



## Perspective

## The Green New Deal in the United States: What it is and how to pay for it

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## ABSTRACT

The US Green New Deal (GND) resolution introduced by Congresswoman Ocasio-Cortez and Senator Markey is the first comprehensive program combining climate change mitigation and the elimination of economic inequality that could, conceivably, soon be adopted as policy in a major economy. We outline its main features, together with Senator Bernie Sanders' more detailed, fully costed version, exploring its implications for policymaking and social science-based energy research. We focus on two of its most striking characteristics: its macroeconomics; and its inextricable linkage of climate change mitigation and the reduction of economic inequality. We find Sanders' GND economically credible and argue that the GND's use of Keynesian demand-side macroeconomics challenges governments, policymakers and citizens to think anew about the nature of money. We suggest social scientists need to challenge neoclassical economic assumptions, which, we argue, enable both climate destruction and inequality to continue. We find the GND's combining of climate protection and equality credible, and argue that shifting the debate away from neoclassical understandings of public debt to careful assessments of inflationary impacts and resource needs will generate more productive analysis. We offer these insights as a first look at the GND and challenge others to join in this research.

## 1. Introduction

The IPCC reports that limiting global mean temperature increase to 1.5 C will require net CO<sub>2</sub> emissions to fall by about 45% by 2030 and reach net zero emissions by 2050 [1]. Achieving this target within 10 years necessitates “rapid and far-reaching transitions in energy, land, urban and infrastructure and industrial systems ...unprecedented in terms of scale” ([1]:17). Attempting to meet this challenge within the US, the Green New Deal (GND) resolution introduced by US Congresswoman Alexandria Ocasio-Cortez and Senator Ed Markey sparked a large global reaction [2]. Co-signed by 111 US Federal legislators, it was endorsed by the majority of the Democratic Party's 2020 Presidential frontrunners. Its chief aims are to radically decarbonize the US economy while significantly reducing economic inequality, in such a way that these two achievements would be inextricably linked, and the rights of vulnerable communities protected and enhanced. In the words of the resolution, it aims “to achieve net-zero greenhouse gas emissions through a fair and just transition for all communities and workers” and “to create millions of good, high-wage jobs and ensure prosperity for all

people of the United States” ([2]:5).

The economic rationale of the GND is based on the adoption of Keynesian<sup>1</sup> demand-side economics of the type utilized by President Franklin Delano Roosevelt (FDR) to revitalise the US economy during the Great Depression of the 1930s — a project known as the “New Deal” — and to finance the US's Second World War (WW2) effort [3,4]. Broadly speaking, in this type of macroeconomic approach a government creates as much money as it needs to, to pay for its projects, and withdraws money from circulation via taxes, fees and the issuing of bonds in order to dampen inflation. The alternative approach, which we call “neoclassical” in this paper, is that governments must first raise money from taxes, fees and borrowing before they can spend it on their projects, i.e. that money originates outside of the government and the government must therefore get it from elsewhere before it can spend it [5,6]. This difference between these two approaches is further discussed in Section 2.

The GND is of critical importance for energy researchers, policymakers, governments and society at large. For the first time, a major political force with the possibility of winning power in a large, wealthy,

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<sup>1</sup> We use the term “Keynesian” in a very broad sense in this paper to include nuances and variations within the economic tradition that are sometimes labelled “neo-Keynesian” or “post-Keynesian”, and also variants that identify as modern monetary theory.

developed country has put together a comprehensive economic, social and technical package aimed to radically avert impending climate catastrophe [7], and to do so in a way that enhances rather than reduces the rights and wellbeing of the most vulnerable. The UK Labor Party, the German Green Party, the Spanish Socialist Party, the Democracy in Europe Movement 2025<sup>2</sup> (DiEM25), and the European Commission have all proposed that a GND (in various forms) should hold a central plank of future government policymaking. US Presidential candidate Senator Bernie Sanders has developed the GND resolution into a fully-fledged and costed policy [8]. As Sanders' plan forms the most financially detailed account to date within the political community promoting the GND we employ it as a case study. Its costing is discussed in Section 3.

In this preliminary analysis we examine two key questions raised by the US GND: (a) Does it make economic sense, i.e. can it be paid for without causing massive inflation? And (b) In what ways do welfare and other social policies, such as the job guarantee, which form a central component of a GND, relate to tackling the climate crisis? By addressing these questions we aim to provide new understandings of the most common concerns expressed about the GND's expansive program.

We explore the first of these in Sections 2 and 3 by examining the type of monetary policy inherent in the GND of both Sanders and Ocasio-Cortez/Markey and offer a detailed account of how this stands up to critique. We explore the second in Section 4 by explaining a raft of ways in which social equity and climate change mitigation appear to be interlinked.

The idea of a "green new deal"<sup>3</sup> is not new. Luke [9] surveyed proposals of the late 20th and early 21st century that considered how environmental policy initiatives could be financed after the manner of FDR's Keynesian-based funding of the New Deal of the 1930s and WW2 effort of the 1940s. He and subsequent authors labeled these "green new deals". In Klein's [10] words, they contrast with attempts by governments over nearly 3 decades to find climate solutions that "do not clash with 'free market' orthodoxies of deregulation, privatization, low taxes for the rich, and public austerity". Mainstream economic solutions to climate change have been carbon-centric approaches: e.g. carbon taxes and emissions trading schemes, or narrow regulations on polluters [10]. Keynesian-type green new deal proposals, on the other hand, aim to achieve climate change mitigation via and in parallel with a deep transformation of the economy [11,12].

