

建立中国应对气候变化的地方性制度

Creating Subnational Climate Institutions in China

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ABOUT THE PAPER

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摘要

中国的政党体系由多级官僚体制组成，虽然下级政府对共同的领导负责，但在实现不同目标方面具有实质自治权。对于部分财政措施，中国是世界上权力最分散的国家。因此，中国特殊的“准联邦主义”权力制度，以及党和国家的统一，将在经济上极大地影响和制约温室气体排放（GHG）的控制权。本文介绍了自 1978 年“改革开放”以来中国地方分权制度的演变，中国制度变迁的不同理论，以及经验及理论文献如何帮助我们理解主导温室气体排放活动的制度演变。

气候政策由于以下原因需要我们进一步分析中国的地方政权。首先，中国需要大规模的制度转型，以促使政府官员的激励与“减少温室气体排放”的新目标相一致——这需要进一步延展已建立的大规模政府职能。其次，地方政治经济根植于这些制度，使得实现这一任务比建立一套独立的理想制度（基于国际最佳的实践经验）要复杂得多。地方政策和制度可能会出现长期的地理变异性。第三，有效的政策指示将需要创造性地使用中央集权管理，因为地方利益大不相同；但也应与地方政府当局协调，以推进其他领域的快速改革。

在制度职能方面，中国中央政府在经济规划、税收政策、一些定价和标准设定方面具有很大的影响力。与此同时，地方政府控制了更多的准许权、其他方面的定价权、部分的生产权、以及土地政策。在这些情况下，自大约 2007 年以来，政府对气候变化的担忧越发凸显，尽管减少温室气体排放的优先任务并不是统一中央和地方的政府制度。此外，相较于提升气候变化重要性的整体制度框架，目前的制度框架仍存在关键的差距。通常地，政策的中央强制执行力度随着与其他更为突出的政策目标的协同而加强，例如减少空气污染。

人事决策对执行的许多方面至关重要：地方官员通过干部选拔和晋升、行政命令和预算，受到上级的领导及约束。各省级政府与中央政府之间的牢固关系和一致利益，可以促进各省政策的实施。然而，这种牢固关系也可能会降低地方官员因地制宜调整政策的灵活性，从而降低政策效率。另一方面，如果实施过程主要考虑当地利益，则可能无法实现国家目标。

这些研究结果影响着将于 2020 年左右启动的国家碳市场的设计和实施。新成立的生态环境部是气候变化政策的主管部门，但其权威性在中国复杂的制度框架下仍处于发展之中，无论是在中央还是在地方层面。全面实施国家碳市场的一个重要组成部分是使现有试点一致，最终实现有效价格和消除跨省贸易壁垒。然而，鉴于不同的地方政策设计和行业结构，这将是困难的。更为根本的是，对其试点拥有相当大（但非排他性）权力的各省市的利益必须与推进国家体系建设的核心优先事项保持一致。另一个挑战是缺乏运转良好的电力市场——首个针对全国碳市场的部门。因此，全国碳市场的设计者正在开发“基于比率”法（即基准线法）和“间接排放”许可体系。最终，全国碳市场的成功将取决于电力市场改革，而电力市场改革正在以未知终期的方式平行进行。

EXECUTIVE SUMMARY

China's party-state consists of multiple hierarchies of bureaucrats and officials accountable to a common leadership, yet it also gives substantial autonomy to lower levels of government in pursuing various objectives. By some fiscal measures, China is the most decentralized country in the world. As such, China's particular flavor of "quasi-federalist" control, as well as integration of party and state, will heavily influence and constrain options for controlling greenhouse gas emissions (GHG) in the economy. This paper describes the evolution of decentralization over the reform period beginning in 1978, different theories of institutional change in China, and how both the empirical and theoretical literatures help us understand the development of institutions for governing GHG-emitting activities.

Climate policy merits this extended look at the subnational Chinese state for several reasons. First, large institutional transformations are required to align incentives of government bureaucracies with the new goal of reducing GHGs—extending across a wide range of established government functions. Second, the local political economy embedded in these institutions ensures that this task is significantly more complicated than prescribing a single set of ideal institutions (e.g., based on international best practices). There will likely be extended periods of geographic variation in policies and institutions. Third, effective policy prescriptions will thus require creative use of centralization where local interests diverge substantially, but also align with and exploit local government authorities to advance rapid reforms in other areas.

In terms of institutional functions, China's central agencies have a great deal of power over economic planning, tax policy, some pricing, and standard-setting. Meanwhile, local governments control much permitting, other aspects of pricing, portions of production, and land policy. Within these, climate change concerns are increasingly reflected since around 2007, though the prioritization of reducing GHG emissions is by no means uniform across central and local government institutions. Additionally, there remain crucial gaps in the overall institutional framework that would elevate the importance of climate change. Central enforcement of policy implementation generally increases when policies align with other, arguably more salient, policy goals, such as reducing air pollution.

Personnel decisions crucially determine many aspects of implementation: local officials are directed and constrained by superiors via cadre-leadership selection and promotion, administrative mandates, and budgets. Strong relationships—and consonance of interests—between provincial and central authorities and institutions may facilitate policy implementation by provinces. However, such strong ties may also reduce local officials' flexibility in adapting policies to local conditions—and hence reduce policy effectiveness. On the other hand, if the implementation process primarily reflects local interests, state objectives may not be achieved.

These findings have implications for the design and implementation of the national carbon market set to start around 2020. The newly-created Ministry of Ecology and Environment is the locus for climate change policy, but its authority within China's

complex institutional framework is still being developed, at both central and local levels. One important component of fully implementing a national carbon market will be to harmonize existing pilots with the goal of generating efficient prices and eliminating cross-provincial trading barriers. However, this will be difficult given differing local policy designs and industry structures. More fundamentally, the interests of the provinces and municipalities with considerable (though not exclusive) authority over their pilots must be aligned with the central priority of advancing the national system. Another challenge is the absence of a well-functioning market for electricity—the first sector targeted under the national carbon market. Designers of the national carbon market are therefore developing second-best “rate-based” approaches and “indirect emissions” permit systems. Ultimately, the success of the national carbon market will depend on electricity market reforms, which are being pursued in parallel with an uncertain end-date.

1 BACKGROUND ON CHINA'S CENTRAL-LOCAL GOVERNANCE

1.1 UNPACKING THE CHINESE STATE

The Chinese state extends from the inner rooms of Zhongnanhai in Beijing to the markets of rural villages. Multiple hierarchies of bureaucrats and appointed officials govern all aspects of the political system—revenues, promotion, and regulation—through a set of formal and informal institutions.¹ In contrast to federal systems of government such as the United States that separate powers and appointment at each level of government, China's central government retains direct authority over appointments of many subnational officials and, more fundamentally, is the apex of all lower level government organizations.

However, the Chinese system is also heavily decentralized, with substantial autonomy given to lower-level officials to carry out and even make policy in service of broad state goals. China is, according to government revenues and expenditures, “by a wide margin the most decentralized country on earth” (Kroeber, 2016, p. 111). Expenditures by subnational governments account for 70-80% of all government outlays, twice that of OECD countries, and five times of developing countries. Provincial and sub-provincial governments had significant autonomy in governing production decisions under the former “centrally-planned” economy—compared to virtually none in the USSR—and dramatically enhanced their role in economic policy through market experimentation beginning in the 1980s.

Decentralization brings many benefits in terms of flexibility to adapt to local conditions, enhancing policy effectiveness (Heilmann, 2008). However, it also yields a number of challenges for achieving state objectives when interests between central and local governments are not aligned. This has prompted several waves of recentralization. Ambiguities (e.g., in terms of the scope, reporting requirements, and accountability of government organizations) are inherent to this process of adjustment, which can rely on *de facto* arrangements that differ from *de jure* specifications. These basic characteristics of China's subnational governance system shape the creation of new institutions and, more importantly, their durability—i.e., feasibility in terms of alignment with existing political realities, and sustainability in terms of incentives to maintain and strengthen institutions over time.

Due to the long horizon of impacts and significant economic scope of climate change, establishing a constellation of institutions with substantial durability is of paramount importance. In this brief, I first introduce several features of China's subnational governance, laying out the variables important to institutional durability. In

¹ Here, and throughout the report, I use the broad definition of institutions as “humanly devised constraints that structure political, economic, and social interaction” (North, 1991).

Section 2, I give an overview of the range of actors at the central and local levels involved in governing greenhouse gas (GHG)-emitting activities. In Section 3, I discuss the implications of this institutional structure on China's efforts to create a national carbon market. Finally, I offer some concluding remarks.

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1.2 CHINA'S QUASI-FEDERAL SYSTEM OF GOVERNMENT

The careful balance of the roles for central and local governments has led many scholars to consider China as “quasi-federalist,” to distinguish it from more top-heavy forms of single government rule. The decentralized governance structure is often referred to as *tiao-kuai*, for the set of functional, vertical relationships (*tiao*) and territorial, horizontal relationships (*kuai*) forming an extended “system” (*xitong*) that determines to whom a given agency reports (Lieberthal & Oksenberg, 1988; Schurmann, 1968). Officials and organizations in areas of governance where responsibilities are vested with local governments will rely more heavily on *kuai* relationships, while governance areas of more centralized control will have *tiao* lines of authority.

From the beginning, this system, formally adopted in the 1950s, has yielded benefits in terms of flexibility to adapt to local conditions and aligning incentives of local actors with growth objectives, but has also generated some confusion for agencies that have multiple lines of reporting and interdependencies. Under central planning, for example, the coal department was more territorially-governed, while the electricity department was more functionally-governed, leading to a generic problem termed “fragmented authoritarianism” (Lieberthal & Oksenberg, 1988). To overcome gridlock, stakeholders have used a policy process that is diffuse, protracted, and dependent on informal bargaining. More recent work has emphasized the complexity of this policy process, noting the role of many more stakeholders including state-owned enterprise managers and civil society (Deng & Kennedy, 2010; Mertha, 2009).

From the perspective of establishing markets—the genesis of much of this literature—a set of conditions describing “market-preserving federalism” has been put forward, which includes subnational governments having primary control over the

economy in their jurisdictions, national governments retaining the ability to police markets, and some durability of these arrangements (Weingast, 1995). These attributes are pointed to as key engines of China's economic success (Jin, Qian, & Weingast, 2005).²

The center manages its subordinate local organizations through formal institutions of the Chinese Communist Party (CCP) and the state. The CCP—the largest political party in the world and second longest in power after North Korea—has *de facto* control of all important political decisions. The CCP Central Committee makes broad changes in policy that filter down to local officials (discussed in the next sections). It primarily ensures achievement of these goals through the selection of cadre-leadership (*ganbu*)³ who are close to the center (and removal of those with more “regionalist” tendencies), shared education through a Party ideology and Party schools, and the accelerated use of quantitative targets through the Party's cadre-leadership evaluation system (Landry, 2008; Schurmann, 1968). The number of cadre controlled by the CCP's Organization Department is around 4,000, with lower level leadership determined in the respective organization's personnel department (Li, 2016).

Formal state (governmental) institutions, through which important policy decisions are also made, are, in fact, led by CCP members. This state hierarchy is headed by the State Council and consists of governments at every level, paired with CCP party secretaries or with overlapping CCP/state leadership. This government structure plays an important role in non-leadership staffing decisions, including setting the total number of staff (*bianzhi*), which indirectly controls the budget of various local government agencies (Hart, Zhu, & Ying, 2017; Mertha, 2005). The central-local organization for the case of a Provincial Development and Reform Commission is illustrated in Figure 1.

