

State infrastructural power through scalar practices: On China's decarbonization endeavors

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journals.sagepub.com/home/epn**Wenyong Fu** 

Department of Geography and Environmental Sciences, Northumbria University, Newcastle upon Tyne, UK

Abstract

To offer a fresh angle on the state capacity to advance decarbonization, this article brings into dialog political economies of scale and the Mannian notion of state infrastructural power, animating this conceptual cross-fertilization with an analysis of China's evolving policy framework for decarbonization. This article begins with building the conceptual construct of scalar practice as a source of state infrastructural power and categorizing three key scalar practices, namely, interscalar rearranging, interregional reshuffling, and urban–rural scalar mixing. Building upon this, the article critically evaluates China's policy framework and state actions against the notion of infrastructural power: the Chinese state applies noncoercive means to elicit support, extract resources, and coordinate actions while transitioning to decarbonization-driven accumulation regimes, and these noncoercive means are mobilized together with coercive means through the art of scalar structuration that (re)defines central–local, urban–rural, and interregional relations. Overall, this study elucidates how state-orchestrated processes of (re)territorialization for the decarbonization agenda give rise to the expansion of the state's autonomous power in relation to civil society, albeit in a manner that manifests contested power struggle and conflicting internal logics.

Keywords

Decarbonization, nation-state, infrastructural power, scalar practices, green energy infrastructure

If there were a Red Queen, we should all quail at her words – from Alaska to Florida, from the Shetlands to Cornwall there is no hiding place from the infrastructural reach of the modern state. (Mann, 1984: 114).

You know, things are moving so damn rapidly. Things are changing so rapidly in the world, in science and technology and a whole range of other issues, that – the question is: In a democracy that's such a genius as ours, can you get consensus in the timeframe that can compete with autocracy? (Biden, 2021).

Corresponding author:

Wenyong Fu, Department of Geography and Environmental Sciences, Northumbria University, Ellison Building, Newcastle upon Tyne NE1 8ST, UK.

Email: wenying.fu@northumbria.ac.uk

Introduction

The socioeconomic movement to fight climate change has been gaining traction since the beginning of the new millennium. Despite current struggles amid the global energy crisis and certain retreats to fossil energy, decarbonization is still accentuated as a long-term solution in climate emergency agendas worldwide. The EU set out its carbon neutrality blueprint in 2019, and China chose to follow suit in 2020, aiming to hit its emission peak by 2030 and reach carbon neutrality by 2060. To the surprise of many international commentators, China and the US—two nations with escalating geopolitical tensions—even agreed to enhance cooperation in climate actions at COP26 Glasgow (BBC, 2021). In 2013, the 12th Five-Year Plan in China proposed that wind power capacity should increase annually by 26% and solar power capacity by 90% (Chinese State Council (CSC), 2013). This policy led to a massive expansion of green energy infrastructure¹ within the state space. While China was criticized for its continued investment in coal power plants in 2020, the global community vigorously debated whether China could become a global green leader.

Ostensibly, China, as a topic of public and scholarly debates in global decarbonization endeavors, could be understood in terms of the state's coercive power—through the use of “authoritarian methods” and “draconian measures,” as framed by Li and Shapiro (2020: 5) in defining coercive environmentalism—to opt out of the high-carbon system (Gilley, 2017; Kostka and Nahm, 2017). Although Li and Shapiro (2020: 6) insightfully acknowledge the predominant use of noncoercive mechanisms such as “centralized and targeted disbursement of research funding, channeling of industrial subsidies and support for state-owned enterprises”—measures that can be equally practised by the so-called liberal capitalist states—the framing of state actions under the terms of *coercive* and *authoritarian* environmentalism nonetheless downplays a growing body of geographical literature with an alternative critique. This literature begins to address *and* problematize decarbonization as a form of infrastructure-led development that enables capital accumulation at the expense of the less privileged (Bumpus and Liverman, 2008; Harlan, 2020), reproduces uneven development in and beyond the boundaries of nation-states (Dunlap, 2020; Webber et al., 2022), and builds upon existing geographical complexities of political economies (Bouzarovski, 2022; Bridge and Gailing, 2020). Undervaluing the practices of state power that are produced and reproduced through noncoercive forms of infrastructural development hinders the potential of China study to generate new theoretical insights.

In light of this, Michael Mann's sociohistorical notion of infrastructural power, *vis-à-vis* the coercive form of despotic power owned by the nation-state, appears resoundingly relevant to the governmentality to “penetrate and centrally coordinate the activities of civil society through its own infrastructure” (Mann, 1984: 114). The Mannian notion of infrastructural power is widely applied in studies of international political economy, with the conjecture that both materialized beings and routinized institutions serve as means for the state to exercise control and regulation over social relations and everyday life within and beyond borders (Kim, 2019; Mann, 1984, 2008; Soifer, 2008; Weiss and Thurbon, 2018). Infrastructural power naturally, albeit less explicitly, embodies the relationship between the central state and subnational actors with which studies on political economies of scale in geography have long engaged (Amin, 2002; Bok, 2019; Jessop, 2002; MacKinnon, 2011; Peck, 2002; Swyngedouw, 1997). As Bridge and Gailing (2020) acutely identified, studies in international political economy are limited by the way scalar relations are obscured, while this “constitutive role of space” (Bridge & Gailing, 2020: 1038) is taken up by geographers studying infrastructure and, more recently, energy infrastructure and transitions.

This article brings these two key notions, namely, state infrastructural power and scalar politics, into dialog and aims to make two key interventions animated by an analysis of China's decarbonization endeavors. First, I develop a new species, the scalar practices defined as the state's capacity to mobilize scalar relations, under the genus of infrastructural power. A review of contributions from political economies of scale allows me to propose three types of scalar practices: interscalar

rearranging, interregional reshuffling, and urban–rural scalar mixing. With decarbonization as a new paradigm of accumulation regime, the three scalar practices foreground the state’s infrastructural power to invigorate, accommodate or compromise growth at the level of subnational regions.

