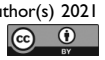
Theme issue article

Economy and Space

EPA: Economy and Space
1–17



DOI: 10.1177/0308518X211062601
journals.sagepub.com/home/epn

Rentiers of the low-carbon economy? Renewable energy's extractive fiscal geographies

Sarah Knuth
Department of Geography, Durham University, Durham, England

Abstract

Progressive movements today call for transformative state-led investment in renewable energy and other climate infrastructures—in the United States, a vision that confronts inherited legacies of austerity. I argue that a significant obstacle is the neoliberal toolkit through which the US federal government subsidizes renewables, an indirect, highly opaque system of tax credits and incentives. For forty years, tax subsidies have 'paid' private financial players to invest in renewables, via allowing them to claim legal tax shelters against their other income. In this political economic analysis, I question, first, how US renewable energy acquired this peculiar form of public finance 'through the tax code', unique in the global industry. Second, I explore how the model has shaped US renewables financing, development, and ownership. I center two decisive moments: the California 'wind rush' in the 1980s, and the ongoing renewables boom of the last fifteen years. This history articulates financial experiments and tax sheltering scandals of the Reagan Administration with exploitation returned today in more organized (and lucrative) form, as 'tax equity' finance. Via tax equity, a handful of major US banks dominate financing for renewables and other politically embattled public goods. They exert a troubling ability to extract rents for their capital, gatekeep what projects get built and by whom, and stall US renewables development altogether. Today, the practice is increasingly strained by these and other problems—growing public costs, private capacity ceilings, and amplification of sectoral crises. Under Biden, it faces probable reform, but may need more comprehensive reimagination.

Keywords

renewable energy, financial geographies, politics of taxation, rent and rentierism, United States

The Biden Administration is a potential watershed moment in the US federal government's response to energy and climate crises. In the late 2010s, progressive movements revived visions of a Green New Deal, calling for unprecedented state-led investment in renewable energy and

Corresponding author:
Sarah Knuth, Department of Geography, Durham University, Lower Mountjoy, South Road, Durham, DH1 3LE, England.
Email: sarah.e.knuth@durham.ac.uk

other key climate infrastructures, while linking climate action to a broader refunding and reimagination of the welfare state. Efforts to implement these transformative visions confront inherited neoliberal legacies in many forms. Some challenges are widely recognized, such as successive rounds of federal tax cuts—a priority for each Republican presidency since Reagan—their contribution to the US's inherited debt, and burden on ambitious new spending. In this paper, I argue that other aspects have gone under-examined by critical scholars and movements, yet equally demand reappraisal.

Centrally, I highlight the inherited toolkit through which the US federal government subsidizes renewable energy (as well as other central Green New Deal projects like affordable housing and urban climate retrofits). Over the last forty years, the United States has avoided direct federal spending on key environmental and social goods, instead evolving an indirect, highly opaque system of tax credits and incentives. Federal credits effectively 'pay' private financial players to invest in these public goods infrastructures on the government's behalf, via allowing them to claim legal tax shelters against their other income. I argue that this privatized model has imposed problematic costs, mounting for renewable energy as US wind and solar have boomed over the last fifteen years. Estimates suggest that renewables' two central credits, the Investment Tax Credit (ITC) and Production Tax Credit (PTC), generated as much as $18 billion in tax shelters in 2020 alone, almost all claimed by a handful of the US's largest banks. Moreover, these players, known as 'tax equity' investors, exert a troubling ability to extract rents for their capital, choose what types of renewable energy projects get built and by whom, and stall US renewables development altogether.

The paper centers two main empirical and interpretive questions, in conversation with growing scholarship on the political economy of renewable energy and climate (or 'low-carbon', Bridge et al., 2020) finance. First, how did US renewable energy acquire this peculiar form of public finance 'through the tax code', used nowhere else in the sector? Second, what work has this model done in shaping US renewables financing, development, and ownership, particularly the perverse and extractive outcomes described above? I propose that answering these questions requires a somewhat different history of US renewable energy than featured in existing literature, and a distinct understanding of its neoliberal legacy. Namely, scholars have explored US renewables' roots in the 1970s Energy Crisis and environmental counterculture, as well as seeds of electric utility deregulation and green neoliberalism sown then (Hirsh, 1999; Knuth, 2019). They have further tracked renewable energy and neoliberal de/reregulation as co-evolving US experiments in the late 1990s and early 2000s, led by infamous players like Enron (Harrison, 2020; Stokes, 2020).

Conversely, few think of renewable energy as a product of the Reagan era. However, I argue that to situate US renewables' *financial* politics, we must look to the broader neoliberal investment booms of the 1980s. Like other recent scholarship (Tapp, 2019), I draw a direct line between tax sheltering scandals of the Reagan Administration and investment practices returned today in more organized (and lucrative) form, as tax equity finance. The paper successively explores two moments that I argue have decisively shaped US renewable energy finance. First, I examine 1981–1986, the years of the California 'wind rush'. This boom inaugurated the modern renewables era (beyond earlier hydroelectric development) and influenced many subsequent industry practices. Simultaneously, it provided a billion-plus dollar windfall for tax evaders, though one that quickly collapsed alongside a host of other Reagan era shelters. Second, I analyze the period from 2005-present. In the last fifteen years, US renewable energy returned from a long fallow and experimental time from the later 1980s to early 2000s, chronicled elsewhere, to again become big business for financial markets. At the same time, it recommenced, via federal tax subsidies and tax equity, a sizeable draw on the public purse. In examining today's practices, I highlight three worsening strains: mounting public costs and strained private capacities, financial rentierism and project gatekeeping, and amplification of sectoral crises.

On the one hand, in unpacking neoliberal austerity, tax sheltering, and rentierism as legacies that distinguish US renewable energy finance and its accumulation strategies, the paper advances situated insights into questions emerging across a now-mainstream global industry. Political economic analysis suggests that renewables financing in other contexts is enabling gatekeeping and sometimes rent extraction by financiers, and contributing to the rising dominance of major transnational developers/owners (Baker, 2015, 2021; Kennedy, 2018). On the other hand, centralizing tax equity highlights connections with other social and environmental infrastructures that are now Green New Deal priorities. Echoing other recent political economic interventions (Bigger and Millington, 2020; Cohen and Rosenman, 2020), I maintain that diagnosing (and overturning) US neoliberal legacies in an era of climate change requires this synthetic public goods lens.