² Many still question the validity of these “market-preserving” conditions in China. For example, the durability of these arrangements is questionable given dramatic changes to personnel arrangements, budgetary processes, and property rights (Mertha, 2005).

³ This is also frequently referred to as the *nomenklatura* system, after the Soviet Communist Party organization on which the CCP based theirs.

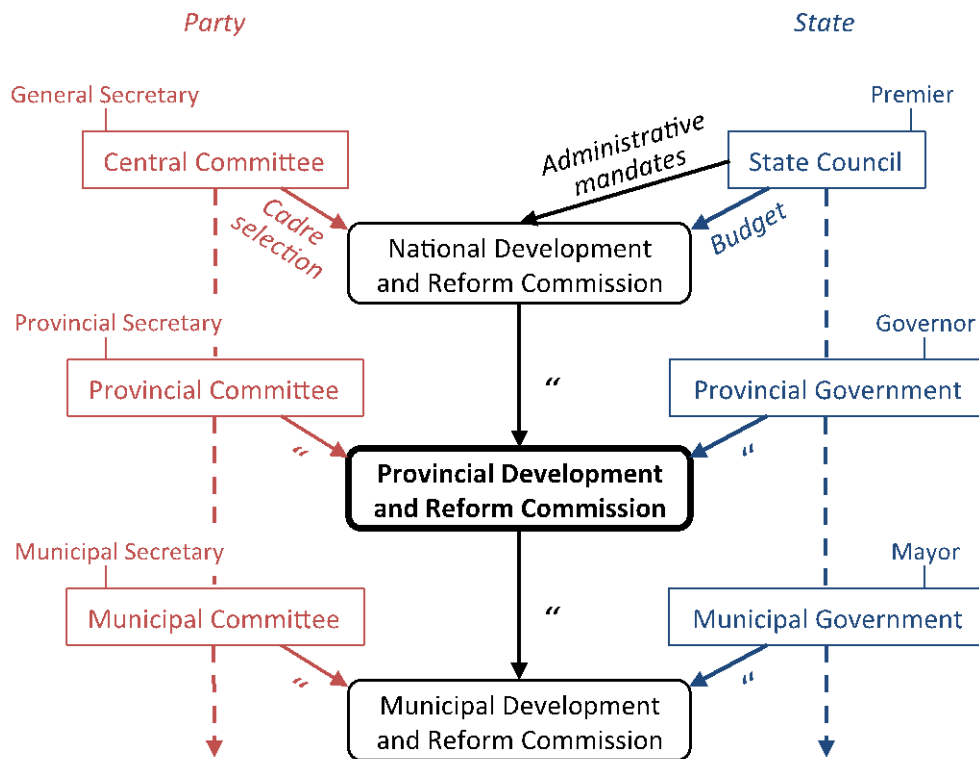


Figure 1. Central-local organization of Party and state for the case of a Provincial Development and Reform Commission. Adapted from (Hart et al., 2017).

The ranks of both the organization and its leader have a large impact on what mandates can be issued as well as the weight placed on them. Formally, every government organization extending down to local government bureaus has a bureaucratic rank. For example, a central ministry has the same rank as a provincial government.⁴ A person’s bureaucratic rank is usually associated with the highest rank of organization they have led, and they may also have a more informal “prestige” rating within the CCP (Lieberthal & Oksenberg, 1988).

⁴ China has four municipalities that are treated as provinces in this system, i.e., administered directly below the central government: Beijing, Chongqing, Shanghai, and Tianjin.

1.3 DECENTRALIZATION IN THE REFORM ERA

In 1978, China's central leadership inaugurated a new period of "reform and opening up" that began with pilots to eliminate collective land ownership in rural areas and led to dramatic changes to the power and activities of local officials. Initial experiments with eliminating central planning proved successful and prompted reforms to bureaucratic incentives, with quantitative growth and other economic indicators becoming more important criteria for promoting officials (Landry, 2008). Local officials, building on an already decentralized bureaucracy compared to other socialist states, were given further latitude to experiment with a variety of industrial policies, unleashing untapped economic growth potential.

Of the many important effects of decentralization, the system of economic regulation—and the evolving institutions of property rights, in particular—is pronounced for its local variation.⁵ Property rights are recognized as a key component of modern societies and markets (Hayek, 1948; North, 1990). Rural land decollectivization in the 1980s reassigned property rights for land and was followed by loosened restrictions on private ownership and on the activities of township and village enterprises (TVEs). Local governments actively promoted the expansion of TVEs when the revenues began to be retained locally (Oi, 1999). At the same time, the role and interpretation of *minyng* enterprises (literally, "people-run"—typically translated as "private") showed much variation (Rithmire, 2014). With lines blurred between governments, firms, and the officials that run them, a set of "hybrid" or partial property rights developed, but that nevertheless fulfilled some of the same roles as more traditional private ownership structures elsewhere (Oi & Walder, 1999). With local control and rents from the firms protected from central confiscation, rural industry exploded, reaching 50% of total industrial output in 1991 (Oi, 1992).

Economic regulation diverged considerably at the local level as restrictions were relaxed on a range of formerly planned sectors. In the resulting "dual-track" system of plan and market, market forces stimulated new entrants and improved efficiency of incumbents, thereby increasing supply and productivity and enabling certain sectors to "grow out of the plan" in a natural way (Naughton, 1995). Most aspects of these markets were governed by local governments, who used the levers to compete with each other for access to capital and other inputs (Rawski, 1995).

These decentralized arrangements, while generating massive growth, led to key challenges for the center: local protectionism, falling tax collection, inefficiencies in the state sector, and non-compliance with central regulations. Local governments facing threats from other jurisdictions would erect "unfair barriers to entry, engage in illegal production and sales, or both" (Mertha, 2005, p. 793). Some dispute the economic

⁵ The focus here is primarily on institutions that shape economic activity.

effects of these protectionist measures, and even claim they generated competitive pressure for more reforms, but they were nevertheless perceived as dangerous by central reformers (Wedeman, 2003). These and other challenges prompted various programs of recentralization over the 1990s and 2000s.

Falling collection of taxes was more dire. In addition to feeding into fears of a renewed “regionalism,” the direct revenue impacts on the central government were substantial (Oi, 1992). Total government revenues fell from 30% of GDP in 1978 down to 11% in 1994, and the central share of those revenues fell from 40% in the mid-1980s to below 20% (Kroeber, 2016). The 1994 tax reform centralized many aspects of the tax system, standardizing tax remittances and establishing a fixed percentage of the value-added tax (VAT)—expanded to most corporate and personal income taxes in 2002—to be returned to localities (Zhang, 1999). Local governments were thus guaranteed revenues but denied the ability to change tax policies or rates, e.g., in response to necessary expenditures. A lasting repercussion from this tax overhaul was the creation of structural deficits in local governments—whose formal revenue was fixed and lower than expenditures—that required special central government transfers and put pressure on local governments to raise additional funds, e.g., through land policy (Kroeber, 2016).

Meanwhile, many inefficient small and medium-sized state-owned enterprises (SOEs)⁶ had arisen or expanded over the years of local experimentation. By 1993, they accounted for over half the employment and slightly under half of the output, but only one-third of profits and taxes from the state sector (Cao, Qian, & Weingast, 1999). Extricating the state from these inefficient enterprises, and reforming the financial sector that supported them, became an important central government priority over the 1990s. The center corporatized major state-run ministries into SOEs—creating a corporate board and transferring state ownership from government ministries to a central agency (Pearson, 2007). Furthermore, under the banner of “grasping the large and letting go the small,” the central government began a massive privatization program with the aim of forcing divestiture of smaller state-owned firms (Cao et al., 1999).

Through this unprecedented reform program, in the span of a few years (1995-1997), over 20 million workers in SOEs were laid off as many of these firms closed down or reduced excess employment (Qian, 1999). Local governments also faced pressure to reform underperforming enterprises because of increasingly hard budget constraints, competition from the (largely FDI-backed) private sector, and international competition (Cao et al., 1999; Thun, 2004).

The surviving SOEs further cemented government control in numerous strategic sectors, particularly the larger ones administered by the central government. In these areas, the state retained levers over leadership, what is produced, investment decisions,

⁶ Exact definitions of size vary by industry, but some approximate “large” as the largest 1,000 enterprises (Cao, Qian, & Weingast, 1999).

use of profits, etc. (Pearson, 2015).⁷ The State-owned Assets Supervision and Administration Commission (SASAC), a new government agency that formally managed the strengthened SOEs, replaced “weak accounting-style oversight” of its predecessor with market-oriented reform goals to make its prime, state assets into major “national champions” and take advantage of growing global trade (Naughton, 2015). The central SASAC currently supervises roughly 100 enterprises, including virtually all major companies in power, energy, heavy industry, and several other strategic sectors (SASAC, 2017). Local branches supervise many more SOEs.

China’s accession to the World Trade Organization (WTO) in 2001 prompted further centralization, as Chinese leaders at the time regarded the WTO as the most significant economic policy since market reforms began in 1978 (Lin, Cai, & Li, 2003). The WTO came with many new requirements and trading rules that constrained the actions of local governments, which, as noted above, had enjoyed significant autonomy in developing their own industrial policies. To ensure policy implementation and enforcement, China embarked on a form of “soft centralization” in several sectors—concentrating authority into the hands of provincial governments instead of at lower levels of government—prefecture or county (Mertha, 2005).

Nevertheless, the strong role of local governments—both provincial or sub-provincial—remains a challenge for compliance of central regulations. As Figure 1 shows, local branches of central agencies tasked with enforcing central administrative mandates are dependent on many local government actors, including those with potential interests in regulated firms or who are themselves the target of regulations. The difficulties of implementing environmental regulations—under the Ministry of Ecology and Environment (formerly, Ministry of Environmental Protection), not formally independent from the government organizations it oversees—is the subject of much scholarship (Hsu, 2013; Kostka & Nahm, 2017; Wong & Karplus, 2017).

It has been documented from industrialized country experiences that market development is dependent on a constellation of governance institutions ranging from financial, antitrust, and labor regulation to corporate governance rules—or, “freer markets need more rules” (Vogel, 2018). One way to enforce a more rules-based approach is through independent regulators, which are functionally and financially separate from all interested parties, tasked with creating a level playing field in the market, and vested with the authority and personnel capacity to do so (Pearson, 2005). From 1992 to 2003, China created four independent regulators, three in the financial sector and one in electricity (Tsai, 2014). In theory, these regulators—through their offices in local jurisdictions with *tiao* leadership—could enforce consistent policy

⁷ For example, the assets of the electricity ministry were transferred to a new utility SOE, which then separated its generation and grid assets into several powerful companies, headed by many prominent government leaders and their families (Chen, 2010; Zhang & Heller, 2007).

implementation and break down local protectionism toward the goal of an integrated national market.

