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Mapping China's Climate & Energy Policies

December 2018 Edition

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Executive Summary and Foreword

China is now a critical country shaping the outcomes of the international climate negotiations.

China is the world's largest emitter of greenhouse gases on an absolute basis, and its emissions have surpassed the European Union on a per capita basis, placing its emissions profile squarely among developing countries.

China's actions, along with those of other major economies, will determine the future of our planet. In the negotiations that culminated in the Paris Agreement and those to implement it, China has claimed a leadership position advancing its positions through multilateral and bilateral diplomacy, its ongoing efforts to curb its greenhouse gas emissions and adapt to climate change, and pledges of financial and technical support to other developing countries.

This report aims to assist those from government, industry, and civil society interested in better understanding China's policy formation processes concerning climate change and energy.

This fourth version of *Mapping China's Climate & Energy Policies* updates analysis reflecting China's government reorganization in spring 2018, the evolution of China's climate and energy policies, expansion of China's climate-based diplomatic efforts, and China's negotiation positions and interventions at the UNFCCC and the International Civil Aviation Organization. This version adds a new chapter on China's general economic policies essential to understanding climate and energy policies. In this version, climate and energy policies are now covered in separate chapters, with both chapters expanding their coverage of their respective policies.

China's climate and energy policies are developed based on consensus among stakeholders inside and outside government, led by a dominant government agency. Following the spring 2018 government reorganization, the Ministry of Ecology and Environment (MEE) assumed responsibility for leading and coordinating China's international climate negotiations efforts, and coordinating domestic climate policy amongst ministries. In energy policy, the lead agency remains the National Development and Reform Commission (NDRC).

Although no longer responsible for China's climate portfolio, the NDRC still influences climate policy through energy policy and its broader responsibilities for China's economic development. Other central and sub-national government bodies exert varying degrees of influence over China's climate policies based on the particular issue and through implementation. Important examples of stakeholders outside of government that influence the formation of China's climate policies are state-owned industry, exerting influence through economic power, and expert organizations such as China’s major universities, exerting influence through their expertise and ability to inform and legitimate political and economic positions.

This report identifies "clusters" of policymakers that contribute to the formation of specific substantive climate policies - such as mitigation, adaptation, technology transfer, and finance - as well as policies relevant to broader state interests implicating foreign relations. The stakeholders engaged in developing consensus on climate policy for each substantive area depends on a number of factors, including jurisdiction for administering applicable laws and regulations, lines of political authority within government and the Communist Party of China (the Party or CPC), technical expertise, and the technology relevant to a particular issue.

Climate policy has emerged as a political priority for China. President Xi's goal to establish a national carbon market by 2020, President Xi and Premier Li's personal engagement with foreign leaders on climate, and China's pledges to scale up funding for South-South cooperation to fight climate change are examples that confirm that China's top leaders direct climate policy.

Top leadership engagement on climate change represents a transition from a predominantly technical policymaking process at the government level to high profile political decision making led by the Party and

government officials at the highest levels. The shift in climate policy from the technical towards the political realm is likely to intensify as China faces increasing pressure in international negotiations to reduce its greenhouse gas emissions.

As part of this shift, climate change is being integrated with China's broader development assistance and foreign policy strategies with respect to G-77 countries in its climate negotiating alliance. The integration of clean energy, climate and sustainability themes in China's Belt and Road Initiative illustrates how climate change has emerged as foundational to China's broader foreign relations.

This report mainly confines its analysis to domestic Chinese organizations of the Party, the government, expert organizations, and state enterprise. The report also consider the role of specific domestic and foreign NGOs and intergovernmental organizations in limited cases where these organizations have been instrumental in influencing policy development and failure to report their participation would foster an incomplete understanding of the dynamics shaping policy. This is an extremely high bar. Thus, general coverage of NGOs and intergovernmental organizations is not the focus of this report, nor is our purpose to evaluate the relative contributions or impact of NGOs. Thus, although intergovernmental organizations and NGOs are collectively playing a significant role in supporting the development of policy, shaping opinion, and providing financial and technical support for projects and policies, it is not possible to recognize all of these organizations by name in this report.

This report relies on information from public resources, including Chinese government documents, UNFCCC records, news reports, academic papers, trade publications and other published materials in English, Chinese and French. In addition, the authors conducted extensive interviews with stakeholders and experts who are knowledgeable about the international climate negotiations and China's climate and energy policies.

This report comprises twelve chapters organized in three sections: stakeholders and policy formation process, policies, and future strategy. In Part I: Stakeholders and Policy Formation Process, Chapter 1 provides an overview of China's central government, setting out the main stakeholders engaged in climate policy formation at the national level. These include government and non-governmental actors such as industry and expert organizations. Chapter 2 summarizes key Party organizations and leadership task forces engaged in climate, energy and environmental policy. It explains how the Party leads government policy formation processes. Chapter 3 analyzes the MEE and NDRC and institutions specializing in climate and energy policies associated with the State Council. Chapter 4 focuses on expert organizations and Chapter 5 on industry stakeholders. Chapter 6 draws on sociological theory to present "clusters" of stakeholders that influence specific climate and energy issues, varying according to political, administrative, economic, and technical bases of authority.

In Part II: Domestic Policies, Chapter 7 explains aspects of China's political economy essential for understanding its environmental and energy policies. This chapter covers the co-existence of the centrally planned and market economy, the pervasiveness of subsidies, decentralized tax administration, and related land development and finance policies. Chapters 8 and 9 present China's climate and energy policies that are critical to its ability to meet its Paris Agreement contributions. Chapter 8 also examines how China's efforts to control greenhouse gas emissions must synergize with solving air, water and land pollution.

In Part III: International Context and Future Strategy, Chapter 10 summarizes China's positions at the UNFCCC and other international fora, and how China's nationally determined contribution (NDC) under the Paris Agreement was developed in relation to its domestic five-year planning process. Chapter 11 examines the imperative for China to take immediate action on climate and how China's efforts to advance climate policies have emerged as a foreign policy strategy. Chapter 12 concludes by considering the future of China's climate policy formation process and how it might influence China's broader reform agenda, its foreign relations, energy policy, and the critical step of local implementation of its NDC to achieve its pledges to the international community.

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The authors thank those individuals in government, industry and civil society organizations who shared their insights with us. Too numerous to name, these individuals work towards improving China's environmental and development conditions every day through their service in government, their research at academic institutions and media organizations; their advocacy through NGOs; and their work towards creating a low carbon economy within the private sector.

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The views expressed in this report are those of the authors and do not necessarily represent those of our sponsors.

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1. Overview of China's Government and Climate Policy Stakeholders

The government of the People's Republic of China (China) is composed of the National People's Congress, the executive State Council, the President, and the Premier. Legislative and executive office holders are appointed for five-year terms. Mainland China comprises 22 provinces, four municipalities directly under central government control, five autonomous regions, and the special administrative regions of Hong Kong and Macau. Except for Hong Kong and Macau which have unique governance arrangements, each of these political subdivisions elect local people's congresses and are administered by people's governments

China's government is a unitary system combining the legislative, executive, and judicial functions in a single organ. The system is intended to work in unison, sometimes with shared responsibilities over certain functions.

The National People's Congress is the national legislative body and, formally, the highest organ of state power. The National People's Congress comprises 2,980 delegates that are selected from provinces, municipalities, autonomous regions and the armed forces. In additional to adopting legislation, the National People's Congress is responsible for amending and overseeing enforcement of China's constitution. The National People's Congress approves the President and members of the State Council, as well as the 175 members of the Standing Committee of the National People's Congress, which meets when the National People's Congress is not in session. In practice, the powers of the National People's Congress are exercised by its Standing Committee and the State Council, as further described below.

In addition to the National People's Congress, local People's Congresses at the provincial, city and county levels are responsible for legislating and supervising the implementation of laws, appointing and removing officials, and deciding major issues. All administrative, judicial and prosecutorial organs of the state are created and supervised by a People's Congress at the corresponding level.

Each People's Congress is a single house legislative body. Representatives of the national and local People's Congress serve on a part-time basis and are elected for 5-year terms. The deputies to congresses at the county and township levels are elected directly by their constituencies. Deputies to the National People's Congress and to the People's Congresses of provinces, autonomous regions, municipalities directly under the Central Government, cities divided into districts, and autonomous prefectures are elected by the people's congresses at the next lower level (Article 2, Electoral Law of the National People's Congress and Local People's Congresses of the People's Republic of China, as amended through March 14, 2010). There are approximately 2.6 million deputies to the people's congresses at all levels nationwide (State Council, 2017).

The National People's Congress meets in session once a year, and local people's congresses meet at least once a year. The National People's Congress may not exceed 3,000 deputies pursuant to the Electoral Law of the National People's Congress and Local People's Congresses of the People's Republic of China. Due to the number and part-time status of its deputies, the National People's Congress Standing Committee was established pursuant to the Constitution to exercise national legislative functions when the National People's Congress is not in session. The Standing Committee has the right to propose bills to the National People's Congress and to revise existing laws without the approval of the National People's Congress. People's Congress deputies also have the right to propose bills.

The **Communist Party of China**, described in Chapter 2, has held power since China's founding in 1949. The Political Bureau of the CPC Central Committee (Politburo) sets policy and controls important administrative, legal and executive government appointments. The Standing Committee of the Politburo leads the Party and, in turn, the government.

Certain government ministries play a major role in the development of climate change and energy policies. Key government ministries and agencies include:

State Council is the chief administrative authority of the People's Republic of China. The State Council is chaired by the Premier and comprises the approximately 50 heads of governmental departments and agencies. The State Council supervises the various subordinate provincial governments. In practice, the State Council acts through the National Development & Reform Commission with respect to regulation of the economy.

National Development & Reform Commission (NDRC) is a super-ministry, a half rank higher than all other ministries, responsible for developing and carrying out China's economic reform and opening policies for the State Council. In its role of guiding China's economic reform, NDRC exercises broad responsibilities for China's development and economic planning. NDRC prepares China's national five-year plan and sets price guidance for a range of basic inputs including capital, land, labor, and fuel. NDRC drafts the national energy development strategy; implements plans, policies and standards in all industrial sectors including energy; and is responsible for promoting new energy and energy efficiency. The NDRC acts for the State Council in reviewing and approving infrastructure projects throughout China. The **National Energy Administration** (NEA), an independent agency within NDRC, also develops energy policy and regulation, and is described in greater detail in Chapter 3 of this report. Until the spring 2018 government reorganization, the NDRC was responsible for China's climate policy.

Ministry of Ecology and Environment (MEE) is China's national environmental policy and enforcement body responsible for monitoring and regulating air, water (surface and ground water), and soil pollution. MEE is responsible for drafting and implementing environmental protection planning, policies and standards. Since the spring 2018 government reorganization, MEE is responsible for developing, implementing and coordinating China's climate change policies and for leading China's delegation at the international climate negotiations. MEE thus became responsible for developing China's greenhouse gas accounting regulations and implementing the national carbon market. Within MEE, the Climate Department and the **National Center for Climate Change Strategy and International Cooperation** (NCSC), both of which transferred intact from the NDRC, are responsible for climate change policy. The MEE also houses the **National Nuclear Safety Administration** (NNSA), which regulates nuclear safety and facilitates nuclear energy standards development.

Ministry of Foreign Affairs (MFA) is responsible for China's international relations and has special responsibilities and expertise in negotiating treaties. MFA shares responsibilities with the MEE for the climate negotiations.

Ministry of Finance (MOF) is responsible for budget and tax management, and for administering the National Social Security Fund. MOF administers environmental resource taxes and the CDM Fund, which promotes energy efficiency and renewable energy using funds collected from CDM projects. MOF approves all borrowing from international organizations, such as the World Bank, Asian Development Bank, the Asian Infrastructure Investment Bank, and the BRICS' New Development Bank.

State Agency for International Development Cooperation formulates policies, and coordinates and evaluates China's foreign aid efforts carried out by other government agencies in their specific fields. It supports China's Belt and Road Initiative and other aid activities.

Ministry of Science and Technology (MOST) is the lead agency preparing China's science and technology development plans and policies, drafting related laws and regulations, and implementing the country's basic and applied research programs. MOST administers several national R&D initiatives that fund basic and applied research for technologies important to climate mitigation and adaptation, especially in the carbon management area.

Ministry of Industry and Information Technology (MIIT) develops and implements plans, policies and standards for the industrial sector, with the aim of accelerating innovation and development of

indigenous technologies. It regulates the postal service, Internet, wireless, broadcasting, communications, electronic and information goods, software industry and promotes advanced knowledge-economy industries. MIIT also develops standards for clean technology industries, including electric vehicles, industrial water conservation and energy efficiency technologies.

Ministry of Natural Resources is responsible for developing policies, regulations and standards for, and approving, the utilization of land, mineral, water, and ocean resources. Following the spring 2018 government reorganization, the Ministry of Natural Resources houses the State Oceanic Administration and State Forestry and Grassland Administration, and thus possesses responsibilities relating to biological diversity and adaptation.

State Forestry and Grassland Administration under the Ministry of Natural Resources is responsible for supervision and management of forests, grasslands and wetlands. It possesses jurisdiction over China's national parks and other natural protection sites. Its responsibilities also include supervising and managing the exploitation, utilization and protection of forest, grassland, wetland, desert and terrestrial wildlife resources; organizing ecological protection and restoration campaigns; and carrying out afforestation and greening work. Forestry is expected to play an important role in supplying offset credits to China's national carbon market for reducing greenhouse gas emissions through biological sequestration of carbon.

Ministry of Agriculture and Rural Affairs is responsible for agriculture, fisheries and animal husbandry. Following the spring 2018 reorganization, its responsibilities expanded to include rural affairs and the livelihood of farmers. It provides guidance to other ministries on non-point pollution and greenhouse gas emissions from agriculture, and is a leading agency for rural adaptation policy issues.

Ministry of Water Resources is responsible for managing water resources in China, specifically zoning, water sewage, protection of watersheds and river basins. Its responsibilities include planning and approving dam construction, international cooperation on trans-boundary waterways, and rural water supply. In the spring 2018 reorganization, it assumed responsibility for supervising the South-to-North Water Transfer Project and the Three Gorges Dam. It plays a leading role in China's nascent adaptation efforts. As noted previously, other ministries have responsibilities for certain aspects of water policy and enforcement: the Ministry of Ecology and Environment is responsible for environmental protection of water resources, which appears to be shared responsibility for watersheds and river basins; the Ministry of Natural Resources is responsible for approving utilization of water resources; and the Ministry of Housing and Urban-Rural Development is responsible for urban sewage water management.

Ministry of Housing and Urban-Rural Development is responsible for managing China's urbanization. As such, it plays an important role in eco-city and green technology development for buildings, and leads planning efforts for urban adaptation.

Ministry of Emergency Management was established in the spring 2018 reorganization consolidating responsibilities across agencies for emergency management, disaster prevention, mitigation and relief. The Ministry of Emergency Management incorporates under its supervision the State Earthquake Administration, the State Administration of Coal Mine Safety Supervision, the State Flood Control and Drought Relief General Command, the State Disaster Reduction Commission, the Earthquake Relief Command of the State Council, and the State Forest Fire Prevention Command. It assumed the responsibilities of the dissolved State Administration of Work Safety Supervision and Administration. The Ministry of Emergency Management directly controls fire departments and other response units throughout China.

China Meteorological Administration (CMA) is responsible for meteorological and climate data collection, analysis, and forecasting. The CMA supports the Ministry of Emergency Management by supplying forecasts and real time monitoring data to prevent or respond to natural disasters. The CMA is a leading expert agency in China's adaptation planning.

State Grain and Materials Reserve Bureau is responsible for planning national reserves of grain and cotton and to enhance the state's ability to respond to food emergencies.

State Administration for Market Regulation (SAMR) is responsible for enforcing laws concerning competition, intellectual property, food health and safety, and standards. SAMR develops standards, including those relevant to energy technologies, health and safety.

State-owned Assets Supervision and Administration Commission of the State Council (SASAC) supervises and manages State-owned enterprises, including China's large power companies and oil and gas companies. SASAC appoints, evaluates the performance of, and removes directors and senior executives of the enterprises it supervises (SASAC, 2019). SASAC controls 33 percent of China's total industrial assets nationwide (Zweig, 2015).

People's Bank of China (PBOC) is China's central bank and primary financial regulatory body. **China Securities Regulatory Commission** (CSRC) is China's securities regulatory body. The PBOC and CSRC are active in market-based climate change policies that operate through financial markets.