A spate of such proposals emerged from academia and NGOs during and in the aftermath of the Great Recession of 2008–9. Açııcı and Bünlül [13] suggested a green new deal<sup>4</sup> as a way of revitalizing the world economy through stimulus spending. Custers [14] proposed a green new deal as a solution to the convergence of global environmental and economic crises, drawing strong parallels with Keynes' macroeconomic approach [3,4] in FDR's New Deal in the 1930s and during WW2.<sup>5</sup> One of the first NGOs to publicly launch the idea was the UK Green New Deal Group [15]<sup>6</sup> who in 2008 published its first "Green New Deal"

<sup>2</sup> A pan-European organization called DiEM25 [81] launched its own GND policy proposal, which it pushed ahead of European Parliamentary elections in May 2019.

<sup>3</sup> From this point on we use lower case letters for the general idea of a green new deal and upper case for the Green New Deal currently before the US Congress.

<sup>4</sup> New York Times Pulitzer Prize-winner Thomas Friedman first used the term "Green New Deal" in January 2007

<sup>5</sup> Unlike Keynes, however, Custers challenged the idea of economic growth, arguing it is destructive of the environment. Taking this further, Bauhardt [91] proposed a green new deal as an "ecofeminist" alternative to a growth-based, capitalist economy. More generally, Mundaca and Richter [92] reviewed stimulus packages aimed at increasing the share of renewable energy, many of which covered the period of the Great Recession.

<sup>6</sup> A coalition of influential politicians, journalists, and NGO representatives

report. Soon afterwards, the Green European Foundation backed by the European Parliament's Green Party became a major advocate for a green new deal for Europe [16]. Around the same time in the US the progressive Centre for American Progress proposed a Green Recovery Program to "boost a struggling economy and jumpstart... long-term transformation to a low-carbon economy" ([17]:1). Outside Europe and the US, the South Korean government announced the adoption of a green new deal in 2009. In addition to national initiatives, the United Nations Environmental Programme (UNEP) promoted the idea of a "global green new deal" [18] as an urgent response both to financial and environmental collapse.

While most green new deal proposals which emerged following the 2008 financial crisis (e.g. Obama's 2009 bill<sup>7</sup>) shared elements of a Keynesian interventionist economic model, many adopted an "ecological modernization" approach [19,20], predominately focusing on investments in technological solutions [21].<sup>8</sup> Feint and Cowell [19] argued that a common weakness of these initiatives was their technological focus, such as energy efficiency increases and renewable energy sources, without sufficient regulation to forcibly reduce CO2 emissions.

The goals of the Ocasio-Cortez/Markey GND resolution and of the Sanders GND, which is largely based on it, are far more radical and far-reaching (see Table 1). First, the Ocasio-Cortez/Markey GND resolution calls for a "national, social, industrial and economic mobilization at a scale not seen since World War II and the New Deal era" in order to decarbonize the US economy by 2030 ([2]: 5). Second, it positions addressing structural inequality, poverty mitigation, and neoliberal-driven welfare state retrenchment at its center. The resolution sees the climate crisis as interlinked with deeply entrenched racial, regional and gender-based inequalities in income and wealth [2], and so insists on tackling these with an array of programs that have hitherto been seen as disconnected. By bringing economic wellbeing into the heart of a program to reduce greenhouse gas emissions, the GND promises, "to provide all people of the United States with (i) a "job guarantee with a family sustaining wage" including "high-quality union jobs" that have "adequate family and medical leave, paid vacations and retirement security"; (ii) "high-quality health care"; (iii) "affordable, safe and adequate housing"; (iv) "economic security"; and (v) "clean water, clean air, healthy and affordable food, and access to nature."

Energy researchers and policymakers are no strangers to the first of the GND aims, since energy use is the main source of CO2 emissions. For over two decades energy researchers have vigorously employed sociological, psychological, economic, engineering, sociotechnical, social practice and policy science frameworks to explore how society can reduce GHG emissions. The second goal of the GND – eliminating poverty – has not been so evident in energy research or policy-making [22,23], despite enormous increases in economic inequality over the last 3–4 decades [24,25,26,27,28]. We return to this theme in Section 4.

The Keynesian, demand-side economic theory on which some of these proposals are based was effectively ousted from developed countries' economic policies when neoliberal, supply-side economics began to dominate both policy and popular discourse from the 1980s onwards [6,24,27,28,29]. However, Keynesian economics underwent a brief and rather narrowly restricted revival under the guise of quantitative easing in governments' attempts to reflate economies after the Great Recession [30]. Some leading economists see increasing support for a Keynesian approach arising as the neoclassical approach of stimulating demand by reducing interest rates becomes ineffective – since real interest rates are now at or around zero in most developed economies [31,32].

<sup>7</sup> President Obama spent an unprecedented \$90 billion on clean energy and green initiatives through The American Recovery and Investment Act of 2009.

<sup>8</sup> The GND served as a central platform of the Green party US presidential campaign of Jill Stein in 2012 and 2016. Stein's 2016 platform included a job guarantee target of 20 million.