Since the beginning, however, independent regulators in China faced a number of structural challenges: the continued existence of powerful supra-regulatory government agencies, regulatory personnel who came from the bureaucracies they were supposed to regulate, and at times ambiguous authority (Pearson, 2005). In electricity, the State Electricity Regulatory Commission (SERC) is a classic example, facing uphill battles getting information and support from planning agencies and limited authority to shape the direction of markets (Lin & Purra, 2018). SERC was formally disbanded in 2013 and its authorities subsumed by the National Energy Administration (NEA), which is now facing similar issues in carrying out electricity regulatory functions.⁸

1.4 HOW DO CHINA'S INSTITUTIONS EVOLVE?

Given the dramatic, yet uneven, institutional changes in China over a relatively short period of time, it is interesting to consider how reform actually takes place in this large decentralized yet integrated system of government. What precipitates reforms? What are the necessary conditions for interventions to institutional structure to be adopted? Which institutional forms have a higher likelihood of implementation and durability?

Two diametrically-opposed explanations of institutional change in China place emphasis on either the role of local actors or the machinations of Beijing politicians. In the first, local policy experimentation is seen as critical to the adoption of market reforms, as localities were given circumscribed discretion (e.g., identifying a single sector and type of reform) and allowed to experiment with different strategies, with successful strategies later adopted elsewhere (Heilmann, 2008). In addition to agricultural decollectivization, these sectors included special economic zones with preferential access to foreign capital, rural industries, and stock markets (Heilmann, 2008; Oi, 1992). Through political incentives tied to growth and guarantees that successful localities would maintain their autonomy, local pilots can result in durable, lasting arrangements.

On the other end of the spectrum, political changes are associated with “elite politics” among politicians in the center, whose expressions and repercussions are felt in the provinces. Leaders have factions of supporters, whose ties occur outside formal bureaucratic lines of authority (Nathan, 1973). As central leaders typically establish themselves first in a province, they create geographic networks that persist when they

⁸ The market regulation responsibilities are now under the Market Supervision Offices of the NEA at the central, regional, and local levels. NEA regulators still lack *de facto* power to approve or reject provincial plans; rather, in the rare case they raise objections, this serves the purpose of prompting further negotiation. (Interview with regulator, July 2016)

move to Beijing. In many of the oft-cited examples of policy experimentation—decollectivization, special economic zones, and SOE profit retention reforms—the reforms grew out of areas with strong ties to (pro-reform) leader Deng Xiaoping and were promoted first to Deng’s allies before the rest of the country (Cai & Treisman, 2006). Periods of inflation and contraction have also been explained as different factions promoting decentralization and centralization of finance (Shih, 2008). Durability in this case rests more carefully on informal ties to central leadership as well as their current policy directions.

In some respects, this debate centers on the type of institution being discussed. I identify three generic categories of institutional change: the creation or significant modification of formal institutional structures, the establishment of new administrative mandates, and the formation and communication of priorities of leadership. The most visible changes, which draw significant attention from policy scholars, are the creation and missions of organizations in the Party or state. The strength of these new organizations largely depend on the rank of the organization and its leader, the background of the leader, and the organization’s mandate. For example, the elevation of environmental protection to ministry-level status and then to the Ministry of Ecology and Environment (MEE) incorporating even more responsibilities—including over climate change—indicates new power and presumed changes to institutional incentives (Hu & Montero, 2018). Economic planning ministries were reorganized several times in the 1980s and 1990s (into the current NDRC), which naturally affected their leaders’ positions on a variety of reforms, such as electric power (Chen, 2010). Some of these organizations have been “commissions”, such as the NDRC, which have a higher rank than ministries and have the formal authority to issue instructions to them (Lieberthal & Oksenberg, 1988). A frequent defect of reorganizations is the ambiguity of responsibilities—either by under-specification or through shared oversight—that localities can exploit to pursue various strategies without accountability (Heilmann & Perry, 2011).

Administrative mandates can be established at many levels of the government.⁹ Formally, the National People’s Congress (NPC) passes new laws, and the State Council as the highest decision-making body outside of the CCP establishes policy directions, action plans, and important departmental reorganizations (e.g., State Council, 2013). Within the CCP, the Central Committee announces large organizational changes, such as the sweeping changes in 2018 that created the MEE (CPCCC, 2018). Ministries and other government agencies create a range of documents, from five-year plans down to individual regulations and, in many cases, implement and oversee them. Similar organizations exist at sub-national levels (Hart et al., 2017). The strength of these mandates depends largely on which agency issues them (e.g., NDRC has more weight

⁹ This description is necessarily a simplification of the range of government actions, which depend on the administrative level, constitutional powers, and specific role of the CCP. Additionally, several steps may needed to be taken consecutively (e.g., law passage and regulation promulgation) to have the full weight of government (Gallagher & Xuan, 2018).

than MEE) and on which department within the agency. It is well-documented that local officials have a wide range of formal obligations and targets, and assuming the center cannot enforce all priorities, local officials exercise discretion in which policies to implement (Mei & Pearson, 2014). Furthermore, durability of the status quo has been linked to division within the ruling coalition, analogous to the role of an excess of “veto points” in parliamentary systems (Truex, 2018).

Despite the large formal bureaucracy, many scholars contend China is fundamentally a “mobilizational” system, in that changes occur by the leadership articulating and motivating subordinates to accomplish their desired objectives (Fewsmith & Nathan, 2018). The CCP Central Committee meets annually at “plenums” where major new directions have been announced through communiqués, including: opening and reform in 1978, pursuing commodity markets in 1984, and deepening the role of markets in 2013 (CPCCC, 2013; Fewsmith, 1994). The CCP Central Committee also has a number of quasi-permanent and ad-hoc “leading groups” or “commissions” that help form and communicate policy directions (CPCCC, 2018; Miller, 2008). Finally, statements made by top leaders outside these formal organizations can carry enormous weight: Deng Xiaoping, through his famous “Southern Tour” of market experiments in 1992, generated momentum for restarting stalled central-level reforms (Montinola, Qian, & Weingast, 1995; Wedeman, 2003). Local officials can use these indications to align themselves with their faction or gauge areas of enhanced policy enforcement, though the informal nature of these statements do lack some durability as they are subject to change with new leadership.

2 SUBNATIONAL GOVERNANCE OF GREENHOUSE GAS EMITTING ACTIVITIES

2.1 CHINA'S ECONOMIC INSTITUTIONS

Effective climate change policy to reduce GHGs will need to contend with the constellation of existing economic institutions, as well as modify and create new and durable ones that promote a lower-carbon development path. In this section, I focus particularly on economic institutions that vary across the country or are particularly fraught with central-local tensions, as outlined above.¹⁰

As a guiding framework, I examine institutions governing decision-making in three areas: 1) investment, 2) production, and 3) consumption. This framework is roughly designed to reflect the divisions within the Chinese bureaucracy and its respective planning philosophy, which persists even in marketized sectors through a “hands-on” approach to the economy.¹¹ Examples are drawn from important sectors such as energy, industry and manufacturing, and construction and real estate. I return to these sectors in more detail in the next sub-section on where and how climate change considerations are affecting institutions.

2.1.1 INSTITUTIONS GOVERNING INVESTMENT

The level and number of government agencies involved in investment decision-making rests on the size of the investment, and to a lesser extent, its sector. Very large infrastructure projects, e.g., large hydropower dams, are decided at the highest levels of the central government (Yeh & Lewis, 2004), because of the enormous financial requirements and societal impacts. Smaller infrastructure projects, e.g., a coal-fired power plant, require the approval of departments in the national or local Development and Reform Commissions (DRCs), with some limited say by the offices of the National Energy Administration (NEA). The corporatization reforms have created some managerial autonomy in SOEs, where evaluation measures include asset value

¹⁰ This report does not discuss the equally pressing issue of adapting to climate change impacts, which also has many implications for economic policy. Interested readers should consult China's National Adaptation Strategy (2013). Many areas of institutional development remain (Hart, Zhu, & Ying, 2017).

¹¹ Other frameworks are possible. For example, Andrews-Speed (2014) divides China's energy policy-making into categories of strategy, investments, sectoral reforms, and policy experimentation. Wang, Liu, & Wu (2018) consider a broader climate policy framework of interactions among state, market, and civil society.

(Naughton & Tsai, 2015). SOE managers thus engage directly with lower level government offices to expand their scope, sometimes without the knowledge or approval of their central overseers (Bai & Qian, 2010; Cheng & Tsai, 2008). In energy, the central government has used the range of levers at its disposal—e.g., market access, contract price parameters, and personnel management—to selectively encourage or discourage local and foreign investments in response to broader supply conditions (Cunningham, 2009).

In certain sectors, central agencies—such as the Ministry of Science and Technology (MOST)—stimulate investments in basic R&D and demonstration projects through programs designed to “catch-up” to international technology levels and develop homegrown technologies. MOST’s committee of scientists and officials determine what and how much is funded, coordinating a network of leading universities, academies and SOEs in acquisitions of technology abroad and domestic R&D (Zhi & Pearson, 2016).

Where local governments have a disproportionately larger say is in the disposition of land. The zoning and sale of urban land, one of the elements of the earliest reforms in the post-1978 era, is decentralized to local governments. The central government—through the Ministry of Land and Resources (MLR) and the NDRC—restricts overall urbanization rates by allocating land quotas to lower governments (Rithmire, 2017). While much local government revenue is standardized as a result of the tax reforms beginning in 1994, governments at the municipal and lower levels collect “extra-budgetary” income from various sources, including land leases to developers. By 2010, land revenues for municipal and county governments nearly exceeded that from tax-based revenues (Rithmire, 2017). These incentives are major drivers of demand for carbon-intensive construction, and local governments have encouraged and engaged in much wasteful infrastructure development as a result.

Local governments can also use land as a lever of industrial policy, by giving reduced-price land to preferred industries or constraining industrial activity through land governance, e.g., forcibly relocating certain firms and building up concentrated central service areas (Ang, 2016; Nahm, 2017). Industrial upgrading has also benefitted greatly from advances in manufacturing, which has been the target of many local government policies, e.g., in the administration of “high-technology industrial development zones.” Local governments help procure loans from central banks and provide various preferential policies related to land and permitting. Finally, local governments have made many of these subsidies conditional on meeting production or revenue requirements, creating a strong incentive for scale-up and exporting (Nahm, 2017).

2.1.2 INSTITUTIONS GOVERNING PRODUCTION

The direct role of governments in determining production totals has waned in the reform era for a large number of sectors and is continually being phased out in historic monopolies (e.g., electric power). The government agencies with the largest extant role in production planning are the network of Economic and Information Commissions (EICs) and Industrial and Information Commissions (IICs)—local counterparts to the Ministry of Industry, Information and Technology (MIIT)—and the network of local Development and Reform Commissions (DRCs) connected to the NDRC.

In electric power, up until 2015, provincial EICs/IICs controlled most aggregate production decisions through the annual generation planning process, which they coordinated together with the grid companies and other stakeholders (Kahrl & Wang, 2014). Provincial governments have used this power historically to give preference to locally-owned generators over central SOEs (Bai & Qian, 2010), and this practice of allocating equal or larger shares to less efficient generators draws substantial attention from central regulators (NEA, 2016). The 2015 electricity sector reforms have begun a rapid reduction in the importance of these annual planning processes.