National Bureau of Statistics is responsible for compiling, processing and publishing China's official statistics, including those relating to economic activity and energy consumption.

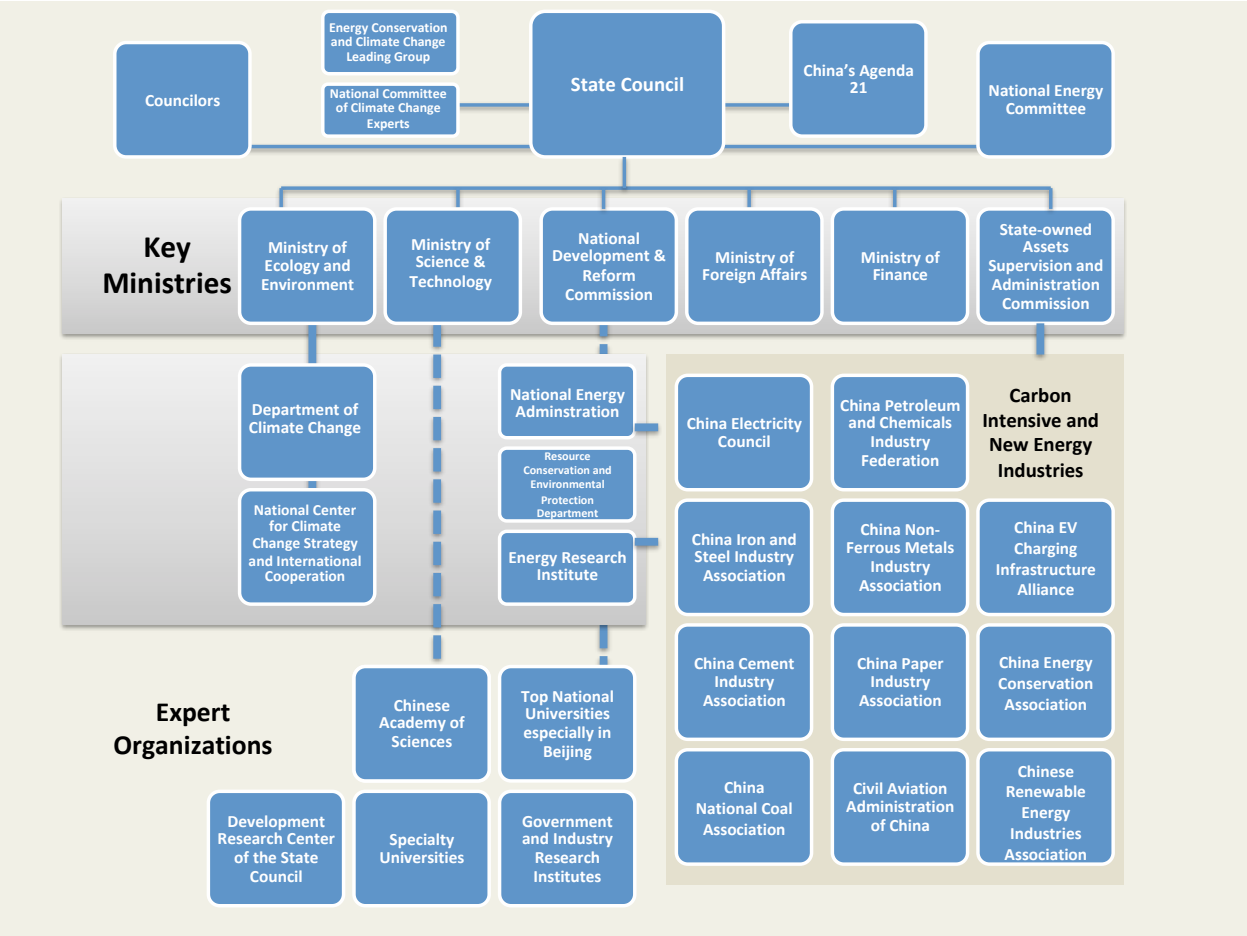
The following groups coordinate and support energy and climate policy development: the **National Energy Committee** comprised of members of each of the major government ministries and agencies, the **Climate Change, Energy Conservation and Emissions Reduction Leading Group** created by the State Council, and **China's Agenda 21**. These groups are described in greater detail, together with the MEE and NDRC, in Chapter 3.

In addition, the State Council is advised by the **National Committee on Climate Change Experts** and individual Counselors, typically senior Party members and government officials. The **Chinese Academies, China Meteorological Administration,** the **Development Research Center of the State Council,** and China's university system support the government in developing policy by providing specialized expertise. These and other expert organizations are described in Chapter 4.

China maintains Party-affiliated industry associations that act as arms of the Party-state in coordinating enterprises within an industry on important issues such as foreign technology acquisition, representing state enterprise with government ministries, and in some cases exercising regulatory powers. These associations play an important role in the development of climate and energy policies affecting industry. For example, in developing China's national carbon market, industry associations advocated for their constituents, coordinated the collection of data, and, in the case of the electricity sector, the China Electricity Council is directly engaged in developing the regulations and allocation methodologies governing the power industry. Chapter 5 describes industry associations in greater detail.

The diagram below shows selected central government entities and stakeholders that would be involved in formation of climate and energy policy in China. It identifies agencies, departments and institutes that are part of or affiliated with the MEE and NDRC, and assist them in carrying out climate and energy policy responsibilities, respectively. Regional or local government entities are not shown on the diagram. Dashed lines represent funding or collaborative relationships, as opposed to reporting lines. The industries presented on the diagram are among the most carbon-intensive and are for illustrative purposes only; they are not intended to be exhaustive.

Figure 1: Overview of Major Climate and Energy Policy Formation Organizations



Source: Authors' analysis

2. The Party and its Relationship to Government

Understanding China's policymaking process requires understanding the role and operation of the Communist Party.

As a single party state, the Communist Party maintains a monopoly on political power within China.[1] The General Secretary of the **Political Bureau of the CPC Central Committee** (the Politburo) (中国共产党中央委员会总书记) is the highest Party official. Under the Party's Constitution, the General Secretary must be a member of the Party's Politburo. Starting with Jiang Zemin, the General Secretary of the Communist Party of China has held two key government positions - the Chairman of the Central Military Commission (中央军事委员会主席), making him commander-in-chief of the People's Liberation Army, and the President of the People's Republic of China. The Premier controls the civil bureaucracy, a powerful position, and usually holds the number-two position in the Party leadership.

The present Politburo has 25 members comprising the Politburo Standing Committee members, the Vice Premiers, Party chiefs of major provinces, and high-ranking Party officials with responsibilities for such matters as military affairs, propaganda, and legislation.

The Politburo Standing Committee comprises the top leaders of the Party, most of who also hold top government leadership positions. The Politburo Standing Committee is regarded as the highest decision making body in China. The committee presently has seven members. The committee meets once a week every Wednesday morning and makes decisions by consensus (Personal communications, November 2015). Each member is responsible for a portfolio covering a major governance system, grouped in clusters, generally as follows:

- Party affairs - party matters and relations with other Communist parties;
- Organizational affairs - allocation of party positions;
- Propaganda and education - news organizations and universities;
- Police and legal affairs - police organizations, courts, social campaigns;
- Economic development, natural resources and the environment;
- Finance and economics - led by the Prime Minister; and
- Military - controlled by the Party General Secretary and President.

China's strategic decisions concerning climate change are made or approved by the Politburo Standing Committee, with the assistance of the leading groups and task forces described below.

The Politburo appoints leadership small groups from among its members that study and develop policy in areas important to strategic planning and governance of the country. In the spring 2018 reorganization, the Party converted several of its most important small groups to the status of committees. These high-level groups are intended to lead Party, government and economic stakeholders towards consensus positions consistent with Party objectives. The Politburo has formed committees and leadership small

[1] Eight other small political parties operate in China. They supported the Communist Party during World War II (1937-1945) and the civil war against the Kuomintang (1945-1949), and today form a "multi-party cooperation system". These political parties do not compete for power or stand in opposition to each other, but rather are "partners" supporting the Communist Party by providing a forum for consultation on policy matters.

groups on the reform process; financial and economic affairs; foreign policy; national security; rural development; network and information security; and Hong Kong, Macao and Taiwan.

In the March 2018 Party-state reorganization, the Party upgraded four of its most important small leading groups to committee status, three of them relocating their offices to ministries from *Zhongnanhai* - the administrative compound housing the headquarters of the General Secretary of the Party and the State Council.

Locating Party committees within ministries strengthens Party control over government, and further blurs the distinction between Party and state. This represents centralization towards the Party, complementing the simultaneous yet distinct centralization of authority towards the central government. While these committees may not formally direct ministry actions, a senior Party official typically serves as director of a committee embedded within a ministry, and is supported by a vice director who may be the minister responsible for that ministry. The Party official reports to the committee chair, who for the most important committees is the Party General Secretary and China's President. By subordinating the government minister to a Party official, and establishing a reporting line to China's paramount leader, the arrangement effectively bypasses the State Council and subordinates the ministry to Party control.

In the 2018 reorganization, Party organs also extended direct control over certain critical administrative functions. The Party's Organizational Department took over responsibilities for appointing and supervising civil servants as part of the dissolution of the Civil Service Bureau, and the Propaganda Department now directly administers Xinhua News Agency. Transfer of administrative power to Party organs raises fundamental questions of accountability, as Party organs are not subject to China's administrative procedure laws or legal process generally.

The most important of the Politburo committee is the **Central Committee for Comprehensively Deepening Reform** (中央全面深化改革委员会). The 18th Central Committee of the Communist Party formed the group in 2013 as a policy formulation and implementation body established under the Politburo to deepen and expand China's continuing reform agenda. The group enables President Xi to strengthen his direct control over China's State Council and the government, which is historically the domain of the Premier, and to advance his programs through the government bureaucracy (Huang, 2013). This committee meets periodically and has issued a number of published decisions relating to the environment.

The Central Committee for Comprehensively Deepening Reform established the **Reform Task Force for the Promotion of Economic Development and Ecological Progress** (经济体制和生态文明体制改革专项小组), through which it developed the *Integrated Reform Plan for Promoting Ecological Progress* (2015), an important document that calls for institutional changes to China's government structure to achieve environmental objectives. Other Party task forces relating to the environment include the **Ecological Civilization Promotion Task Force** (生态文明促进会) and the **Low Carbon Economic Development and Innovation Task Force** (低碳经济发展与创新). These task forces are comprised of Party leaders, ministry personnel and experts.

Additionally, the **Party's Central Committee for Financial and Economic Affairs** (中央财经委员会) serves as the top decision making body for financial and economic policy, focusing on financial system stability and risk, which has implications for infrastructure development and in turn energy policy.

Prior to the spring 2018 government reorganization, the NDRC's Resource Conservation and Environmental Protection Department served as the coordinating agency supporting the Reform Task Force for the Promotion of Economic Development and Ecological Progress's work on the *Integrated Reform Plan for Promoting Ecological Progress,* acting in effect as its secretariat for this particular policy document. Following the reorganization, responsibility for coordinating the climate work of Party committees and leading groups shifted to the MEE, which also coordinates environmental work. The

NDRC is expected to continue to coordinate the energy conservation work of Party committees and leading groups.

The Politburo, with the Politburo Standing Committee as the paramount decision-making body of the Party, working through the Central Leading Group for Comprehensively Deepening Reforms and its various task forces, direct the actions on the government. The State Council supported by the NDRC, described in greater detail in Chapter 3, implements the policies of these Party decision-making bodies at the highest levels.

The Party's organizational structure parallels the government at every level - national, provincial, prefecture, county, township, and village. Within towns and cities, Party committees penetrate down to the district and then neighborhood committee levels (Zweig, 2015). A Party branch and Party secretary exists for each government agency, court and legislative body at all levels of government. For example, the CPC National Party Congress corresponds to the National People's Congress; and the CPC Central Military Commission similarly corresponds to the State's Central Military Commission.

The Party's control over society is operationalized through its structure and power to appoint the leadership of government and state-owned enterprise through the *Nomenklatura* system. Under this system, the Party possesses the right to appoint and approve individuals to certain government and industry leadership positions. The Party at each level controls the nomination and appointment of government positions through Party committees corresponding to the level and specific organization of the government. Thus, Party members often hold dual appointment to the government position corresponding to their Party position.

The Party's influence was further strengthened in the spring 2018 Party-state reorganization dissolving the Civil Service Bureau and vesting the Party's Central Organization Department with authority to directly appoint government officials.

Like government positions, Party positions are elected for five-year terms at each level of government, with elections for Party positions being held several months prior to government transition, enabling the Party to select its leadership for that term and appoint those who will assume corresponding positions within the government. In general, Party and state officials are limited to two five-year terms, however the provision in China's national constitution limiting the President and Premier to two consecutive five-year terms was abolished in the constitutional amendment adopted as part of the spring 2018 Party-state reorganization.

In addition to the *Nomenklatura* system, the Party guides the behavior of its appointments through the cadre evaluation system, under which targets are set for individual cadres appropriate to their position that are used for determining future advancement. The cadre evaluation system, which traces its own roots to imperial practices, enables the Party to centrally control a government that is otherwise highly decentralized.

The cadre evaluation system operates in parallel with a distinct system of administrative mandates through which government ministries and agencies set goals for government organs at levels below them. While the two systems should in theory reinforce each other, the Party's cadre system focuses on individuals, whereas the administrative mandate system sets goals for government units implementing policies, and thus differences in priorities and incentives between the two systems exist (Personal communications, October 2013).

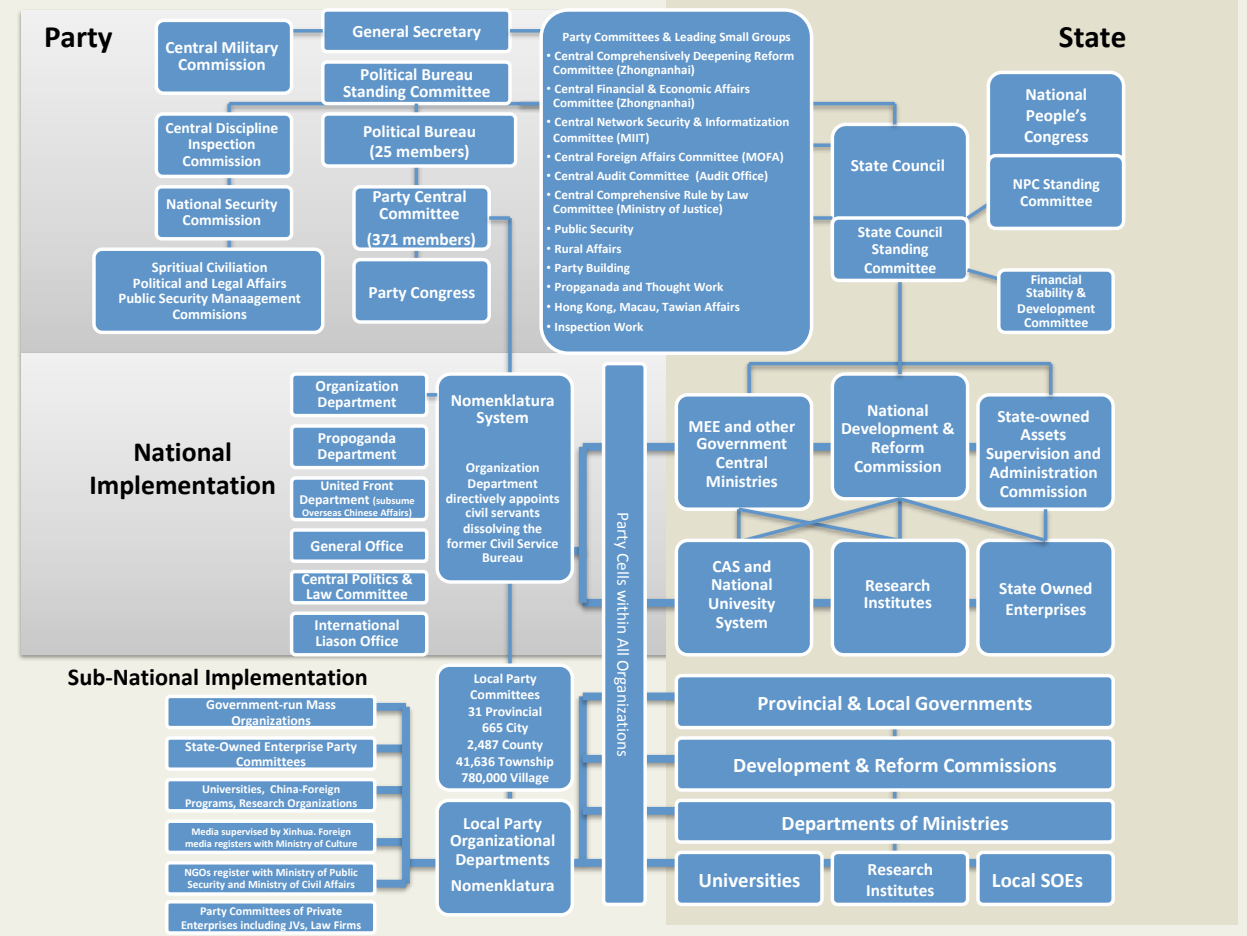
Although not described in China's Constitution, the Party *Nomenklatura* system enables it to control the People's Congresses at each level from townships to the national government. Formally, candidates are nominated from among representatives at the congress immediately below the congress being elected (e.g., county representatives may stand for provincial congresses), however candidates nominated by ten or more deputies of the People's Congress may also stand for election, subject to candidate/seat ratios imposed by law (Articles 29-30, Electoral Law of the National People's Congresses of the People's

Republic of China, as amended through March 14, 2010). In practice, nominees are restricted to Party–approved candidates drawn from its ranks and people's organizations (Party mass organizations) (Li, 2010: 8-9). By confining the nomination process to those elected to Congresses at the next lower level and limiting the number of candidates relative to seats, the rules ensure that the Party controls Congresses at all levels.