Methodologically, the analysis here draws on over a hundred archival and contemporary documents, and more generally on fifteen years of fieldwork in the US sector. As researchers and industry players frequently note (Brown and Sherlock, 2011; Tapp, 2019, 2020; Tiller, 2019), tax investment is highly opaque. Though often referred to as a 'market', tax equity is more a collection of disparate insider deals. Consequently, costs charged for capital, deal terms, and overall investment flows are not openly reported or tabulated. Investigating the practice thus requires triangulating multiple data sources. Here these included regional and national news archives, renewable industry trade literature, secondary histories, and materials from industry associations, as well as public research from entities such as the National Renewable Energy Laboratory. The US Congressional Research Service was a useful source on contemporary and historical tax credits. Finally, I drew extensively on the financial press, particularly specialized tax equity reporting from entities such as *Tax Equity Times, Bloomberg Tax*, and major business law firms like Norton Rose Fulbright. The last's *Project Finance Newswire* goes back to 1998 and notably includes transcripts from a running set of industry roundtables with high-profile tax equity players. These and other roundtables, geared toward developers and other financial players, provide crucial insights into the changing state of a closed industry.

Theorizing US renewables finance: Orientations and gaps

In investigating these questions, the paper aims to advance and integrate political economic scholarship on austerity and the politics of taxation, particularly within US neoliberalism; renewable energy and its financial geographies; and broader climate-financial politics. Rent extraction is a theme throughout, particularly its growing financialization via the strategies of powerful private financial players.

US tax politics under austerity

First, this research contributes new empirical and analytical insights into governmental legacies of 'roll-out' neoliberalization (Peck, 2012) in the United States, and their challenges for would-be transformative energy and climate action today. I join other recent analyses (Kay, 2016; Tapp, 2019, 2020) in centering tax subsidies and shelters as key US neoliberal tools for provisioning environmental and social goods, and unpacking the rent extraction they can enable. Collectively, these interventions illuminate how funding for important public goods infrastructures has negotiated an era of austerity and frequent ideological hostility—and with what concessions.

These contributions underline the centrality of tax politics in US neoliberalism, and its situated expressions of austerity (Peck, 2012). The populist 'tax revolt' of the late 1970s-early 1980s was formative in neoliberalism's rise (Tapp, 2019). It cut taxes and imposed government spending limits across a swathe of US states—notably California with Proposition 13, for this paper's story—before helping sweep Reagan into national power under a low-tax promise (Sbragia,

1983). The experience has shaped endemic US austerity pressures since, periodically refueled by movements like the Tea Party in the late 2000s and 2010s. More broadly, the tax equity practices I center here reinforce the need for further analysis of fiscal geographies (Tapp and Kay, 2019) and the financial politics of taxation (Aalbers, 2018) as meaningful lenses into contemporary political power and accumulation strategies.

The investigation in this paper builds particularly on Tapp's (2019, 2020) recent examination of the US Historic Rehabilitation Tax Credit (HRTC) (also significant for a Green New Deal as a subsidy for energy efficiency retrofits, Knuth, 2019). With the ITC and PTC for renewables, the HRTC, Low-Income Housing Tax Credit (LIHTC) for affordable housing, and New Markets Tax Credit (NMTC) for economic development in low-income neighborhoods are the central federal credits that feed today's tax equity market. Unlike other federal tax break recipients like oil and gas companies, developers of tax equity-facing infrastructures are for varying reasons typically unable to use tax credits themselves. Rather, they are compelled to 'sell' project tax breaks to third-party investors in return for upfront capital invested, diverting significant shares of intended subsidies and imposing additional costs. Failing to secure these tax sheltering financial partners, some projects are never able to use their legally entitled tax credits (Keightley et al., 2019), and others may fail to proceed altogether.

Similar to this paper's analysis of the ITC and PTC, Tapp (2019) suggests that exploitation of the HRTC began with wealthy individuals in the early 1980s tax shelter boom under Reagan (and see Fainstein, 1994; Weber, 2015). Parallel too (if a few years later than for renewables), Tapp argues that the entry of tax equity in the 2010s meant the financialized 'return of tax sheltering as an accumulation strategy' (p. 870)—rent extraction in more professionalized and lucrative form, led by major US banks.

Trends in renewable energy finance

In centering renewable energy as a target for US government support and private financial exploitation, I also further critical questioning of an increasingly mainstream global industry. The US federal subsidies central to this paper's story were originally created forty years ago, a time when renewables were not economically competitive with fossil power sources and frequently classed—and marginalized—as a feel-good countercultural experiment. The global situation is radically different today. The sector is attracting $300 billion and growing in investment ever year, while transnational corporations account for a rising share of project development and ownership (Baker, 2021; IRENA, 2020).

Growing research scrutinizes these industry trends, including changing financing. Early political economic theorization of renewable energy as a potential spatial (and socioecological) fix for capitalist crisis (Castree and Christophers, 2015; McCarthy, 2015) has developed into more situated analyses of its fast-evolving financial geographies internationally (Baker, 2015, 2021; Bridge et al., 2020; Kennedy, 2018; Knuth, 2018). Scholars have investigated state-led investment like China's Belt and Road Initiative (Williams et al., 2020), as well as the complexities of China's 'go out' renewables investments in practice (Shen and Power, 2017). Meanwhile, they have explored how the low-yield environment of the 2010s drove institutional investors like BlackRock into a new asset class (Knuth, 2021). Crucial questions include: who is now developing, financing, and owning renewable energy across different contexts? How does that shape what renewables are built, where, and for whom? With what other distributional outcomes?

Most renewables development globally still uses project finance structures pioneered in California in the 1980s wind boom, I will argue in part to qualify for the federal tax credits examined here. As scholars have explored, this norm of project finance means loans tied to specific renewable energy projects (e.g. a large 'utility-scale' wind or solar farm), rather than the

'balance sheet' corporate financing standard in the fossil energy industry (Baker, 2021; Bridge et al., 2020; Knuth, 2018). (In the US's exceptional case, tax equity means that financial institutions take direct ownership shares in renewable energy projects as well as lending to project developers.) Project finance structures are frequently complex, and usually expensive relative to balance sheet finance. However, research suggests that the rush of financial capital into renewables in the 2010s (Knuth, 2021) has meant that favored kinds of project and developer can get project-level loans increasingly cheaply (Baker, 2021; IRENA, 2020)—falling capital costs that may be furthered by the entry of green bonds and other financial innovations (Bridge et al., 2020; Knuth, 2018).

However, an equally crucial emerging finding (Baker, 2015, 2021; Kennedy, 2018) is private financiers' gatekeeping capacity, and their decided preference for certain forms of renewables development over others. This includes a constrained subset of 'mature' technologies (onshore wind, solar photovoltaic, increasingly offshore wind), very large utility-scale projects, major corporate developers, and regions with 'favourable investment environments' (IRENA, 2020: 40). As I explore further in the US case, today's boom in private financing structurally excludes many kinds of renewable energy project—distributed and small-scale projects; small private, public, and non-profit developers and owners—and continues to marginalize sites and communities deemed risky or unprofitable.