National and local DRCs still retain a large influence on production through price-setting in the agencies' pricing departments, which are aligned vertically to a larger extent than production planning. All major energies except for coal (and the increasing marketized fractions of electricity) have standardized price-setting. The NDRC generally plays the stronger role of the two in this process, controlling electricity generation tariffs, although local DRCs do adjust retail electricity prices according to local economic conditions and industrial structure (Ma, 2011). Adjusting prices for these commodities according to input cost changes has been notoriously difficult, leading to large swings in profitability up the value chain that can disrupt production, e.g., electricity generators refusing to produce at a loss when retail electricity prices do not reflect changes in the coal market (Zeng et al., 2013). The Ministry of Finance's control over VAT rates for both domestic and imported goods differentiated by sector also indirectly influences the cost of production. Environmental, health, and safety regulations are administered by a number of agencies, including within some specialized organizations (e.g., MEE) as well as within the planning agencies. The primacy of local government leaders and DRCs over other regulatory agencies is well-documented (Kostka, 2016).

2.1.3 INSTITUTIONS GOVERNING CONSUMPTION

In contrast to the central planning era when governments at once allocated production and consumption at set prices, the reform era inaugurated new out-of-plan consumption at prices determined by market competition. Through this, consumption

decisions of the vast majority of goods were transitioned out of the government bureaucracies (DRCs, EICs, IICs, etc.) and into the hands of consumers. Nevertheless, the pricing departments have retained control over a handful of key retail prices with the often conflicting aims of passing through changes in fuel costs and controlling inflation (Ma, 2011).

While subsidizing a large number of commodities, governments also discourage consumption of certain goods. The majority of these take the form of administrative constraints, e.g., highly congested cities instituting multi-year waiting times to register license plates (Wang, 2010). A fewer number of policies are price-based, such as high VAT rates on imported luxury goods (Sandalow, 2018). Local governments can also encourage consumption of locally-produced goods by providing incentives to manufacturers to sell locally or by enacting protectionist trade barriers making goods from other areas more expensive (Helveston, Wang, Karplus, & Fuchs, 2019; Wedeman, 2003).

2.2 INTEGRATING CLIMATE CHANGE CONSIDERATIONS INTO ECONOMIC INSTITUTIONS

Beginning in the 1990s and accelerating with the adoption of the first national climate action plan in 2007, China has integrated considerations of climate change into a number of the economic institutions outlined above.¹² In the first sub-section below, I discuss high-level reorganizations and communication of leadership priorities with regards to climate change. The following sub-sections then describe changes to institutions governing the three types of decision-making.

2.2.1 HIGH-LEVEL INSTITUTIONAL FRAMEWORK FOR CLIMATE CHANGE

China established a central “coordinating group” on climate change in 1990, contemporaneous with the start of international climate change negotiations. First housed in the meteorological agency, it was then upgraded to the planning ministry in 1998, until finally becoming the “Climate Change Leading Group” in 2007—the highest-level of working group under the State Council (Sandalow, 2018). This coincided with the inaugural National Climate Action Plan that expressed climate change priorities in relation to many ongoing reforms in the energy, industrial, and forestry sectors (State Council, 2007). The action plan enshrined, for example, energy intensity reduction targets in the 10th Five-Year Plan (2006-2010) as one of the key policies addressing climate change, which were handed down to local governments as “binding” targets.

¹² This section draws heavily from comprehensive resources on China’s climate change policies (Hart et al., 2017; Sandalow, 2018).

Subsequent five-year plans include binding carbon intensity reduction targets, officially placing GHG emissions in evaluations of local government performance. Some provinces also established their own “leading groups”, which now include 30 regions (NDRC, 2017a).

While the climate change leading group is under the State Council and headed by Premier Li Keqiang, commissions (formerly, leading groups) of the CCP Central Committee have more influence. The Central Financial and Economic Affairs Commission (CFEAC; chaired by General Secretary Xi Jinping) has historically had the largest role in forming energy policy. The Central Comprehensively Deepening Reforms Commission (CCDRC), newly created by Xi Jinping in 2013, has an even higher stature due to its broader scope, and has put forward key environmental documents (Hart et al., 2017; Li, 2016).

The lack of a national climate change law—or classification of GHG emissions as pollutants under existing laws—has hamstrung some efforts to increase the stringency of carbon targets and their implementation. While being discussed for at least a decade, not much visible progress has been made—though, the recent reorganization has raised some hopes that legal drafting will gain traction (Hu & Montero, 2018). Shenzhen’s local legislation in support of the CO₂ emissions trading systems (ETS) has formed the legal basis for its pilot (Gallagher & Xuan, 2018). In addition to providing a legal basis for enforcement, a climate change law could also ensure appropriate monitoring of data quality, which has emerged as a key goal of the nationwide ETS.

GHG emissions are closely linked with more salient environmental concerns in China, namely, air pollution. In the first Air Pollution Action Plan (2013-2017), the central government established targets (e.g., PM_{2.5} reductions) on local governments in certain dense regions (State Council, 2013). Given increasing concern that air pollution mitigation measures could exacerbate climate change mitigation strategies if not designed appropriately (e.g., Karplus, 2015), revisions to the air pollution law explicitly called for coordinated reductions in GHGs and air pollutants (NPC, 2015). Also in 2015, the Central Comprehensively Deepening Reforms Commission laid out a broader vision for “ecological progress” impacting many environmental areas including climate change (CPCCC, 2015). It appears to extend the “soft centralization” observed in other sectors (Mertha, 2005), by centralizing environmental monitoring and enforcement at the provincial levels, which could improve the fragmented nature of enforcement at the local levels (Hart et al., 2017). In tandem, revisions to the Environmental Protection Law clarify that the Party cadre evaluation system should include environmental targets (NPC, 2014). The framework of organizations and policy levers relevant to climate change are illustrated in Figure 2 along with general factors affecting implementation

and durability from the discussion in Section 1.¹³ These policy levers are described in greater detail in subsequent sections.

2.2.2 CLIMATE CONSIDERATIONS IN INSTITUTIONS GOVERNING INVESTMENT

The largest GHG impacts come from investments in coal, coal-fired power, and carbon-intensive industry such as iron, steel, and cement. The institutions governing their investments have changed hands multiple times over the years: in 2014, following the high-level directive of embracing markets and reducing the (central) government's role in the economy, project approvals were decentralized to the provinces (State Council, 2014). This resulted in a rapid increase in coal power installations and permitting, with some estimates that the likelihood of permitting increased three-fold following decentralization (Ren, Branstetter, Kovak, Armanios, & Yuan, 2019). Central agencies responded by cancelling some permits and setting capacity reduction plans for steel and coal similar to those a decade ago, from the perspective of encouraging the “healthy development of the industry” (NDRC et al., 2017). Independent review of ongoing construction has revealed many of those cancelled have been resumed (Shearer, Yu, & Nace, 2018). Central rules prohibit the building of very inefficient coal plants and the 13th Five-Year Plan encourages efficiency retrofits (NDRC & NEA, 2016b).

Coal mines have been even more difficult for central agencies to regulate, likely due to their dispersed nature and traditional autonomy afforded local governments. Largely from a mine safety perspective, the 12th Five-Year Plan called for reducing the number of mines nationwide to 4,000, but the 13th Five-Year Plan relaxed this goal to 6,000 (Hart et al., 2017). Smaller, locally-owned mines are much more labor-intensive and thus have a outsized impact on local government considerations around employment (UIBE & CASS, 2018).

¹³ This figure and the text combines—and avoids detailed discussion of—the “law and regulation system” and the “document and policy file system” which operationalize policies in different manners (Gallagher & Xuan, 2018).

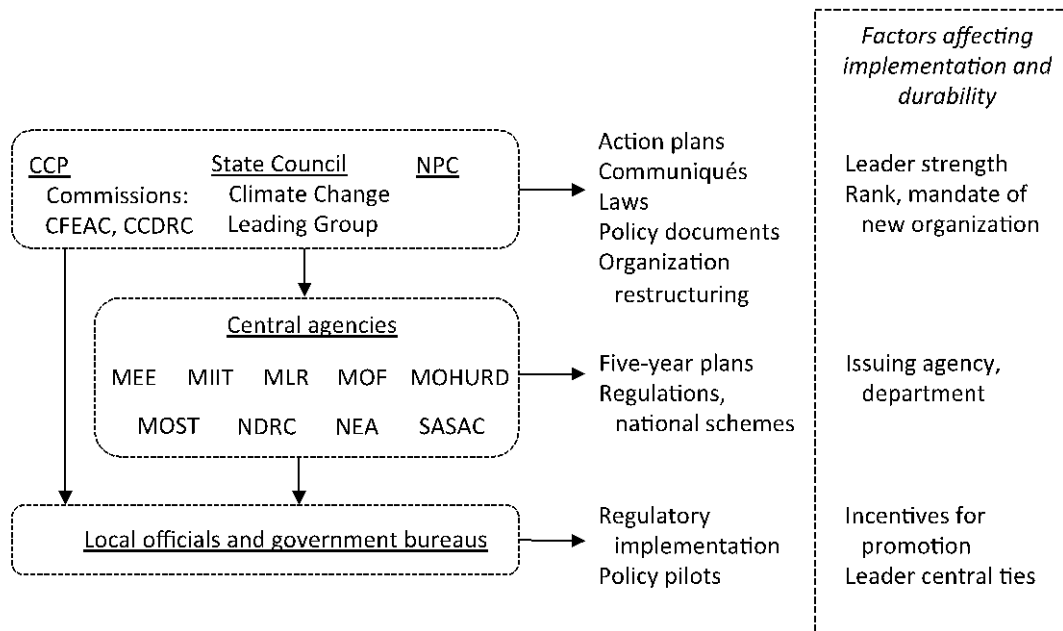


Figure 2. Organizations, major policy levers, and factors affecting implementation and durability of climate policy. *CCP*: Chinese Communist Party, *CFEAC*: Central Financial and Economic Affairs Commission, *CCDRC*: Central Comprehensively Deepening Reforms Commission, *NPC*: National People’s Congress, *MEE*: Ministry of Ecology and Environment, *MIIT*: Ministry of Industry, Information and Technology, *MLR*: Ministry of Land and Resources, *MOF*: Ministry of Finance, *MOHURD*: Ministry of Housing and Urban Rural Development, *MOST*: Ministry of Science and Technology, *NDRC*: National Development and Reform Commission, *NEA*: National Energy Administration, *SASAC*: State-owned Assets Supervision and Administration Commission.

China’s central science and technology institutions have remained largely unchanged in response to climate change, except for some elevation and coordination of climate-related activities. MOST led the preparation of a special plan for climate change in the 13th Five-Year Plan (2016-2020) that lists a wide range of priorities, from developing world-leading climate datasets to advancing carbon capture, utilization and sequestration (CCUS) technology (MOST, MEP, & CMA, 2017). In an agenda for longer-term energy innovation, NEA outlined 15 key technologies to develop out to 2030 (NEA, 2016). The framing of targeted technological breakthroughs are consistent with previous technology plans, and do not indicate any major changes to the central and local institutions for innovation. This could be problematic for coal-fired power, as technology programs and demonstrations generally neglect local conditions and the enhanced need for flexibility in a lower-carbon power system (Davidson, forthcoming).

Entrepreneurial local governments have signed up to be “low-carbon cities” under the NDRC, which includes incentives for investments in energy-saving buildings and technologies as well as encouraging changes to urban design (Sandalow, 2018). Building energy codes developed by the Ministry of Housing and Urban Rural Development (MOHURD) nominally regulate efficiency and the designation of “green buildings”, though these regulations are being changed to improve implementation (Feng et al., 2017). In transportation, MIIT administers vehicle and fleet fuel efficiency standards that push manufacturers to reduce the carbon impacts of its vehicles (Sandalow, 2018). The levels of decision-making authority for general economic and climate-related institutions for these three areas are shown in Table 1.