**Table 1**  
Ocasio-Cortez/Markey Green New Deal resolution summary.

Goals	Projects	Requirements
Millions of new, high-paying jobs.	Resilient community-defined projects	Just transition
Net-zero GHG emissions via fair + just transitions	Repair + upgrade U.S. infrastructure	Provide training + high-quality education to all
	U.S. power demand met through 100% clean energy sources	Envir + social accounting via old, new laws; policies
Sustainable infrastructure + industrial policy	Smart grids + distributed energy	Public investment in new, clean tech R&D
	Restore damaged ecosystems	Appropriate public ownership stakes + returns via government agencies, organizations + businesses
Justice + equity for “frontline + vulnerable communities”	Mitigate + manage climate impacts	Democratic planning, implementation, administration
	Natural + working land restoration	New union jobs, local hiring of impacted workers
	Decarbonize U.S. buildings, manufacturing, farming, + transportation	Job guarantee, decent wage, adequate family + medical leave, paid vacations, + retirement security
Clean air + water; climate + community resiliency; healthy food; access to nature; sustainability.	International technology exchange + expertise: help other countries GNDs	Enforcing trade rules, procurement standards + border adjustments to stop job transfers + pollution overseas
	Identify + clean up new emission sources	Labor standards
	Clean hazardous sites	Collective bargaining rights
		Protecting oceans/public patrimony; not abusing eminent domain
		FPIC for Indigenous rights; honoring treaties; enforcing sovereignty + land rights
		Protections against unfair business competition.
		High-quality health care; affordable housing; economic security; clean water, air; healthy, affordable food; nature.

Along with the discussion of green new deals over the past few decades there has therefore been much literature exploring updated versions of Keynesian demand-side economics. This is often broadly termed “modern monetary theory” or “modern money theory” (MMT), though there are fine distinctions in this tradition and some eschew the label MMT and simply call their approach Keynesian, neo-Keynesian or post-Keynesian, as we see by comparing Bell [33], Fullwiler et al. [34], Juniper et al. [35], Palley [36,37], Smithin [38], Tymoigne [39,40], Tymoigne and Wray [43] and Wray [5,41,42]. Since the GND resolution was published, this literature has presented debate and discussion of whether the US GND can be financed without unacceptably high inflation, as seen in Nersisyan and Wray [46], Palley [44], Sweeny [45] and Tymoigne [40]. Much of the debate is between modern money theorists such as Nersisyan and Wray [46] and less radical Keynesian approaches such as Palley’s [44] – a discussion we return to below.

Public debate on the issue of financing has also ensued: For example, see op-ed exchanges between Nobel Prize winning economist Paul Krugman [47] and Professor Stephanie Kelton [48] a leading MMT scholar, who has advised both Senator Sanders and Congresswoman Ocasio-Cortez.

The remainder of this paper proceeds as follows. In Section 2 we offer a brief description of relevant aspects of demand-side economics, which are basic to so-called Keynesian, neo-Keynesian, post-Keynesian and MMT economic theory, contrasting this with supply-side economics, which is basic to current dominant neoclassical or neoliberal approaches. We also offer a longer and more detailed primer on Keynesian monetary approaches and MMT in the Supplementary Material. In light of this discussion, in Section 3 we explore arguments as to whether the GND makes economic sense, taking Sanders’ fully costed GND as a case study. In Section 4 we explore the ways in which the Green New Deal interweaves climate change mitigation and a program for radically reducing economic inequality. We offer conclusions in Section 5.

## 2. Demand side economics and modern monetary theory

Neoclassical economics assumes or argues that money originates external to governments and therefore, in order to be able to spend money, governments first have to raise money via taxes, fees, fines or borrowing (which is also called issuing bonds). This is the standard approach of most economics textbooks, though none, to our knowledge, actually offers a convincing case for it, if a case at all [6,49,50]. In fact,

however, it is easy to see that in the modern world, countries who are sovereign over their own currencies – such as New Zealand, Australia, Canada, the UK and the US – create their own money out of thin air and dissolve it back into nothing, to suit their needs [5,33,51]. This does not apply to Germany, France or other Eurozone countries, which have surrendered sovereignty over their currency to a pooled authority, but it certainly applies to the US.<sup>9</sup> There is nothing in principle to stop the US government creating as much money as it wants, denominated in US dollars, and injecting it into the economy by paying its workers and contractors, buying things like jet fighters and school equipment and providing social welfare and other benefits. All money denominated in the country’s own currency is *endogenous* [33,38,41]. It always originates from inside government apparatus, not from some outside source of wealth.

There is nothing controversial about this claim. Even avowedly neoclassical or neoliberal economists do not dispute that this is what happens in practice. It is simply a statement of what happens in modern economies. In the Supplementary Material we explain in more detail how modern money works by tracing the lines of debt and credit through the banking system. We also comment there on how banks also create money out of nothing when they issue a loan, and that this is a less “powerful” form of money than that which governments create, since it is only backed by the economic health of the bank.

The US government can go on creating money out of nothing as long as it wants to. It can never “run out of money”. When President Barack Obama appeared to imply, on 4 December 2013, that his government could not pursue certain programs because “there is no more money”, this was fiscally enigmatic. There is *always* more money if the government decides to create more.

There is, however, a very important catch. If a government allows there to be more money circulating in the economy than the perceived value of the goods and services on offer, this will cause inflation – more and more money chasing the same quantity of goods and services [37,40,43]. The government therefore has to withdraw money from the economy – not in order to raise money to finance its spending, but to dampen or prevent inflation. It does this by raising taxes, charging fees

<sup>9</sup> Nor does it apply to countries like Saudi Arabia which pegs the value of its currency to another country’s currency such as the US dollar. It only partially applies to countries like Japan and China, which peg the value of their currency to a basket of other major currencies.

and fines, and issuing bonds. When it receives this money it dissolves it back into nothing and writes off the equivalent amount from the debit side of its books (or adds it to the credit side, which has the same arithmetic effect).

So the question governments have to face in financing something like the GND – or schools, parks, bridge construction, the military or missions to Mars – is not “Can we raise enough money to pay for this?”, but “Will it be inflationary?” Will it increase the number of dollars circulating such that goods and services of limited quantity, such as brain surgery, houses, petrol and legal services, will become increasingly expensive as people bid against each other for these with their excess dollars?