Scholars argue that other existing policies are exacerbating regressive industry trends. For example, certain competitive renewable auctions internationally favor transnational corporate developers over smaller local or regional players (Baker, 2021). In the United States, new renewable energy projects are increasingly massive (Mulvaney, 2019), developed and owned nationwide by a concentrated set of 'independent power producers' (IPPs)—many the same transnational leaders observed elsewhere (Baker, 2021). Accounts such as Hirsh (1999) and Harrison (2020) have linked these US trends to neoliberal utility de/reregulation, as it supported the rise of IPPs against regulated private and public utilities. However, with some exceptions (Bridge et al., 2020; Knuth, 2018), US renewables *finance* has been under-examined. I argue that federal tax subsidies and tax equity also shape these trends.

Climate-financial politics and rent

Research has noted that US renewables finance has remained relatively expensive even as capital costs have declined across the broader sector (Knuth, 2018). I will argue that financialized rent extraction via tax equity is a major reason why, and has been structurally enabled by the US state.

In exploring how US renewable energy financing costs are meaningfully shaped by political economic factors, I seek to complicate mainstream narratives that naturalize progressive capital cheapening as an outcome of renewables' technological 'maturation' and associated derisking. (Its influence can show up in more critical takes as well, e.g. framing assumptions in Mazzucato and Semieniuk, 2018; Bridge et al., 2020 provide a more grounded analysis of the sector's 'technology risks' and shifting risk-return calculations.) The narrative neglects how capital costs differ geographically, as well as the politics and histories of this inequality. Uneven financing costs may persist despite ongoing technological development in renewables—meaning that some places continue to pay outsize prices for capital, if they can access it at all. These political factors go beyond the US case examined here; for example, Baker (2015) demonstrates how rent extraction can be hidden within selectively applied narratives of 'country risk'.

Finally, this discussion of renewable energy rentierism advances insights into broader emerging questions in climate finance, here defined broadly to encompass low-carbon investment as well as financing for resilience (and see Bridge et al., 2020). As visions of a Green New Deal and other transformative funding programs reclassify diverse public goods as priority climate infrastructures, it is instructive to consider the precedents and legacies of such classification projects. For example,

a theme linking climate finance tools such as green bond markets (Bigger and Millington, 2020; Bridge et al., 2020), impact investing (Cohen and Rosenman, 2020), and green real estate labeling and investment instruments (Knuth, 2016) has been the search for added-value: all seek to positively differentiate assets and secure value premiums via 'green' or 'low-carbon' classification.

Conversely, I argue that tax equity exemplifies classification as a legacy problem. In assembling renewable energy and other social and environmental infrastructures into an effective asset class, neoliberal tax subsidies impose a meaningful *negative* differentiation: collectively offering up these politically embattled public goods for a particular kind of financial exploitation. Tax equity thus joins other forms of negative financial differentiation, in which qualitatively distinguishing assets or borrowing populations becomes a pathway for marginalization, exclusion, and extraction—with racial capitalism a particularly significant example and challenge for just climate finance (e.g., Bigger and Millington, 2020; Ponder, 2021). Today's Green New Deal movements confront many of these embedded legacies at once.

Tax shelters and a wind rush: An inaugural renewables boom (1981–1986)

Looking back to the beginnings of US renewable energy finance uncovers the roots of many current practices and problems.

From the early to mid-1980s, California wind power became the central site of a crucial US-based experiment, the world's first modern renewables boom. California wind projects attracted an inrush of national and international investors, renewable energy project developers, and technology suppliers. Between 1981 and 1986, a host of specially formed companies rolled out projects in the state's windy Altamont, Tehachapi, and San Gorgonio Passes—by 1985, nearly $2 billion in total investment (Starrs, 1988). By the end of this wind power 'Gold Rush', they had constructed around 12,000 wind turbines of varying technical design and soundness, in theory capable of generating from 900–1100 megawatts (MW) of electricity—then approximately 96% of wind power worldwide (Garud and Karnøe, 2003; Righter, 1996).

Histories of the renewable energy industry acknowledge the enduring significance of this conjuncture in establishing norms such as wind turbine sizing (Garud and Karnøe, 2003; Van Est, 1999)—and, as I will explore, key project development and financing practices. Yet the California wind rush was anything but an unqualified success. It terminated amid widespread public criticism and a collapse in 1986 engineered by both Republican and Democratic policymakers. This prominent bust helped stall California and US renewable energy development for almost twenty years, before investment returned at scale in the mid-2000s. How might we explain this 1980s boom and bust, particularly within its broader conjunctural moment in the rise of US neoliberalism?

First, it is important to acknowledge earlier roots of the 1980s wind boom. Important histories like Hirsh (1999) unpack some of its crucial enabling policies as late 1970s responses to the decade-long Energy Crisis, in California and at the federal level. Hirsh and others particularly underline the far-reaching significance of the Carter Administration's Public Utility Regulatory Policies Act (PURPA) in 1978. PURPA required regulated energy utilities to purchase and transmit all electricity supplied to them from then-new IPP challengers, and to do so at favorable rates. In so doing, it both provided crucial support for a wave of nascent 'nontraditional' energy technologies including renewables and sowed the seeds for later electricity deregulation. On the financial end, industry sources like Yescombe (2013) similarly argue that PURPA was one key origin of project finance as a modern infrastructure instrument. However, federal tax credits for renewables have been

less scrutinized, in influencing these early experiments with project finance and in other enduring financial practices.

The federal tax credits that have become central to US renewables finance were also initially created under Carter, in The Energy Tax Act (ETA) of 1978. Though they would not see major usage until the boom of the 1980s, these earlier roots reinforce how the late 1970s conjuncture, including the Energy Crisis and tax revolt, seeded neoliberalization that would accelerate under Reagan (Huber, 2013; Sbragia, 1983). The ETA established a 10% special investment tax credit for nontraditional power producers, including renewables—the source of today's ITC. The Crude Oil Windfall Profits Tax Act of 1980 (WPT) subsequently increased the rate to 15% and extended it through the end of 1985 (Keightley et al., 2019; Lazzar, 2008; Sherlock, 2018). Project developers could 'stack' these new federal tax credits, along with any additional state-level ones, atop more general investment tax credits and depreciation allowances—for example, wind energy equipment additionally qualified for the federal government's regular 10% investment tax credit.

The US government has historically used two distinct strategies for subsidizing electric power research and deployment. Large-scale hydroelectricity and nuclear power have relied heavily on direct government funding and ownership, in New Deal and Cold War spending and beyond—as did much early phase wind and solar research (Garud and Karnøe, 2003; Knuth, 2018; Van Est, 1999). Conversely, the new tax credits for renewables superficially resembled US governmental subsidies for fossil fuels. On the books for much of the 20th century, these governmental incentives operated indirectly through the tax code (Lazzar, 2008; Starrs, 1988). Such tax subsidies involve the usage of tax credits and deductions for interest and depreciation—the latter justified (though often in name only) through the material breakdown of fixed capital over time, its devaluation, and replacement costs. For oil and gas, tax-based support has included policies like depletion allowances and 'wildcatting' incentives.