The legislative process is synchronized to the Party and government appointment cycles in order to ensure Party control over the legislative agenda. The CPC Central Committee defines five-year guidance for the country's legislative plan, mirroring the national five-year plans adopted by the government. In practice, the CPC Central Committee approves all major legislation before being proposed for consideration by the National People's Congress.

The figure below shows the relationships between the Chinese Communist Party and the state.

Figure 2: China's Communist Party and the State



Source: Authors' analysis

3. Climate and Energy Policy Bodies

This chapter discusses the role of the Ministry of Ecology and Environment and the National Development and Reform Commission as the leading agencies for coordinating climate change and energy measures, respectively. It also considers groups associated with the State Council focusing on climate and energy policies - the National Energy Committee; the Climate Change, Energy Conservation and Emissions Reduction Leading Group; and China's Agenda 21.

Prior to the spring 2018 Party-state reorganization, the NDRC was the dominant agency occupying the central position for almost all climate and energy policy issues. Following the reorganization, the MEE assumed responsibility for climate policy and the NDRC's entire Climate Change Department and the affiliated National Center for Climate Change Strategy and International Cooperation transferred intact to the MEE. Separating responsibilities for climate and energy policy in different ministries affects the way climate policies are developed, and the degree to which climate policies are integrated with energy policy and overall economic planning carried out by the NDRC.

National Development and Reform Commission

NDRC is subordinate to, and exercises certain powers on behalf of, the State Council. Importantly, the Director-General of the NDRC sits a half rank above China's other ministries, and NDRC's department heads or deputy directors hold full ministerial rank equivalent to those other ministries. In this sense, NDRC is a super-agency that coordinates among ministries. NDRC is organized into departments that track the responsibilities of other ministries.

The NDRC is responsible for developing policy and regulations that affect the national economy and guiding economic reform. The NDRC is staffed by approximately 900 professionals. NDRC is responsible for preparing China's national economic plans, such as the five-year plans, and planning the country's infrastructure development. In the energy field, the NDRC drafts the national energy development strategy; implements planning, policies and standards in the energy and other industrial sectors; and develops targets and programs for new energy and energy conservation and efficiency. It exercises broad authority on behalf of the State Council, including the power to approve infrastructure projects throughout China. For example, the NDRC issues power plant licenses for facilities over 25 MW, with smaller plants being approved by the local DRCs.

As a result of its responsibilities and relationship to the State Council, the NDRC is the single most influential government agency shaping China's future development, and by extension its greenhouse gas emissions trajectory. Under the NDRC, several departments play potentially important roles for climate change policy development:

> ***National Energy Administration,*** established in August 2008 to replace the National Energy Bureau, studies and drafts national energy development strategies and considers major issues of energy security and development. The National Energy Administration has certain regulatory authority over the power and oil and gas sectors.[2]
>
> ***Resource Conservation and Environmental Protection Department*** has jurisdiction over environmental matters as part of NDRC's mandate in leading China's economy and market reforms. It is responsible for leading NDRC energy efficiency and energy conservation programs. Prior to the 2018 Party-state reorganization, it supported the Party's Central Committee for Comprehensively Deepening Reform in developing the *Integrated Reform Plan for Promoting*

[2] The National Energy Administration is often understood to be a ministry-level agency, however it is identified on Chinese government websites as one of the "State Bureaus Under the Jurisdiction of Ministries & Commissions". The NDRC website identifies it as a department of NDRC.

Ecological Progress, and is expected to continue to support this body with respect to energy efficiency and conservation policies along with the MEE who will act as primary support on environment and climate policies.

Pricing Department of the NDRC sets prices for commodities such as coal and oil produced by state-owned enterprises, prices for items purchased by the government, including the military, and prices and subsidies for commodities controlled for price stabilization purposes, such as medicines and agricultural products. The Pricing Department sets hundreds of prices and exercises broad discretion, controlling pricing for a significant portion of China's economy. Significantly, any regulations that may exist guiding their decisions are not published. To the extent climate policy is advanced through market-based mechanisms, the Pricing Department could potentially resist or seek to weaken such efforts, as the department represents the interests of influential segments of China's economy in policy matters.

In addition to NDRC's departments, several research institutes are affiliated with the NDRC. Although these organizations are part of the NDRC for practical purposes, these organizations fund a portion of their budget through outside contracts and, as a result, engage with external stakeholders relatively openly. Also, due to their budget arrangements, their staffs do not count against the official NDRC staff allotment.

Energy Research Institute (ERI) is a research organization within NDRC's Academy of Macroeconomics, which provides macroeconomic research support on energy, transportation, pricing and other topics important to NDRC's economic planning function. ERI focuses on energy and technology policy. It also manages research on energy transition and low carbon development pathways.

State Information Center (SIC) is a research and forecasting institute that conducts economic studies to support policy decisions concerning climate change. For example, the SIC has conducted studies of marginal abatement costs under the planned national carbon market, and researched proposed electricity market reforms.

Ministry of Ecology and Environment

Following the spring 2018 Party-state reorganization, the MEE leads China's climate negotiations and is responsible for developing greenhouse gas regulation. It is responsible for establishing China's national carbon trading system.

Department of Climate Change, established in 2008 as a department within NDRC and transferred to MEE in 2018, leads the climate negotiations for MEE, develops climate policies, and is responsible for implementing China's national carbon trading scheme. It is further subdivided into divisions, with their responsibilities noted below:

- General Affairs

  Administration and coordination
  Climate finance
  Carbon capture, use and storage technology

- Strategy Research & Coordination

  Emissions targets
  Plans including five-year and mid-century plans
  Nationally Determined Contribution
  Low Carbon Cities Initiative
  Climate Change, Energy Conservation & Emissions Reduction Leading Group

- Domestic Policy and Implementation

  Domestic compliance with international obligations
  Emissions target analysis and verification
  National Emissions Trading Scheme
  Low carbon emissions standards and technology
  Adaptation
  Climate change risk analysis

- International Policy and Negotiations

  Leads China's international climate negotiation efforts
  Analyzes other countries' contributions and emissions trends

- Foreign Cooperation and Exchange

  Engages with international organizations
  South-south cooperation
  North-south cooperation unless associated with another unit's programs

The Department of Climate Change maintains several focal points for the negotiations:

- Mitigation
- Adaptation
- Technology Transfer
- Finance
- Legal Frameworks (e.g., form and substance of the negotiation text)
- Market-Based Policies (e.g., carbon markets)

In addition to the Climate Change Department, MEE also houses affiliated research institutes that are semi-autonomous from a budget and staffing perspective:

> ***National Center for Climate Change Strategy and International Cooperation (NCSC)*** is a research organization founded in June 2012 under NDRC and transferred to MEE in 2018 that serves mainly as a resource for the Climate Change Department and the MEE in shaping policies and positions for the international climate negotiations. This group maintains a climate model of the Chinese economy that it uses for testing policy scenarios. The NCSC's personnel were drawn heavily from the NDRC's Energy Research Institute and universities.

The **Party Central Committee for Comprehensively Deepening Reform** (中央全面深化改革委员会), as more fully described in Chapter 2, serves as the Party's pre-eminent policy formulation and implementation body established under the Politburo to deepen and expand China's continuing reform agenda. This committee has issued several important documents guiding climate and climate policies, including the *Integrated Reform Plan for Promoting Ecological Progress* (2015).

The **National Energy Committee** serves as a coordinating body on energy policy. It does not meet regularly nor is it a decision-making body. The Premier chairs the committee and its membership is comprised of heads of each of the major government ministries and agencies. The National Energy Administration supports the work program of the National Energy Committee.

The **Climate Change, Energy Conservation and Emissions Reduction Leading Group** (also known as the Climate Change Leading Group) serves as a high-level coordinating and consultative body on climate change policy. The State Council created the group in 2007 (China, 2007). The Premier leads this group, and its membership includes the heads of all major agencies. It therefore overlaps to a great degree with that of the National Energy Committee, however, the leading group's members also include heads of technical bureaus and commissions that have expertise in climate change. According to China's Second National Communications to the UNFCCC (November 2012), the Climate Change and Energy Conservation Leading Group is mandated to develop major strategies, guidelines and policies on climate change, to take actions in response to climate change, to review plans for international cooperation and negotiations, and to coordinate actions in addressing climate change. Notwithstanding the leading group's formal mandate, its role is confined mainly to coordination and consultation, and meets rarely. The leading group is hosted by the MEE's Climate Change Department, which supports its work for climate matters, and also supported by the NDRC for energy conservation work. Provinces have been directed to establish provincial climate change leading groups comprised of government agencies to take action at the local level on climate change, and many cities and counties have also established such groups according to China's Second National Communications.

The Climate Change Leading Group members are ministries and departments, as well as state bureaus with technical expertise in climate change:

Ministry of Ecology and Environment
National Development and Reform Commission
Ministry of Foreign Affairs
Ministry of Science and Technology
Ministry of Industry and Information Technology
Ministry of Education
Ministry of Civil Affairs
Ministry of Justice
Ministry of Finance
Ministry of Natural Resources
Ministry of Housing and Urban-Rural Development
Ministry of Transport
Ministry of Water Resources
Ministry of Agriculture and Rural Affairs
Ministry of Commerce
Ministry of Culture and Tourism
National Health Commission
People's Bank of China
State-owned Assets Supervision and Administration Commission
State Administration of Taxation
State Administration for Market Regulation
National Bureau of Statistics
State Agency for International Development Cooperation
Chinese Academy of Sciences
China Meteorological Administration
National Energy Administration
State Forestry and Grassland Administration
China Railway Bureau
China Civil Aviation Administration

Closely connected to this leading group is the **National Committee of Climate Change Experts**. The Climate Change Leading Group appoints experts drawn from academia and research institutions to this expert committee.

China's Agenda 21 is a government body tasked with supporting China's sustainable development goals. Its members include all ministries, key government agencies, trade groups and other state organizations with an obligation to progress sustainable development. Although formally created under the State Council, China's Agenda 21 is housed in, staffed by, and associated with, the Ministry of Science and Technology. The organization actively promotes China's development of renewables, energy efficiency and other technologies both to mitigate China's emissions and to support China's export industry. It develops South-South cooperation programs focusing on technology transfer. China's Agenda 21 plays a mainly support role as well as an external relations role, and lacks authority for policymaking.

Coordination Among Agencies

Transferring climate policy to the MEE changes the way in which climate and energy policy will be coordinated in order to achieve China's Nationally Determined Contributions (NDC) pursuant to the Paris Agreement. Prior to the spring 2018 Party-state reorganization, when climate and energy policies were both the responsibility of the NDRC, the Climate Department could easily access colleagues responsible for energy policy and the national five-year development plan. This access afforded the Climate Department with the ability to offer input directly and receive draft plans in advance.

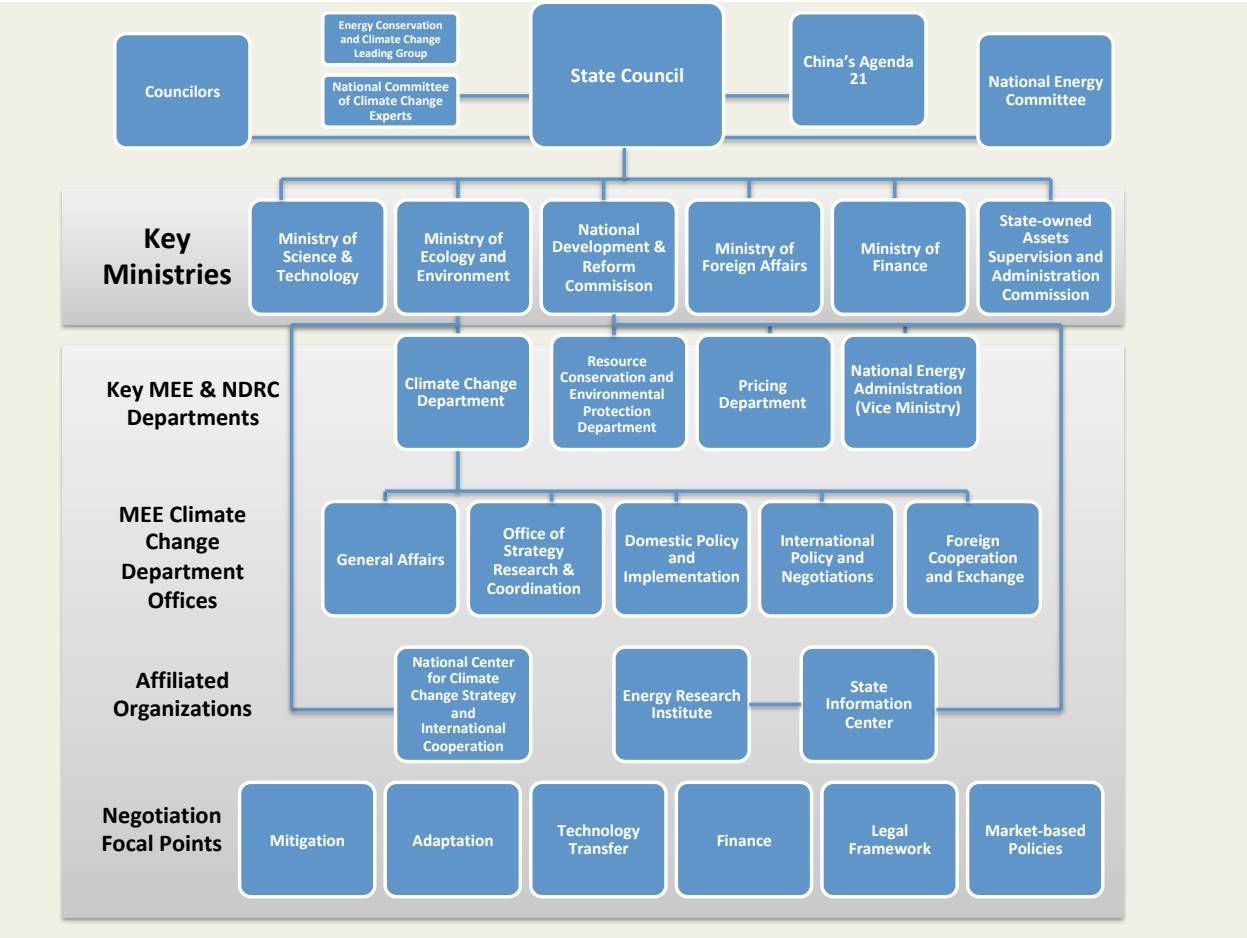
Since the reorganization, the MEE's Climate Department and NCSC will now submit its proposed input for the five-year plan at an early stage along with all other government agencies and then will be provided with an opportunity to review the final plan. The NDRC will evaluate proposals from all agencies, establish priorities, and prepare the plan with little further engagement until the end of the process. At the final review stage, the MEE will lack the ability to influence the plan if the NDRC deprioritizes climate policies.