Second, I critically evaluate China’s decarbonization agenda against the notion of infrastructural power as the key manifestation of state capacities for engineering new accumulation regimes. Unlike conventional infrastructure, such as roads, dams and railways, green energy infrastructure consists of rapidly evolving hardware artifacts and production regimes that demand, in turn, the state’s scalar practices of governance by dynamically reconstituting the domestic institutional landscape. Using China’s decarbonization endeavors as a case in point, this article offers a fresh angle of the state’s capacity to advance the decarbonization agenda by mobilizing not only centralized coercive signaling but also centralized infrastructural power.

The following section discusses how the new decarbonization-driven accumulation regime triggers a process with inherent tensions that simultaneously reinforce and destabilize the established sociopolitical configuration, based on which I argue that state capacities are manifested through both facilitating market creation and managing crises. To understand the capacity of the central state to use noncoercive means to penetrate society, the third section draws attention to the studies on state infrastructural power; this is followed by the fourth section, which identifies three types of scalar practices as sources of state infrastructural power. The fifth section critically reevaluates the evolution of the Chinese policy framework for decarbonization, contemplating how scalar practices feed into the state’s autonomous power in relation to civil society. Finally, I summarize the contributions of this research and provide insights for future research agendas.

Decarbonization, accumulation regime, and state capacities

Among the many influential theories that elucidate social relations underlying economic forces, including the French regulation approach (Boyer, 2000; Jessop, 2013) and Neo-Marxian approach (Conroy, 2023; Fraser, 2018), the accumulation regime is the sociopolitical configuration *made* compatible and interdependent with economic functioning despite independent operational logics. If we further take the state as “the political form of capitalist social relations” (Alami and Dixon, 2023: 84), a decarbonization-driven regime could be enabled through the state’s efforts to reconfigure sociopolitical relations to sustain capital accumulation. In the face of an overaccumulation crisis, revived developmental states—characterized by a high level of market participation by the state and industrial policy coordination—are eager to shape the market potential of decarbonization by investing in green energy infrastructure (Organisation for Economic Co-operation and Development (OECD) (2013), facilitating industrial ecosystems (Kim, 2019), and securitizing and financializing commodities and assets related to decarbonization (Mathews et al., 2022). Within the decarbonization-driven accumulation regime, the capitalist expansion of valorizing the low-carbon nature is a process with inherent tensions that simultaneously reinforce and destabilize the established sociopolitical configuration.

On the one hand, capitalists eagerly embrace the opportunities to expropriate the new form of “cheap nature,” including renewable energy as well as the underutilized land resources that embody this energy form. The capitalist expansion is further driven by the cross-emulation of state capitalism (Alami and Dixon, 2023), in which geoeconomic competition is connected to the state capacity to scale up the green economy and thus dominate strategic supply chains. With the rapidly evolving hardware artifacts and technological parameters in green energy infrastructure, however, such a hybrid state-capitalist push for decarbonization-driven accumulation engenders crisis tendencies. This is reified by China’s experience as a case in point.

First, large-scale energy infrastructure motivates a myriad of economic actors to continue debt-driven growth through convenient access to financial credit in China. As an emerging strategic industry, solar photovoltaic (PV) manufacturing received high levels of loans from the banking sector with

the launch of a 4 trillion RMB stimulus package following the 2008 financial crisis (Zhang et al., 2014). Local state corporatism features interregional competition to submit developmental results through unaccountable debt-raising capacities, and this trend could become problematic precisely because of the propensity to transfer system-level financial fragility to the central state (Ansar et al., 2016) and of the susceptibility to macrolevel economic restructuring (Xue and Wu, 2015). To a certain extent, the proliferation of green energy infrastructure investment reinforces the previous regimes of infrastructure-led growth, which are inclined toward generating a high level of debt (Liu et al., 2022; Tsui, 2011). Second, debt-driven overinvestment ushers in overproduction that demands ongoing technological and spatial fixes to absorb excess capacities (Harvey, 2007). In China, previous rounds of hard infrastructure development since the new millennium have already produced surpluses in cement, steel, and construction-related equipment. Renewable energy products, *inter alia*, have experienced rapid growth in production capacities through state subsidies and low-cost financing, with the solar PV capacity of China, for instance, approximating 150% of global demand in 2012 (European Commission, 2013).

On the other hand, compared to the postwar energy transition from *King Coal* to oil and gas, the low-carbon transition features much lower levels of energy return on investment than those obtained from fossil fuel energy (King and van Den Bergh, 2018). Therefore, on the level of global capitalism, a low-carbon transition generally elevates energy and production costs for most firms in the short to medium term, exposing the whole capitalist system to a greater risk of an overaccumulation crisis if not remedied with technological fixes to enhance energy efficiency in the production and consumption spheres. As in the historical energy transition, frictions in the low-carbon energy transition tend to create an uneven spatial terrain of tensions and pressures in the crisis-prone accumulation process. This geographical unevenness was manifested in the last round of energy transitions, including the US's partial reversal from an oil- to coal-based economy in the 1970s due to considerations of energy independence and price stability (Brathwaite et al., 2010), as well as the UK's long-lasting dominance of the coal-mining industry and its affiliated labor power through the National Union of Mineworkers until the 1970s (Garavini, 2022).

More notably, social unrest and class struggles are likely to increase during the green transition and include land grabbing (Dunlap, 2020) and exploitative and insecure labor practices (Bouzarovski, 2022). To ensure political legitimacy, the state seeks to mitigate social unrest during decarbonization. Atomized Chinese wage laborers, most of whom are rural-to-urban migrants constrained to undertake collective bargaining (Franceschini and Nesossi, 2018), are forced to lose their source of income because of the declining profits of urban industries, which are further aggravated by decarbonization efforts.