2.2.3 CLIMATE CONSIDERATIONS IN INSTITUTIONS GOVERNING PRODUCTION

In the electricity sector, GHG emissions depend on production decisions (“dispatch”) made by provincial governments and grids among the fleet of generators. In a joint Obama-Xi climate announcement, China committed to building a system of “green power dispatch” that prioritizes renewable energy, other low-carbon sources, and more efficient coal (The White House, 2015). This appears to indicate some enhancement over an earlier version—“energy-efficient dispatch”—that faced numerous implementation problems in the provinces (Tong et al., 2011). China also launched a new round of power sector reforms in 2015 that aims to create market-based competition in both supply and retail of electricity. The initiative has been left mostly to provinces, which have opened up the generation plan to market-based medium-term contracts, particularly with coal (CEC, 2018). The effect is to improve some of the inefficiencies in plan allocation, but does not fundamentally change dispatch yet to improve the situation for low-carbon resources, as discussed later. It could also affect investment as central documents have clarified that new plants permitted after 2015 should “in principle” not receive a plan allocation (NDRC, 2017c), though there is no indication that local governments have followed through on this.

The center has played a large role in incentivizing electricity production from renewable sources. Feed-in-tariffs (FITs) differentiated by region are set by NEA and NDRC for wind, solar, and biomass. In response to tightening central budgets and falling renewable energy capital costs, these FITs have been adjusted downward and will likely be phased out. In their place, the current path is renewable purchase obligations on utilities and large consumers, effective in 2019, that mandate a certain percentage of electricity from renewable sources (NEA, 2018).

Table 1. Institutions governing investment, production, and consumption of greenhouse-gas emitting activities at different levels of government

<i>Level</i>	<i>Investment</i>	<i>Production</i>	<i>Consumption</i>
	<ul style="list-style-type: none"> • Large infrastructure projects • Technology priorities 	<ul style="list-style-type: none"> • Producer prices for strategic sectors • Environmental, health, and safety regulations 	<ul style="list-style-type: none"> • VAT rates
Central	<ul style="list-style-type: none"> • Limited recentralized project permitting • Energy efficiency standards (industry, autos, buildings) <p><i>Climate considerations</i></p>	<ul style="list-style-type: none"> • Firm-level energy efficiency mandates • Renewable tariffs • Renewable obligation standards 	<ul style="list-style-type: none"> • Energy consumption targets • Tax incentives
	<ul style="list-style-type: none"> • General project permitting • Land policy 	<ul style="list-style-type: none"> • Plans for remaining non-market sectors • Regulatory implementation 	<ul style="list-style-type: none"> • Retail prices for key goods • Protectionist policies
Local	<p><i>Climate considerations</i></p>	<ul style="list-style-type: none"> • “Green dispatch” and electricity markets • Carbon market pilots 	<ul style="list-style-type: none"> • Coal caps • Carbon market pilots • Transportation demand management

Regulatory mandates in many other sectors originate from the center as well. In industrial sectors, China has continually strengthened its energy efficiency mandates, including mandatory savings targets in the “Top 10,000 Program” (formerly, “Top 1,000”) of large enterprises. This central program enlists local officials by mutually signing “responsibility contracts” with both their superordinate organization and the targeted

firms, which has helped improve implementation by, e.g., local officials providing perks for firms (e.g., access to loans) that achieve the targets (Kostka & Hobbs, 2012).¹⁴

The introduction of a carbon pricing scheme has the potential for economy-wide effects on production. China launched seven provincial/municipal ETS pilots starting in 2013, and is currently designing a national ETS. There have been claims that the pilots did not effectively create market institutions, and was preferred because of the ease with which it integrates in the existing NDRC bureaucracy (Goron & Cassisa, 2016). Nevertheless, the ETS has had an impact on institutions for monitoring and data collection (Zhang, Wang, & Du, 2017). The ETS is discussed further in the next section.

2.2.4 CLIMATE CONSIDERATIONS IN INSTITUTIONS GOVERNING CONSUMPTION

Climate change has had minor impacts to date on institutions shaping consumption, although creating a resource-efficient society is one of the four energy “revolutions” for which Xi Jinping has called (Xinhua, 2014). Perhaps most significant is the proliferation of coal consumption caps by multiple provinces, preceding a national cap in the 13th five-year period (NDRC & NEA, 2016a). Much of the work of this initiative is at the production level, identifying energy-saving technologies and processes (e.g., CCA, 2017). ETS pilots have also affected consumption of electricity through the allocation of demand-side permits (“indirect emissions”) traded alongside production performance standards (Munnings, Morgenstern, Wang, & Liu, 2016).

Local governments have broader control over the transportation sector, which they have used to enact or strengthen transportation demand management institutions to reduce emissions. For example, cities control license plate quotas and driving restrictions (e.g., forbidding certain fractions of cars from entering the city center each day), which have been in effect for many years in some cities to reduce congestion (Wang, 2010). In addition to the encouragement of EVs through central tax incentives (State Council, 2012), many cities now waive license plate restrictions for EVs, effectively expanding the scope of this policy to prioritize environmental benefits as well as local industry (Sandalow, 2018). The GHG impacts of EVs in coal-heavy China are hotly debated, with some analyses showing higher lifecycle GHGs, particularly when considering battery production (Qiao, Zhao, Liu, Jiang, & Hao, 2017). Nevertheless, EVs operated on electricity from very low carbon sources are considered essential to meet deep decarbonization objectives.

¹⁴ These energy efficiency programs target individual firms and localities while centralizing the list and data, but non-compliance still remains a problem (Karplus, Shen, & Zhang, 2016).

2.3 LESSONS FROM CONVENTIONAL ENVIRONMENTAL POLICY

The demands on subnational government institutions to carry out climate change policies span many agencies, sectors, and established interests, and thus have no parallel in the Chinese context. Nevertheless, because it pertains to controlling pollutant emissions and because many elements of climate change policy have recently been transferred to the Ministry of Ecology and Environment, some lessons for climate change institutions can be drawn from conventional environmental protection efforts.

The implementation gap of local Environmental Protection Bureaus (EPBs) of the former Ministry of Environmental Protection (MEP) has been widely documented. These local bureaus have had limited authority to monitor and enforce compliance, attributed to their lower status in the local government hierarchy with respect to planning agencies supporting local industry (Hsu, 2013). This is despite the incorporation of environmental targets in cadre evaluation systems, as these cadre face other political incentives to support polluting activities (Eaton & Kostka, 2017; Wang, 2013). Environmental levies on pollution in place since the 1980s represented one disincentive for firms, but these were chronically under-recovered, because of issues with EPB authority as well as local government collusion (Schreifels, Fu, & Wilson, 2012). Emissions trading schemes have also been piloted in select areas for select air and water pollutants, but their effectiveness was also limited by local governments that controlled prices, mandated themselves as sole buyers or sellers, and at times “abruptly scrapped or overhauled” the markets (Zhang et al., 2016).

The first successful large-scale example of conventional pollutant control was the sulfur dioxide (SO₂) emissions program in the 11th Five-Year Plan (2006-2010), which has been attributed to a constellation of factors, including the binding nature of the absolute emissions reduction targets for provincial and subprovincial official evaluations as well as a number of mandatory measures (e.g., plant retirements and pollutant control equipment installation) (Schreifels et al., 2012). These targets have been continued and expanded in subsequent plans, including carbon intensity reductions.¹⁵

More recently, there is a trend of centralized enforcement and central-level attention to meeting environmental targets. In 2017, MEP reportedly sent 5,600 law enforcement officers to cities on inspection work (Hou, 2018). While overcoming local enforcement obstacles, this resource-intensive process is inherently selective. It has been observed that initial inspection work focused on rich, urban areas and left out inland areas (Rooij, Zhu, Li, & Wang, 2017). Later rounds have expanded into areas outside of the Beijing area, though not all of these teams contained central enforcement officers (Hou, 2019). Other durable institutional strengthening includes the relocation of

¹⁵ Total emissions control targets at the government jurisdiction level are scheduled to be replaced with firm-specific targets by 2020 (Hart et al., 2017).

environmental levy collection under the environmental ministry to “environmental taxes” under the Ministry of Finance, which is seen as more reliable since the tax reform, and outside the scope of local interference (Hart et al., 2017).

3 QUESTIONS FOR A NATIONAL CARBON MARKET AND BEYOND

3.1 OVERARCHING INSTITUTIONAL FRAMEWORK

In 2017, the NDRC announced its plan for a national carbon ETS in the electricity sector. The 7-page document describes key principles of the market, basic allocations of authority, a rough timeline, descriptions of market actors, and elements of a supporting system (NDRC, 2017b). It aims to begin nationwide trading by roughly 2020 after a simulation period in 2019. Many details are still undetermined (Jotzo et al., 2018).¹⁶

Just four months after NDRC released the plan, a major reorganization of CCP and government organizations took place, immediately affecting the ETS roll-out by combining climate change-related responsibilities of the NDRC (together with parts of a number of other agencies) into a new Ministry of Ecology and Environment (MEE)—formerly, Ministry of Environmental Protection (CPCCC, 2018). Some observers have indicated that the new MEE has the potential to reduce bureaucratic frictions by clarifying responsibilities for a variety of tasks and furthering the development of a climate change law, an important institutional building block (Hu & Montero, 2018). Others have worried that without the backing—and rank—of the NDRC, climate change efforts will be sidelined by other government priorities (Li, 2018a). In terms of the ETS, the new MEE’s department of climate change action (应对气候变化司) is the expected home for regulations.

In either case, with the reshuffle, questions about the overall institutional framework for the ETS, particularly given the spotty history of compliance with conventional pollutants, are warranted. These include, among others, the relative stringency of national standards compared with local government autonomy, e.g., in permit allocation; the integrity of the payment (and fine) collection and monitoring systems; and the authorities responsible for enforcement and their ability to counteract local government and firm interference. In the next two sections, I will discuss additional questions related to harmonizing local pilots and the ETS’s interaction with ongoing electricity market reforms.

¹⁶ A number of papers have laid out various elements and issues of the ETS based on local pilots, which remain relevant after the 2017 announcement (Duan & Zhou, 2017; Goulder, Morgenstern, Munnings, & Schreifels, 2017).

3.2 HARMONIZING LOCAL PILOTS

The national ETS plan calls for a transition period for the existing local ETS pilots in China, confirming that these pilots should “continue to maintain their current usefulness and gradually transition to a national market when conditions are mature” (NDRC, 2017b). Key deficiencies that also vary across the pilots include allowance allocations, compliance, and data measuring, reporting and verification (MRV) systems (Zhang et al., 2017). Standardizing methods for these—though some differentiation of allowance allocation is possible¹⁷—will be important to eliminate cross-provincial trading barriers caused by local protectionism or issues arising from rules tailored for specific industry structures.

Potential institutional challenges in transitioning the distinct local carbon market pilots to a national system are explored along the dimensions of decision-making from Section 2: investment, production, and consumption. In theory, an ETS will affect decisions related to each of these, although the extent to which governments have a role in these decisions will vary by jurisdiction. Furthermore, many other complementary policies will still be necessary. Theoretically, the case for these is often made in terms of addressing other externalities, e.g., generating learning and spill-over effects through public funding in R&D (Stavins, 2008). In China’s case, a much broader set of complementary policies, such as mandatory energy efficiency targets, will likely continue to play a large role even after carbon markets are in place.