This is the issue facing the GND. The intelligent critiques of it are not those that simply complain it will cost too much, such as the inexplicably high estimate of \$93 trillion by the right-wing think tank American Action Forum [52], or estimates by (other) Fox News sources that it could cost between \$6.8 trillion and \$44.6 trillion [53]. Rather, questions raised by critics such as Palley [36,37,44] and addressed by Nersisyan and Wray [46], Sweeny [45], Tymoigne [39,40] and others are much more salient because they address its likely effect on inflation. This is where focus our analysis in the next section.

### 3. Will the Green New Deal be inflationary?

The GND resolution is in the form of an outline of intended policy initiatives and does not include detailed costing. As noted above, however, Sanders’ GND is costed item by item and serves as our case study.

We begin by noting that Sanders’ GND costing does not include universal health care, which is one of the features of the GND resolution. Instead, his “Medicare for All” is structured separately from his GND [54] and he maintains his restructuring of health care will actually save the Federal government as much as \$5.1 trillion over 10 years, which amounts to about 2.7% of GDP. Most independent estimates agree that Medicare for All would bring a net saving [55,56, 60], and in the light of these, Nersisyan and Wray [46] suggest a conservative estimate is a saving of 3.7% of GDP, which amounts to about \$0.7 trillion per year, or \$7 trillion over 10 years. However, in our analysis below we will err on the safe side by refraining from subtracting likely gains through healthcare reform from the cost of the GND. We will also consider the effects of Palley’s claimed increase in health care in our analysis.

Aside from health care, Sanders’ \$16.3 trillion GND plan aims to “pay for itself over 15 years” through generating revenue (or, as Keynesian economists might express it, through withdrawing money from circulation) from the following sources: (a) \$3.085 trillion by eliminating all fossil fuel subsidies, increasing taxation of fossil fuel companies and increasing polluter fines and litigation; (b) \$1.215 trillion from reducing military expenses related to protecting oil-shipping routes; (c) \$6.4 trillion from selling energy via power marketing authorities; and (d) \$2.3 trillion from income taxes on the 20 million new jobs created. Sanders also argues his GND will: (a) save \$1.31 trillion by reducing the need for what the US currently spends on public assistance programs, due to the creation of 20 million new jobs; and (b) raise a further \$2 trillion by making the wealthy and large corporations pay “their fair share” of taxes [57].<sup>10</sup> \$16.3 trillion spent over 15 years is about 5.7% of GDP annually.

What do critics and commentators say about figures such as these? One of the GND’s most persistent critics working within a Keynesian framework is Thomas Palley [44], whose earlier critiques of green new deals in general [36,37] were in turn critiqued by a number of economists (e.g. Smithin [38], Tymoigne and Wray [43]). Palley accepts the

<sup>10</sup> See also commentary in [https://www.huffpost.com/entry/bernie-sanders-climate\\_n\\_5d5e2104e4b0b59d256f42cc](https://www.huffpost.com/entry/bernie-sanders-climate_n_5d5e2104e4b0b59d256f42cc)

Keynesian tenets outlined in Section 2. Working within this framework he argues that “simple arithmetic” proves that the amount of extra government spending required for the GND would increase the money supply so much as to require unacceptably high taxes to keep inflation down. Since his is probably the most systematically thought-through economic critique, we outline his numbers and the steps in his argument below. We relegate explanations of technical terms to footnotes.

First, Palley [44] calculates an *additional* expenditure for Medicare for All at 8.6% of GDP (\$ 1.76 trillion per year), free college tuition for all at 1.7% of GDP (\$0.35 trillion per year) and the GND itself at 2% of GDP (\$0.41 trillion per year), less relief saving<sup>11</sup> at 1% of GDP, a net increase of 11.3% of GDP (\$2.32 trillion per year). He then includes a “Keynesian expenditure multiplier effect”<sup>12</sup> of 1.5, implying that GND expenditure will result in a total increase in economic activity of \$3.49 trillion per year (1.5 x \$2.32 trillion) or 17% of GDP. We note that Palley’s estimate of the cost of the GND itself is lower than Sanders’, at 2% of GDP compared to 5.7%.

Second, Palley “generously” assumes the “full employment unemployment rate” is 2%, i.e. that “full” employment would actually see 2% of the employable workforce still unemployed, since unemployment has never been below 2% in post-WW2 years. Since the official unemployment rate was 3.9% (6.3 million persons) at the time of his critique, he maintains that this implies there is only room for reducing unemployment by 1.9% (3.1 million persons). He then uses an “Okun coefficient”<sup>13</sup> of 0.5, to calculate that the economy has spare capacity of twice this percentage, i.e. 3.8% of GDP. He takes this to mean the economy could absorb an increase in economic activity of 3.8% of GDP without inflationary pressure due to job creation.

Third, he points out that this 3.8% is well below the 17% increase that (he calculates) would result from the GND and associated social welfare programs. The difference, 13.2% of GDP, represents the excess of demand that cannot be absorbed by the fall in unemployment.

He therefore concludes that the government would have to increase the tax take by 13.2% of GDP, or about \$2.7 trillion, to mop up extra spending power and stave off high inflation. Current tax take is \$3.48 trillion (equal to about 17% of GDP), so, he concludes, the total tax take would have to increase by about 77%.