Coordination between the NDRC and MEE for the five-year plan will necessarily influence China's level of ambition in revising its NDC in successive stocktaking exercises under the Paris Agreement. Greater ambition in future NDCs will depend on cooperation by the NDRC in setting energy efficiency targets, a key indicator under NDRC's control, which in turn largely determines progress in achieving the MEE Climate Department's carbon intensity targets. According to unpublished Chinese government assessments, the NDRC's energy efficiency program accounts for roughly 80 percent of China's carbon reductions (Personal communications, 2018). Yet, with the division of responsibilities for climate and energy in the two ministries, the Climate Change Department will have limited access to energy efficiency program data and policy discussions. Significantly, the NDRC considered abandoning its own energy efficiency target in favor of the MEE setting carbon reduction targets directly, and relying on overall energy caps. Such a change in policy could undermine China's carbon reduction efforts, as carbon targets alone are not viewed as sufficient to drive reductions (Personal communications, November 2018).

Although MEE and NDRC lead climate and energy policies, respectively, these agencies must coordinate with other agencies. Their roles relative to other agencies are discussed in Part 6 of this report, which considers policy formation by specific issue.

In the international climate negotiations, the MEE coordinates with the Ministry of Foreign Affairs as the negotiations directly implicate China's foreign relations. The NDRC and its Energy Research institute also continue to participate in the negotiations given their responsibilities for national economy and energy policies.

Figure 3: China's Climate and Energy Policy Formation Organizations



Source: Authors' analysis

The composition of China's delegations to UNFCCC meetings for COP 20 through COP 24 confirms the importance of government agency organizations relative to each other in the climate negotiations. After the spring 2018 Party-state reorganization, the MEE and the MEE's NCSC together accounted for 16.8 percent of all delegates to the 2018 COP 24. The NDRC accounted for 10.8 percent of China's COP 24 delegation, which included NDRC's Energy Research Institute. The Ministry of Foreign Affairs sent the third largest delegation representing 7.2 percent of the overall delegation. All other ministries remained roughly similar in participation levels before and after the 2018 reorganization. Due to UNFCCC limits on the number of delegates, Chinese officials sometimes also attend as delegates nominated by NGOs and other UNFCCC-accredited organizations. However, analysis of official delegate lists does not capture these individuals. The table below shows the number of delegates and frequency of participation for the most frequently attending government agencies based on China's official delegates lists for COP 20 to COP 24.

Table 1: China's Delegations Percent to Recent UNFCCC COPs

Agency \ Meeting	COP 20	COP 21	COP 22	COP 23	COP 24	Instances of Participation COP 20-23	Frequency of Participation COP 20-23	Frequency of Participation COP 24
Delegates	87	268	77	81	83	513		
NDRC	19	22	15	15	9	71	13.8%	10.8%
NCSC	13	14	11	8	8	46	9.0%	9.6%
MEP/MEE	2	4	1	3	6	10	1.9%	7.2%
Ministry of Foreign Affairs	8	59	10	5	6	82	16.0%	7.2%
China Meteorological Administration	2	3	2	3	3	10	1.9%	3.6%
Tsinghua University	5	6	4	4	3	19	3.7%	3.6%
ACCA21	2	2	2	1	2	7	1.4%	2.4%
Chinese Academy of Engineering	2	2	1	1	2	6	1.2%	2.4%
Local Government	7	9	2	5	2	23	4.5%	2.4%
Ministry of Finance	2	2	2	2	2	8	1.6%	2.4%
MOST	2	5	1	1	2	9	1.8%	2.4%
State Forestry and Grassland Administration	3	3	2	2	2	10	1.9%	2.4%
Chinese Academy of Agricultural Sciences	3	3	4	2	1	12	2.3%	1.2%
Chinese Academy of Social Sciences	1	1	1	1	1	4	0.8%	1.2%
Ministry of Agriculture and Rural Affairs	1	1	1		1	3	0.6%	1.2%
State Council	2		1		1	3	0.6%	1.2%
Civil Aviation Administration of China	1	1		1		3	0.6%	0.0%
China Association for Science and Technology		1		1		2	0.4%	0.0%
Embassy	4	48	1			53	10.3%	0.0%

Source: Authors' analysis of UNFCCC records

4. Expert Group Stakeholders

Various expert organizations contribute to the development of China's climate and energy policies. These organizations can be categorized as follows: (1) government-sponsored research institutes, typically affiliated with government agencies or state enterprises, including the Chinese academies, (2) state-funded public universities, (3) Chinese nongovernmental organizations (NGOs) and think tanks, (4) foreign-funded environmental NGOs operating in China, and (5) private for-profit consulting organizations (Hart, 2019).

The order of these categories is presented in terms of degree of government control from greatest to least (Hart, 2019). Independence from government potentially influences whether the Chinese government is receiving objective advice from these organizations and their messaging to the public. Government control is not only a function of direct funding, staffing, and supervision, which are particularly important in the case of the first two categories, but also ability to diversify funding sources and organizational culture, which for universities and some government-affiliated institutes give them greater autonomy (see Chen (2017) for further discussion of the degree of independence of state-affiliated expert organizations). Yet, even the last three types or organizations, which are nongovernment by nature, can only operate in China with either formal or tacit approval of the government (e.g., registration), and to operate effectively they require access to government officials or may even depend on government contracts (Hart, 2019).

This chapter focuses on experts within the first two categories that provide policy support to the Chinese government. These are:

- Government ministry expert agencies and research institutes;
- Chinese Academy of Sciences, Chinese Academy of Social Sciences, and their affiliated organizations; and
- Universities, primarily focusing on leading institutions located in Beijing.

It also considers individual participation in the National Committee of Climate Change Experts and international bodies such as the China Council for International Cooperation on Environment and Development.

Government Ministry Technical Agencies and Research Institutes

Government ministries maintain research organizations that play important roles in supporting China's negotiations efforts as well as meeting its obligations to the UNFCCC.

The Development Research Center of the State Council (SCDRC) supports the State Council by providing research on a wide range of topics relevant to the development of legislation and policy. SCDRC is comprised of various departments and institutes, among which the Environment and Resource Policy Institute and the Research Department of Industrial Economy are especially important for climate change. The SCDRC is staffed by academics that often are affiliated with leading universities. Examples of research topics SCDRC studies include carbon markets and urbanization policy. Significantly, SCDRC is both highly active in producing policy documents on climate policy, and enjoys a relatively direct channel to the State Council.

The China Meteorological Administration is a technical agency with responsibility for air quality monitoring and climate prediction. It assists China in meeting certain national reporting obligations to the UNFCCC and serves as the national coordinator for China’s IPCC contribution. It also is one of the leading expert agencies contributing to the development of China's adaptation strategy and policies.

As described in Chapter 3 of this report, the Ministry of Ecology and Environment maintains the National Center for Climate Change Strategy and International Cooperation (NCSC), which provides support to

China's negotiators through analysis of potential greenhouse gas reduction scenarios in relation to China's economy. The NCSC also provides expert supervision of China's Low Carbon Cities Initiative and Chinas Emissions Trading Scheme pilot programs. The MEE's China Research Academy for Environmental Science (CRAES) provides research support on traditional pollution regulation and air quality. The Policy Research Center for Economy and Environment (PRCEE) conducts policy research for MEE on green growth and economy, green finance, and environmental law.

NDRC's Energy Research Institute provides support on technology and policy options for conventional and clean energy, and conducts research on decarbonizing China's energy infrastructure.

The Ministry of Finance's Institute of Fiscal Science provides support in climate negotiations on finance issues, and it also leads research on different possible carbon related taxation mechanisms.

National Bureau of Statistics

China's National Bureau of Statistics is a vice-ministry level entity under the State Council. In its role of managing the collection, processing and publication of China's statistics for economic activity, energy use, and pollution emissions, the National Bureau of Statistics plays a unique role among government expert organizations. It maintains an energy division to specifically prepare China's energy-related statistics. The need for consistency and credibility of statistical data makes its expertise increasingly relevant to China's efforts in the international climate negotiations and, by extension, China's messaging to the outside world.

Although the National Bureau of Statistics possesses special expertise in the processing of statistics, it does not conduct this function independently. The Party's Propaganda Department supervises the statistics bureau, and China's upward revision of over a decade's worth of coal consumption statistics in the latter half of 2015 revealed that the revision was done in consultation with the NDRC and academic institutions.

Chinese Academies

The Chinese academies are distinct state-sponsored organizations that operate independently and in some cases are only nominally affiliated with each other. Individual Chinese academy institutions may be associated with a particular ministry, while others organized under the State Council may serve a broader group of ministries or stakeholders. The figure below lists representative entities that have participated in the international climate negotiations, on advisory committees supporting negotiation efforts, or conduct research on climate change science and policy. As suggested by the figure below, the Chinese academies provide negotiators with support on such issues as engineering, low-carbon policies, agriculture, forestry, atmospheric sciences, and geosciences.

Universities

China's government supports an extensive system of universities and research institutes. These organizations are government institutions, however they operate in a relatively open environment. Well-supported financially and relatively free to engage in research and academic debate, they serve as both think tanks to the government, as well as an alternative means to engage with foreign audiences. The best funded with the greatest access to government are generally located in Beijing.

General funding for facilities, research support, and the ability to attract top faculty and students are among the factors that determine a university's ability to provide sustained support to the government. Geographic access to government officials is also important to the ability of universities to contribute to the policy-making process. Thus, leading universities located in Beijing typically have greater influence.

Among the leading universities located in Beijing, Tsinghua University has been the primary resource for China's climate negotiation efforts, given its specialization in engineering and the sciences. Tsinghua University has long supported the government in preparing China's greenhouse gas inventories for its

national communications obligations to the UNFCCC. It also supported China's implementation of the Clean Development Mechanism, and is now deeply involved in supporting the development of China's pilot and national carbon market policies.

Based on analysis of China's delegations to UNFCCC COPs as shown on Table 1 in Chapter 3, Tsinghua University alone typically accounts for 3 to 6 percent of China's delegations to the UNFCCC, more than any other organization of any kind except MEE, the NDRC, and the Ministry of Foreign Affairs.

Peking University hosts the Center for Climate Studies, which undertakes studies to support China's government. Faculty from the School of Environment, School of Architecture and other departments participate in advising the government on low-carbon policies and other aspects of climate change.

Renmin University of China's School of Environment and Natural Resources supports the MEE's National Center for Climate Change Strategy and International Cooperation with climate modeling capability.

While these universities are among the primary academic institutions supporting China's formation of climate policy, these are not the only expert organizations engaged on these topics. Top national universities outside Beijing such as Fudan University, Nanjing University, Shanghai Jiaotong University, Wuhan University and Zhejiang University, as well specialized universities such as China University of Petroleum, Central University of Finance and Economics, and North China Electric Power University play roles in supporting the formation of government policy in their particular area of specialization or technology focus.

National Committee of Climate Change Experts

China's national government formed the National Committee of Climate Change Experts to advise on climate change issues. The Committee is comprised of approximately 30 senior level academics and researchers drawn from various expert organizations.

International Expert Organizations

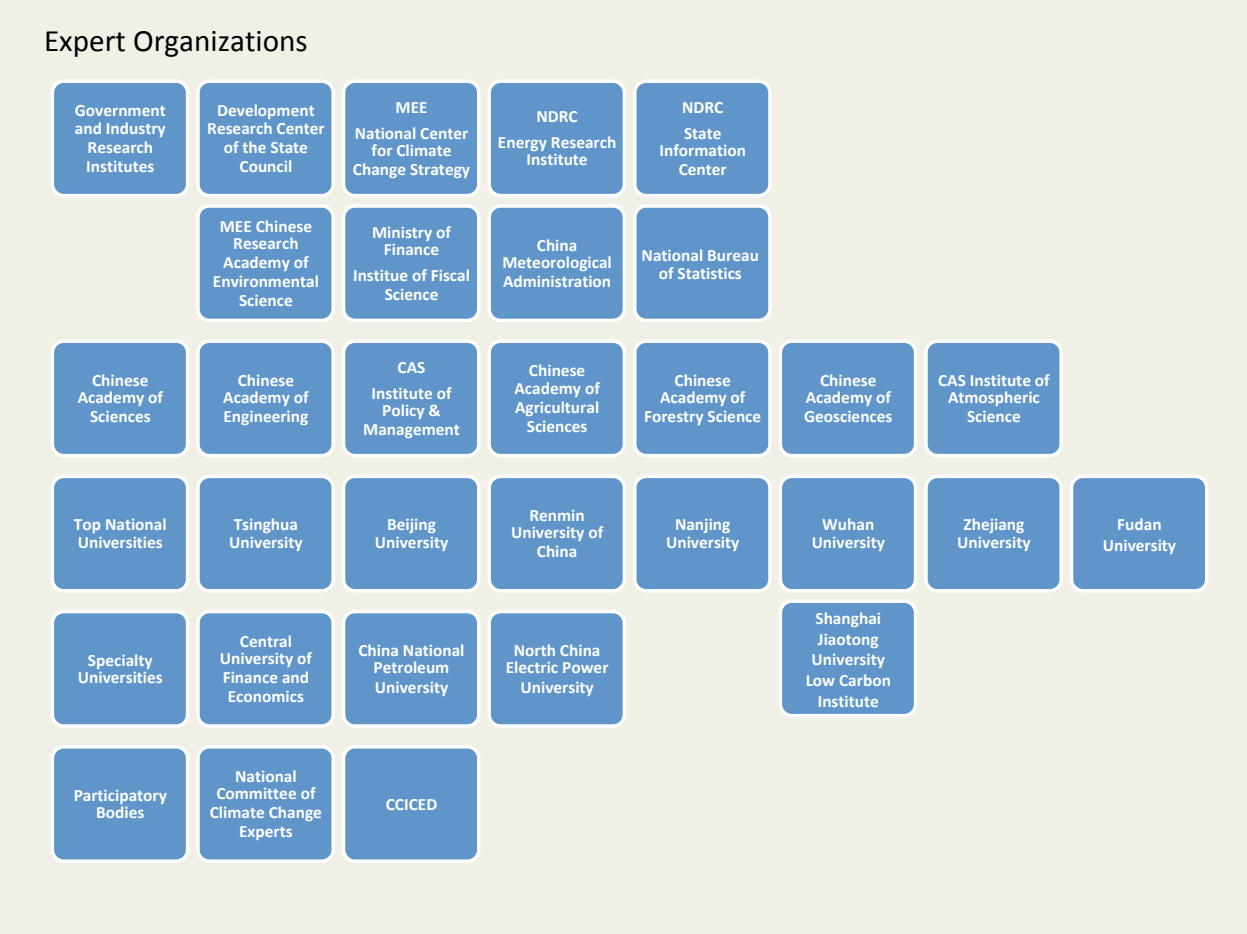
Chinese experts from academia, government institutions and industry also participate in various international expert organizations, such as the Intergovernmental Panel on Climate Change, the Clean Development Mechanism Executive Board, and the International Standards Organization technical groups that consider greenhouse gas accounting and low-carbon technologies. Governments such as the European Union regularly sponsor various programs facilitating knowledge and capacity building.

Expert organizations provide Chinese stakeholders with opportunities to learn from international practice and to develop collaborative relationships with colleagues in foreign countries in order to strengthen China's own capacity in specific fields. While international expert organizations do not play a direct role in policy formation, they provide significant information resources to Chinese experts and potentially influence individual expert's viewpoints.

In particular, the China Council for International Cooperation on Environment and Development (CCICED), a high-level, advisory body, is especially significant in the context of China's climate policy formation process. China's State Council established CCICED in 1992 in order to further strengthen cooperation and exchange between China and the international community in the field of environment and development. CCICED is operated by a joint Chinese-foreign Secretariat and is funded by China and other countries. It composes experts drawn from China and foreign countries to prepare studies on various topics, including on energy, pollution control, resources accounting and pricing, and biodiversity. Its studies are intended for use by the Chinese government to shape policy. As CCICED is sanctioned by the State Council, focuses on China's own environmental and development challenges, and provides a forum for candid exchange of viewpoints, it is in a unique position to propose policies to the China's government. China's State Council requests CCICED to undertake projects on specific topics of

importance to the government, and the CCICED is chaired by China's Vice Premier responsible for environmental matters, who is also typically a member of the Politburo Standing Committee.

Figure 4: Representative Expert Organizations in Climate and Energy Policy



Source: Authors' analysis

5. Industry Stakeholders

Industry stakeholders, particularly state-owned enterprises, influence climate and energy policies due to their economic power and technical expertise. Importantly, state-owned enterprises that were separated form former government ministries retain ministerial rank within the state bureaucracy, which may impart political and even quasi-regulatory power.

