms that might be used to curtail fossil energy directly, a topic that lies beyond the scope of this paper. For the record, I advocate a system of carbon permits, comprehensive with no loopholes or carveouts, where permits are fully auctioned with revenues returned to the public on a progressive, equal per capita basis. Such an approach would dovetail in most respects with GND activism—but not all.[15]

I hope it is possible to graft a carbon suppression package onto the broad outlines of a GND program. This involves more than adding new planks while the others are left unchanged, however. Part of the problem is rhetorical: many advocates of a GND are invested in a conceptual framework that views measures to curtail fossil fuel use as tainted by the use of markets ("neoliberal") and destined always to fail, as past carbon taxes and permits largely have. I have rebutted these tropes elsewhere; here it should be enough to say that the investment agenda of the GND is robust enough to survive a change in the language used to promote it.[16] That is, the rhetoric of opposition to all use of markets can be dropped with no harm to the GND agenda itself, and this would allow extending it to include pragmatic carbon suppression policies.

A more difficult set of issues is raised by the problem of costs. If we could stabilize the climate solely through investment, and if the main economic problem were insufficient demand, not supply, a GND could indeed be a spur to prosperity. I suspect these conditions would be local, not global, but even so millions of people would benefit materially from the employment-generating effects of an investment boom. Once the suppression of fossil fuels is added to the mix, however, the cost assessment has to change.

There are two reasons for this. First, while investment in renewable sources of energy can only reduce the prices of fossil fuels (via competition), suppression of fossil fuels can only raise them. In fact, the intensity of suppression required to achieve the 5% global annual decline in admissions needed to stabilize atmospheric carbon concentration at 450 ppm will raise them *greatly*. Simulations conducted by teams of climate economists using integrated assessment models generally show that, if speculative technologies to capture and sequester carbon are disallowed, the price of carbon can quickly approach or exceed $1000 per metric tonne, which translates into a $10 increase in the price of a gallon of gas at the fuel pump.[17] And it can go still higher. (For one possible scenario, suppose, as is currently the case, approximately, every 5% decrease in fossil fuel use requires a 10% increase in its price. Compound that calculation annually over several decades.)

A different way to come to the same conclusion is to consider again the point about renewable energy, carbon energy and total energy use. We saw that no feasible increase in renewable energy sources could, on its own, possibly achieve our carbon targets when total energy is free to increase. But now we can also ask, *by how much must total energy use decrease in order to achieve these targets?*

Going back to Figure 1, suppose nonfossil energy rose from 2017-18 at its historic rate, but somehow fossil energy managed to fall by 5%. That would mean that total energy use, rather than increasing by almost 3%, would fall by about 3.4%, a 6.4% gap between actual demand and our hypothetical, fossil fuel-reducing supply. Of course, clean energy could and should have risen

faster than it did, but it would take nearly a 50% increase in all nonfossil energy (including hydro and nuclear) to bridge the gap. In one year. The inescapable conclusion is that, in the short to medium term, total energy supply will need to fall below demand if fossil fuel use is suppressed to adhere to the IPCC's carbon budget. Shortages will drive up prices—and rationing is not an answer, since it simply distributes the same sacrifice in a somewhat different manner.

If energy prices rise dramatically with no offsetting policies, the living standards of most people in the world will be impaired. That is an ethical problem and also a political one, since, as the *Gilets Jaunes* have shown us, people will not take these price increases lying down.[18] The only solution is to ensure that the money taken out of people's pockets through higher energy prices is returned to them, ideally in a progressive manner.[19] The pinch of energy shortages will still be felt, as this is unavoidable, but at least most people will have more real income as a result of such a policy, and they can spend it on other goods and services to compensate. Recycling energy costs back to the public also serves a crucial symbolic purpose, making it clear that the well-being of the population is a primary concern, and that climate mitigation will not be sought at its expense.