How sound is Palley’s critique? We will apply Palley’s approach to Sanders’ own estimates for GND funding (given in Table 2), which does not include Sanders’ estimated reduction in the cost of healthcare. The total cost of \$16.36 trillion amounts to \$1.636 trillion per year if condensed into 10 years. Sanders plans to spread the cost over 15 years, bringing it to \$1.1 trillion per year, but we follow Palley for now and use the 10-year horizon. Sanders’ GND figures omit the cost of additional new housing, of \$1.48 trillion [58], or \$0.148 trillion per year over 10 years, as he intends to finance this through a national housing trust. However, we include it here so as to accord with Palley’s approach, bringing the total annual cost to \$1.784 trillion per year.

Following Palley’s approach by using a Keynesian expenditure multiplier effect of 1.5, this amounts to an increase in economic activity of \$2.676 trillion on an annual basis. This is 13.1% of the 2018 GDP figure of \$20.5 trillion [59], substantially lower than Palley’s figure of

<sup>11</sup> Relief saving is savings made when new government funded programs make existing programs and expenditure no longer necessary.

<sup>12</sup> A Keynesian expenditure multiplier effect arises as follows. Suppose that every extra dollar of income a person receives results in them spending an extra 30cents. The person who receives this 30cents therefore spends an extra 9 cents, and so on, as a geometric progression:  $1 + 0.3 + 0.09 + 0.027 + \dots$ . The sum of the infinite series is about 1.41, i.e. if the expenditure multiplier is 0.3, each injection of an extra \$1 into the economy will lead to an increase in GDP of about 1.41 times its directly calculated effect.

<sup>13</sup> The Okun coefficient is the percentage by which GDP (or alternatively, GNP) increases as unemployment falls by 1%. In the US this is generally taken as a 2% increase in GDP for each 1% decrease in unemployment. Note that Palley’s calculations are actually based on an Okun coefficient of 2.0, not 0.5.

**Table 2**  
Cost estimates of Senator Bernie Sanders' Green New Deal (Authors table: derived from Sanders [8]).

Category	Item	Cost (US \$BN)	Type
Renewable energy & energy efficiency	Renewable energy	1520	Internal
	Energy storage capacity	852	
	Smart grid	526	
	Weatherize buildings	2180	
Public transport	Electrify low-income communities	964	Internal
	Increase public transit ridership 65% by 2030	300	
Aviation & shipping	Regional high-speed rail	607	Internal
	Replace all shipping trucks	216	
electric vehicles (EVs)	Fully decarbonize shipping / transportation	150	Internal
	New EV grants	2090	
	Vehicle trade-in program grants	681	
	EV charging infrastructure	86	
Low-carbon economy R&D	School & transit electric buses grants	407	Internal
	R&D: energy storage (StorageShot initiative)	30	
	R&D: decrease cost of EVs	100	
	R&D: decarbonise shipping & aviation	500	
International leadership sustainable & resilient communities	Green Climate Fund (intl. emissions reduction)	200	Overseas
	Climate Justice Resiliency Fund	40	Internal
	Sea-level rise adaptation	162	
	Wildfire firefighting	18	
	FEMA Hazard Mitigation Grant Program	2	
	broadband infrastructure improvement	150	
Clean air & water	Repair national water systems (via WATER Act)	35	Internal
	Green infrastructure & public lands conservation	171	
	Fund the Land & Water Conservation Fund	1	
	End National Park maintenance backlog	25	
Roads, bridges & water infrastructural improvements	Roads: national highways	75	Internal
	Roads: surface transportation needs	2	
	Repair transportation networks	5	
	Repair & retrofit travel infrastructure	636	
	Resiliency of new infrastructure	300	
	Just transition	New jobs, pensions, 5-year wage guarantee etc.	
Targeted regional economic development	Miners Black Lung Disability Fund	15	Internal
	Dept. labor training for high-risk workers	<1	
	Fossil fuel well & mine clean-up	100	
	Superfund sites clean-up	238	
	Brownfield sites clean-up	150	
	Appalachian Regional Commission	3	
	Delta Regional Authority	1	
	Denali Commission	<1	
	Northern Border Regional Commission	<1	
	Southeast Crescent Regional Commission	<1	
Social safety net	Economic Development Assistance Programs	2	Internal
	Infrastructure for impacted communities	130	
	Expand LIHEAP	25	
	Universal school meals	216	
Sustainable agriculture & farmer support	Expand SNAP	311	Internal
	Eco-regenerative agriculture	410	
	Pay farmers to keep carbon in soil	160	
	R&D: new framing techniques & seeds	1	
	Farmland conservation	25	
	Organic farming	1	
	Rural Energy For America Program	1	
	Disadvantaged & Beginning Farm program	<1	
	Tribal land access & extension program	1	
	Farmer Opportunity Training & Outreach program	1	
Connect consumers with local farms & healthy foods	Victory lawns & gardens initiative	36	Internal
	Co-op / community-owned grocery stores	15	
	Local food processing (inc. slaughter & dairy)	31	
	On-farm processing & farmers markets funds	<1	
	Food recovery & composting programs	160	
	Total costs	16,364	

17%. Using Palley's assumptions for the minimum unemployment rate, this would result in an excess stimulus of  $13.1 - 3.8 = 9.3\%$  of GDP, which could not be absorbed by further increase in employment. Using Palley's methodology on this figure the total tax take would therefore have to increase by 9.3% of GDP, or \$1.907 trillion, an increase of 54.5%. This contrasts with Palley's figure of 77% and Sanders' own figure of 40%.

We note that if we were to remove health care costs from Palley's

estimate, the required tax increase in his calculation would be much lower than 77%.