The national ETS must address the decentralized nature of permitting for investment in GHG-intensive activities given the many non-economic inputs to such decisions discussed in Section 2. First, local governments have found ways to bypass fees and avoid other central regulations. Given that local governments will generally administer the carbon markets, they may find ways of blunting the impact of a carbon price on investing in preferred activities. Upstream sectors such as coal mining may be preserved or expanded long after it is uneconomic according to carbon pricing signals. Second, cost pass through (i.e., changes in output prices reflecting changes in input prices) is imperfect in many sectors due to government control over pricing and production. Where governments do not proactively internalize carbon prices when making permitting decisions, the market signals will be distorted. The experiences of the 2014 permitting decentralization demonstrate the potential need for a strengthened role of central institutions and standardization for these decisions. A key question for China will be how much revenue to raise from the carbon markets, and who (i.e., national or local governments) gets to decide how it is spent. Most other major carbon pricing

¹⁷ The efficiency of an ETS is independent of the specific allowance allocation (assuming the cap remains the same) (Stavins, 2008). The Chinese central government may have an interest in allocating more allowances to under-developed regions to address regional equity (Zhang, Wang, & Du, 2017).

systems internationally allocate some portion of revenues to R&D activities (Burtraw & Sekar, 2014).

The ETS pilots have not been recognized to generate efficient carbon prices (i.e., price reflects the marginal cost of abatement), which directly affects production decisions. This is partially attributable to an ongoing learning process for covered entities, but is also due to a range of local government influences, including setting final allocations late into the compliance period, and colluding to give certain firms additional allocations (Zhang et al., 2017). Others have made bolder claims that the ETS pilots have not created market institutions, but instead reinforced state planning, particularly in local governments (Goron & Cassisa, 2016). The same concerns around investments also apply to production in terms of local price-setting authorities not passing through costs of carbon permits and local planning departments propping up inefficient production that would otherwise not be cost effective under the direct carbon price. Electricity sector dispatch (largely provincial) and pricing (historically centralized but increasingly decentralized) are not harmonized, which create real issues for the national ETS's first targeted sector.

Cost pass-through is similarly an issue of institutions shaping consumption, which will depend on the willingness and capability of price-setting authorities to create cost-reflective tariffs. Where these are more localized (e.g., retail electricity tariffs), unifying these elements will be key challenge of a national ETS. More broadly, carbon prices will be most effective when internal barriers to trade are eliminated. Local protectionism affects many low-carbon sectors, such as electric vehicles, which reduces the adoption of least-cost transportation options, though protected local markets may have some beneficial long-term effects in encouraging experimentation with new low carbon technologies (Helveston et al., 2019). As ground transportation is not covered under any ETS pilots,¹⁸ this will not be an issue for harmonization.

3.3 DEPENDENCIES ON ELECTRICITY MARKET REFORM

In 2015, the State Council inaugurated a new round of power market reforms, focused on releasing the annual production planning process to markets, improving regulation of grid companies, creating exchanges to facilitate multiple new products, and slowly opening up retail competition (State Council, 2015). The reforms do not go beyond what was laid out in principle during the last round of reforms (1997-2002), and the market experiments called for under the previous plans largely failed (Andrews-Speed, 2013). By contrast, the latest round of market experiments has been more successful: market volumes have sky-rocketed in the last several years, reaching one-quarter of all sales in 2017 (CEC, 2018). These largely take the form of province-level

¹⁸ The Shanghai pilot did cover aviation (Zhang et al., 2017). Clearly, carbon prices associated with flight travel require national standardization.

markets for medium-term contracts (typically, annual) between large generators and industrial consumers.

The successful introduction of markets in this round has been smoothed by a combination of local initiative and high-level support. First, local governments control the introduction and retain many levers to guide market outcomes by setting market design, timing, access, and even prices (Davidson, 2018). The lack of an independent regulator and weakness of local energy agencies with respect to local governments have enabled local control. Second, electricity markets have received high-level attention by leaders and in CCP leading groups (Jiang, 2014; Yicai, 2013). Third, reducing electricity prices for industry was explicitly targeted in the 2018 government work report, which current markets can help deliver (Li, 2018b). Based on current efforts, there is little likelihood of standardization of provincial markets in the near-term—and inter-provincial markets are rare and heavily constrained—which will lead to a continued heterogeneous system of electricity markets.

Given these realities, the ETS pilots and the current national design adopt a “rate-based” approach to electricity production as it does for other sectors, which requires covered entities to meet a specific ratio of emissions to output. Inefficiencies of this system relative to an absolute cap-based system arise from the setting of the benchmarks for plants, which leads to firms facing different prices for abatement (Goulder & Morgenstern, 2018). Institutionally, these benchmarks (e.g., average emissions rates based on generating type and size) have been determined by local governments. It is clear that benchmarks that vary by province but that are in an integrated market would have different marginal costs and, hence, unfavorably affect dispatch.

Additionally, some electricity consumers must meet certain limits in terms of their “indirect emissions” from electricity generation, with the aim of bypassing the cost pass-through problem from generation to retail tariffs (Teng, Jotzo, & Wang, 2017). The joint inclusion of direct and indirect emissions is unique to the Chinese system. Some other systems include indirect emissions only, or include both but in separate markets (Munnings et al., 2016). Modeling studies indicate that this system is less cost-effective relative to full market pricing, while nevertheless achieving some reductions (Teng et al., 2017). Given the larger diversity of firms covered under indirect emissions, the appropriate roles of local governments should be specified and additional central regulations might be required.

Restructuring the electricity sector will be a long process, reflecting the number and diversity of actors involved. It is likely that a single national design for even relatively simple markets—e.g., annual bilateral contracts—will not be accepted in the near-term, not to mention more complex spot markets that trade on hourly or sub-hourly bases.¹⁹ In

¹⁹ Interviews with central government officials and electricity planning managers, 2018.

the interim, the design of the ETS should closely match developments in the power sector with the purpose of lessening distortions. This includes possible revisions in response to emerging concepts of “green dispatch” and increasing standardization of inter-provincial dispatch procedures.

4 CONCLUSION

China does not have a unitary state. The importance of central-local relations and tensions—in China’s particular flavor of “quasi-federalism”—for institutional transformations over the last four decades of the reform era cannot be understated. The particular organizational structure—in terms of position, rank and mandate of related party and state bureaucracies—as well as less formal institutions communicating leadership priorities will thus heavily influence and constrain options for controlling GHG emissions in the economy in a lasting manner.

Through the lens of institutions governing investment, production, and consumption decisions, there are general divisions between central and local governments that affect climate policy. China’s central agencies retain a lot of power over overall economic planning, tax policy, strategic goods pricing, and standard-setting. Local governments control permitting, some retail pricing, portions of production, and land policy. High-level attention by central leaders has accelerated the introduction of some reforms, particularly when climate goals are aligned with other objectives such as reducing air pollution and introducing electricity markets.

These divisions reflect local political economies, which necessarily constrain what is possible in terms of prescribing climate policy. It is unlikely that a single set of institutions will be adopted uniformly across the country in the near future (or perhaps even much later). One possible strategy might be to creatively exercise centralization where local government interests are particularly divergent, and to leverage and modify local government incentives where long-lasting authorities exist.

These findings also have implications and raise questions specifically about the national carbon market set to start around 2020, which must engage with investment, production, and consumption in order to be effective. The newly-created Ministry of Ecology and Environment is the locus for climate change policy, but its authority within China’s complex institutional framework is still being developed. In practical terms, harmonizing local carbon market pilots faces issues around generating efficient prices given differing local designs, cross-provincial trading barriers, and industry structures. The ultimate success of the national carbon market will depend on electricity market reforms, being pursued in parallel and also with its own complex array of central-local tensions.

REFERENCES

- Andrews-Speed, P. (2013). Reform Postponed: The Evolution of China's Electricity Markets. In F. P. Sioshansi (Ed.), *Evolution of Global Electricity Markets: New Paradigms, New Challenges, New Approaches* (pp. 531–567). Waltham, MA: Elsevier.
- Andrews-Speed, P. (2014). China's Energy Policymaking Processes and Their Consequences. In *China's Energy Crossroads: Forging a New Energy and Environmental Balance*. National Bureau of Asian Research. Retrieved from <http://www.nbr.org/publications/issue.aspx?id=309>
- Ang, Y. Y. (2016). *How China Escaped the Poverty Trap*. Cornell University Press.
- Bai, C.-E., & Qian, Y. (2010). Infrastructure development in China: The cases of electricity, highways, and railways. *Journal of Comparative Economics*, 38(1), 34–51. <https://doi.org/10.1016/j.jce.2009.10.003>
- Burtraw, D., & Sekar, S. (2014). Two world views on carbon revenues. *Journal of Environmental Studies and Sciences*, 4(1), 110–120. <https://doi.org/10.1007/s13412-013-0151-y>
- Cai, H., & Treisman, D. (2006). Did Government Decentralization Cause China's Economic Miracle? *World Politics*, 58(04), 505–535. <https://doi.org/10.1353/wp.2007.0005>
- Cao, Y., Qian, Y., & Weingast, B. R. (1999). From federalism, Chinese style to privatization, Chinese style. *Economics of Transition and Institutional Change*, 7(1), 103–131. <https://doi.org/10.1111/1468-0351.00006>
- CCA. (2017). *Cement Industry Coal Control Strategy and Implementation Research* (China Coal Consumption Cap Plan and Policy Research Project). China Cement Association. 《水泥行业煤控战略(计划)实施研究》.
- CEC. (2018). 2017 National Electricity Market Information Summary. China Electricity Council. 《2017 年度全国电力市场交易信息简要分析》.
- Chen, L. (2010). Playing the Market Reform Card: The Changing Patterns of Political Struggle in China's Electric Power Sector. *China Journal*, 64, 69–95.
- Cheng, T., & Tsai, C.-M. (2008). Powering rent seeking in the electricity industry. In T.-W. Ngo & Y. Wu (Eds.), *Rent Seeking in China*. Routledge.
- CPCCC. (2013, November 12). Third Plenary Session Communiqué: Major Issues in Comprehensively Deepening Reform. Communist Party of China Central Committee. 《中共中央关于全面深化改革若干重大问题的决定》.
- CPCCC. (2015). Integrated Reform Plan for Promoting Ecological Progress. Communist Party of China Central Committee. Retrieved from

http://english.gov.cn/policies/latest_releases/2015/09/22/content_281475195492066.htm