To summarize, capitalist accumulation under a low-carbon energy transition is a paradoxical dialectic, expanding on the logic of infrastructure-led growth while posing overaccumulation risks in existing areas of production. In view of this, the state capacity to engineer the decarbonization-driven accumulation regime embodies not only central coordination and effective facilitation of newly created low-carbon markets but also the capacity to ride the coattails of a sociopolitical crisis. Although such capacity inherently includes the violent practices of coercion—which Gilley (2012) defines as the key differentiated feature of authoritarian environmentalism, which involves little consultation with or participation from society in contrast to democratic environmentalism—it is also vital to consider state capacities in light of pursuing opportunities by expanding the infrastructural power that penetrates civil society. Indeed, noncoercive means are essential for the state in testing, regularizing and stabilizing new sociospatial relations that are central to accommodating an emerging accumulation regime under decarbonization. In the following section, this perspective will be brought into dialog with the notion of state infrastructural power developed by Mann and his followers in international political economy.

State infrastructural power

The infrastructural power of the state lies crucially in its capacity to advance agendas *through*, not over, society (Mann, 1984). Infrastructural techniques, including artifacts, rules, and institutions, are used by modern states to maintain “the logistics of the political control” (Mann, 1984: 192). Infrastructural power encompasses both “the relations between state leaders and their officials” and “the relations between state and society” (Mann, 2008: 356). Therefore, state infrastructural power simultaneously manifests and mobilizes the sociopolitical configuration of the accumulation regime.

In Mann’s (1984) view, the state’s autonomous power derives first from its regulatory role in binding together strangers for daily transactions and societal coordination and further grows by exploiting this functionality of delivering social utility. Throughout the history of capitalist development, the state’s role in economic life has extended far beyond building institutions to developing areas of macroeconomic stabilization (Weber, 2021), building up national industrial competitiveness (Kim, 2019), coordinating structural economic change in response to external pressures (Kanai and Schindler, 2019), and resolving (transnational) capital-labor conflict via provisional arrangements of coercion and consent (Werner, 2021). Mann (1984: 197) provided insight into this multiplicity of state roles:

[And] they bring the state into functional relations with diverse, sometimes cross-cutting groups between whom there is room to manoeuvre. The room can be exploited. Any state involved in a multiplicity of power relations can play off interest groups against each other.

To expand into multiple roles and exert power through society, the modern state has developed a myriad of organizational means (Mann, 1984; Soifer, 2008; Weiss, 2006), ranging from hard infrastructure (e.g. transportation and telecommunications) to routinized regulations (e.g. taxation systems) and governance modes (e.g. public–private partnerships). Mann’s thesis further reflects the state-society dialectical movement, in which the state attempts to appropriate infrastructural techniques developed as the fruit of “human beings’ increasing capacities for collective social mobilization of resources” (Mann, 1984: 193).

Recognition of state-society relations goes beyond the Weberian notion of the state/market divide, in which Weber highlighted administrative and hierarchical bureaucracy as the fundamental organizational means of modern states (Weber, 1958), yet the Mannian vision is still limited in accounting for the deeply entangled state-market hybrid in the context of the heightened exposure to global environmental crises and competitions combined. In the emerging context of globalization, Mann (1997) further analyzed whether this trend would weaken state capacity. While admitting that the findings are mixed globally, he asserted,

If world development stalls, then so will the extension of the nation-state; indeed, some “paper” nation-states may collapse. But if development is possible, it will occur in those countries which most resemble nation-states and it will in turn enhance them. (Mann, 1997: 488)

Here, Mann (1997) implies how capitalist development feeds into the power of the state. Weiss (2006) extended Mann’s notion of infrastructural power in the framework of *governed interdependence* (GI). GI adds to the functionality of the state by justifying its role in coordinating responses in the face of external stimuli and further carves out a special interest community in which the state takes the lead to “extract and exchange vital information with producers, stimulate private-sector participation in economic projects, and mobilize a greater level of industry collaboration” (Weiss, 2006: 168). This corresponds with recent debates in geography on uneven and combined state capitalism (Alami and Dixon, 2023), where state logic and market-oriented profitability are co-constitutive. The ensuing question is how the state manages to maintain and gain its autonomous power in this ever-expanding partnership.

Table 1. State scalar practices.

	Interscalar rearranging	Interregional reshuffling	Urban–rural scalar mixing
Specifics of application	Decentralizing centrally defined parameters (e.g. GDP, environmental performance)	Maneuvering subnational regions to accomplish historical tasks of capital accumulation	Empowering rural unit with infrastructure provisions to a point that approximates those of urban units
Functions qua IP	Motivating	Balancing	Stabilizing
Chinese characteristics enabling the practice	Nomenklatura personnel system; State-capital hybrid	Muscular form of statism (e.g. spatial development plan)	Collectivization of rural land as communist legacy

Source: The author.

The crisis tendencies in the decarbonization-driven accumulation regime, as illustrated above, inextricably dictate proactive state rescaling to accommodate and negotiate susceptibility to change. While scholars engaging with the concept of infrastructural power contend that state power rests on the organizational means of territorial control, the scalar practice of orchestrating state-society relations is rarely discussed. Prior to reevaluating infrastructural power in and through decarbonization, it is necessary to establish the logic of how scalar practice serves as a source of infrastructural power.

Scalar practice as a source of infrastructural power

The conceptual metaphor of the *scalar fix* emerges in response to state rescaling in the face of deepening globalization (Harvey, 2001), highlighting the role of territorial states in enabling and managing capitalist social relations. The scalar fix concept embodies “a strategically functionalist purpose to illustrate important structural dimensions of capitalism” (Bok, 2019: 1102). Epistemological registers of geographical scales have shifted since the 2000s from the site of power struggles to the means of state agency to define, orchestrate and strive for control, rekindling interests in the reasserted role of the nation-state (Alami and Dixon, 2023; Lim, 2019; MacKinnon, 2011; Peck, 2002).