State enterprises seek to influence policy directly and through their industry associations. China maintains Party-affiliated industry associations that act as arms of the Party-state in coordinating enterprises within an industry on important issues such as foreign technology acquisition, representing state enterprise with government ministries, and in some cases exercising regulatory powers. Many of China's most important industry associations evolved from the over two-dozen industry-specific ministries that were dissolved by the Jiang-Zhu administration's initiative to reduce bureaucracy and corporatize industry in the late 1990s to early 2000s.

Industry associations are particularly important for sectors that have a relatively greater number of state enterprises or where fragmented industry structure favors collective representation. For example, the China Petroleum and Chemicals Industry Federation (CPCIF) represents a diverse group of enterprises that are important to China's economy and hold the largest share of the global chemicals market. The CPCIF was created as a legacy of a former ministry through which it inherited quasi-regulatory powers, thus it issues licenses, develops standards, investigates accidents, and recognizes superior performance within the industry. In contrast, the China's nuclear industry is highly concentrated in three state enterprises, obviating the need for a nuclear industry association, as each enterprise is capable of representing its own interests, which often diverge due to adoption of different technologies. The China National Nuclear Corporation, the largest of the three, was corporatized from the former Ministry of Nuclear Power, and thus it controls the standards setting body for nuclear power and supports the government in developing nuclear policy (Personal communications, November 2018).

Determinants of Influence

Several important factors determine the degree to which industry stakeholders influence climate and energy policy formation in China. These include:

- Ownership
- If state-owned, the level of ownership and rank
- Size by revenues and number of employees
- State of technology, and national dependence on or future plans for that technology
- Carbon intensity of the industry

Ownership

State-owned enterprise remains a central foundation of Party-state power and a focal point of government policy. The Chinese government retains control over "strategically important" industries spanning machinery, finance, telecommunications, armaments, natural resources, and transportation. However, in total, the state owns 325,800 national and subnational SOEs, roughly two-thirds of which are provincial SOEs managed by provincial SASAC offices. These enterprises employed almost 61 million people. Additionally, China maintains 249,946 collective-owned enterprises, which employed almost 5 million people (China Statistical Yearbook, 2018).

SOEs have direct and uniquely effective channels not typically found in other economies to lobby government agencies at the national and provincial levels over proposed regulation. They regularly participate in government commissions that set policies, and SASAC rotates SOE managers through its headquarters to participate in setting policy and drafting laws and regulations over the very companies they will return to manage (Hills and Wang, 2014). Industry executives also often rotate among SOE leadership positions within the same industry, creating potential opportunities for industry collusion. A revolving door of top executives and bureaucrats among state-owned enterprises and the departments that regulate them ensures a confluence of interest between the regulator and regulated industry centering on enterprise preservation.

Also unique to China, many SOEs maintain ministerial or government rank, a legacy of their prior status as state bodies before corporatization, which confers upon them standing within the bureaucracy and often quasi-regulatory authority through their ability to adopt rules and standards governing their operations (Hart, 2019). Large national state-owned enterprises holding ministerial rank is especially prevalent in the energy industry, in which ministries were corporatized leaving no unified ministry-level energy regulatory body. The combination of the power to adopt rules and standards and the absence of a ministry dedicated to energy effectively implies a strong degree of self-regulatory power.

Sub-national state-owned enterprises have their own distinct means to influence policy. Local government-owned enterprises generate profits, employ workers, and contribute taxes that benefit the local economy and support government operations. They may also be partly owned by local government officials. Government finance also empowers SOEs to influence the policy agenda, particularly at the subnational level where SOEs can choose among locations within China to operate. Taxes collected from enterprises are local government's most significant tax revenue source. Taxes collected from enterprises in the form of value-added tax, business tax, and enterprise profit tax account for approximately 90 percent of local government revenues (See Hart, 2019 based on China National Statistical Yearbook 2017 data). Thus, subnational SOEs exert strong influence over local governments, given that they may account for a large portion of the jurisdiction's economy and thus can influence enforcement of laws and regulation.

China's government faces unique challenges in attempting to force state-owned industry to reduce greenhouse gas emissions or impose limits on energy consumption. State industry is owned by and thus part of the state. The state is also industry's primary creditor. The owner/creditor/regulator relationship presents fundamental conflicts beyond the traditional conflicts faced by all governments dependent on industry for tax revenues and jobs creation. These conflicts constrain the state from playing any one of these roles properly (Hart, 2019).

Because the state owns and finances industry, government at the central and local levels has naturally embraced the role of protector of enterprises owned by or affiliated with them. Thus, for example, SASAC, ostensibly appointed to supervise SOEs, is also tasked with nurturing "national champions" and "global leading companies," making them more facilitator than regulator (Hart, 2019).

However, the relationship between the state and state-owned industry is not necessarily reciprocal, as state ownership often does not equate to control over these enterprises. Indeed, state-owned enterprises constitute an important power base in China with their own interests distinct from the government. While SOEs formally are part of the state, SOEs do not necessarily embrace regulation any more than their counterparts in market economies. Like their counterparts elsewhere, SOE insiders have incentives to preserve their own management authority, protect and retain enterprise revenues within their organizations, and avoid costs. Thus, SOE managers may attempt to resist or negotiate the stringency, timing, and burden of regulations (Hart, 2019).

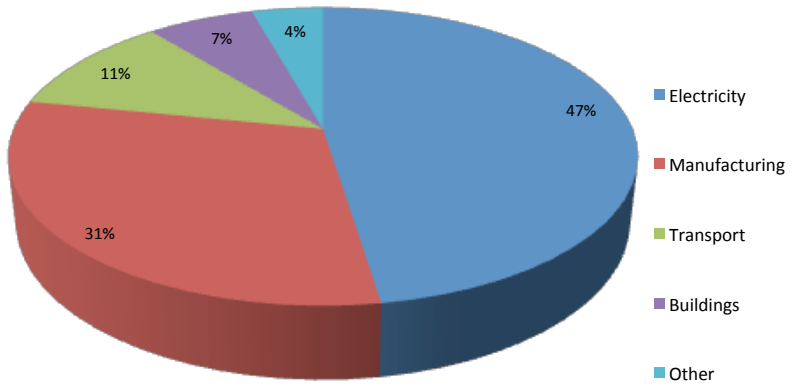
Size, Technology and Carbon Intensity

The overall importance of an industry or enterprise in terms of the monetary and technological value of their products, revenues, number of employees, and contribution to China's economy and foreign trade are factors that determine which industries and enterprises are able to influence climate change and energy policies.

The carbon-intensity of an industry's products, the resulting impact carbon regulation would have on profitability, and the capacity of enterprises to implement carbon management measures also enhance their motivation to engage with policymakers and their ability to exert influence.

The power, petroleum and petrochemicals, chemicals, iron and steel, cement, aviation, infrastructure and certain other carbon-intensive manufacturing are most active in attempting to shape climate policy in China. These industries are among the most highly exposed to the risks associated with greenhouse gas reduction policies. Significantly, these sectors were covered by one or more of China's seven regional pilot carbon markets, and are candidates for future inclusion in China's national carbon market expected to commence as a compliance market in 2020 initially covering only the power sector.

Figure 5: China's CO_2 Emissions by Sector, 2017



Source: International Energy Agency (2017)

Within these sectors, large state-owned enterprises are important economically and enjoy the closest ties to the Party and government. They are therefore likely to play the greatest role in shaping policy. National state-owned enterprises generally enjoy greater access to decision makers and ability to participate in policy formation, thereby enhancing their influence.

Industry Strategy to Decarbonization Policies

Decarbonization and energy policies have the potential to impose significant costs on China's economy and traditional industry, and to create opportunities for low-carbon and energy efficient industries. Thus, in any policy scenario, there are industries and enterprises that will be harmed by regulation, and those that will benefit. In China as in any other country, industry will seek to influence government regulators according to their interests.

For carbon-intensive heavy industry that are harmed by carbon regulation, these enterprises engage in tactics to protect profits, including to:

- Block or delay carbon regulation;
- Minimize the extent of regulation;
- Divert the incidence of regulation to other industries or parts of the value chain within their industry;
- Shape regulations, standards and rules to enhance their compliance, such as rules concerning emissions limits, monitoring and reporting;
- Seek to influence government to weaken enforcement of regulations;
- Seek policies that do not impose economic penalties or only weak penalties;
- Manipulate data and information concerning compliance with regulation;
- Relocate or promise/threaten to relocate operations; and
- Seek compensation (when regulation is inevitable) in the form of subsidies in exchange for compliance or even aggressive action (Hart, 2019).

For newly emergent industries that benefit from decarbonization policies, these industries seek:

- Policies that strengthen environmental standards and require greener production techniques and products;
- Subsidies to build new, greener industries, including no-cost or preferential start-up funding and operating capital through "green finance" channels, and financial support for R&D;
- Government contracts through "green procurement" policies favoring their products over traditional products; and
- Policies that protect these new, greener industries from competition posed by traditional industries or foreign firms (Hart, 2019).

Certain enterprises will also become crossover enterprises that operate inefficient, highly polluting facilities yet recognize an opportunity to upgrade their operations to make them more efficient and profitable, and, in the process, capture potential government subsidies, contracts, publicity and other support such as low cost capital (Hart, 2019). These industries potentially have the most to gain or lose, and will be a high priority for government decarbonization policies. They may employ a combination of decarbonization defensive and aggressive tactics for different business, essentially exhibiting differing corporate strategies to influence regulation (Hart, 2019). Importantly, crossover state enterprises in carbon intensive industries that operate decarbonization projects supported by the government possess specialized expertise that enhance their access and qualifications as experts to advise government officials in the formation of policy.

Chinese enterprises are generally not directly represented at the international negotiations, as demonstrated by the analysis of attendees at UNFCCC meetings presented in Chapter 3. Chinese enterprises, unlike their western counterparts, direct their engagement on climate change issues to domestic political and government institutions. As described previously, the Ministry of Ecology and Environment engages industry on decarbonization policy, and the NDRC engages industry stakeholders on energy policy and general economic planning. The Ministry of Industry and Information Technology, Ministry of Commerce and the State-owned Assets Supervision and Administration Commission (SASAC)

also engage industry in developing policies relevant to climate and energy policies. MIIT, in particular, is responsible for issuing standards that impact both decarbonization and energy policies, such as guidelines for vehicle fuel efficiency and electric vehicles.

While Chinese state enterprises are unlikely to outright oppose central government climate policy, they may oppose particular aspects or details of policies that affect their profitability or competitiveness or seek to delay implementation of regulation. For example, prior to the government's decision that the national carbon market will initially only include the power sector, various carbon-intensive industries lobbied the government over how China's emissions trading system will allocate permitted emissions. While most stakeholders, including industry, recognize the advantages of using performance-based benchmarks for allocation of allowances (see Hart and Ma (2014) for a discussion of performance benchmarks), many industries objected to benchmarking in favour of a grandfathering approach based on historical emissions intensity with incremental annual improvements. Objections to performance benchmarks by Chinese industry include concerns over performance data quality (China Carbon Forum, 2016) and overly strict emissions limits (Slater *et al.*, 2018). In reality, incumbent industry likely objects to benchmarks because grandfathering their emissions relaxes the rigor of regulation, is supported by data that they have greater knowledge of and control over, and potentially provides incumbent producers with competitive advantages in terms of market access vis-à-vis newer entrants that have more advanced technologies yet produce at smaller scale.

Reflecting the ability of industry stakeholders to influence policy, China ultimately adopted a hybrid approach to allocations for its national emissions trading scheme in which the overall cap will be determined by totalling historical emissions of participant enterprises, taking into consideration expected future mitigation actions based on a benchmark method that in turn takes into consideration the development status of the particular industrial sector. Allowances would then be issued to emitters based on their sector's portion of the cap, the starting point for which is the sum of historical emissions. As noted previously, since the national carbon market initially will only cover the electricity sector when it starts trading on a compliance basis in 2020, the China Electricity Council has been working with the MEE and Tsinghua University to develop the methodologies that will determine allocations and thus reduction requirements.

Perhaps the most pervasive, and environmentally and economically significant example of enterprise resistance to environmental policies concerns subsidies. China's state industry enjoys various kinds of direct and indirect subsidies, supporting both heavily polluting and clean/renewable industries. Many of these subsidies reinforce inefficient, uncompetitive, polluting behavior. Because these subsidies are in some cases critical to these enterprises remaining profitable, state industry fiercely resists their elimination. Chapter 7 on general economic issues discusses China's subsidies regime in greater detail.

Where enterprises are concentrated in certain regions or owned by local governments, state enterprises may enlist local government to advocate on their behalf with the central government, often on grounds of adverse impacts to the local economy and employment. Examples include resistance by local coal mining companies to central government efforts to restructure or eliminate them, described in Chapter 9.

Major Enterprises in China's Energy Complex and Carbon Intensive Industries

This section describes several of the enterprises in China's energy complex that are especially influential in relation to energy and climate policy based on the above criteria.

China's five major power companies are the Huaneng Group, China’s largest power producer and the second largest power producer in the world, Datang Group, Huadian Corporation, China Energy Investment Corporation and the State Power Investment Corporation. The State Power Investment Corporation is a wholly state-owned company that acts as the government’s arm for investment in the power industry and owns and operates power plants directly as well as holds shares in other generation, transmission and distribution companies.

China National Petroleum Company (CNPC), its subsidiary PetroChina, and Sinopec are China's largest mainland petroleum exploration and production companies. China National Offshore Oil Corporation conducts foreign oil and gas operations.

China Energy Investment Corporation resulted from the merger of the former China Guodian Corporation with the Shenhua Group, the world's largest coal company.

These companies are all critical to China's economy and their operations are highly energy intensive. They are already subject to various types of carbon reduction regulation, which will intensify as China steps up its decarbonization efforts. The Chinese government has already forced the closure of inefficient power plants, and set emissions-based performance standards for new plants. The electricity sector will be regulated under China's national carbon market starting in 2020 on a compliance basis. Coal consumption is subject to a cap and is required to decline according to Chinese policies and its NDC by 2030, affecting both the coal production and electricity generation sectors. Several types of environmental taxes are already collected in China affecting transportation fuels - the most significant being elevated sales taxes for vehicles and petroleum fuel, followed by resources taxes (mainly on crude oil, natural gas and coal), and annual vehicle and vessel taxes.