However, new renewable energy forms and IPP project developers that entered in the 1980s had a key difference. Unlike fossil fuel incumbents, they typically had little to no initial revenue, and could not actually *benefit* from tax breaks. (A phenomenon common to projects and project development companies across the later tax equity world.) What they actually needed was upfront capital, for then-risky and expensive development experiments. Early framers of the legislation perhaps anticipated this difficulty—the original 1978 version of the ITC was 'refundable', which effectively meant that it functioned as a direct grant (Keightley et al., 2019; Sherlock, 2018). However, the WPT in 1980 repealed this element, with no official explanation as to why (Giegerich, 2012). As we will see, this dilemma would be met with a problematic solution.

California had reason to embrace renewable energy alternatives. As Hirsh (1999) discusses, the Energy Crisis was compounded there by scarce power reserves and high energy costs, and substantial material and political obstacles in developing conventional generation. California policies included an especially favorable rate for independent power purchases under PURPA. California's Public Utility Commission (CPUC) directed state utility power companies to provide new competing IPPs with standard contracts that locked in particular rates and pricing formulas for years, including a highly attractive one that became central to the wind boom, Interim Standard Offer 4 (ISO4). ISO4's formula for projecting future utility costs assumed, like many at the time, a future of high oil and natural gas prices. It quickly became obvious that this assumption would be erroneous amid the low fuel prices of the 1980s. However, independent generators who secured the contracted rate before the CPUC suspended the offer in 1985 were nonetheless entitled to years of highly attractive above-market returns.

Moreover, California added its own state-level tax subsidies atop the federal credits. The most generous of any state, these additional incentives included a further 25% tax credit for business investment in wind turbines or other renewable energy equipment. Combined with the federal

tax credit, wind developers could take a hefty 50% tax write-off in the first year of a turbine's operation (Righter, 1996). In the early 1980s, these combined incentives helped galvanize an unprecedented run on California wind projects (solar was then still in its infancy for commercial applications). According to Hirsh (1999) they generated interest far beyond expectations—proposals for over 15,000 MW of wind by the end of 1985. This was far more power than was then needed or would ultimately be built.

However, this unexpected boom did not only result from federal and California energy tax credits, or ISO4's accidental 'sweetheart deal'. It was given crucial fuel in the 1980s by further tax breaks and shelters created by the new Reagan Administration, and a broader investor rush on these opportunities. Key here were comprehensive accelerated depreciation schedules brought in by Reagan's Economic Recovery Tax Act (ERTA) in 1981, a major campaign promise and sweeping reorganization of the federal tax structure. ERTA reduced the top marginal personal tax rate, cut capital gains taxes, and further accelerated depreciation of commercial property—all highly regressive interventions in that they disproportionately benefited wealthy individuals and investors.

Moreover, ERTA became notorious for creating a host of tax shelters. Hanchett (1996) notes that tax sheltering and forms of rentierism based upon it had become omnipresent in US commercial real estate investment from the 1950s, particularly after the Eisenhower Administration qualified real estate for accelerated depreciation. However, ERTA made these tax shelters even more profitable. It allowed investors to write down the full value of real estate over a fifteen-year period, rather than the preexisting forty-year assumed lifetime of buildings. Moreover, via the new Accelerated Cost Recovery System (ACRS), it tweaked the formula for that depreciation so that value was written down faster in the early years of an investment (31% in the first three years). This tweak hastened the payout for tax investors (Fainstein, 1994). For example, wind turbines' depreciation was accelerated to five years, letting investors reap very quick returns on their project investments. ERTA's new tax handouts prompted a major bubble in commercial construction in the early to mid 1980s, considerable overbuilding, and a near structural crisis in US property markets (Fainstein, 1994; Weber, 2015).

Placed in this perspective, the California wind rush constituted one investment frontier within a more comprehensive boom in the Reagan era, a speculative property bubble that ranged from skyscrapers in Manhattan to booms in Sunbelt cities like Houston (Fainstein, 1994; Weber, 2015). As in other US property sectors at the time, a major driver of the California wind boom was a rush to exploit lucrative tax shelters available to wealthy individuals. Renewable project developers learned important strategies amidst the broader investment wave. Crucially, they looked to new syndicated partnerships created for tax sheltering as a key strategy to 'monetize' federal and state tax credits for renewable energy: a way to bring in third-party investor partners to whom they could effectively 'sell' the tax avoidance benefits of projects in return for upfront capital.

It is in part to facilitate these complex partnerships that early US wind projects became organized as Special Purpose Vehicles (SPVs). These limited liability companies or partnerships are 'set up for the sole purpose of developing, operating and owning the project…largely held off the balance sheet of [any] parent companies involved' (Baker, 2021: 11). SPVs have become typical in project finance, with returns for owners, tax investors, and lenders tied to the 'self-financing' capacity of a project's own revenues (Knuth, 2018). For US renewables, those may come from energy sold or as monetized income from tax credits and depreciation allowances. However, because of their legal detachment, SPVs have no preexisting income taxes of their own to qualify for federal subsidies. To gain this income, they *must* partner with other investors. SPVs remain the norm for renewables development internationally—in the United States, in part to continue to solve the challenge of monetizing tax credits.

Before the 1980s boom, US wind power players were typically government labs and regulators, technology manufacturers, or advocates primarily interested in renewables' social and environmental benefits (Garud and Karnøe, 2003). The California rush created a new species of wind project developer. The vast majority of these entrants were financial firms with a background in real estate ventures, packaging and developing capital-intensive projects. Most had no previous experience in the unique technological and material challenges of wind power development, and often little investment in the long-term health of the industry. Rather, they were primarily interested in generating and selling tax credits to the wealthy (Garud and Karnøe, 2003; Righter, 1996; Starrs, 1988).

Righter (1996) argues that for individual investors who put their money into these wind projects, the deals' short-term ability to shelter taxes from income earned elsewhere was *the* primary motivation, rather than any interest in furthering renewable energy or even generating power. Most tax investors in California wind projects 'never saw a wind turbine. They were doctors and dentists, and once they got their tax credits, they were satisfied' (Poulsen, in Garud and Karnøe, 2003: 294).[1] One estimate at the time suggested that a $150,000 investment in wind would yield $75,000 in federal and state tax credits in the first year alone and $138,000 from five years of depreciation deductions—yet only $12,000 per year in revenues from the actual sale of electricity (Time, 1986).

This image of tax sheltering dentists perhaps undersells the personal wealth needed to qualify for these benefits. US tax shelters have always been a realm for the rich, typically only returning profits to those in the highest tax bracket. Hanchett (1996: 1104) argued in that even in the 1970s, with far less polarized national wealth than today, 'less than 1 percent of Americans qualified for benefits from the real-estate tax shelter game'—though even in 1970, he argued that lost revenues from these tax shelters amounted to fully 25% of the annual federal budget deficit. For California wind, financial dealmakers courted investors whose income tax rates were at the maximum federal (50%) and state (11%) levels. According to Starrs (1988: 141), 'investment opportunities were tailored to individuals who could invest perhaps $150,000…[and] some developers required investors to provide evidence of a net worth of at least $600,000.' Moreover, 'because investors had to have high tax bills to benefit from major tax reductions…the vast majority of investors fit the image of the wealthy taxpayer sheltering income.'