Table 1 proposes three scalar practices by the central state, in which I submit that scalar practice constitutes a type of organizational means through which the state is able to “provide centrally coordinated services” (Weiss, 2006: 172). The functions of the three scalar practices in terms of infrastructural power are to motivate bottom-up initiatives for implementation of the state agenda; to balance tensions among different regions, sectors, and regimes of accumulation; and to stabilize unrest generated by periodic crises of accumulation. Furthermore, Table 1 presents the Chinese characteristics that enable and entrench these scalar practices, which may vary in ways or degrees between different national contexts. For example, the EU seeks to enhance state capitalism with stronger support of state aid to foster energy transition in the race with the US and China, but this practice inevitably weakens the bloc’s territorial control that integrates the member states through a historically defined competition rule (Wilks, 2005). Therefore, recognizing these geographically specific characteristics helps us move beyond Chinese exceptionalism and methodological nationalism while foregrounding the contextualized and evolutionary nature of sociopolitical configurations in accumulation regime.

Interscalar rearranging

Under the transition to a Schumpeterian workfare state (Jessop, 2013), the “interscalar rule regime” (Peck, 2002: 333) has been accompanied by increasingly asymmetrical power relations between the central and the local state. As aptly pointed out by Peck and Tickell (2002: 386), “local institutions

and actors were being given responsibility without power.” Meanwhile, the “productivist state capitalist impulse” (Alami and Dixon, 2023: 18) prompts the state to motivate place-based efforts to enable and facilitate capitalist accumulation.

Central-local dynamics are instituted through a dual process of top-down policy directives and bottom-up policy entrepreneurialism. On the one hand, the central state defines key developmental tasks and employs technocratic tools to institute “reform at a distance” (Peck, 2002: 332). The governing tactic, termed “experimentation under hierarchy” by Heilmann (2008) in the context of China, enables the party state to maintain systemic stability while advancing the national agenda. In the UK, the fundamental role of the central state in defining priority areas is asserted through the parameters of the central funding scheme and centralized regulatory power (Dawley et al., 2015). On the other hand, bottom-up actions reinstate a neoliberal logic of policy entrepreneurialism. Local governments form growth coalitions with private firms and developers premised upon localized social relations for value capture (Park, 2009).

State infrastructural power is, to a great extent, dependent on the enforced power to ensure the subordination and cooperation of these localized growth coalitions. In the Middle Eastern regimes, decentralization is framed with reform narratives by the central state to not only “satisfy and contain the civil society” but also “manage the opposition of relevant [local] elites” (Vollmann et al., 2022: 365). For the Chinese central government, a critical means to inform, monitor and incentivize local officials is the Communist Party’s nomenklatura system, which appoints officials between different administrative levels and geographical areas (Edin, 2003). Furthermore, since the 2010s, marked by the global rise of state capitalism (Alami and Dixon, 2023), state-capital hybrids (e.g. central state-owned enterprises and development banks) constitute a crucial economic tool through which the central state is able to advance industrial policy goals and broader social agendas (Chen et al., 2023; Kim and Sumner, 2021).

Decentralization feeds into the center’s economic and material power but simultaneously generates pressure for the center to wrestle with the centrifugality arising from myriad localized growth coalitions (Chung, 2016; Kupchan, 2012; Rolf, 2019; Zhong, 2001). To maintain control, decentralization involves the state’s strategic selectivity in discreetly choosing the domains of reform and the appointed localities with institutional advantages (Heilmann, 2008; Vollmann et al., 2022). In sum, this creates an interscalar dialectics, as many scholars aptly capture with arguments such as “recentralizing while decentralizing” (Ribot et al., 2006: 1864) or decentralization becoming “a function of centralization” (Lim, 2019: 203).

Interregional reshuffling

The area of selectivity further relates to the second scalar practice, through which growth opportunities are strategically reshuffled among subnational regions. Accompanying the neoliberal transformation, inter-locality competition has been mobilized as a dominant discourse and practice, which substitutes evaluations of unique places with metric-driven locations succumbing to the interests of “the mobility requirements of capital” (Phelps and Wood, 2023: 2). Under this circumstance, inter-regional relations become hostile, rendering a fragmented geography that is readily subject to orchestration from extra-local rule regimes (Peck, 2002).

The spatial practice of interregional shuffling goes beyond an in-situ construction of an ad hoc regional model but rather constitutes a dialectical process of geographical reconfiguration. Vertical central-local arrangements reconfigure sociopolitical relations that motivate local efforts in selective areas, but they simultaneously generate overaccumulation and debt risk (Liu et al., 2022; Nakatani, 2023), rendering imperative the scalar capacity to loosen horizontal geography to ease the pressure points of overaccumulation. Such function is practised through spatial development strategies as a muscular form of statism (Alami and Dixon, 2023). More importantly, the spatial development plan

exhibits a high level of spatial-institutional selectivity in areas of macrospatial programs for capitalist development (Stepputat and Hagmann, 2019), endorsements of free trade zones (Capik, 2013), and centrally coordinated pilot programs (Lim, 2019).

Although spatial balancing has been widely used in policy narratives—from China’s “Great Western Development” strategy, through the UK’s “Leveling up” strategy, to the EU’s Structural Fund Scheme—the actual practices in reality turn out to be not so much a sociospatial goal of equality as a *means* through which crises were to be mitigated and transferred, with place-based long-term interests sidelined as secondary. For example, the “Great Western Development” strategy in China only started to materialize in the hope of generating infrastructure-driven growth when the export-based accumulation regime became untenable (Lai, 2002). It took a devastating financial crisis in 2018/2019 for Westminster in the UK to ultimately realize the unsustainability of finance-led capitalism and consider, to some extent, rebalancing the UK’s economy to restore manufacturing-based export capacity to counteract financial trade loss (Lavery, 2018).