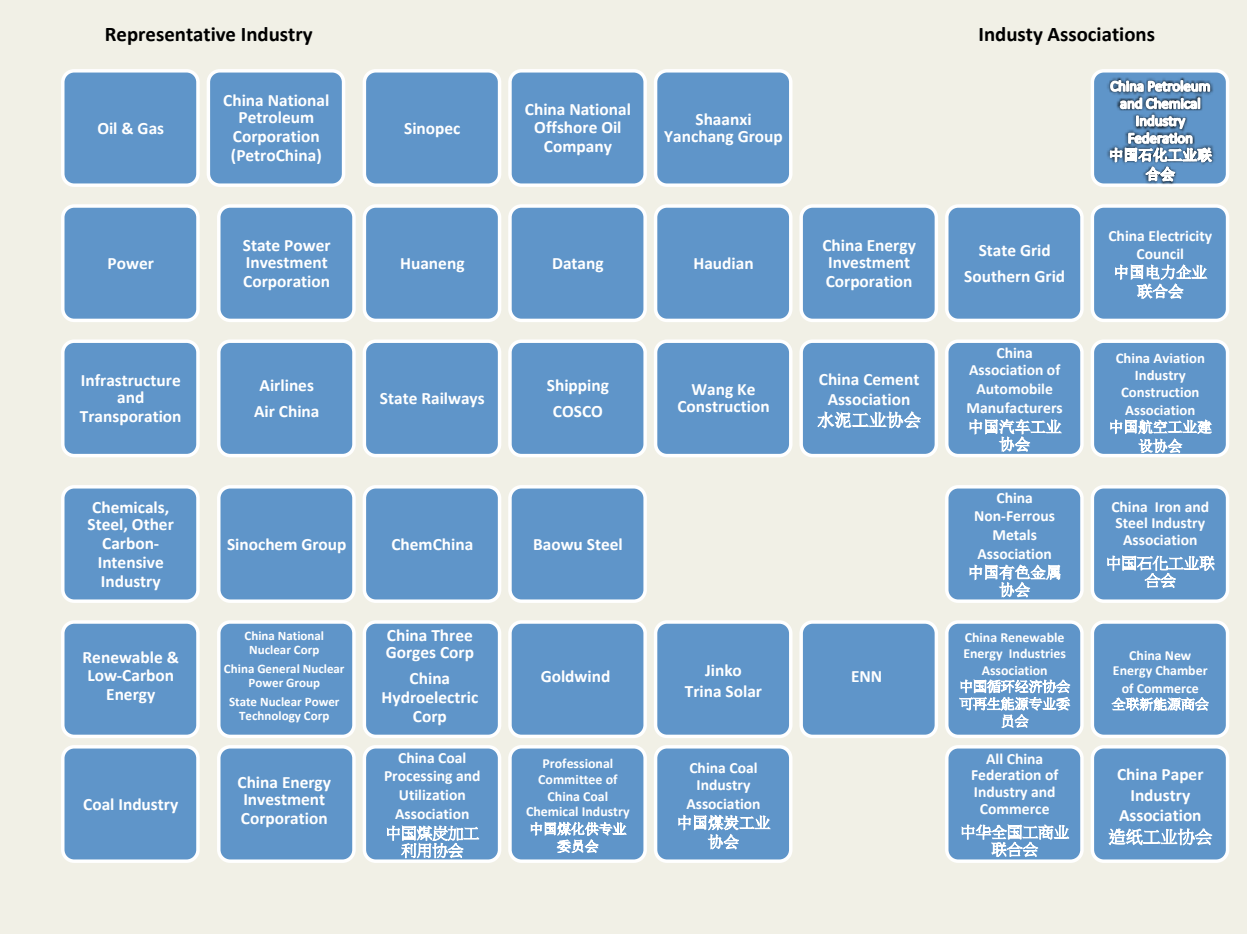
Importantly, these enterprises are responding to existing and anticipated future carbon regulation by seeking to develop low-carbon technologies, often with state financial support. Prominent examples include the GreenGen project to design, build and operate the country's first integrated combine cycle gasification (IGCC) power plant in Tianjin that integrates coal gasification for hydrogen production, power generation and supplies CO_2 for use in enhanced oil recovery on a test basis. GreenGen is a joint venture, majority-owned and developed by the Huaneng Group, with investment from China's other large state-owned power producers (Datang Group, Huadian Corp, China Energy Investment Corporation, and State Power Investment Corporation), China's top coal mining companies (China Energy Investment Corporation, which assumed Shenhua Group's stake, and China Coal Group), China's State Development and Investment Corporation (SDIC), and the Peabody Energy Corporation. The Shenhua Group now owned by China Energy Investment Corporation developed the Shenhua Ordos Coal Liquefaction project, the world's first commercial direct coal liquefaction plant that supplies CO_2 for use in enhanced oil recovery and stores it in the process. This project has received substantial state financial support. China's oil companies are similarly developing carbon capture, use and storage technologies (CCUS) as a means to store CO_2 to comply with anticipated regulatory requirements, while using CO_2 in enhanced oil recovery operations.

These and other initiatives in controlling greenhouse gas emissions illustrate that China's large state-owned enterprises actively engage with the government in seeking potential technological solutions to climate change with state financial support. In turn, industry's technical contributions influence climate policy. The government relies on enterprise expertise to manage these projects and, by doing so, brings these enterprises more deeply into the climate change policy formation process. These projects shape the views of government policy-makers as to what is technologically and economically feasible for Chinese industry to achieve, and thus informs actual targets, deadlines and requirements required by the government.

In addition to technology initiatives, enterprise can seek to influence climate change and energy policy using their specialized expertise through the standards setting process. Under China's Standardization Law effective in 2018, five types of standards are recognized: national standards, industry (sector or professional) standards, local standards (applicable for province, autonomous region, municipality level), group standards (e.g., industry associations), and enterprise standards. Industry sectors and enterprises anticipating carbon regulation are already exploring the standard setting process as a means to define their practices and comply with future regulation. These efforts will also potentially inform climate policy formation, particularly at the detailed level of regulation and performance requirements.

The figure below sets out selected representative industries, enterprises and industry associations that are influential in China's climate change and energy policy formation process.

Figure 6: Industry Influential in China's Climate and Energy Policies



Source: Authors' analysis

6. Issue-Specific Climate and Energy Policy Clusters

This chapter analyzes China's climate and energy policy formation process on an issue-specific basis. Having introduced the main stakeholders in the Party, government, expert organizations and industry, this chapter argues that China's climate and energy policies are determined by varying clusters of stakeholders depending on the specific issue.

Within each cluster, there is a lead ministry around which other government agencies and stakeholders coalesce. The lead ministry is expected to build consensus, however policy decisions are typically contested within these clusters.

Prior to the 2018 Party-state reorganization, for almost all issues, the lead agency was the NDRC, and it will continue as the lead agency for energy issues. Following the reorganization, the MEE became the lead agency for climate policy. However, the NDRC and the MEE do not enjoy exclusive control over their respective policy scopes. As the climate and energy portfolios are closely interconnected, and as these agencies seek to assert control over their respective domains, they will inevitably compete to influence each other's policies. Moreover, China's other ministries also develop policies relevant to climate and energy. Understanding the role of the various stakeholders and how they engage with one another to form a complete picture of policy formation for each general policy area is therefore essential.

This chapter first analyzes stakeholder sources of authority and power drawing in part on sociological paradigms. Next, it considers specific climate negotiation issues and, based on sociological theory, the clusters of stakeholders that influence each issue. Each cluster is represented graphically, showing the dominant agency and other key stakeholders.

Determinants of Influence in Chinese Policy Formation

The following four factors explain which stakeholders will be influential within a policy formation cluster:

- Political power
- Administrative or regulatory authority for implementation
- Economic power
- Subject-matter expertise

Stakeholders may rely on one or more of these sources of influence.

These determinants of influence on climate policy draw on sociological theories of the sources of power generally. These are validated in the case of China based on interviews, government documents, published research relating to Chinese government policy making generally, and Chapter 3's analysis of the relative frequency of participation in China's delegations to the UNFCCC meetings.

Political power broadly resides mainly in the NDRC for general economic development and energy policies. The NDRC sets prices across China's economy, restructures industries, and approves energy and other infrastructure projects. The NDRC's status as a super-agency tasked with implementing policy on behalf of the State Council place it above other ministries.

Following the 2018 reorganization, for climate change policy, political power shifted to the Ministry of Ecology and Environment, which will be shared to some degree with the Ministry of Foreign Affairs for issues impacting international relations, and the Ministry of Finance over issues impacting state finances. The MEE's power is derived from its role as the coordinating agency of China's climate change negotiation and implementation of domestic climate action efforts such as the national carbon market.

Administrative and regulatory power represents a base of authority related to political power but distinct in nature. Administrative and regulatory powers derive from implementation of laws, regulations, and statutory responsibilities. The authority of the Ministry of Ecology and Environment and the Ministry of Science and Technology, for example, are based mainly on administrative jurisdiction over environmental protection and technology development, respectively.

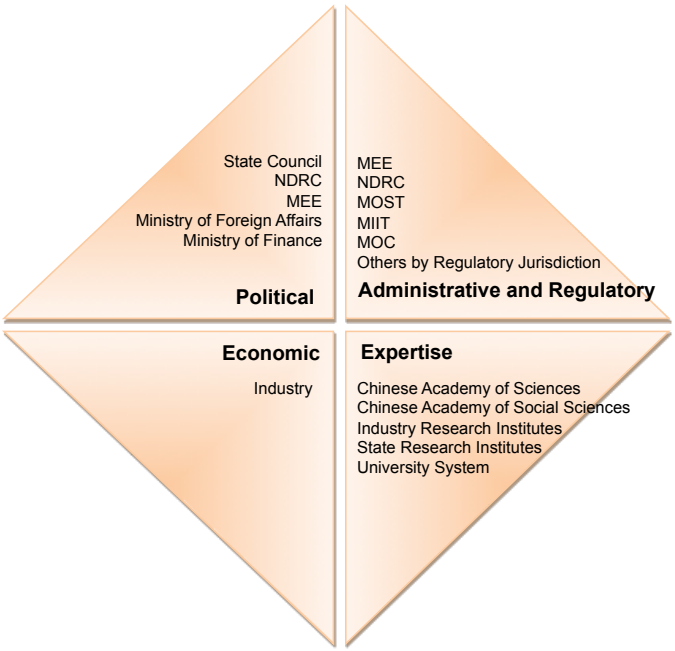
For climate policy, the NDRC's political, administrative and regulatory responsibilities over energy policy effectively limits the MEE's corresponding authority over climate to the extent that climate depends on energy policy or economic planning. As previously noted, the NDRC sets energy efficiency and conservation targets accounting for an estimated 80 percent of China's carbon reductions over business as usual scenarios (Personal communications, November 2018). Thus, NDRC retains control over the key policy that is central to MEE's ability to drive emissions reductions. Moreover, NDRC's responsibilities for economic development and approval of infrastructure projects enable it to define China's future emissions trajectory by locking-in the country's carbon intensity through infrastructure decisions.

Economic power is primarily the domain of industry, however certain ministries such as the NDRC, MIIT, Ministry of Commerce, and SASAC set regulations and standards governing industry, and have authority to restructure industrial sectors. Party-affiliated industry-specific trade associations also represent industries before regulatory agencies, and may be especially important where industry is fragmented.

Expert authority is dominated by the Chinese academies and the university system. Government ministries such as the MEE, NDRC, and the Ministry of Science and Technology possess significant technical expertise in their areas of competence and host research institutes that support their respective regulatory missions. As previously discussed, industry and individual enterprises also possess specialized expertise enabling them to influence policy, particularly where policy depends on the availability of technology solutions for specialized industrial applications, knowledge of which is crucial for establishing detailed regulations or standards.

The figure below shows bases of authority and associated stakeholders for climate policy generally.

Figure 7: Bases of Authority of Selected Stakeholders



Source: Authors' analysis

Climate Issues and Policy Stakeholder Clusters

This section analyzes core issues in the climate negotiations using the four traditional "Bali Building Blocks" - mitigation, adaptation, technology transfer and finance.

For each of these issues, the roles of key stakeholders are evaluated using the four determinants of influence - political power, administrative/regulatory power, economic power and expert authority.

Stakeholder clusters are diagrammed for each specific issue. The diagrams distinguish stakeholders that possess political power based on their role as the lead coordinating agency, typically designated by legislation or the Party, and secondary agencies that rely on administrative/regulatory authority over specific aspects of policy implementation.

Mitigation

Mitigating greenhouse gases significantly impacts the economy and therefore concerns a broad range of stakeholders. The MEE, NDRC, other ministries, industry, and various expert organizations are concerned with the economic and competitive impacts of mitigation measures. Because China regulates electricity and fuels as a primary mitigation measure, the cost of electricity and fuels affects China's entire economy generally, thus all consumers and industry.

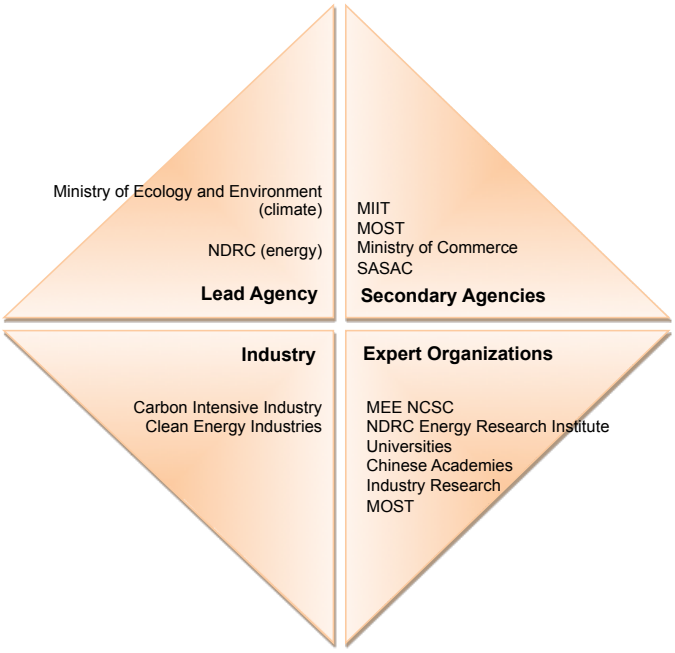
The MEE is formally responsible for mitigation following the 2018 Party-state reorganization, and thus has emerged as the regulator for greenhouse gas emissions trading. As such, the MEE is the lead agency in the mitigation area. However, as previously noted, the NDRC controls energy policy and sets energy efficiency targets that have driven China's emissions reductions (Personal communications, November 2018), and it prepares national economic development plans that will define China's emissions profile for decades to come through the priorities it sets for infrastructure development. For these reasons, the NDRC is represented as a leading agency in terms of administrative power for climate mitigation, even though the MEE possesses formal political authority for climate mitigation.

The Ministry of Finance plays an important role in administering resources and pollution taxes designed to curb pollution and greenhouse gas emissions. NDRC, MIIT, Ministry of Commerce, and SASAC set policies and standards concerning industrial performance and competitiveness, and thus represent industry constituents in policy debates. In particular, MIIT establishes standards to advance new technologies, including technologies with implications for emissions reductions such as standards for average vehicle fuel efficiency and electric vehicle production quotas, described in greater detail in Chapter 9.

The Chinese academies, university system, specialized state research institutes, and industry all possess expertise that inform and shape policy outcomes. The NDRC's Energy Research Institute (energy) together with Tsinghua University (industrial processes), the Chinese Academy of Agricultural Sciences, Institute of Atmospheric Physics (agriculture), Chinese Academy of Forestry (forestry), and Chinese Academy of Environmental Science (waste treatment), for example, prepared China's national greenhouse gas inventory in their respective fields noted in parenthesis (Second National Communication on Climate Change of the People's Republic of China, 2012).

Since mitigation measures are typically technology-driven and industry-specific, the specific stakeholders for policy formation may vary based on industry and technology. For example, power generation and fossil fuel consumption together account for the majority of China's greenhouse gas emissions, and mitigation discussions revolve around the technical feasibility and cost of adoption of specific technologies applicable to specific sectors in determining targets and policies. Thus, the policy cluster concerning greenhouse gas reductions for coal-fired power generation technologies, such as carbon capture, use and storage technologies, differ from those relating to renewable energy technologies.

Figure 8: Policy Formation Cluster - Mitigation



Source: Authors' analysis

Adaptation

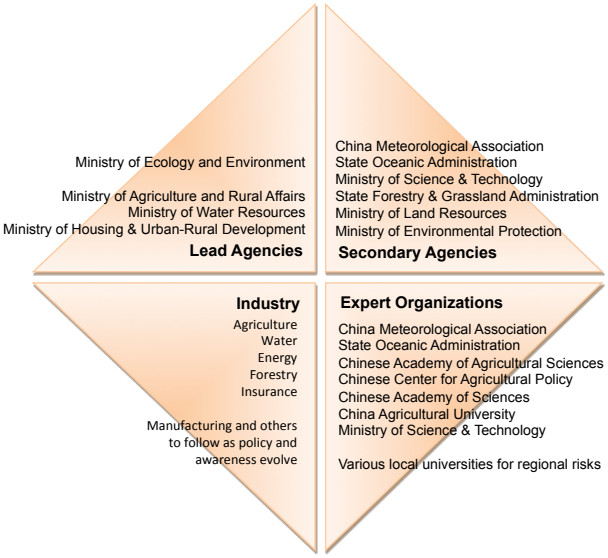
Climate adaptation is the least developed of China's climate policies. To some extent, this is because the risks posed by climate change vary significantly across China given variations in temperature and weather conditions, precipitation patterns and water resources, forest resources and agricultural crops, disease vectors, and levels of development. Climate impacts are only recently becoming more fully understood by stakeholders as monitoring and forecasting capabilities are developed.

The MEE is responsible for adaptation policy. Prior to the 2018 Party-state reorganization, its Climate Change Department, when it was part of the NDRC, coordinated the development of China's National Adaptation Strategy together with 12 other ministries. The Ministry of Housing and Urban-Rural Development shares responsibility for urban adaptation policy and measures. On adaptation sub-issues such as agriculture, water, forestry, and biodiversity, the Ministry of Agriculture and Rural Affairs, Ministry of Water Resources, the Ministry of Natural Resources, and the State Forestry and Grassland Administration lead policy formation efforts, respectively. A third work stream focuses on disaster risk management, a long-standing priority for China, which is now led by the Ministry of Emergency Management and supported by the Ministry of Civil Affairs and the National Health Commission.