The appeal to tax-motivated investors caused major problems in the California wind boom. Contemporary critics noted that tax subsidies were linked to upfront capital investment (in wind turbines and associated equipment) rather than the actual *production* of wind power, and reiterated that successful electricity sales were a minor concern for many investors. This model opened the door to inexperienced and fly-by-night project developers, rampant equipment failures through poor design and construction, and fraud (Van Est, 1999). Deliberately overvaluing wind farms and their equipment to produce huge tax credits and depreciation deductions was one form of the last (Hirsh, 1999). If uncompleted 'see-through' office buildings were one landscape of the early 1980s bubble (Weber, 2015), another was a swathe of California wind farms with fast-failing or never-workable designs.

In total, the California Energy Commission (CEC) estimated that through 1985, renewable energy tax subsidies diverted $630 million and $770 million in tax revenues, respectively, from US federal and California state treasuries (CEC, 1986); a considerable amount of this simply extracted from the state and public purse without producing useful infrastructure. Meanwhile, controversies over tax sheltering lost wind potential supporters on the left. California's most vocal political critic of wind tax shelters became progressive Democratic Congressman Pete Stark, who famously argued 'they're not wind farms, they're tax farms' (Tri-Valley Herald, 1984) and fought to repeal them. By the mid-1980s, mounting national opposition to ERTA tax shelters caused Reagan to change tack. The Tax Reform Act (TRA) of 1986 further lowered overall tax rates, but eliminated many of the early 1980s loopholes (Mitchell, 2018).

Wind energy's fortunes waned amidst this controversy, and both federal and California tax credits for wind specifically were let lapse. When a federal tax credit for wind was reinstated in 1992 in the form of the PTC, it was pointedly framed as a 'production' rather than 'investment' tax credit in response to 1980s abuses (Brown and Sherlock, 2011) (i.e. projects are credited according to power actually produced). Contra Stokes (2020), the ITC actually never went away for power sources like solar. It was extended several times at varying rates before being made a permanent part of the tax code at a 10% rate, also in 1992. However, since solar's major US growth boom did not pick up until the 2010s, there was little cost associated with this credit for most of its history (Sherlock, 2018). After the mid-1980s bust, US renewables lapsed into two decades of more fitful regional experimentation.

US renewables finance today: The tax equity era (2005–Present)

Moving forward to today's ongoing boom, the mid-2000s marked the return of major US renewable energy projects to the national stage—and renewed interest from financial markets, including tax equity investors.

Federal tax credits, the PTC (used mostly for onshore wind) and ITC (central for solar from the 2010s, and favored for new technologies including offshore wind), are widely acknowledged as central supports for this fifteen-year boom. Each has been subject to a series of expirations, declining rates, and political reauthorizations. The PTC remains temporary and has been renewed eleven times since 1999; the ITC was meaningfully raised to 30% in 2005, but that higher rate is also temporary. Both are scheduled to expire or wind down soon without new Biden Administration interventions. At full mid-2010s value, PTC and ITC subsidies were ~$0.025/kWh and 30% of project capital costs, respectively. Additionally, most renewable energy equipment continues to qualify for five-year accelerated depreciation under the Modified Accelerated Cost Recovery System (MACRS), a reformed version of depreciation created by the TRA in 1986.

In key ways, today's renewable tax subsidies have recreated patterns of the 1980s with a more powerful set of tax investors, in modern tax equity. As discussed above, renewable energy project developers continue to use SPVs, and rely on third-party investors to monetize these tax benefits. However, tax-motivated investors in today's renewable energy deals are typically a highly restricted set of the US's largest banks, insurance companies, and financial institutions—JPMorgan Chase, Bank of America, and Berkshire Hathaway are leading and indicative players today. They have been joined more recently by a handful of giant corporations like Google and Amazon. Tax benefits from the PTC, ITC, and MACRS are monetized for these entities via a series of complex deal structures (partnership-flips, sale-leasebacks, and inverted leases), which contractually bind SPV partners and allow legal transfer of tax benefits.

This trend has again been shaped by the state. As well as rolling back the excesses of ultra-accelerated depreciation, the TRA's tax reform in 1986 created new 'passive loss' and 'at-risk' rules that made it difficult for wealthy individuals to directly use tax shelters. Instead, tax investment became the province of wealthy *institutions*—professionalized, financialized, and scaled up. As Tapp (2019: 15) contends:

> *Changes associated with TRA86 not only altered the regulation of the tax credit industry but also ushered in new financial logics that would eventually frame the credit for financialization…while* [the passive loss] *rule eliminated the market for individual investors who expanded the program under Reagan, it* [offered] *earners of passive income an unlimited opportunity to offset their tax burden.*

In the 1990s and 2000s, LIHTC and affordable housing dominated the tax equity market, which was estimated at $20 billion overall in 2017 (Tiller, 2019). However, renewables' share climbed

rapidly from around 2005 (Mintz Levin, 2010), pioneered by institutions like JPMorgan Chase and GE Capital. The former is still a market leader, though GE Capital and other inaugural renewable tax equity investors of the 2000s like Lehman Brothers, AIG, and Wachovia were casualties of the subprime collapse (Zindler, 2011). From 2016 to 2019, renewable tax equity alone averaged $10–13 billion annually. In 2020, that estimated share jumped to $17–18 billion (Norton Rose Fulbright, 2020, 2021; Tiller, 2019).

For a tax equity player, investment in a major renewable energy project qualifying for the PTC or ITC can now mean hundreds of millions of dollars for the project—but also in federal taxes avoided. Moreover, the practice is not merely the federal government unofficially contracting out private investment in a public good in lieu of taxes, in some simple one to one exchange. Tax equity players systematically divert a portion of this subsidy, an invisible but important public revenue loss (and see Tapp, 2020). Moreover, tax equity players charge renewable project developers fees and highly variable additional premiums for use of their capital, sometimes also demanding a cut of longer-term energy sales. Unlike normal equity, they also claim priority over loans often also needed to complete a US project, creating complicated and expensive capital stacks now usually involving multiple tiers of owners and tax owners, construction lenders, and term lenders.