Urban–rural scalar mixing

A less mentioned state scalar practice is the use of urban–rural scalar mixing. In studies on political economies of scale, the focus has overwhelmingly been on cities as “a site of network practices” (Amin, 2002: 393) and as “points of translation and transmission in the economy of distanced organisation and flow” (Amin, 2002: 395). However, it is rarely discussed how the vast rural hinterland is socially reconstructed and mass mobilized. Indeed, agriculture-based rural development is closely related to the key construct of state infrastructural power identified by Mann (1984), namely, territorial centrality, because industrial and commercial sectors are relatively footloose.

The nation state, not least in the developing context, attempts to accommodate the urban–rural relations with the ebbs and flows of capital accumulation. During an upward economic cycle, the state encourages a massive scale of rural–urban migration, leading to rural depopulation and infrastructural deterioration (Webber, 2008). When an overaccumulation crisis emerges and further intensifies, infrastructural power is intentionally inscribed into rural areas as either a stabilizing container of capitalist crisis through providing everyday subsistence (e.g. during the employment crisis as shown by Wen, 2013) or as land resources for expropriation to extend further accumulation (Barney, 2009).

In many countries, the nation state employs open coercion, state-backed strongmen, racialized politics, and land use planning in rural areas to acquire stronger infrastructural power over rural resources and land (Vandergeest and Peluso, 1995; Woods, 2020). Even in China, with the massive collectivization of rural land as a communist revolutionary legacy (Chen et al., 2023), which enables the state to leverage vast rural areas, myriad measures are still in place to enforce state-governed collectivization on the ground. According to Chen et al. (2023), the central state developed a range of governing tools, including auditing, subsidies in infrastructural bidding, and performance evaluations, to ensure the consistency of rural collective units’ actions with national objectives.

In summary, the key inquiry emerging from the decarbonization-driven regime is not only the possibility that the central state may again invoke previous scalar practices but also how the shift to decarbonization deepened and reshaped these scalar practices to penetrate civil society. The next section will consider this topic.

Re-evaluating China’s decarbonization endeavors through the state’s scalar practices

In what follows, I will reevaluate the evolution of the Chinese policy framework (Figure 1) from the perspective of how the state adopts and adapts the three scalar strategies in and for decarbonization. Notably, some of the policy measures identified in Figure 1 are coercive in nature, including the

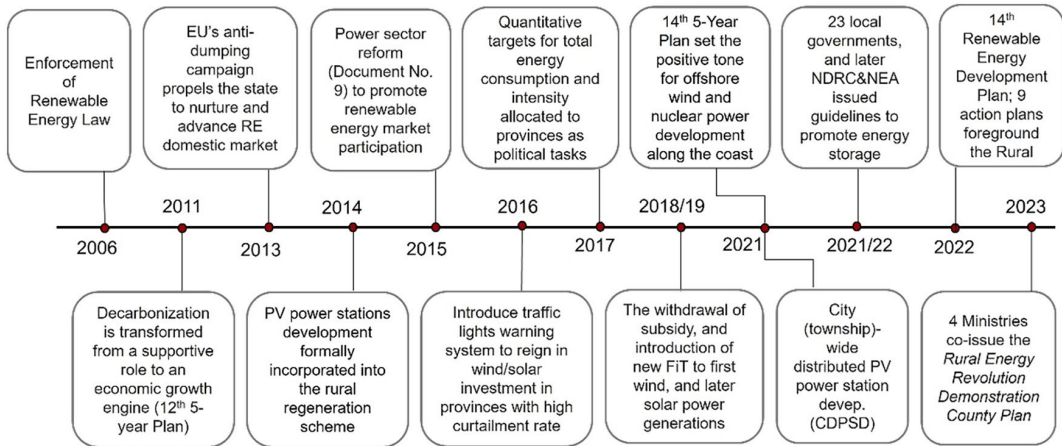


Figure 1. Milestones of decarbonization-related state policy in China since the 2000s.

Source: Chinese State Council Policy Archive²; author's summary.

traffic light warning system and quantitative targets. By foregrounding noncoercive infrastructural power, I further highlight the temporal co-constitution of coercive and noncoercive state practices, as well as the unexpected consequences for the central state when employing both types of practices.

To set the context, China's industrial capacity in green energy has been nurtured by both indigenous innovation and trade and FDI relations with European partners since the late 1990s (Harlan, 2023; Huang et al., 2016). In the 2000s, while the pioneering wind turbine sector was first supported with foreign aid and later facilitated by nation-level S&T policy and state-coordinated marketization (e.g. concession bidding and local content requirements), the rapid expansion of the solar panel sector was driven mainly by entrepreneurial activities and the support of local governments (Huang et al., 2016). In 2011, China's 12th Five-Year Plan listed the new energy sector as one of the national strategic industries, signaling that decarbonization had been transformed from auxiliary "cleaning" industries into an economic growth engine (Figure 1). Although the wind industry has been developed since the implementation of the Renewable Energy Law in 2006, the promotion of the scale operation of wind and solar power was first mentioned in 2011 in the Five-Year Plan. Further prompted by the antidumping campaign in the EU in 2013, the renewable energy industry began to cater to the domestic market with stronger policy support.