These efforts are supported by leading expert organizations, including the China Meteorological Administration, which operates weather monitoring and data collection stations throughout China, the State Oceanic Administration, which provides data and analysis for marine environments and coastal regions, and the Ministry of Science and Technology, which supports research in adaptation risk identification and mitigation. Relative to mitigation, fewer academic institutions have focused on adaptation as an explicit subject. Adaptation research programs are established at the Chinese Academy of Agricultural Sciences, Chinese Academy of Social Sciences, and research institutes associated with the various ministries engaged on adaptation issues, particularly in the fields of agriculture, hydrology, health, and disease control. Provincial universities and research institutes are studying adaptation issues within the context of traditional disciplines, as local governments seek their assistance to confront challenges posed by a changing climate to agriculture, resource use, and other areas. Locally developed

knowledge and expertise dispersed across China's university system appears substantial yet remains fragmented.

Figure 9: Policy Formation Cluster - Adaptation



Source: Authors' analysis

Climate Finance

The Ministry of Finance administers national budget allocations and international financial support both as donor and aid receipt. Through commitments made in the climate negotiations and the Belt and Road Initiative, China increasingly supports project to promote mitigation, adaptation, and technology transfer in other development countries. The Ministry of Finance therefore plays a role in climate finance negotiations alongside the MEE to the extent they concern China's accepting outside financial support, such as from the World Bank or foreign governments, or extending financial support to other countries.

The Ministry of Finance's Budget Department, Treasury Department and the Economic Construction Department (formulates investment policies, budget proposals and earmarks funds for capital intensive infrastructure) are involved in climate finance-related decisions.

Other government agencies participate in budgeting decisions depending on the specific policy or aspect of climate change. The NDRC also shares responsibility for coordinating investment policies and budget proposals, and thus budgeting in its role as the planning agency for the state, which also encompasses environmental protection and climate-related investment. The NDRC's Finance Department facilitates overall budgeting and the provision of subsidies, the Department of Resource Conservation and Environmental Protection engages in budgeting for environmental projects, and the Department of Fixed Asset Investment coordinates planning among ministries for infrastructure investment (Nadin, Optiz-Stapleton and Jia, 2016: 315-315).

The fact that China itself expends substantial public funds on climate-related investment domestically suggests that the mechanisms for climate finance are already routinized within the Chinese government. According to estimates by the Climate Group (2013: 7), China's public investment in climate-related activities in 2012 amounted to $26 billion, which leveraged additional investments from other sources. In 2015, the Ministry of Finance's budget included a specific line item for climate change (Nadin, Optiz-Stapleton and Jia, 2016: 316-317, 321).

China supports negotiation of climate finance issues on behalf of the G-77 plus China in an effort to strengthen its alliances within this group, even though it may decline to accept funds it has helped negotiate. These efforts are exercises in foreign diplomacy and thus the Ministry of Foreign Affairs plays an important role in these negotiations.

China's government actively supports bilateral South-South cooperation programs on climate change. China's September 2015 commitment to devote $3.1 billion to assist other developing countries in addressing climate change expanded China's efforts in terms of volume of funding, target countries and ministries engaged in South-South efforts. These programs aim to provide finance, technology and capacity building support to least developed countries in Africa and South East Asia, as well as to China's broader G-77 relationships. The China Development Bank and the Export-Import Bank of China support China's provision of financial support to other developing countries in connection with climate change technologies and development as part of China's Belt and Road Initiative. China's State Agency for International Development Cooperation coordinate and evaluates China's foreign aid efforts carried out by other government agencies in their specific fields.

Figure 10: Policy Formation Cluster - Finance

Source: Authors' analysis

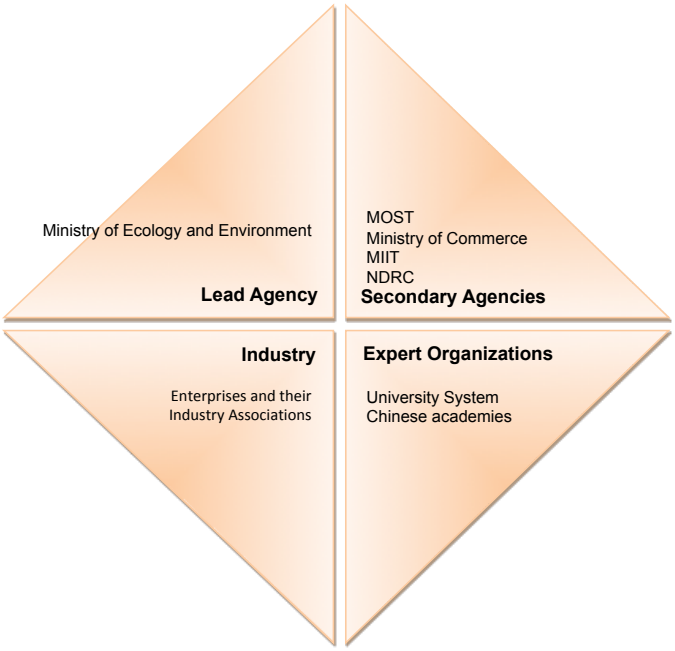
Technology Transfer

Technology transfer is an area of intense interest for China in the international negotiations due to its relationship to economic development and competitiveness. China is one of the most sophisticated countries in absorbing new technology and has been highly successful in commercializing and scaling-up deployment of renewables and other technologies for reducing greenhouse gas emissions.

Responsibility for technology transfer for domestic climate applications is led by the MEE and shared with MOST. For example, MOST and NDRC jointly issued the *National Scientific and Technological Actions on Climate Change During the 13th Five-Year Plan Period.* Significantly, MOST is primarily responsible for funding R&D programs for next-generation technologies and developing road maps for technology adoption for climate change and other fields. MOST also sponsors South-South cooperation focused on climate change technology transfer to other developing countries. In addition to these ministries, the Ministry of Commerce contributes to technology transfer policy formation relating to intellectual property, and MIIT concentrates on emerging technologies.

Expert organizations, especially China's university system and the Chinese academies, play a prominent role in technology transfer policy formation.

Figure 11: Policy Formation Cluster - Technology Transfer



Source: Authors' analysis

7. General Economic Policies

China's climate and energy policies operate within the context of its economic system. Economic institutions and policies enable and limit the potential effectiveness of climate and energy policies in achieving their intended objectives.

Accordingly, this chapter describes general economic policies that are essential to understanding the potential effectiveness of climate and energy policies. These policies are the co-existence of central planning and market-based economic systems, subsidies, local government finance through land development, and fiscal decentralization to local governments.

Central Planning and Market-Based Approaches

Since it's founding in 1949, China's central government has relied on command-and-control measures to direct all aspects of the country's development. Implemented through a series of five-year plans, China's policies focus on economic development, primarily through state-owned enterprises. With the reforms instituted by Deng Xiaoping starting in 1978, the central government introduced markets in limited measure to the economy, and in the last several years have stepped up efforts to "marketize" the economy.

Chen Yun, a member of the Politburo Standing Committee during the Deng years and an influential economic planner, explained the dual nature of China's new economy in a March 1979 statement that helped shape current economic policy:

> There must be two types of economy, *throughout* the socialist period:
>
> (1) The planned economy (the type that needs to be developed in a planned and proportionate way).
>
> (2) The market-regulated economy (the type that is not subject to planning but is conducted in accordance with the changing market supply and demand, i.e., regulated in an unplanned way).
>
> The first type is fundamental and predominant; the second, though supplementary in nature, is indispensable. (Perkins, 2015: 229, emphasis added).

The Deng period opened with reforms in the countryside, empowering farm households to sell their excess production on the open market. The household contract system tolerated limited private entrepreneurship, mostly to absorb the unemployed and those returning from the countryside after being "sent down" during the Cultural Revolution (Chu and So, 2010: 52). As a result of its success in increasing household farm productivity, the system was extended to enterprises, which were allowed to sell products above the state quota on the open market at unregulated prices, and to grant employees limited shares in the profits of their firms (Chu and So, 2010: 51-52). However, these reforms did not privatize state enterprise or encroach on central planning.

The planned economy and the state sector still co-exist with a limited market economy and private enterprise. The degree to which China has progressed towards economic reform is debated within policy and academic circles. Perkins (2015: 230-239, 296-305) proposes the following criteria for evaluating China's progress towards a market economy:

- Creating markets for inputs and outputs, whereby goods are allocated via markets and not administrative allocation
- Making enterprise managers behave in accordance with the rules of the market, through hard budget constraints and allowing enterprises to fail
- Introducing competition and abolition of monopoly power
- Setting prices in accordance with relative scarcities, as opposed to price controls

The degree to which China's reforms have achieved the above objectives depends on the sector - farming, rural enterprises, and state-owned enterprises - as well as the time period in question. Progress towards these goals is measured by degree, and is typically halting.

By these criteria, central planning still dominates China's economy. Although official policy speaks of China "marketizing" its economy, markets operate in a limited sense, as a means to transact, but not as the primary means to allocate resources or set prices. The Price Law of 1997 established that the great majority of prices should be set by the market, yet contains provisions authorizing administrative authorities to regulate the process by which prices are set. Today, the NDRC's Pricing Department continues to set prices for critical factor inputs such as capital (interest rates and lending targets), energy (fuels and electricity), water and land, which have indirect effects through the entire economy (Lardy, 2012: 106). The state also controls pricing for certain commodities and services purchased by the government, including the military, prices and subsidies for consumer commodities in order to stabilize prices for essentials such as medicines and foodstuffs, and even the pricing of banking services and products (He, 2014: 54). The NDRC exercises enormous discretion in pricing decisions, acting pursuant to highly general published regulations and no judicial review (as standing for citizen administrative review suits only exist where agencies act with respect to a specific citizen), giving them wide discretion in controlling pricing for key inputs into the economy.

Beyond setting prices, the state through the NDRC and other ministries adjust the competitive relationships among firms by determining market entry requirements or merging state-owned emprises. China maintains monopolies on salt, civil aviation, petroleum and petrochemicals, power generation and transmission, coal, telecommunications, and even on such ordinary products as tobacco and salt. By perpetuating anti-competitive market structures, and setting pricing for a wide variety of products and services, the state shields state enterprise from competition at the expense of consumers, market reform efforts, and the environment.

The state sector remains significant. In total, the state owns 325,800 national and subnational SOEs, roughly two-thirds of which are provincial SOEs managed by provincial SASAC offices. These enterprises employed almost 61 million people. Additionally, China maintains 249,946 collective-owned enterprises, which employed almost 5 million people (China Statistical Yearbook, 2018).

As described in greater detail in the next section, China's government heavily subsidies these state enterprises. Sheng and Zhao (2013: xxii) estimate that well over 100 percent of the profits of China's largest centrally-owned SOE profits were accounted for by subsidies during the 2001 to 2009 period. The sources of these subsidies are varied, including reduced costs for land and fuel, tax breaks, and monopoly pricing.

Notwithstanding thee poor financial performance of SOEs, their employees enjoy greater job security and earn well more than average Chinese citizens. SOE employees receive salaries seven times higher than

the national average, with employees of enterprises whose monopoly concentration are greater within their industry earning higher salaries (Sheng and Zhao, 2013: xxii - xxiii, 101, 105).

Worse, subsidizing SOEs has concentrated financial flows through several large enterprises capable of destabilizing the economy. The nominal profits of just ten large companies accounted for 70 percent of all net profits of central SOEs in 2009. CNPC and China Mobile together accounted for a third of total profits (Sheng and Zhao, 2013: xxi). Highly concentrated cash flows supplemented by bank credit have resulted in SOEs channeling large inflows of capital to real estate, stocks, and commodities markets, creating the potential for valuation bubbles and market manipulation.

Lending to loss-making enterprises directly impacts the health of the banking system. Losses resulting from SOE lending grew so large that in 1998, the central government floated bonds to recapitalize the four centrally owned state banks. Prior to the bailout, non-performing loans were estimated to represent as much as 40 percent of Chinese commercial banks' portfolios. Even afterward, non-performing loans still accounted for up to a quarter of state bank balance sheets at the beginning of 2002 and were consuming all bank profits (Yueh, 2011: 150, 147).

Significantly, state lending disadvantages the truly dynamic sectors of China's economy. Private small and medium-sized enterprises have in the past been mostly unable to obtain credit from the state-dominated banking system. China's banking system was designed to fund state-owned enterprises and centrally planned programs. Private enterprises remained outside the planning system, and the banks were neither encouraged nor equipped to lend to them (Tsai, 2003: 33-35). Yet, small, private enterprises have been the true engine of growth that produce the myriad of China's export products ranging from toys to electronics, often operating on razor thin margins to compete. Without access to bank credit, many of these enterprises cluster in and around special economic zones to attract foreign investment to fund operations (Wang, 2005). Lardy (2012: 33-36) suggests that the situation for small and medium private enterprises may be improving. Under China's stimulus program in response to the global financial crisis, roughly one third to almost one half of lending by China's banking system during 2009 and 2010 went to household businesses and small firms. During the economic slowdown of 2018, China's leadership re-emphasized its intention to support and guide private enterprise development (Xinhua News, 2018). Yet, as Walter and Howie (2012: 187) point out, state banks exist to serve as the "mechanical financial facilitator" of central planning, and will prioritize SOEs as long as they exist and the Party controls the economy.

Consistent with central planning of the economy, China relies on traditional command and control measures for regulation of virtually all aspects of society. Environmental protection was, until recently, largely disregarded in China's almost single-minded quest for economic development. Only in the 1990s did China's leadership start to publicly recognize the environmental consequences of its path, culminating today in China's "War Against Pollution" and President Xi's recent call for an "Energy Revolution." Similar to economic policies, environmental policy has operated on the basis of command-and-control methods. Pollution control policies such as forcing the closure of small, highly polluting and inefficient coal-fired power plants (Gao et al., 2009) and manufacturing facilities typified environmental policies. These policies have been effective to a point, but also highly costly.

As with China's broader approach to national development, the government has recognized the inherent limits in command-and-control policies and the need to expand its arsenal of policy options by embracing market-based mechanisms to help solve the country's environmental problems. A raft of policy reforms designed to internalize the cost of pollution and thereby incentivize its reduction is underway. The movement towards market-based approaches was strengthened in 2011 when China issued the *12th Five-year Plan (2011-2015)* and China's State Council issued the *Decision to Strengthen Priority Work of Environmental Protection*, reiterating the policy to establish environmental markets as a means to achieve environmental goals. China's *13th Five-year Plan (2016-2020)* emphasizes integrating development with environmental goals in green growth and green finance strategies, and calls on regulators to use market approaches for environmental and energy management.

As a result, China's environmental and energy policies increase to seek to influence behavior through incentives. These include China's embrace of carbon markets, environmental taxes, green credit, green securities and green consumption policies. These policies represent a new breed of policies that operate by increasing the costs of operation for polluters or generate revenue for those that produce products more efficiently and with less pollution. These policies are significant for exactly this reason - the Chinese government is now equating regulatory compliance with profits.

While the present trend in environment and energy policy encourages greater reliance on markets, Chinese policymakers are at the beginning of experimenting with regulation through the market. As previously described, China's "markets" do not actually operate to allocate resources and set prices, nor do they allow free competition, all of which are essential to support market-based environmental and energy policies.

By extension, an essential foundation of a properly operating market is information. Competitive markets require information be available to all market participants, as the persistence of information asymmetries enables non-competitive practices and economic rents. Along with China exercising central control over much of its economy, it also heavily restricts information to the marketplace. Even basic economic data, such as GDP, inflation and employment rates, is controlled by the Party Propaganda Bureau (Brady, 2008). Information concerning environmental pollution and state enterprise performance is similarly controlled (See discussion in Hart, 2019).

Restrictions on information have implications for the operation of market-based environmental and energy policies. Arguably, for market-based regulation to operate effectively, access to information is even more essential than in an ordinary commercial setting in which commercial stakeholders have clear incentives for price discovery and goods and services can be priced in reference to international markets. In contrast, policy markets which are created by regulators and thus unique to a particular jurisdiction often lack external price references.

China's Economy-wide Subsidies

Understanding China's political economy and evaluating the effectiveness of its environmental and energy policies requires considering China's economy-wide system of direct and indirect subsidies.

Subsidies are a pervasive feature of China's political economy. Subsidies can support or undermine environmental and energy policies that rely on markets to help to incentivize clean production or set a price for carbon, such as China's nascent national carbon emissions trading system. In particular, for China's carbon markets to succeed, regulators must place a degree of trust in the market to set prices for carbon allowances. Yet, the question of whether China's carbon market will operate effectively hinges to a great extent on whether China's regulators will allow robust competition to prevail in domestic markets for goods and services more generally.