- CPCCC. (2018). Deepening Reform of Party and State Organizations. Communist Party of China Central Committee. 《深化党和国家机构改革方案》 .
- Cunningham, E. A. (2009). *A portfolio approach to energy governance: state management of China's coal and electric power supply industries*. Massachusetts Institute of Technology.
- Davidson, M. R. (forthcoming). Technology Integration in China's Electricity System: Central Targets and Local Challenges. In T. G. Rawski & L. Brandt (Eds.), *Policy, Regulation and Innovation in China's Electricity and Telecom Industries*, forthcoming. Cambridge University Press. in press.
- Davidson, M. R. (2018). *Creating Markets for Wind Electricity in China: Case Studies in Energy Policy and Regulation* (Ph.D. Thesis). Massachusetts Institute of Technology.
- Deng, G., & Kennedy, S. (2010). Big business and industry association lobbying in China: The paradox of contrasting styles. *The China Journal*, 101–125.
- Duan, M., & Zhou, L. (2017). Key issues in designing China's national carbon emissions trading system. *Economics of Energy & Environmental Policy*, 6(2). <https://doi.org/10.5547/2160-5890.6.2.mdua>
- Eaton, S., & Kostka, G. (2017). Central Protectionism in China: The “Central SOE Problem” in Environmental Governance. *The China Quarterly*, 231, 685–704. <https://doi.org/10.1017/S0305741017000881>
- Feng, W., Li, X., Szum, C., Zhou, N., Bendewald, M., Meng, Z., & Zeng, Y. (2017). From Prescriptive to Outcome-Based — The Evolution of Building Energy Codes and Standards in China. Lawrence Berkeley National Laboratory.
- Fewsmith, J. (1994). *Dilemmas of Reform in China: Political Conflict and Economic Debate: Political Conflict and Economic Debate*. Routledge.
- Fewsmith, J., & Nathan, A. J. (2018). Authoritarian Resilience Revisited: Joseph Fewsmith with Response from Andrew J. Nathan. *Journal of Contemporary China*, 0(0), 1–13. <https://doi.org/10.1080/10670564.2018.1511390>
- Gallagher, K. S., & Xuan, X. (2018). *Titans of the Climate: Explaining Policy Process in the United States and China*. Cambridge, MA: MIT Press.
- Goron, C., & Cassisa, C. (2016). Regulatory Institutions and Market-Based Climate Policy in China. *Global Environmental Politics*, 17(1), 99–120. https://doi.org/10.1162/GLEP_a_00392
- Goulder, L. H., & Morgenstern, R. D. (2018). China's Rate-based Approach to Reducing CO2 Emissions: Strengths, Limitations, and Alternatives (p. 19). Presented at the Allied Social Science Associations 2018 Annual Meeting, Philadelphia.

- Goulder, L. H., Morgenstern, R. D., Munnings, C., & Schreifels, J. (2017). China's National Carbon Dioxide Emission Trading System: An Introduction. *Economics of Energy & Environmental Policy*, 6(2). <https://doi.org/10.5547/2160-5890.6.2.lgou>
- Hart, C., Zhu, J., & Ying, J. (2017). Mapping China's Climate Policies. Development Technologies International.
- Hayek, F. A. (1948). *Individualism and Economic Order*. University of Chicago Press.
- Heilmann, S. (2008). From Local Experiments to National Policy: The Origins of China's Distinctive Policy Process. *The China Journal*, (59), 1–30. <https://doi.org/10.2307/20066378>
- Heilmann, S., & Perry, E. J. (Eds.). (2011). *Mao's Invisible Hand: The political foundations of adaptive governance in China*.
- Helveston, J. P., Wang, Y., Karplus, V. J., & Fuchs, E. R. H. (2019). Institutional complementarities: The origins of experimentation in China's plug-in electric vehicle industry. *Research Policy*, 48(1), 206–222. <https://doi.org/10.1016/j.respol.2018.08.006>
- Hou, L. (2018, June 11). New round of pollution inspections begins. *China Daily*. Retrieved from <http://www.chinadaily.com.cn/a/201806/11/WS5b1dac89a31001b82571f2cd.html>
- Hou, L. (2019, April 30). Why is air pollution worse in places? Inspectors in new round will find out. *China Daily*. Retrieved from <http://www.chinadaily.com.cn/a/201904/30/WS5cc7a06da3104842260b93cf.html>
- Hsu, A. (2013). Limitations and Challenges of Provincial Environmental Protection Bureaus in China's Environmental Data Monitoring, Reporting and Verification. *Environmental Practice*, 15(03), 280–292.
- Hu, M., & Montero, D. (2018). Opinion: The climate policy to hope for under China's new ecology ministry. *CGTN*. Retrieved from https://news.cgtn.com/news/3d3d514d33456a4e79457a6333566d54/share_p.html
- Jiang, X. (2014, November 26). New electricity reform plan submitted: separation of transmission and distribution not adopted. *Diyi Caijing*. Retrieved from <http://www.yicai.com/news/2014/11/4044884.html>
- Jin, H., Qian, Y., & Weingast, B. R. (2005). Regional decentralization and fiscal incentives: Federalism, Chinese style. *Journal of Public Economics*, 89, 1719–1742.
- Jotzo, F., Karplus, V., Grubb, M., Löschel, A., Neuhoff, K., Wu, L., & Teng, F. (2018). China's emissions trading takes steps towards big ambitions. *Nature Climate Change*, 8(4), 265–267. <https://doi.org/10.1038/s41558-018-0130-0>
- Kahrl, F., & Wang, X. (2014). Integrating Renewables into Power Systems in China: A Technical Primer - Power System Operations. Regulatory Assistance Project.

- Karplus, V. J. (2015). Double Impact: Why China Needs Coordinated Air Quality and Climate Strategies. *Paulson Institute*. Retrieved from http://globalchange.mit.edu/files/document/MITJPSPGC_Reprint_15-1.pdf
- Karplus, V. J., Shen, X., & Zhang, D. (2016). *Scaling Compliance with Coverage? Firm-level Performance in China's Industrial Energy Conservation Program*. MIT Joint Program on the Science and Policy of Global Change.
- Kostka, G. (2016). Command without control: The case of China's environmental target system. *Regulation & Governance*, 10(1), 58–74. <https://doi.org/10.1111/rego.12082>
- Kostka, G., & Hobbs, W. (2012). Local Energy Efficiency Policy Implementation in China: Bridging the Gap between National Priorities and Local Interests*. *The China Quarterly*, 211, 765–785. <https://doi.org/10.1017/S0305741012000860>
- Kostka, G., & Nahm, J. (2017). Central–Local Relations: Recentralization and Environmental Governance in China. *The China Quarterly*, 231, 567–582. <https://doi.org/10.1017/S0305741017001011>
- Kroeber, A. R. (2016). *China's Economy: What Everyone Needs to Know*. Oxford University Press.
- Landry, P. F. (2008). *Decentralized Authoritarianism in China: the Communist Party's control of local elites in the post-Mao era*. New York: Cambridge University Press.
- Li, C. (2016). *Chinese Politics in the Xi Jinping Era: Reassessing Collective Leadership*. Brookings Institution Press. Google-Books-ID: 6kzDCQAAQBAJ.
- Li, J. (2018a, April 9). China's new environment ministry unveiled, with huge staff boost. *Climate Home News*. Retrieved from <http://www.climatechangenews.com/2018/04/09/chinas-new-environment-ministry-unveiled-huge-staff-boost/>
- Li, K. (2018b). Government Work Report. Xinhua. Retrieved from <http://news.sina.com.cn/china/xlxw/2018-03-05/doc-ixipenn0170413.shtml> 《李克强作政府工作报告》.
- Lieberthal, K., & Oksenberg, M. (1988). *Policy making in China: Leaders, structures, and processes*. Princeton University Press.
- Lin, J. Y., Cai, F., & Li, Z. (2003). *The China miracle: Development strategy and economic reform*. Chinese University Press.
- Lin, K.-C., & Purra, M. M. (2018). Transforming China's electricity sector: Politics of institutional change and regulation. *Energy Policy*. <https://doi.org/10.1016/j.enpol.2018.07.041>
- Ma, J. L. (2011). On-grid electricity tariffs in China: Development, reform and prospects. *Energy Policy*, 39(5), 2633–2645. <https://doi.org/10.1016/j.enpol.2011.02.032>

- Mei, C., & Pearson, M. M. (2014). Killing a chicken to scare the monkeys? Deterrence failure and local defiance in China. *The China Journal*, (72), 75–97.
- Mertha, A. (2009). “Fragmented Authoritarianism 2.0”: Political Pluralization in the Chinese Policy Process. *The China Quarterly*, 200, 995.
<https://doi.org/10.1017/S0305741009990592>
- Mertha, A. C. (2005). China’s “soft” centralization: shifting tiao/kuai authority relations. *The China Quarterly*, 184, 791–810.
- Miller, A. (2008). The CCP Central Committee’s Leading Small Groups. China Leadership Monitor.
- Montinola, G., Qian, Y., & Weingast, B. R. (1995). Federalism, Chinese style: the political basis for economic success in China. *World Politics*, 48(01), 50–81.
- MOST, MEP, & CMA. (2017). 13th Five-Year Special Plan on Scientific and Technological Innovation on Climate Change. Ministry of Science and Technology. Retrieved from
http://www.most.gov.cn/mostinfo/xinxifenlei/fgzc/gfxwj/gfxwj2017/201705/t20170517_132850.htm 《“十三五”应对气候变化科技创新专项规划》.
- Munnings, C., Morgenstern, R. D., Wang, Z., & Liu, X. (2016). Assessing the design of three carbon trading pilot programs in China. *Energy Policy*, 96(Supplement C), 688–699. <https://doi.org/10.1016/j.enpol.2016.06.015>
- Nahm, J. (2017). Exploiting the Implementation Gap: Policy Divergence and Industrial Upgrading in China’s Wind and Solar Sectors. *The China Quarterly*, 231, 705–727.
<https://doi.org/10.1017/S030574101700090X>
- Nathan, A. J. (1973). A Factionalism Model for CCP Politics. *The China Quarterly*, (53), 34–66.
- Naughton, B. (1995). *Growing out of the plan: Chinese economic reform, 1978-1993*. New York, NY : Cambridge University Press, 1995.
- Naughton, B. (2015). The Transformation of the State Sector: SASAC, the Market Economy, and the New National Champions. In B. Naughton & K. S. Tsai (Eds.), *State Capitalism, Institutional Adaptation, and the Chinese Miracle* (pp. 46-). Cambridge University Press.
- Naughton, B., & Tsai, K. S. (2015). State Capitalism and the Chinese Economic Miracle. In B. Naughton & K. S. Tsai (Eds.), *State Capitalism, Institutional Adaptation, and the Chinese Miracle* (pp. 1–24). Cambridge University Press.
- NDRC. (2017a). China’s Policies and Actions for Addressing Climate Change (2017). National Development and Reform Commission.
- NDRC. (2017b). Plan for National Carbon Emissions Trading Market Construction (Electricity Sector). National Development and Reform Commission. Retrieved from

- http://www.ndrc.gov.cn/zcfb/gfxwj/201712/t20171220_871127.html 《全国碳排放权交易市场建设方案(发电行业)》(发改气候规〔2017〕2191号).
- NDRC. (2017c). Reply Regarding Newly Permitted Coal Plant Electricity Allocation. National Development and Reform Commission. Retrieved from http://yxj.ndrc.gov.cn/gzdt/201711/t20171110_866766.html 《关于新核准煤电机组电量计划安排的复函》(发改办运行〔2017〕1794号).
- NDRC et al. (2017). Opinion Regarding 2017 Work Resolving Steel and Coal Industry Overcapacity Reduction Problems. National Development and Reform Commission. Retrieved from <http://www.chinatax.gov.cn/n810341/n810755/c2665717/content.html> 《关于做好2017年钢铁煤炭行业化解过剩产能实现脱困发展工作的意见》.
- NDRC, & NEA. (2016a). 13th Five-Year Plan on Coal Industry. National Development and Reform Commission. Retrieved from <http://www.ndrc.gov.cn/gzdt/201612/W020161230415967105993.pdf> 《煤炭工业发展“十三五”规划》.
- NDRC, & NEA. (2016b). 13th Five-Year Plan on Electricity Development. National Development and Reform Commission. 《电力发展“十三五”规划》.
- NEA. (2016). 2015 National Electricity Dispatch Exchange and Market Operations Supervision Report. National Energy Administration. 《能源局公布2015年全国电力调度交易与市场秩序监管报告》.
- NEA. (2018). Notice Seeking Comment on Implementing Renewable Energy Obligation System. National Energy Administration. Retrieved from http://www.nea.gov.cn/2018-11/15/c_137607356.htm 《关于实行可再生能源电力配额制的通知》意见的函.
- North, D. C. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge University Press.
- North, D. C. (1991). Institutions. *Journal of Economic Perspectives*, 5(1), 97–112. <https://doi.org/10.1257/jep.5.1.97>
- NPC. (2014). Environmental Protection Law (Amended). China National People's Congress. Retrieved from http://www.npc.gov.cn/npc/xinwen/2014-04/25/content_1861279.htm 《中华人民共和国环境保护法》(2014年修订).
- NPC. (2015). Air Pollution Prevention and Control Law (2015 Amendments). China National People's Congress. Retrieved from http://www.npc.gov.cn/npc/xinwen/2015-08/31/content_1945589.htm 《中华人民共和国大气污染防治法》.
- Oi, J. C. (1992). Fiscal reform and the economic foundations of local state corporatism in China. *World Politics*, 45(01), 99–126.