Interscalar rearranging in and for decarbonization

State action on the market formation of renewable energy was shaped first by the active lobbying of local governments and private entrepreneurs, especially in setting up feed-in tariffs that follow the German model. Notably, this later evolved to include not only authoritative rule-setting and fiscal incentives through subsidies but also a decentralization of power station development that mobilized local governments—through cadre performance evaluation by the nomenklatura system (Kirkegaard and Caliskan, 2019)—to profit from not only renewable power generation but *also* land value capture. Until 2017, utility-scale solar plants accounted for over 80% of the total solar installation capacity (Hove et al., 2021). This opportunity was seized particularly by local governments in the resource-rich peripheries to commodify their natural resources and to expand the land revenue regimes primarily through one-off land lease income (Harlan, 2023).

Decentralization serves the state's agenda of *swiftly* nurturing the domestic renewable energy market. Such swiftness is pressured by looming imperatives to absorb the overcapacity of wind turbines and PV production through utility-scale plant development. Noncompliance, which Wedeman (2001) suggested to be coercively controlled, is even deliberately emboldened in the decentralization stage. However, local enthusiasm leads to a high curtailment rate of wind and solar power; for example, in some provinces, such as Gansu, the wind curtailment reached over 40% in 2015. The fervent investment rush of local governments, coupled with central SOEs seeking to occupy a larger market share by holding onto scarce wind resources (Zhu et al., 2019), compelled the state to introduce a traffic light warning system in 2016 to cool down the overheated investment (Figure 1). In this case, the coercive measure constitutes a response to the inherent crisis created by noncoercive practices in a specified timeframe of market expansion. Such a short-term investment boom further revoked Harlan's (2023) notion of precarity, which he uses as an enclosure of the low-carbon frontier through which decentralization serves the state agenda of decarbonization but not necessarily enable localities to capture sustained development.

The high curtailment rate of wind and solar power in the northwestern provinces considerably constrained the decarbonization goal. This is largely attributed to the highly rigid power market in which the price and (most) quantity of electricity are planned annually by national and provincial governments (Guo et al., 2020). Paradoxically, the state goals of delivering electricity at low prices by rigid planning hindered the accomplishment of market creation, as the collection of in-time demand and interprovincial market exchanges of renewable energy is not viable despite the central state's urging of coastal provinces to purchase wind and solar power from the northwestern provinces (Guo et al., 2020).

In 2015, China undertook power market reform to, *inter alia*, increase the integration of renewable energy. According to Davidson and Perez-Arriaga's (2020) evaluation, the reform did not yield many significant outcomes. As intuitively noted in their analysis of the reform's pitfalls, the Chinese model of the developmental state, where economic powers are concentrated in key ministries to "meet central strategic goals" without strong independent regulators to collect information and set market rules (Davidson and Perez-Arriaga, 2020: 133), constitutes the root cause of chronic curtailment within renewable power expansion. Because of vested interests among provincial governments and grid monopolies (Davidson and Perez-Arriaga, 2020; Zhao et al., 2013), the reform cannot truly decentralize the system to delegate power to participants (e.g. retailers) in newly created markets. In this case, a too muscular form of party statism—which penetrates deeply into economic realms and leaves limited room for regulatory independence (Davidson et al., 2017)—affirms the state infrastructural power in terms of accruing capital in the early stage of market creation but simultaneously challenges it in the later stage of market expansion and integration.

To further overcome wind/solar power overcapacity and inefficient interprovincial transactions, the policy focus then shifted from utility-scale power plants to distributed energy within built-up areas. Interestingly, this model of distributed energy featured a "shift from an extensive, central layout . . . to one in which consumers and prosumers actively participate in energy production" (Hove et al., 2021: 2). Enabled by this technological configuration, models of decentralized energy generation have emerged in the Global North (Becker and Naumann, 2017), with new forms of organization such as unionized cooperative enterprises (Webber et al., 2022).

Indeed, the number of "prosumers" in distributed energy were increasing in China, with 26 experimental projects launched in the local electricity market in 2019, yet this movement has encountered difficulties. With the decreasing technological cost of solar/wind energy infrastructure, the nontechnological costs—including land, financing and grid-connecting license fees—are repeatedly heightened in policy documents as a significant barrier to the expansion of renewable energy. These nontechnological costs reflect the noncompliance of local governments and regional grid operators (Hove et al., 2021). To address this dilemma, in 2021, the central state launched a round of

experiments called *city (township)-wide distributed solar power station development (CDPSD, 分布式光伏整县开发)*. The *city- and township-wide* framing conveys the upscaling of the distributed energy model while arousing concerns about elevated entry barriers and the monopolization of market power. When the National Energy Administration (NEA) issued this policy document, it simultaneously copied it to the 10 national energy monopolies, signaling legible information in appointing them as key agents of implementation.

The negotiation costs inherent in high-rise buildings with shared rooftop space justify the domination of state actors in the configuration of the renewable energy market. Taking control of infrastructural development rights is fundamental for SOEs to govern the production value chains of renewable energy (e.g. establishing technological standards and prices).³ The legitimacy of this recentralization was inadvertently gained from central-local power struggles: the bargaining power of state-backed actors against local governments was pivotal for the rollout of distributed energy. Via state-capital hybrids, the state gained and expanded its autonomous power to harness green energy infrastructure.

The dominance of SOEs, not least those administered at the central level, was further reinforced when many local governments in 2021 started to request wind and solar power plant investment to install 5%–15% of energy storage in total capacity. In 2022, the NEA/NDRC further issued several guidelines to promote the development of new energy storage (Figure 1). Although energy storage helps to enhance the effective utilization of wind and solar power, many domestic firms have already started to struggle to make ends meet after the withdrawal of subsidies in 2019. The post-2020 renewed expansion of solar, wind, and hydropower dominated by SOEs is also an outcome of the central-local power struggle, as local governments strive to secure local economic interests by requesting local content in energy infrastructure, pushing central SOEs to further squeeze the market space of private firms in downstream industries.