Here we encounter a tension between the necessity of fossil fuel suppression and the ambitions of the GND. Whenever the possibility of carbon revenues has arisen, GND advocates have viewed them as a source for financing green investments or defraying costs to particular "front line" communities such as racial minorities and energy sector workers. Indeed, every dollar recycled to the public is one dollar less for home retrofits, mass transit, grid upgrading and so on. Of course, in principle all or most of the carbon revenue could be recycled and the GND agenda could be financed by some combination of budget repurposing, tax increases and debt. That in fact is how it should be done. The problem is that, in the absence of any recognition that climate goals require the suppression of fossil fuels and that this will be costly to everyone, there is no will to forego this extra source of investment finance. Moreover, this very recognition contradicts the central political promise of the GND, that it will be a source of abundance.

The second problem is that a rapid and historically unprecedented runup in energy prices will send shock waves throughout every modern economy.[20] No existing study does justice to this vulnerability. The "stranded asset" literature primarily focuses on private owners of carbon energy resources; their losses would be substantial but only a portion of the total.[21] In a study conducted several years ago, the International Renewable Energy Association (2017) added fossil fuel-powered equipment and infrastructure, like pipelines and boilers, in buildings and manufacturing, and their worst-case scenario generated a capital loss of $20 trillion. All of these estimates, however, consider only the supply side; the demand-side impacts will likely be even greater. What is at risk is every productive asset whose economic value derives from demand that is susceptible to energy shocks. Thus, not only the gas furnace or cooking appliance in a house may lose value because of rapid increases in natural gas prices; the house itself may undergo a sudden and radical depreciation if its use requires extensive commuting, and driving becomes a lot more expensive. The same applies perhaps even more to commercial real estate. For another example, capital losses to an airplane manufacturer like Boeing will include not only the equipment that uses fossil fuels or depends on hydrocarbons as feedstock, but perhaps most of its productive plant if air travel collapses and these investments lack alternative uses.

Seen in this light, a radical and largely unanticipated increase in energy prices will rather quickly result in a high level of economic *disinvestment*, reductions in the value and employment-generating capacity of the capital stock which will take many years of new investment (GND and otherwise) to replenish. The overriding economic task of a humane, progressive climate program would then be, not directing the fruits of abundance to this group or that, but safeguarding, as far

as possible, the living standards of the majority of the population: anticipating demand bottlenecks, offsetting the harsh impacts of dislocation, and fostering the growth of sectors less dependent on energy inputs. This will be challenging in any case, but it will be impossible unless we recognize the nature of the problem in advance and prepare to address it. Moreover, contrary to the rhetoric that typically accompanies GND campaigning, the economy-wide vulnerability of capital indicates that business (and wealth holders) in general are likely to oppose serious climate policy, not just fossil energy interests.[22]

These considerations do not detract from the desirability of the investment program at the heart of the GND. They do indicate that some of the specifics of that program, such as its financing, will need to be revised, and above all they point to the need for a rhetorical shift in the way the agenda is explained and promoted.

V. Re-visioning

According to this analysis, insofar as the GND offers an encompassing framework for building a future decarbonized economy, its emergence is a source of hope. It is indeed important to think big, to see the many strands of a green investment program as interconnected and mutually supportive. Foregrounding the political dimensions of the program—the need to address diverse needs and overcome inherited inequalities, the importance of democratizing the public sector so it can play a larger and more productive role in setting and meeting economic and social goals—is also crucial. The criticisms made in this paper should not be viewed as being hostile to GND motives and proposals in any general sense.

The guiding vision, however, is a problem. It proposes that climate imperatives can be the basis for a new era of abundance, with residual costs borne only by the rich and the carbon-addicted. Corrections that could readily be made to adapt to real world constraints have thus far been resisted because they don't fit the vision that has brought the GND such quick political success.

Can a different vision, more realistic but nearly as attractive, be put in its place? Here is one possibility.