It is worth re-running Palley's approach to accord with Sanders' plan to spread costs out over 15 years, bringing a total annual expenditure of \$1.19 trillion per year. With a Keynesian multiplier of 1.5 this gives an increase in economic activity of \$1.785 trillion, or 8.7% of GDP. Again assuming a dampening effect of 3.8% of GDP from the jobs scheme, this would require tax increases equivalent to 4.9% of GDP, or \$1.00

trillion, to eliminate the inflationary effects of the GND. This would be equivalent to an increase in the total tax take of 28.6%, somewhat lower than Sanders' estimate of 40%.

We conclude, then, that Palley's figure of a 77% tax increase could only hold true if the GND were to be paid for within 10 years, the cost of Medicare for All were very large and positive rather than small or negative, and the new housing costs were accounted for within the GND plan – none of which is feasible. Indeed, even including the housing costs and assuming high costs for Medicare for All, the 15-year time frame would bring the required tax increase down to around 51%. We note, however, that a new, very robust study of US healthcare concludes that Medicare for All would save the US economy \$450 billion per year [60].

Sanders' proposed increase in the tax take by 40% is therefore reasonable, even perhaps an overestimate. It would amount to \$1.4 trillion per year, a calculation that accords with Nersisyan and Wray's estimates [46, p.40], and this would reach \$1.79 trillion with a tax increase of 51%. If this contingency did arise, the gap of \$0.39 trillion could be covered by compulsory and voluntary savings. These would include the pension schemes associated with government-created jobs as well as war-type bonds aimed to mature at staggered intervals after the GND period, similar to how the US ran war bonds in the 1940s [61]. Hence, even using Palley's methodology on Sanders' own figures and allowing for a portion of excess funds to be withdrawn from circulation via government bonds, we find that Sanders' GND would require tax increases only a few percent higher than Sanders himself claims.

Further, a major difficulty with Palley's approach is his non-dynamic assumptions about the unemployment rate. He assumes that increases in job opportunities do not stimulate people who are currently in economically non-productive roles to move into the workforce. Mroz and Savage [62] argue that creating more well-paid jobs actually increases the number looking for regular work as they turn away from activities like study, housekeeping or zero-hours contract work. This would provide scope for yet more government expenditure and act as downward pressure on inflation. There might still be 2% registered as unemployed, but many of these would represent new jobseekers entering the job market.

The above line of argument, then, leads to an estimate for the required tax increase (for a GND of the form explicated in detail by Sanders) as lying close to Sanders' figure of 40%.

The question to be faced, therefore, is whether US society would find tax increases of around 40% acceptable. During WW2 total government expenditure – financed by taxes, fees, fines and bonds – rose to a peak of 45% of GDP in 1943–44 [59]. Clearly the US public found this acceptable in wartime. Interestingly, it then fell rapidly as the war continued, reaching 14% of GDP in 1946 and bottoming out at 10% in 1947. Further, inflation never went higher than 11% in the war years and averaged about 5% during that period [63] – despite government expenditure reaching 45% of GDP.

In conclusion, Sanders' GND proposal does not seem to break any vital economic rules and would not necessarily lead to inflation if managed sensibly. The main unanswered question is whether US society would accept 1940s-70s-style tax rates on its wealthiest citizens.

One approach to this question is to consider tax rates in recent US history. The graph in Fig. 1, from data gathered by Thomas Piketty and used in his new book, *Capital et idéologie* [28] helps to address this question. It shows the proportion of different US groups' income paid as tax, including all taxes less social welfare transfers and food stamps – i.e. the net proportion of persons' income paid in tax. It is here clearly seen that prior to about 1981, the top earners in the US paid at least 40% more tax than today, as did the next highest band prior to about 1957. There are therefore many years of recent historical precedent for increasing tax rates for the very wealthy. Further, recent polls show significant support for a wealth tax and a 70% top income tax rate, across party lines [64,65].

#### 4. Combining CO2 emission reduction with reducing inequality

In this section we ask why the GND tightly combines the task of reducing CO2 emissions with that of eliminating poverty and reducing inequality. Both the Ocasio-Cortez/Markey and Sanders' GNDs affirm that the US is currently undergoing interlocking crises, most notably the climate emergency and deepening extremes of economic inequality. Consequently there are a number of social, egalitarian and justice concerns embedded in the Ocasio-Cortez/Markey GND resolution. It calls for the US to reach “net-zero greenhouse gas emissions” “through a ten-year national mobilization” and embeds climate solutions within an anti-inequality agenda. This includes creating high-paying union jobs including a “job guarantee”; addressing racial and gender inequities; and providing adequate family and medical leave, paid vacations and retirement security.

Similarly, Sanders' GND proposes to create 20 million well-paid, unionized jobs; build 7.4 million affordable and decent low carbon homes; upgrade existing dwellings' energy efficiency including 1.2 million federal housing units; green the electricity grid including energy storage capacity; fund climate resilience programmes for marginalized and indigenous communities; fund regional development in neglected rural areas; and invest in agriculture to support the production of more nutritious foods with less carbon-intensive methods [8,66,67].

These aspirations would make an interesting study for their own sake. However, our concern here is to ask how such goals relate specifically to climate change mitigation. Why would a social welfare and fiscally redistributive approach be needed, to stave off a climate disaster? We approach this question from a pragmatic, rather than normative, point of view. Energy justice scholars will no doubt be interested in the normative links, but we leave this for others to consider.