Interregional reshuffling in and for decarbonization

Through interscalar rearranging, the key capacities of the state in the decarbonization regime transition could create friction with one another (e.g. the provision of societal coordination in electricity production versus the creation of new energy markets), or result in cacophony within different stages of single capacity development (e.g. regulatory vs developmental functionality in the processes of creating a market). In this sense, state infrastructural power as a vigorously expanding register is not pre-given but could be complicated and disturbed by its internal logics. Such internal logics create unevenness not only between sectors and actors but also between regions.

One key example is power market reform, which was discussed before, and how it provides room for market reform for some provinces but not others. In 2015, eight provinces, namely, Guangdong, Zhejiang, Shandong, Fujian, Sichuan, Neimenggu, Shanxi, and Gansu, were chosen as pilot spot markets. These provinces were carefully selected and paired as either surplus (renewable) energy generators or net consumers. Maintaining an experimental and selective nature of the power market reform is essential for improving the geographical supply-demand imbalance by instituting more efficient market signaling without shaking the interests of regional grid monopolies.

A notable simultaneity with the power market reform is the introduction of *quantitative targets for total energy consumption and intensity (QTTECI)* in 2015, which further materialized through specific goal assignment in 2017 to provinces as political tasks. Enhancing carbon energy prices is vital, especially when the Chinese state planned to withdraw subsidies for wind/solar power stations in 2019. Measures of QTTECI are implemented through state signaling in a more coercive manner that is akin to the despotic power described by Mann (1984) in contrast to infrastructural power. This coercive approach includes site visits by ministerial officials that may endanger the political career of local officials in a nomenklatura personnel system, requirements that coal-fired thermal plants operate at a loss, and the imposition of fines on energy-intensive firms that operate beyond a given energy

consumption limit. The coercive measures to mandate QTTECI further forced the advanced coastal regions to purchase more electricity from interior regions, which eased the severe overcapacity of wind and solar power. Interregional shuffling, in this sense, goes beyond state-financed spatial balancing. In this case, the scalar practice features an interregional co-constitution of centralized coercive signaling (QTTECI for coastal regions) and centralized infrastructural power (development rights for interior regions and reform rights in the power market for coastal regions), in which the market for renewable energy is created and facilitated through instituted uneven geography.

Unexpectedly, the coercive QTTECI measures are ineffective to a certain extent because of non-compliance (Kostka and Nahm, 2017). While green energy infrastructure expansion via utility-level plants valorized the land revenue regime in the northern and western regions, the following quantitative constraints on energy consumption restricted the growth potential of localities in the southern and eastern regions. Although renewable industries are concentrated in these advanced regions, their smaller share in the upstream renewable energy market limits their gains in the growth of the domestic market.

Noncoercive practices then occurred when coercive measures led to noncompliance with the environmental goals set by the central state. To alleviate interregional tensions, growth opportunities were reshuffled between economically advanced regions and lagging regions. The 2021 CDPSD, by encouraging the upscaling of distributed power stations, provided the impetus for highly developed city regions because (1) they are the consumption centers of electricity, which would be less confined by the sociotechnical barriers of grid networks despite limited power market reform, and (2) they are a mature industrial base for renewable energy production (Gilley, 2017), providing ample opportunities for meeting the local content requirements. Therefore, these advanced regions attract more central SOEs to launch CDPSD projects. It could be argued, then, that city regions with greater chances of successful outcomes in decarbonization-led growth are more likely to comply with the disciplinary mechanisms of the central state.

In the spatial development plan introduced by the 14th Five-Year Plan in 2021, coastal regions have been further designated as the forefront of offshore wind power and nuclear power development. According to media reports, middle Yangtze River regions such as Hunan and Hubei, which have been bypassed in opportunities for wind/solar power expansion and the following distributed energy projects, have long been lobbying for nuclear development since the 12th Five-Year Plan, while the central state has hesitated because of nuclear safety considerations.⁴ Notably, the geographically uneven policy has led to the revival of coal-fueled power plants in certain places, epitomized by Hunan Province's 14th Five-Year Plan which plans to expand coal-power capacity to 33 GW to meet electricity shortages.

Alongside power struggles from local governments, central SOEs function as infrastructure developers and lead firms in value chains, granting the state maneuvering room to pit local business interest groups against local governments, thus weakening local public-private coalitions that stand against stricter environmental governance. The resulting extent of centralizing power is nevertheless a spatio-historical variation in local growth coalitions, yet through interregional reshuffling, the central state gains discretionary power in this combined geographical process.

Urban-rural scalar mixing in and for decarbonization

Figure 1 shows that the Chinese state incorporated solar power development into the rural regeneration scheme in 2014. Rural development driven by renewable energy is regarded as a way to increase domestic market potential and promote agricultural development. From the perspective of state infrastructural power, a commodifying nature legitimizes the scalar practice of urban-rural scalar mixing because wind/solar power provides a potential means of survival in vast rural areas.

In the face of slowing economic growth and migrant workers returning to their homelands, rural collective land is susceptible to assetization and capitalization to cushion urban unemployment. In 2022, nine key action plans, five of which concentrated on rural areas, were identified in the 14th Renewable Energy Development Plan. In the document, green energy infrastructure, including small-scale wind farms, distributed solar power, bioenergy stations, and power grid upgrading, is regarded not only as service provision but also as the means to increase income and provide job opportunities. In 2023, four Chinese ministries jointly issued the *Demonstration County Plan for Rural Energy Revolution*, which presents a plan to reach 30% of renewable energy in energy consumption in the counties selected for this policy experimentation.

Notably, the development of green energy infrastructure in rural area follows the CDPSD model (Figure 1), in which the county administration issues the whole package bidding plan for the rural collective land. Similar to the rolling out of CDPSD in urban areas, SOEs again take a leading role in scaling up the green energy infrastructure in rural areas. Although it is claimed in the policy document that SOEs undertake this as a political task and operate on a negligible profit margin, it remains unclear how individual farmers and rural households are able to determine and negotiate the specific terms of collective land use (e.g. agricultural/forestry/horticultural vs energy production). Political imperatives that framed green energy-driven rural regeneration as a *revolution* (Figure 1), coupled with corporate interests to capitalize as much land as possible for energy value capture, leave little room and time for grassroots rural actors to reflect, bargain, and decide what works best for their land.