The first step is to reframe the problem away from resentment and blame. Here it helps to convey a simplified version of the science behind the need to curtail our use of fossil fuels. Once upon a time, hundreds of millions years ago, the earth was a much hotter place, far too hot for creatures like human beings. This was because there was a lot more carbon in the atmosphere, so the greenhouse effect was intense. Over many eons carbon was gradually transferred from the atmosphere to plants and other living organisms, since it is a fundamental building block of life, and ultimately most of this carbon found its way to the deep seas or under the earth's crust. The result is that the greenhouse effect was greatly diminished, and temperatures became more moderate. But then human beings discovered how much energy is stored in coal, oil and natural gas, which are concentrations of this same buried carbon. In a few generations we have been undoing a portion of earth history, threatening to return to a climate that hasn't existed for tens of millions of years. This is not because of any defect in our character or institutions; fossil fuels are extremely useful, and when we began basing our economies on them we were not aware of their fatal drawback. Now we know, and we have to quickly transition away from them while preserving the gains they have made possible. Note that this story avoids the moralistic framing of much of the environmental movement. Rather than dividing society into environmental saints and sinners, it presents the climate crisis as a challenge that confronts all of us, together.

The “together” part is at the center of the rest of the vision. We, all human beings alive today, face the difficult task of transforming the energy basis of our economy and are truly in this together. To get through it we need to support one another, especially looking after the most vulnerable but taking steps to safeguard the quality of life of all. This means we will need a much higher level of solidarity than we have shown in the past, reconnecting with our neighbors and fellow citizens but also extending the circle of common purpose to all of us, everywhere; this is a planetary crisis and requires a planetary solution. But coming together in the face of an immense challenge is not just a way to reduce and equitably share the burden of economic transformation; it also offers the possibility of a more cooperative and meaningful life. The carbon imperative puts many of our other, contentious concerns in perspective.

With progressive policies we can minimize the difficulties of the coming decades of transition. Unavoidably, there will be large impacts on the wealthy; many of their investments, tied to the economy we need to dismantle, will lose value. We hope some of them will recognize they can live well with just a fraction of their current wealth, and that the urgency of the problem far outweighs their financial sacrifice. We will welcome them into our common effort. Most will probably continue to resist actions at the scale required to quickly shift away from fossil fuels, however, and it’s a sad truth that our political and economic systems give the upper class far too much power. This means the rest of us, the 99%, have no choice but to organize into a determined political force that can overcome their resistance.

This way of framing the problem draws on a long history of collective action in the face of risk: building dikes against catastrophic floods, irrigation systems against droughts, longhouses, earthen shelters and other structures against storms. Cooperation in the face of mortal threat is a fundamental aspect of what it means to be human—we would not have survived as a species otherwise. Now we have a new challenge to meet. It demands global cooperation, but after centuries of (uneven) economic progress we are well prepared to absorb the costs. We are not inferior to our ancestors; we can do this if we commit to doing it together, in fairness and solidarity.

From this perspective we can explain and justify the various policies needed to minimize and equitably distribute the burden of decarbonization: recycling carbon revenues progressively, using aggressive fiscal policy to maintain full employment in the face of widespread dislocation, making large investments in renewable energy and other forms of green infrastructure, promoting sustainable consumption options, and providing international development support to offset the effects of climate policy in parts of the world with widespread poverty. Unlike the vision that currently frames the GND, however, a viable alternative has to conform to the reality principle by requiring as its centerpiece active measures to keep carbon in the ground, difficult as this will prove to be.

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Endnotes

1. For an account of the origins of this report, see the first section of Kallis and Bliss (2019).

2. Shellenberger and Nordhaus founded the Breakthrough Institute and continued to evolve in their views after writing "The Death of Environmentalism". While espousing environmental goals, they now differ from most environmentalists on issues ranging from energy to agriculture to biodiversity. For an overview, see their website at https://thebreakthrough.org/

3. I had a button that said this. Of course, the underlying reason was different for the New Left: not the dissolution of particular issues into a universalizing value frame but their rootedness in a common system.