Overall, the pool of renewable tax equity investors remains highly restricted today. Conard (2015) frames the market as one for companies owing in excess of $200,000 in income tax. Moreover, even within these rarefied subsectors of US capital, the industry has been concentrated amidst the very large players noted above, in part due to the ongoing opacity of the practice and the costs of setting up each complex tax equity deal (not necessarily worth it for entities without very large tax bills to offset). Tiller (2019) suggests that:

> *68 percent of the $10.25 billion of tax equity invested in the ITC/PTC in 2017 was done in big tranches by big players…*[reinforcing] *the viewpoint of the tax equity investor market that there are 15 to 20 frequent sizeable investors—mostly banks and insurance companies—and then 25 to 35 less consistent or opportunistic corporate investors.*

Norton Rose Fulbright's investor roundtable (2020) estimated an even more restricted 12 to 15 tax equity providers active in renewables in 2019, while respondents suggested that JPMorgan and Bank of America accounted for a full 50% of the market, at $3 billion each. In 2020, *The Financial Times* similarly estimated that the top five investors held 80% of the market (Meyer, 2020).

This constricted set of tax equity players is particularly notable given a much higher number of lenders in the sector, unlike tax equity including a sizeable share of non-US players (Norton Rose Fulbright, 2020). As discussed, these lenders have brought a flood of increasingly cheap capital to the broader sector. Project-level debt is cheap relative to tax equity, particularly for more established renewable technologies (Feldman et al., 2020). It is therefore significant that US tax subsidies and tax equity arrangements structurally restrict lenders to a subordinate and limited share of renewable energy deal structures (Financier Worldwide, 2018).

Growing concentration is also notable on the other side of tax equity deals, in US renewables development and ownership. Though the United States had several hundred renewable project developers in 2017, development was dominated by about forty major players, with the top five largest developers making up a third of projects taking tax credits (Tiller, 2019). According to US national lab research (Feldman et al., 2020), the top ten owners of utility-scale onshore wind and/or solar PV capacity (making up a 43% and 35% share, respectively) were also an increasingly rarefied set of IPP players: very large deregulated US utilities operating beyond their original state territories such as the market leader NextEra, US-based project developers like Invenergy, and

institutional investors such as Global Infrastructure Partners, BlackRock, and Berkshire Hathaway —reflecting growing interest of infrastructure funds and private equity in the sector (and see Knuth, 2021). It also included a raft of big European developers, the deregulated subsidiaries of European utility companies—many such as EDP, Enel, and EDF active internationally (Baker, 2015, 2021).

The role of tax subsidy bias in this IPP dominance demands more scrutiny. Notably, 'tax normalization' rules have made regulated investor-owned utilities in the United States unable to profitably use tax equity (the practice is now under IRS review), creating uneven advantages for IPPs (Feldman et al., 2020). Meanwhile, federal tax credits have systematically excluded publicly owned utilities and nonprofit developers, who cannot qualify for this subsidy.

Growing public costs; strained private capacities

Tensions in these practices have grown. First, the ongoing renewables boom has made tax subsidies increasingly expensive for the federal government. This trend stands to worsen with proposals to expand the ITC to cover new technologies and private payouts. For example, investors estimate that offshore wind requires an unusually massive $700–800 million of tax equity per project, with buy-in from as many as four or five separate tax equity investors (Burton, 2018). One projection suggest that US offshore wind will require $30 billion or more of additional investment over the next two decades, a sizeable leap.

Unlike direct public funding or alternate private finance, tax subsidies create a finite ceiling in the capacity of the tax equity market itself—investors only have so many tax dollars to shelter, and different public goods infrastructures must compete for this pool (Katz and Nazif, 2019). Industry worries about tax equity's sufficiency were particularly prominent after the major Trump Administration tax cut in 2017, which decreased the federal corporate tax rate from 35% to 21%. This lower rate meant that tax equity investors had less need for tax shelters, shrinking the entire market. While the Trump cut did not destroy the market altogether as some industry players feared, it reduced tax equity's share in a typical financial deal. Norms of tax equity's share in 2019–2020 were under 40% of a solar deal and 50–60% of a wind deal; down from 50% and 60–70%, respectively (Norton Rose Fulbright, 2020, 2021).

Financial rentierism and gatekeeping

As market-rate loans for renewable projects have become cheaper, the deal that project developers get via federal tax subsidies has become less advantageous. Industry concerns have been heightened meanwhile by tax equity players' ability to extract premiums, dictate terms, and withhold capital from projects. This gatekeeping power stems particularly from the always-select number of tax equity investors relative to developers seeking their investment. This scarcity, in important ways politically constructed, has allowed investors to extract rents for use of their capital. Transcribed remarks in recent industry roundtables are suggestive. For example, one bank vice president recently argued: 'Our tax capacity is a scarce resource' (in Norton Rose Fulbright 2016). See also a bank director quoted in Burton (2018): 'We get ten requests for tax equity a week and say 'yes' to less than one a week. We have to prioritize opportunities.'

Many observers have noted rent-seeking in tax equity, as players exploit their quasi-monopoly position to raise the cost of capital. Tax equity yields are generally in the 6% to 8% range (Keightley et al., 209; Norton Rose Fulbright, 2021). However, wide variability exists depending on the kind of project and project developer involved, and considerable opacity. Smaller projects and developers can be charged as high as 12% (Tiller, 2019). Feldman and Bolinger (2016: 25) argue that 'because the availability of tax equity is limited, its cost is high: since 2008 tax equity has been more than twice as expensive as the debt that it often supplants from the capital stack.'

Meanwhile, speaking to growing monopoly trends in US renewables development and ownership, tax equity investors are known to favor larger projects and players to increase their profits, especially developers with whom they have existing relationships. One estimate for larger players is an average of $150 million per deal (Tiller, 2019). This financing bias excludes many smaller private projects and developers, leaving many unable to use entitled tax credits (Brown and Sherlock, 2011). Meanwhile, public and non-profit developers are again more structurally excluded—they cannot use existing federal subsidies full stop.

Amplification of crises

Third, tax equity's rentierism and gatekeeping has a temporal dimension, becoming particularly acute during political choke points and broader economic crises. The former are shaped by recurrent uncertainty in the US sector, periods in which federal tax credits (again, still mostly temporary) have expired or neared it before ultimately being extended. A raft of projects typically scramble to qualify before these 'cliff edges', imparting a distinctive jagged pattern to US renewables development. Crucially, these politically constructed choke points also become moments of capital scarcity, during which tax equity players wield particular power over inrushes of competing developers and projects.

Tax equity practices have similarly amplified the pain of economic crises for the sector. Over and above outright collapses, major investors have fewer taxes to offset. In 2008 and again under COVID, tax credit cliff edges have inopportunely collided with economic crises (Meyer, 2020; Norton Rose Fulbright, 2020, 2021; Zindler, 2011). During the subprime collapse, several key investors folded and/or left the sector, while most others recorded little income tax liability for a protracted period. Ultimately, exits left only about five players remaining (Knuth, 2018; Zindler, 2011). This constriction choked off tax equity capital for many projects, and enabled remaining players to charge a super-premium—while being even more exclusive in selecting favored projects and developers.

Conclusions

Returning to the opening provocation, the Biden Administration is a potentially transformative moment for the federal tax subsidies and tax equity models explored here—particularly significant given their deep historical roots in the US sector. I conclude with three points towards further understanding the neoliberal legacies that confront these efforts. I underline problems identified here, raise questions about deeper politics involved, and appraise reforms currently proposed.