Even if rural households regard green energy infrastructure as a viable way to provide basic income within a wider context of increasing urban unemployment, transforming wind/solar energy into a means of survival still places significant demand on infrastructural support (e.g. a high-quality grid network) and rural household input (e.g. mortgages for installation and maintenance of panels). Hence, against the new context of enhanced state-capital hybrid penetration into rural areas, this scalar practice is less straightforward than it was in the prereform era. Despite the difficulties of yielding effective gains, green energy infrastructure still serves as a rhetorical and symbolic sign of the state's intended efforts to stabilize crises.

Discussion and conclusion

In this study, I have developed the conceptual construct of scalar practice as a source of state infrastructural power and have categorized three key practices, namely, interscalar rearranging, interregional reshuffling, and urban–rural scalar mixing. Building upon this, the paper has contributed to the current debates on decarbonization by critically evaluating China's policy framework and state actions against the notion of infrastructural power: the Chinese state applies noncoercive means to elicit support, extract resources, and coordinate actions in the transition to decarbonization-driven accumulation regimes, and these noncoercive means are mobilized together with coercive means through the art of scalar structuration that (re)defines central–local, urban–rural, and interregional relations. I further reify Mann (1984)'s notion of multiplicity of state functions through the analysis of China's decarbonization efforts, crystallizing the state's newly emergent roles as market enabler, renewable power resources owner, lead firms, and crisis manager through scalar practices. The state's expanding roles into multiple dimensions of everyday life further reinforce its autonomous power in relation to civil society, as this provides possibilities for the state to exploit and mobilize diverse power groupings.

Returning to the second quote at the beginning of this article from Joe Biden, does autocracy outperform democracy with respect to governing climate changes and the precipitating changes of accumulation regimes? Green energy infrastructure development is by no means insulated from coercive state power. In the case of China, the coercive power that ensures the compulsory cooperation of nonstate actors is not necessarily violent but is reflected by the monopolistic power of stakeholders

within state-owned sectors over others. This is not to claim that SOEs, one of the key facilitators in the decarbonization agenda, do not work with market logic; rather, coercive power bolsters access to production factors that enable them to endure short-term pains for long-term gains in the transition to decarbonization (see Zhu et al., 2019). Coercive measures, as shown by the policy analysis, are vigorously implemented on a large scale to contain the inherent crisis and failure engendered by noncoercive measures. In turn, state infrastructural practices are established in response to instances where coercive practices face noncompliance from local actors. Furthermore, the policy analysis implies an interregional co-constitution of centralized coercive signaling and centralized infrastructural power for market creation and expansion. In the critical developmental conjuncture of transitioning to a new accumulation regime, the unchecked coercive power in China seemingly has the potential to escalate the scales of infrastructural transformation needed to meet the goal of decarbonization.

However, what stands out from decarbonization policy evaluation is not merely a unilateral and monolithic process in which the central state gains power inexorably through these scalar practices. Instead, it underscores how the evolving configurations of decarbonization technology, the presence of state-capital hybrids at various geographical levels, and the broader macroeconomic conditions underlying the transition from one accumulation regime to another can affirm, complicate and even challenge the state infrastructural power to penetrate civil society.

Even in a strong and durable authoritarian state such as China, decarbonization endeavors demonstrate evidence of enabling the agency of nonstate actors (though primarily business actors other than citizen groups). From a poststructural point of view, making sense of the state logics in scalar practices may inform the bottom-up agency in *jumping between scales* to navigate challenges and opportunities, as well as interregional solidarity to resist shifts of exploitation and expropriation. Arguably, it may be ironic that China's carbon-intensive export sector indeed generates the economic dynamism that provides the central state with fiscal and financial resources to maneuver domestic space to effectively motivate, galvanize and co-opt nonstate actors to build green energy infrastructure and related production networks. While the U.S. and China may compete for infrastructural power in advancing and spearheading decarbonization, in a combined geographical process, they each inextricably feed into each other's remit of accumulation. With China extending its infrastructural power outwards through the Green Belt and Road Initiative, attention to state infrastructural power invites future research to situate geopolitics of decarbonization within a fine-grained and dialectic relativization of state scalar practices.

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ORCID iD

Wenyng Fu  <https://orcid.org/0000-0002-5617-4718>

Notes

1. Throughout the paper, I use green energy infrastructure instead of renewable energy infrastructure to capture a broader conceptualization of developmental infrastructure in terms of decarbonization. The former encompasses not only renewable energy (wind, solar, biomass, etc.) plants and facilities but also auxiliary infrastructure, such as the national grid and smart microgrids.
2. Keywords in the policy archive search involve documents explicitly addressing issues related to carbon, such as low-carbon (*di tan* 低碳), decarbonization (*qu tan* 去碳) and carbon neutrality (*tan zhonghe* 碳中和). The search timeframe is until May 2023.
3. The outcome of the CDPSD is critically evaluated based on the policy interpretation and responses reported by the Chinese industry media *Century New Energy Network*, parts of which can be found at <https://www.ne21.com/news/show-167698.html>, <https://www.ne21.com/news/show-162789.html>, and <https://www.ne21.com/news/show-168961.html> (accessed 28 November 2023).
4. The central-local tension in terms of nuclear development is widely reported in the leading media in energy sector, including https://m.thepaper.cn/kuaibao_detail.jsp?contid=11706134&from=kuaibao, http://paper.people.com.cn/zgnyb/html/2014-04/14/content_1415353.htm (accessed 28 November 2023).

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