First, there is abundant evidence that wealthy elites are responsible for a disproportionate amount of CO2 emissions. A series of studies by Jorgenson and colleagues in high-income countries found a positive correlation between economic inequality and CO2 emissions from consumption. The higher the Gini coefficient of both wealth and income, the higher the CO2 emissions per inhabitant [68,69,70]. Meanwhile, a study by Chancel and Piketty [71] reveals that the personal CO2 emissions of the wealthiest 1% are up to 20 times as large as the average in the US. A more detailed investigation of UK CO2 emissions from consumption concludes that increasing the tax rate on the highest incomes by just a few percentage points and redistributing the proceeds to the poorest households would significantly reduce CO2 emissions [72]. Finally, a series of large-scale household surveys in EU countries reveals a U-shaped curve of CO2 emissions by household income [73]. Emissions of poor households are often disproportionately high because they cannot afford energy efficiency upgrades, while those of rich households are high because of excessive consumption practices. There is abundant evidence, then, that reducing income and wealth inequality in high-income countries is associated with lower CO2 emissions.

Second, an important factor is the direct industrial CO2 pollution of large, fossil fuel emitting firms. Heede [74] showed that 90 companies had produced two-thirds of the planet's cumulative global CO2 emissions up to 2010. It is not simply a case of “the bigger the firm, the bigger its CO2 footprint”. Rather, large firms with proportionately high CO2 emissions often use their excess wealth to wield power in the political process to obstruct legislative and regulatory restrictions on their activities and to propagate public discourse to soften and stave off objections [24,75]. Reich [50] gives a systematic account of the lobbying activities of such firms in the US. He documents the enormous amounts of money they allocate to lobbying and the specific laws and regulations they influence in their favor. Winters [76,77] has shown a similar pattern by wealthy elites on a more global scale. The GND would go a long way to breaking up this nexus of power in the US, making it easier for the government, rather than wealthy elites, to set the agenda for activities implicated in CO2 emissions.

Third, many of the technical developments arising from climate

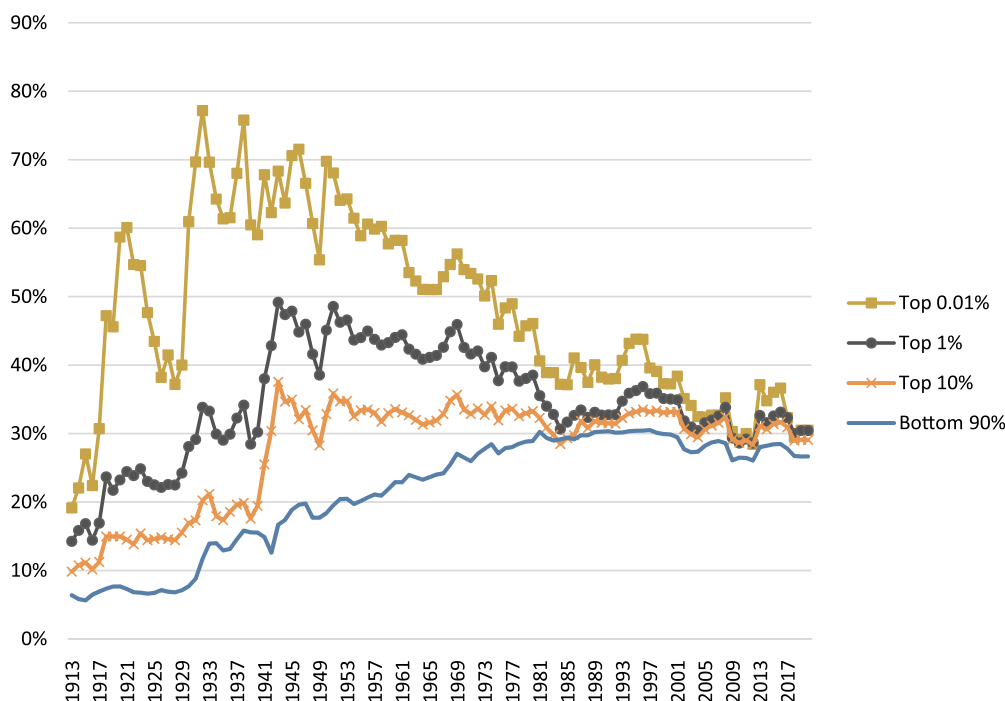


Fig. 1. Percentage of pre-tax income paid in taxes (direct, indirect, federal & other), net of social welfare transfers including food stamps. US, 1913–2017. Data source: Paris School of Economics, <http://piketty.pse.ens.fr/files/ideologie/xls/>.

change mitigation would directly benefit people of low income. The details of what a “net-zero greenhouse emissions” country would entail are spelled out item by item in the GND, including: 100% renewable electricity; making all buildings thermally efficient; making agriculture and food production more climate-friendly; restoring fragile and damaged ecosystems; making industry radically less polluting; and building resilience against natural disasters, including climate damage. With regard to (energy efficient) housing, for example, building new low-carbon housing can act as a decarbonizing lever for the building sector, which contributes approximately 40% of US energy consumption [78].

Fourth, as leading energy economist Reinhard Madlener argues [79], there is a risk that a low-carbon energy transition could impact negatively on low-income and vulnerable groups and cause a political backlash, which could slow down mitigation efforts. Unless strong policies are advanced to support a just transition, fossil fuel dependent and low-income communities will suffer as we decarbonize [80]. Sanders’ GND prioritizes a just transition to “to ensure no one is left behind” [8], providing social safety nets for those who bear the social costs of climate policies.<sup>14</sup> Similarly, carbon-centric approaches can disproportionately impact lower-income families who spend a larger share of their incomes on fuel or public transportation and thereby generate backlash. The Yellow Vests protests in France [81], the 2019 mass public revolt in Chile [82] and uprisings in Ecuador and Haiti were sparked by fuel taxes, rise in public transport costs, and cuts to fuel subsidies. Therefore, quite apart from normative issues of energy injustice [79], there are sensible pragmatic reasons to ensure that decarbonization does not impact negatively on the poor.