First, in exploring fiscal exploitation as crucial to US renewables' long neoliberal legacy, I have argued that federal tax subsidies have essentially paid wealthy individuals (in the 1980s) and even wealthier tax equity players (from 2005 to present) to invest in renewable energy on the government's behalf. This tax shelter-based model has offered up US renewable energy for regressive financing practices and problematic distributional outcomes—diversions from the public purse, rentier extractions in project deals, financial gatekeeping in who develops and owns renewables in the United States. The last favors increasing concentration in US renewables development and ownership.

Second, further research is warranted on the *politics* of tax investment, particularly, more granular insights into how the model has navigated shifting currents of austerity and attitudes toward renewable energy. That renewable energy and other social and environmental goods like affordable housing have been effectively classed and offered up together for tax equity exploitation suggests significant negative differentiation and marginalization. As a first cut, all these tax equity-facing infrastructures seem to have purchased embattled public goods via regressive transfers to

wealthy individuals and financial institutions. However, digging deeper raises questions about renewables' shifting political placement, particularly as the sector has become more clearly profitable.

For example, while California wind projects were fought by progressive Democrats like Pete Stark, powerful Statehouse Republicans—already sensing green capitalist prospects—defended renewable tax credits against a 1983 repeal attempt by a newly elected Republican governor (Van Est, 1999). At the same time, Reagan was a firm ideological enemy of wind at the national level, trying multiple times to repeal federal energy tax credits (initially against bipartisan opposition). This went beyond official policies of 'tax neutrality', refusing subsidies to renewables *or* fossil fuels (honored mainly in the breach; Lazzar, 2008). Reagan took pointed opportunities to trivialize wind energy as an expensive boondoggle, vowing to eliminate 'tax loopholes for things like windmills and so-called education cruises on oceanliners' and elsewhere likening windmills to 'jojoba bean shelters…racehorse writeoffs, and Cayman Island trusts' (Reagan, 1985a, 1985b).

More recently, each successive renewable tax credit extension has generated debates (Stokes, 2020). Here, beyond ideological congruence in a low-tax era, tax credits suggest pragmatic advantages for a sometimes-embattled sector. Unlike grants and potentially even refundable credits, current tax subsidies proceed without fighting their case with a Congressional Appropriation Committee (Brown and Sherlock, 2011). One progressive critic expands: 'federal tax incentives have one redeeming feature. To get a tax incentive only takes one vote of Congress while getting any other kind of monetary subsidy requires two votes, an authorization and then an appropriations bill' (Farrell, 2011). Mitchell (2018: 1) frames LIHTC's similar political success as stemming from its ability to garner 'diverse support from constituents who generally shared no mutual interests'. This political work demands more exploration.

Third, and finally, Biden Administration proposals today suggest notable reforms to the practices surveyed here. While extending the ITC to new technologies, in-progress Biden legislation crucially proposes including a direct grant option, and other loosening to diversify private financing. Amidst the subprime crisis, the Obama Administration's Section 1603 program similarly converted renewable tax credits to a direct grant. This stimulus unleashed a major wave of development free of tax equity's extractions and biases, but was allowed to lapse in 2011 (Brown and Sherlock, 2011). New federal grants could mean cheaper capital for many, as well as subsidies for a broader range of projects including public and non-profit developers/owners.

However, current Biden proposals have not pushed a broader rethinking—towards, for example, the expanded direct provisioning and public ownership of the New Deal past. This paper's discussion suggests that removing the worst abuses of tax equity would indeed help make US renewables investment more just, effective, and stable. However, while peculiarities of US tax equity are thrown into relief by mainstreaming trends across the broader sector, financier extractions, gatekeeping, and industry concentration remain overarching concerns. Without more transformative visions, moving US renewables toward international norms may simply lead to different *forms* of rentierism. In conclusion, this discussion highlights an ongoing need to reimagine the state's role in a just energy and climate transition: in making renewables accessible and affordable for all, and ensuring that investment empowers historically marginalized players and sites rather than reinscribing today's legacies of financial exclusion and extraction.

Acknowledgements

Many thanks to Durham University colleagues and to seminar organizers and participants at the London School of Economics, The University of Sheffield, and University of Sussex for thoughtful comments on earlier versions of this paper. Particular thanks to Ben Anderson, Lucy Baker, Jonathan Darling, Rebecca Elliott, Desiree Fields, Cheryl McEwan, Colin McFarlane, Kasia Paprocki, and Helen Wilson. Many thanks also to three anonymous reviewers and the special issue editors.

Declaration of conflicting interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author received no financial support for the research, authorship and/or publication of this article.

ORCID iD


Sarah Knuth https://orcid.org/0000-0002-3053-5394

Note

1. Johannes Poulsen, then managing director of the world's largest windmill manufacturer, Vestas Wind Systems.

References

Aalbers MB (2018) Financial geography I: Geographies of tax. *Progress in Human Geography* 42(6): 916–927.

Baker L (2015) The evolving role of finance in South Africa's renewable energy sector. *Geoforum; Journal of Physical, Human, and Regional Geosciences* 64: 146–156.

Baker L (2021) Procurement, finance and the energy transition: Between global processes and territorial realities. *Environment and Planning E* OnlineFirst. DOI: 10.1177/2514848621991121.

Bigger P and Millington N (2020) Getting soaked? Climate crisis, adaptation finance, and racialized austerity. *Environment and Planning E* 3(3): 601–623.

Bridge G, Bulkeley H, Langley P, et al. (2020) Pluralizing and problematizing carbon finance. *Progress in Human Geography* 44(4): 724–742.

Brown P and Sherlock M (2011) *ARRA Section 1603 Grants in Lieu of Tax Credits for Renewable Energy: Overview, Analysis, and Policy Options*. Washington, DC: US Congressional Research Service.

Burton D (2018) Renewable Energy Finance Forum: Wall Street soundbites. *Tax Equity Times* 12 September.

California Energy Commission (1986) *Solar and Wind Technology Tax Incentive Impact Analysis*.

Castree N and Christophers B (2015) Banking spatially on the future: Capital switching, infrastructure, and the ecological fix. *Annals of the Association of American Geographers* 105(2): 378–386.

Cohen D and Rosenman E (2020) From the school yard to the conservation area: Impact investment across the nature/social divide. *Antipode* 52(5): 1259–1285.

Conard B (2015) Passive activity for tax equity. *Zenergy* 16 January.

Fainstein SS (1994) *The City Builders: Property, Politics, and Planning in London and New York*. Hoboken, NJ: Blackwell.

Farrell J (2011) Federal tax credits handcuff clean energy development. *Institute for Local Self-Reliance*, 5 December. https://ilsr.org/federal-tax-credits-handcuff-clean-energy-development/.