- Oi, J. C. (1999). *Rural China takes off: institutional foundations of economic reform*. Berkeley: University of California Press.
- Oi, J. C., & Walder, A. G. (1999). *Property Rights and Economic Reform in China*. Stanford University Press.
- Pearson, M. M. (2005). The Business of Governing Business in China: Institutions and Norms of the Emerging Regulatory State. *World Politics*, (2), 296.
- Pearson, M. M. (2007). Governing the Chinese Economy: Regulatory Reform in the Service of the State. *Public Administration Review*, 67(4), 718–730.
- Pearson, M. M. (2015). State-Owned Business and Party-State Regulation in China's Modern Political Economy. In B. Naughton & K. S. Tsai (Eds.), *State Capitalism, Institutional Adaptation, and the Chinese Miracle* (pp. 27–45). Cambridge University Press.
- Qian, Y. (1999). The institutional foundations of China's market transition (pp. 28–30). Presented at the Annual Conference on Development Economics, Washington, DC: The World Bank.
- Qiao, Q., Zhao, F., Liu, Z., Jiang, S., & Hao, H. (2017). Cradle-to-gate greenhouse gas emissions of battery electric and internal combustion engine vehicles in China. *Applied Energy*, 204, 1399–1411. <https://doi.org/10.1016/j.apenergy.2017.05.041>
- Rawski, T. G. (1995). Implications of China's Reform Experience. *The China Quarterly*, (144), 1150.
- Ren, M., Branstetter, L., Kovak, B., Armanios, D., & Yuan, J. (2019). Why Has China Overinvested in Coal Power? National Bureau of Economic Research.
- Rithmire, M. E. (2014). China's "New Regionalism": Subnational Analysis in Chinese Political Economy. *World Politics*, 66(01), 165–194. <https://doi.org/10.1017/S004388711300035X>
- Rithmire, M. E. (2017). Land Institutions and Chinese Political Economy: Institutional Complementarities and Macroeconomic Management. *Politics & Society*, 45(1), 123–153. <https://doi.org/10.1177/0032329216683167>
- Rooij, B. van, Zhu, Q., Li, N., & Wang, Q. (2017). Centralizing Trends and Pollution Law Enforcement in China. *The China Quarterly*, 231, 583–606. <https://doi.org/10.1017/S0305741017000935>
- Sandalow, D. (2018). Guide to Chinese Climate Policy. Columbia University Center on Global Energy Policy. Retrieved from <https://energypolicy.columbia.edu/sites/default/files/pictures/Guide%20to%20Chinese%20Climate%20Policy%207-27-18.pdf>
- SASAC. (2017). Central Enterprise List. Retrieved February 16, 2019, from <http://www.sasac.gov.cn/n2588035/n2641579/n2641645/index.html> 《央企名录》.

- Schreifels, J. J., Fu, Y., & Wilson, E. J. (2012). Sulfur dioxide control in China: policy evolution during the 10th and 11th Five-year Plans and lessons for the future. *Energy Policy*, 48, 779–789. <https://doi.org/10.1016/j.enpol.2012.06.015>
- Schurmann, F. (1968). *Ideology and organization in Communist China*. Berkeley, University of California Press.
- Shearer, C., Yu, A., & Nace, T. (2018). Tsunami Warning: Can China's Central Authorities Stop a Massive Surge in New Coal Plants Caused by Provincial Overpermitting? CoalSwarm.
- Shih, V. C. (2008). *Factions and finance in China: elite conflict and inflation*. Cambridge ; New York: Cambridge University Press.
- State Council. (2007). China's National Climate Change Plan. State Council. Retrieved from <https://www.fmprc.gov.cn/ce/ceuk/chn/zyxw/t332707.htm> 《中国应对气候变化国家方案》.
- State Council. (2012). Energy Saving and New Energy Auto Industry Development Plan (2012–2020). State Council. Retrieved from <http://www.miit.gov.cn/n1146295/n1146557/n1146619/c3072778/content.html> 《节能与新能源汽车产业发展规划（2012-2020年）》.
- State Council. (2013). Action Plan on Prevention and Control of Air Pollution. State Council. Retrieved from http://www.gov.cn/zwgk/2013-09/12/content_2486773.htm 《大气污染防治行动计划》.
- State Council. (2014). Notice of Catalogue of Government Approvals for Investment Projects (2014 version). 《国务院关于发布政府核准的投资项目目录（2014年本）》国发〔2014〕53号.
- State Council. (2015). Opinion Regarding Deepening Electricity Sector Reform. State Council. 《中共中央国务院关于进一步深化电力体制改革的若干意见》.
- Stavins, R. N. (2008). A Meaningful US Cap-and-Trade System to Address Climate Change. *Harvard Environmental Law Review*, 32, 293–371.
- Teng, F., Jotzo, F., & Wang, X. (2017). Interactions between Market Reform and a Carbon Price in China's Power Sector. *Economics of Energy & Environmental Policy*, 6(2). <https://doi.org/10.5547/2160-5890.6.1.ften>
- The White House. (2015). U.S.-China Joint Presidential Statement on Climate Change. Retrieved February 16, 2019, from <https://obamawhitehouse.archives.gov/the-press-office/2015/09/25/us-china-joint-presidential-statement-climate-change>
- Thun, E. (2004). Keeping Up with the Jones': Decentralization, Policy Imitation, and Industrial Development in China. *World Development*, 32(8), 1289–1308. <https://doi.org/10.1016/j.worlddev.2004.02.007>

- Tong, J., Zhang, X., Ren, J., Tang, Y., Xu, X., Jiang, X., & Li, N. (2011). Energy-Efficient Dispatch Implementation Analysis and Policy Recommendations. Energy Foundation. 《节能发电调度实施分析和政策建议》.
- Truex, R. (2018). Authoritarian Gridlock? Understanding Delay in the Chinese Legislative System. *Comparative Political Studies*, 0010414018758766. <https://doi.org/10.1177/0010414018758766>
- Tsai, C. (2014). Regulating China's Power Sector: Creating an Independent Regulator without Autonomy. *The China Quarterly*, 218, 452–473. <https://doi.org/10.1017/S0305741014000381>
- UIBE, & CASS. (2018). *Coal Sector Employment Impacts of Capacity Reduction Policies* (China Coal Consumption Cap Electricity Sector Research Working Group). University of International Business and Economics; Institute for Urban and Environmental Studies, Chinese Academy of Sciences. 《“去产能”政策对煤炭行业造成的就业影响研究》.
- Vogel, S. K. (2018). *Marketcraft: How Governments Make Markets Work*. Oxford University Press.
- Wang, A. L. (2013). The Search for Sustainable Legitimacy: Environmental Law and Bureaucracy in China. *Harvard Environmental Law Review*, 37, 365–440.
- Wang, P., Liu, L., & Wu, T. (2018). A review of China's climate governance: state, market and civil society. *Climate Policy*, 18(5), 664–679. <https://doi.org/10.1080/14693062.2017.1331903>
- Wang, R. (2010). Shaping urban transport policies in China: Will copying foreign policies work? *Transport Policy*, 17(3), 147–152. <https://doi.org/10.1016/j.tranpol.2010.01.001>
- Wedeman, A. H. (2003). *From Mao to market: rent seeking, local protectionism, and marketization in China*. Cambridge University Press.
- Weingast, B. R. (1995). The Economic Role of Political Institutions: Market-Preserving Federalism and Economic Development. *Journal of Law, Economics, & Organization*, 11(1), 1–31.
- Wong, C., & Karplus, V. J. (2017). China's War on Air Pollution: Can Existing Governance Structures Support New Ambitions? *The China Quarterly*, 231, 662–684. <https://doi.org/10.1017/S0305741017000947>
- Xinhua. (2014, June 13). Xi Jinping: Actively Promote China's Energy Supply and Demand Revolution. Retrieved February 24, 2015, from http://news.xinhuanet.com/politics/2014-06/13/c_11111139161.htm
- Yeh, E. T., & Lewis, J. I. (2004). State Power and the Logic of Reform in China's Electricity Sector. *Pacific Affairs*, (3), 437.

- Yicai. (2013, March 21). Should State Grid Be Broken Into Five Pieces? Li Keqiang Says Electricity Market Reforms are Necessary. *Diyi Caijing*. Retrieved from <http://finance.ifeng.com/news/macro/20130321/7802052.shtml> 《国家电网否认一拆为五 李克强曾表示市场化改革是必然》.
- Zeng, M., Xue, S., Li, L., Wang, Y., Wei, Y., & Li, Y. (2013). China's large-scale power shortages of 2004 and 2011 after the electricity market reforms of 2002: Explanations and differences. *Energy Policy*, *61*, 610–618. <https://doi.org/10.1016/j.enpol.2013.06.116>
- Zhang, B., Fei, H., He, P., Xu, Y., Dong, Z., & Young, O. R. (2016). The indecisive role of the market in China's SO₂ and COD emissions trading. *Environmental Politics*, *25*(5), 875–898. <https://doi.org/10.1080/09644016.2016.1165951>
- Zhang, C., & Heller, T. C. (2007). Reform of the Chinese electric power market: economics and institutions. In D. G. Victor & T. C. Heller (Eds.), *The political economy of power sector reform: the experiences of five major developing countries*. Cambridge: Cambridge University Press.
- Zhang, J., Wang, Z., & Du, X. (2017). Lessons learned from China's regional carbon market pilots. *Economics of Energy & Environmental Policy*, *6*(2). <https://doi.org/10.5547/2160-5890.6.2.jzha>
- Zhang, L.-Y. (1999). Chinese central-provincial fiscal relationships, budgetary decline and the impact of the 1994 fiscal reform: An evaluation. *The China Quarterly*, *157*, 115–141.
- Zhi, Q., & Pearson, M. M. (2016). China's Hybrid Adaptive Bureaucracy: The Case of the 863 Program for Science and Technology. *Governance*. <https://doi.org/10.1111/gove.12245>