Fifth, and again from a pragmatic perspective, a green jobs program could break the jobs vs. environment debate that has hindered the acceptance of climate policies for decades [83]. A GND thus has the

<sup>14</sup> Sanders’ plan guarantees 5 years of a worker’s current salary, housing assistance, health care, 4-year college education or vocational job training, pension support, and priority job placement for displaced workers, along with early retirement options. It also proposes \$5.86 billion in funding for regional economic development agencies like the Appalachian Regional Commission.

potential to create new political coalitions in favor of ambitious climate reforms. For example, Bergquist et al’s [84] study of 2476 US residents found that climate ‘policy bundles’ that include social and economic reforms such as affordable housing, a \$15 minimum wage, or a job guarantee increase US public support for climate mitigation, particularly among people of color.

A sixth connecting issue is gender. Changes to the social welfare benefit system in the US and severe cutbacks in the public sector workforce have disproportionately affected women, particularly women of color [85]. The US clean energy economy is older, dominated by male workers, and lacks racial diversity when compared to all occupations nationally ([86]:5). Additionally, it is mostly men who work overtime and women who work part-time. Both the Ocasio-Cortez/Markey and Sanders GNDs have called for the financial and social insecurity of these groups to be addressed.<sup>15</sup> Again (apart from normative issues), this would have the pragmatic effect of keeping the support of gender equality and related movements for serious efforts at climate change mitigation.

These factors indicate that there are clear synergies between the goals of reducing CO<sub>2</sub> emissions substantially and quickly and tackling income and wealth inequality. This is not just a coincidence of a social welfare focused, fiscally active agenda and green politics. Wealth inequality and persistent increases in CO<sub>2</sub> emissions are inextricably interwoven in today’s social and economic context. In particular, the power of actors who are currently free to cause excessive CO<sub>2</sub> emissions needs to be curbed, while the support of currently vulnerable and marginalized groups needs to be won and retained so that the political momentum of mitigation is enhanced.

## 5. Conclusions and research implications

The purpose of this paper has been to explore implications of the US

<sup>15</sup> Sanders GND proposes “federal procurement” that will “will prioritize minority and women-owned businesses”, along with targeted job training and investments in underrepresented groups like “women-farmers”, and “low-income and disadvantaged communities”.

Green New Deal (GND) for policymaking and economics, in the context of social science-based energy research. The Ocasio-Cortez/Markey GND resolution marks a historic shift, as it is the first far-reaching green new deal policy proposal that has a good chance of being adopted by a major economy. Senator Sanders' version of the GND is largely based on the Ocasio-Cortez/Markey GND but fleshes it out with carefully costed details, targets fossil fuels directly through bans on fossil fuel production, and contests the role of private interests in the US energy system more broadly.

We argued that two things are particularly striking about the GND: its assumptions regarding the nature of money and its tight interlinkage of climate change mitigation with radical reduction of inequality. We explained the GND's Keynesian understanding of money and of government financing of projects, bringing this up to date with recent developments in modern monetary theory. We examined recent critique of the economics of the GND and found that Sanders' GND could be financed without causing excess inflation, provided US society is willing to accept tax increases for its wealthiest citizens reminiscent of those of the mid-to-late 20th century.

We also examined the assumption behind the GND that effective climate change mitigation must go hand in hand with progressive social and economic policies to sharply reduce economic inequality. We argued that current US economy, taxation, utilities ownership structure, corporate lobbying power and extreme free-market orientation make it impossible for the government to act decisively and effectively in climate change mitigation. We also argued that pursuing climate change mitigation in ways that benefit poorer and marginalized sections of US society will bring increased public and political support for these mitigation endeavors.

We suggest these discussions bring two major challenges to social science-based energy research and the sociology that lies behind it. First, this research needs to advance into serious discussion and research on the nature of money and how it is intrinsic and endogenous to human society and not just an exogenous commodity which humans make use of. With this renewed approach, social scientists need to challenge neoclassical economists to look critically at their assumptions about money, which just happen to suit a neoliberal culture that is gaining more and more power through syphoning off larger and larger proportions of national wealth to itself and in the process making climate change mitigation increasingly difficult.

Secondly, social science-based energy research needs to urgently develop a research agenda on the linkages between economic inequality and excess CO<sub>2</sub> emissions. To do this we have to reach into the macroeconomic domain, as it is here that "laws are made, tax rates are decided, and social welfare programs are adopted and administered" [87] and the causes of CO<sub>2</sub> emissions can decisively be addressed.

The growing field of energy justice literature should be well-placed to explore the climate emergency in relation to inequality and to some extent it does this (see reviews in [88]). In particular, so-called "recognition" justice research documents the negative impacts on indigenous and other marginalized communities by powerful, wealthy fossil fuel firms and other energy concerns (e.g. [89]), and one recent study puts civil rights center-stage in addressing energy aspects of the climate emergency [90]. Further, a recent, exploratory study by Madlener [79] lays out the economic challenges for achieving a fair, just transition to carbon-neutrality without this being at the expense of the poor.

More generally, social science-based energy scholars have researched around the edges of some of the determinants of CO<sub>2</sub> emissions for decades. Now we need to go right to the heart of what drives climate destruction. In particular, we need to identify the structures, actions and persons that enable specific, powerful individuals and corporations to set the agenda for fossil fuel extraction and the culture of over-consumption. A critical discussion of the US Green New Deal, and of other Green New Deals being proposed around the world, could provide social science based energy and climate research a new

opportunity to do this.

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## Supplementary materials

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