Feldman D and Bolinger M (2016) *Path to the Sunshot: Emerging Opportunities and Challenges in Financing Solar*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-65638.

Feldman D, Bolinger M and Schwabe P (2020) *Current and Future Costs of Renewable Energy Project Finance Across Technologies*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-76881.

Financier Worldwide (2018) Q&A: Capital stacks for investment in the US renewable energy sector. *Financier Worldwide* October 2018.

Garud R and Karnøe P (2003) Bricolage versus breakthrough: Distributed and embedded agency in technology entrepreneurship. *Research Policy* 32(2): 277–300.

Giegerich TW (2012) The monetization of business tax credits. *Fla. Tax Rev* 12(9): 709–826.
Hanchett T (1996) US tax policy and the shopping-center boom of the 1950s and 1960s. *The American Historical Review* 101(4): 1082–1110.
Harrison C (2020) Electricity capital and accumulation strategies in the US electricity system. *Environment and Planning E*, OnlineFirst. DOI:10.1177/2514848620949098.
Hirsh R (1999) *Power Loss: The Origins of Deregulation and Restructuring in the American Electric Utility System*. Cambridge: MIT Press.
Huber M (2013) *Lifeblood: Oil, Freedom, and the Forces of Capital*. Minneapolis: University of Minnesota Press.
International Renewable Energy Agency (IRENA) (2020) *Global Landscape of Renewable Energy Finance 2020*. Abu Dhabi: International Renewable Energy Agency.
Katz E and Nazif O (2019) The rise of the renewable energy fund. *Private Equity International*, July/August
Kay K (2016) Breaking the bundle of rights: Conservation easements and the legal geographies of individuating nature. *Environment and Planning A* 48(3): 504–522.
Keightley M, Marples D and Sherlock M (2019) *Tax Equity Financing: An Introduction and Policy Considerations*. Washington, DC: US Congressional Research Service.
Kennedy SF (2018) Indonesia's energy transition and its contradictions: Emerging geographies of energy and finance. *Energy Research & Social Science* 41: 230–237.
Knuth S (2016) Seeing green in San Francisco: City as resource frontier. *Antipode* 48(3): 626–644.
Knuth S (2018) "Breakthroughs" for a green economy? Financialization and clean energy transition. *Energy Research & Social Science* 41: 220–229.
Knuth S (2019) Cities and planetary repair: The problem with climate retrofitting. *Environment and Planning A* 51(2): 487–504.
Knuth S (2021) Fictions of safety: Defensive storylines in global property investment. In: Ghertner A and Lake B (eds) Ch. 3 in *Land Fictions: The Commodification of Land in City and Country*. Ithaca: Cornell University Press, 62–85.
Lazzar S (2008) *Energy Tax Policy: History and Current Issues*. Washington, DC: US Congressional Research Service.
McCarthy J (2015) A socioecological fix to capitalist crisis and climate change? The possibilities and limits of renewable energy. *Environment and Planning A* 47(12): 2485–2502.
Mazzucato M and Semieniuk G (2018) Financing renewable energy: Who is financing what and why it matters. *Technological Forecasting and Social Change* 127: 8–22.
Meyer G (2020) US renewables look to plug funding gap as pandemic hits tax incentives. *The Financial Times* 12 December.
Mintz Levin (2010) *Renewable Energy Project Finance in the U.S.: An Overview and Midterm Outlook*. https://www.greentechmedia.com/images/wysiwyg/reports/MintzLevin-FINAL.pdf.
Mitchell WR (2018) Sheltering the rich or housing the poor? The story of the Low Income Housing Credit. *Strathclyde Student Law Review* 4(1): 1–22.
Mulvaney D (2019) *Solar Power: Innovation, Sustainability, and Environmental Justice*. Berkeley: University of California Press.
Norton Rose Fulbright (2016) Solar tax equity update. *Project Finance Newswire* April 2016.
Norton Rose Fulbright (2020) Disappearing tax equity. *Project Finance Newswire* August 2020.
Norton Rose Fulbright (2021) Costs of capital: 2021 outlook. *Project Finance Newswire* February 2021.
Peck J (2012) Austerity urbanism: American cities under extreme economy. *City* 16(6): 626–655.
Ponder CS (2021) Spatializing the municipal bond market: Urban resilience under racial capitalism. *Annals of the American Association of Geographers*, OnlineFirst. DOI: 10.1080/24694452.2020.1866487.
Reagan R (1985a) Message to the Congress transmitting proposed legislation, May 29. *Weekly Compilation of Presidential Documents* 21, 3 June, 707.
Reagan R (1985b) Remarks at the Great Valley Corporate Center, May 31. *Weekly Compilation of Presidential Documents* 21, 3 June, 725.
Righter RW (1996) Pioneering in wind energy: The California experience. *Renewable energy* 9(1–4): 781–784.

Sbragia A (1983) *The Municipal Money Chase: The Politics of Local Government Finance*. Boulder: Westview Press.
Shen W and Power M (2017) Africa and the export of China's clean energy revolution. *Third World Quarterly* 38(3): 678–697.
Sherlock M (2018) *The Energy Credit: An Investment Tax Credit for Renewable Energy*. Washington, DC: US Congressional Research Service.
Starrs T (1988) Legislative incentives and energy technologies: Government's role in the development of the California wind energy industry. *Ecology LQ* 15: 103.
Stokes L (2020) *Short Circuiting Policy: Interest Groups and the Battle Over Clean Energy and Climate Policy in the American States*. Oxford: Oxford University Press.
Tapp R (2019) Layers of finance: Historic tax credits and the fiscal geographies of urban redevelopment. *Geoforum: Journal of Physical, Human, and Regional Geosciences* 105: 13–22.
Tapp R (2020) From the state to the shareholder: Rent and the production of shareholder value in real estate. *Antipode* 52(3): 867–887.
Tapp R and Kay K (2019) Fiscal geographies: 'Placing' taxation in urban geography. *Urban Geography* 40(4): 573–581.
Tiller A (2019) Tax equity remains an under-utilized tool for corporate tax strategy. *Bloomberg* 29 January.
Time (1986) Gone with the wind. 20 January.
Tri-Valley Herald (1984) Stark attacks wind power industry as scheme to rip off taxpayers. 22 March.
Van Est R (1999) *Winds of Change: A Comparative Study of the Politics of Wind Energy Innovation in California and Denmark*. Utrecht: International Books.
Weber R (2015) *From Boom to Bubble: How Finance Built the New Chicago*. Chicago: University of Chicago Press.
Williams J, Robinson C and Bouzarovski S (2020) China's Belt and Road Initiative and the emerging geographies of global urbanisation. *The Geographical Journal* 186(1): 128–140.
Yescombe E (2013) *Principles of Project Finance*, 2nd Ed Cambridge, MA: Academic Press.
Zindler E (2011) Cash is king: Shortcomings of US tax credits in subsidizing renewables. *Bloomberg New Energy Finance*, 15 January.