4. "Who cares if a carbon tax or a sky trust or a cap-and-trade system is the most simple and elegant policy mechanism to increase demand for clean energy sources if it's a political loser?"

5. The text of Alexandria Ocasio-Cortez' House Resolution 109 on the duty of the Federal Government to create a Green New Deal can be found at United States Congress (2019). Data for Progress has compiled a useful political scorecard that subdivides the GND into 48 detailed items; see Data for Progress (undated). For a representative version of a European GND see GNDE (undated).

6. There is a tendency in the GND world to adhere to the "good begets good" heuristic, according to which good actions generate only good results, and the attainment of more of some types of good does not require any sacrifice of other types. GND policies are expected to reduce poverty and racism, promote health and a higher quality of life for nearly everyone, and promote political and economic equality. They have no identifiable costs except to very wealthy people in the fossil fuel sector. See Leiser and Aroch (2009).

7. Substantial portions of this section are taken from Dorman (2019).

8. Of course, the science behind climate change dates back more than century to the work of Svante Arrhenius, and concern among those familiar with the issue began building by the early 1970s.

9. In this paper I won't take up the role of land use change. During recent decades deforestation has been a secondary contributor to atmospheric greenhouse gas accumulation, but the future effects of measures to arrest or reverse forest depletion are highly uncertain for reasons I give in Dorman (2019). The bottom line is that efforts to sequester more carbon in forest (and other) biomass are worth undertaking, but as additions to fossil fuel cutbacks, not replacements for them.

10. I am also bypassing difficult measurement issues connected with the combined effect of CO_2 and non-CO_2 gases. There is a vibrant debate in the scientific community around this question, and I'm persuaded that the IPCC may be compelled to alter its current greenhouse gas equivalency weights, reducing the impact of methane to some extent. This is beyond my expertise, however, and in any case the science is still evolving. In this paper I am using CO_2 calculations only and not CO_2 "equivalence". For details, see Dorman (2019).

11. See NOAA (2019).

12. There are many informative overviews of the Energiewende. See for instance Hake et al. (2015), von Hirschhausen (2014) and Jacobs (2012).

13. In general, Germany uses somewhat more hard coal than brown (lignite), which has higher carbon emissions per energy content.

14. For example, Nimgaonkar (2015). A Google search on “Energiewende paradox” (with the quotes) turns up over 17,000 hits.

15. For the full argument, see Dorman (2019). Boyce and Pastor (2019) make a similar case.

16. For a critique of the first trope, see Dorman (2018); for the second Dorman (2019).

17. For the most recent comprehensive compilation of mitigation pathway scenarios, see IPCC Working Group III. (2014). Admittedly, this report is now dated and doesn’t reflect the last several years of research.

18. And an energy-hungry mob is an angry mob.

19. This is discussed at length in Boyce (2019).

20. In retrospect, the energy “crises” of the 1970s were of a much lesser degree and temporary, but they still caused a measure of havoc.

21. The original proponent of the view that most fossil fuel reserves would become stranded assets is Carbon Tracker; see Carbon Tracker and Grantham Research Institute on Climate Change and the Environment (2013). Other studies have updated their calculations and extended the scope of potentially vulnerable assets to energy infrastructure and certain end uses. Examples include Scholten et al. (2017), Battiston et al. (2017), Advisory Scientific Committee (2016) and McGlade and Ekins (2015).

22. This can be seen in the data assembled by Robert Brulle in his network analysis of climate denialism. About 3/4 of the economic organizations that participated denialist coalitions over the years 1989-2015 were from outside the fossil fuel sector, and of those that were most active, participating in more than one such coalition, over half were non-fossil. See Brulle (forthcoming) and for details of my analysis of his data, Dorman (2019).