State-owned enterprises are protected from full competition by government rules limiting entry, and a host of preferential policies, including the provision of subsidies. As previously described, although China has embarked on reforms aimed at strengthening markets, the state still maintains a powerful central planning apparatus that controls the costs of many of the most important basic inputs at artificially low prices in favor of state-owned enterprises, including capital (interest rates on savings and lending), energy (fuels and electricity), water and land, all of which affect the entire economy and environmental incentives. Protection of industry and the thicket of state subsidies create their own incentive structure that market-based environmental policy such as a carbon price is unlikely to overcome and emerge as the primary incentive driving change. If regulators are unwilling to expose state-owned enterprises to full competition in the marketplace, they are equally unlikely to expose them to the discipline of carbon markets, or allow these markets to operate freely and independently of their authority.

If subsidies are available to enterprise, any market price for carbon or other pollutants will compete with state subsidies. The sheer magnitude of China's subsidies would likely negate the effects of

environmental pricing strategies. As described further below, one study of China's 100-plus national-level state-owned enterprises estimated that from 2000 to 2009 all of their profits were attributable to subsidies.

China's state-owned enterprises, as arms of the state, typically enjoy monopoly or oligopoly status, and affiliation with the state has shielded them from the full range of competitive pressures and regulatory requirements private firms face. Most notably, state protection relieves SOEs from hard budgets or the possibility of bankruptcy. Sheng and Zhao (2013: xxii) argue that well over 100 percent of China's SOE profits were accounted for by subsidies during the 2001 to 2009 period. The sources of these subsidies are varied, including reduced costs for land and fuel, tax breaks, and monopoly pricing.

One of the most important subsidies relates to land. SOEs do not pay the full rental value of land. Based on market values for industrial land using average national prices, Sheng and Zhao (2013: xxi-xxii) estimate that SOE underpayment for land alone accounted for 67.2 percent of SOE nominal profits from 2001 to 2009.

SOEs are given reduced rates for borrowing capital from state-controlled banks. SOEs enjoy a 10 percent lower interest rate for M&A financing, compared to private borrowers in China, pay two-thirds less interest on corporate bonds, and enjoy a discount of 200 to almost 300 basis points on operating loans (Ferri and Liu, 2009; Sheng and Zhao 2013: 65-68). When scale is taken into account, large and medium size private enterprises were charged 6 percent higher than state-owned enterprises of corresponding size, and small private enterprises are charged a 9 percent premium relative to their counterparts (Sheng and Zhao 2013: 66-67, citing Liu and Zhou, 2011).

Low interest rates to state industry are made possible by government regulation setting lower than market interest rates to depositors (Lardy, 2012: 83, 98-100; Walter and Howie, 2012: 116-119). Sheng and Zhao (2013: xxii) estimate that avoided interest payments accounted for 47 percent of the profits of state-owned enterprises from 2001 to 2009.[3] Thus the state-banking system is used to subsidize state-owned enterprises, the cost of which is borne by Chinese households in the form of low interest on their deposits, and private borrowers who pay inflated interests rates to compensate for loan defaults by state enterprises.

SOEs pay less in taxes. From 2007 to 2008, the average tax burden of 992 SOEs surveyed was 10 percent, compared to 24 percent paid by private enterprises (Sheng and Zhao, 2013: xxiii). Resource taxes on petroleum, natural gas and coal are also lower for state-enterprises. For example, the state imposed less than a 2 percent charge on the price of oil for state enterprises, far less than the 12.5 percent imposed on joint ventures (Sheng and Zhao, 2013: xxii).

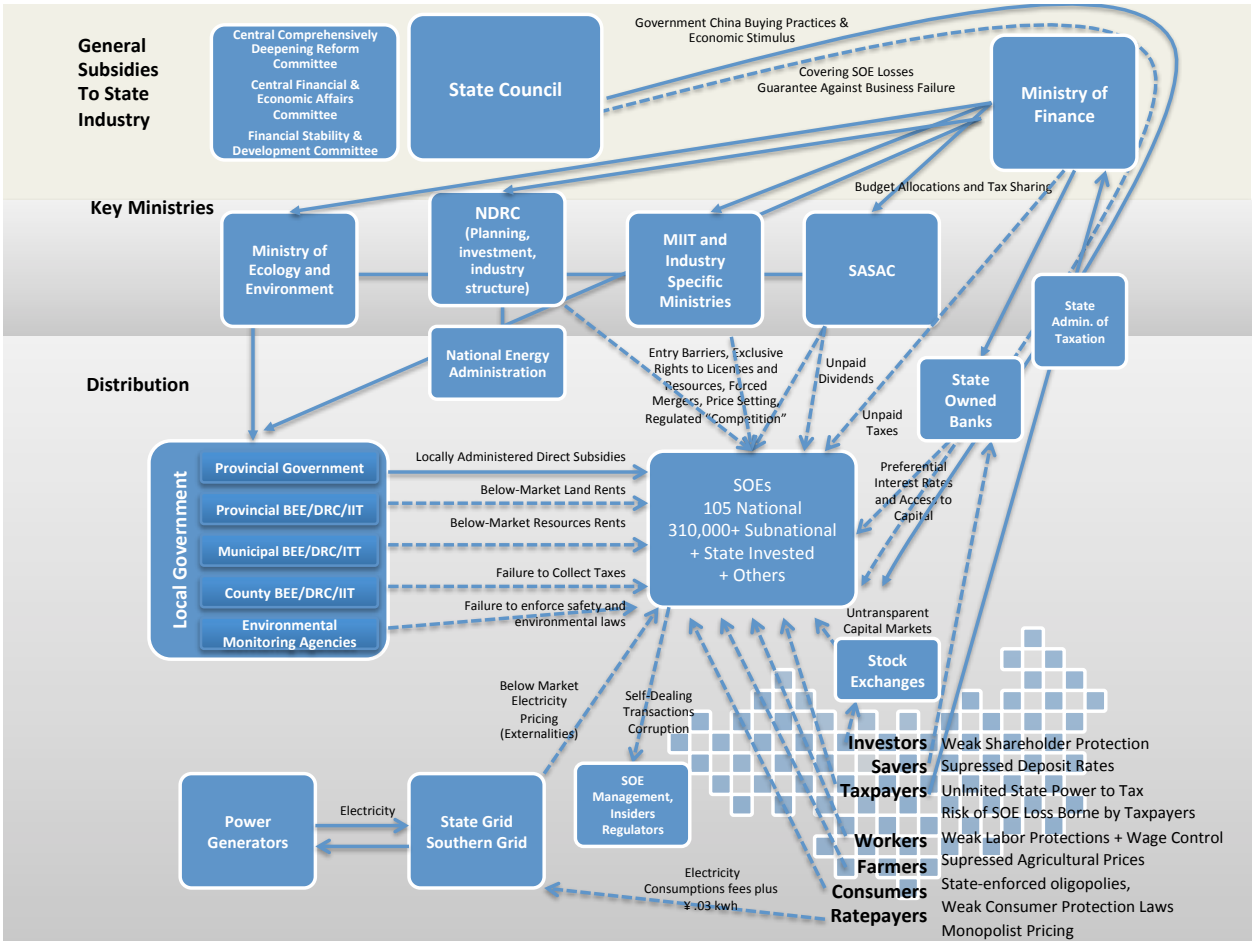
SOEs also enjoy direct cash subsidies such as payments to oil producers to ensure the market supply of crude oil and petroleum products, as well as in-kind subsidies, such as the grant of licensees or other privileges at no cost. For example, state-owned telecommunications enterprises receive valuable radio frequency licenses for which they are not charged. Certain subsidies are difficult to quantify yet substantial, such as cases of SOEs exerting political influence to disregard environmental laws, resulting in the shifting of externalities to the public.

Finally, SOEs enjoy monopoly or oligopoly pricing for various goods and services. For example, China maintains monopolies for tobacco, salt, civil aviation, petroleum and petrochemicals, power generation and transmission, coal, and telecommunications. Although Articles 7 and 8 of the Anti-Monopoly Law authorize state monopolies, they also prohibit abuse of monopoly privileges, a prohibition that has proven an impossible task for regulators to enforce. Due to their monopoly status and state price policies, state-owned petroleum and natural resources companies, for example, charge higher than international market prices for their products (Sheng and Zhao: 2013: 69-73).

[3] Lardy (2014: 108 and Appendix B) challenges the interest rate data and methodology used by Sheng and Zhao (2013), and cites other Chinese government data suggesting that while SOEs may be charged less than private borrowers, the difference is likely less than commonly argued.

The diagram below illustrates the various types of subsidies and the resulting transfer of wealth from Chinese citizens to industry.

Figure 12: Direct and Indirect Subsidies to State Industry



Source: Authors' analysis

Because China grants various types of subsidies to industry for purposes of general support as well as to achieve environmental objectives, general subsidies potentially cancel out the effects of market-based environmental policies. Further, China's overall system of subsidies undermines the transparency of market dynamics and, on the whole detracts from achieving environmental goals. Chapters 8 and 9 further discuss subsidies in their discussion of specific climate and environment, energy, and energy technology development policies.

Government Budgets and Land Finance

Under the Deng's reforms, China further decentralized the collection of taxes in order to support local development. The policy resulted in the gradual erosion of the central government's tax base and a majority of revenues being retained by local government. By 1993, local governments controlled 78 percent of all fiscal revenues. Similarly, China's state-banking sector was highly decentralized, enabling provincial and local branches of state-owned banks to cater to the needs of local governments. Fiscal and financial decentralization fueled rapid growth during the first decade of the reform era, but also unleashed inflation and weakened the central government control over China's development path.

China's central government sought to reassert its control vis-à-vis local governments through a series of reforms, starting with the tax collection system in 1994, reversing the erosion of central revenues and recentralizing control over SOE bank lending policies and thus broader monetary policy. Under the new tax regime, local governments would be required to remit over half of tax collections to the central government, with the result that local governments would only retain 44 percent of revenues in 1994 (Rithmire, 2015: 56, 58).

Simultaneously, during the mid to late 1990s, the state began the process of laying off tens of millions of workers from state enterprise, as many as 100 million by some estimates (Gallagher and Dong, 2011: 44; Solinger, 2002: 304 n.4), and dismantling the centrally-financed social welfare programs supported by these enterprises. The net result was to shift responsibility to local governments for providing China's 1.4 billion citizens with social welfare services that are essential for social stability, yet depriving those governments of the tax revenues needed to finance these obligations.

The resulting mismatch between tax revenues, the majority of which are now collected by the center, and the local governments' increasing burden for social welfare services at a time of widespread layoffs, combined with the tightening of bank credit, created an unsustainable situation in which local governments were forced to resort to extra-budgetary (预算外收入) land sales and taxation to meet their obligations, thus transforming land from being a state resource, to a commodity and fiscal resource (Rithmire, 2015: 28-29, 50).

Using land as a fiscal resource was authorized by the central government in the Urban Real Estate Management Law of 1994, the same year that the central government recentralized China's tax system, by designating municipal governments as the landowners on behalf of the state and requiring them to competitively lease out land (Rithmire, 2015: 57). Thus, land became a primary means for local government to raise government revenues, which in turn has driven urban development and expanding cities incorporating surrounding peri-urban areas within their jurisdiction.

The centrality of land to local government expansion has redefined the relationship between the central government and provincial governments. By some estimates, from 40 to 70 percent of local governments' revenues are generated from land sales (Jacob, 2011; Rabinovitch, 2012). Rithmire (2015: 31, 60) calculates that local government extra-budgetary land-related lease fees and taxes relative to local government budgetary revenue had grown from 25 percent in 2000 to roughly 90 percent by 2010, putting land-related transactions on an almost equal footing with ordinary tax revenue sources.

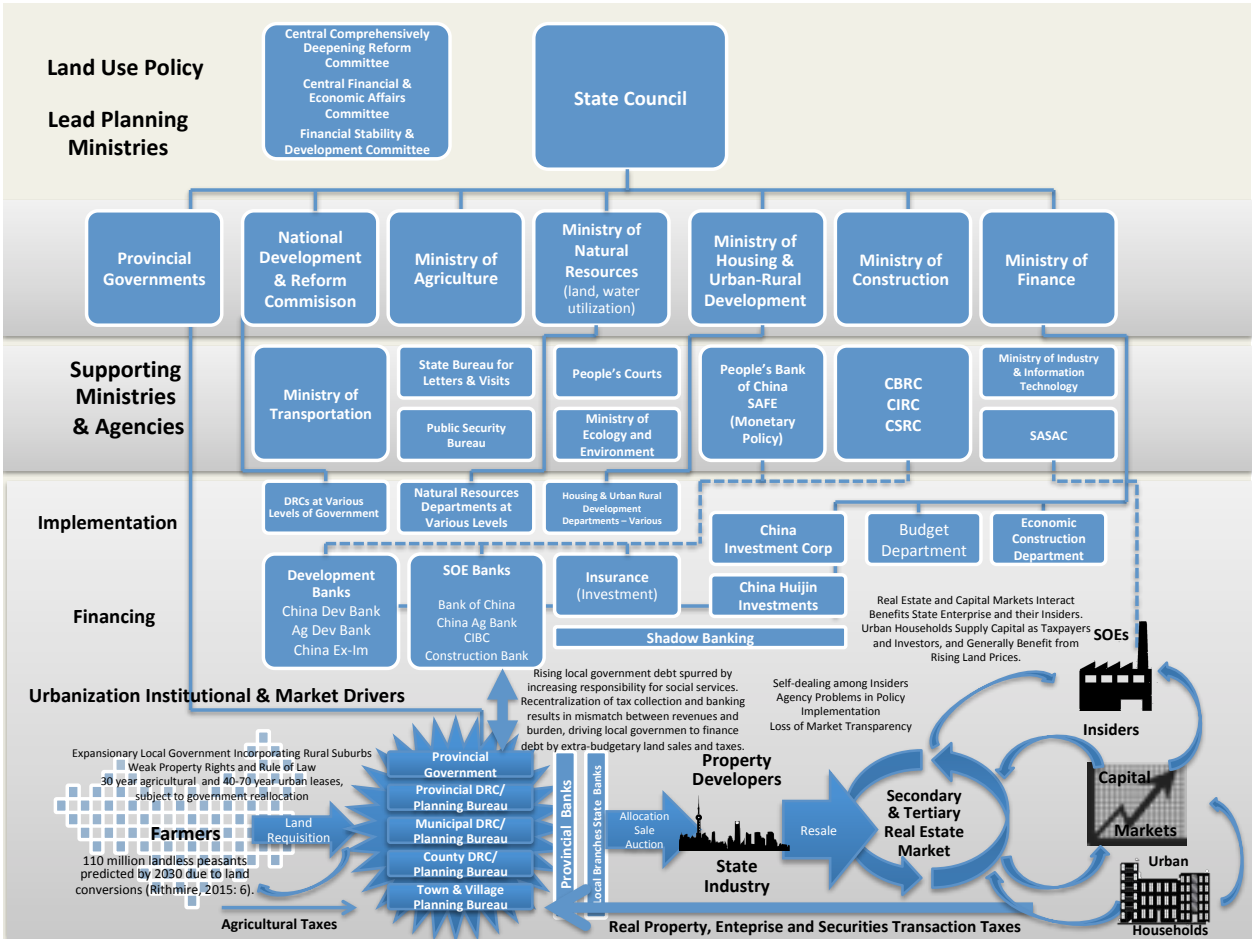
Land transactions have also become indispensable to local governments as a means to finance budget shortfalls and local government debt. Local government debt now represents over half of China's overall government debt, and from 2007 to the first half of 2014 increased at roughly 27 percent per year (McKinsey Global Institute 2015: 81).

China's local-government-controlled land regime has enabled municipalities to pursue urban expansion throughout the late 1990s and 2000s, with implications for both the environment and rural residents. To expand, local governments typically requisition land from farmers and then transfer it to development companies that are often government-owned or affiliated. The expansionary ambitions of municipal

governments has created cities that are massive in scale, with cities reaching as many as 15-25 million people, including Beijing, Shanghai, Chongqing, Chengdu, Tianjin and Guangzhou.

The diagram below shows how land use policy in China operates to transfer land from farming to urbanization, typically at the expense of rural farmers to benefit urban residents. This pattern of development negatively impacts the environment due to conversion of natural ecosystems, increases in urban energy consumption, and greenhouse gas emissions resulting from land use change.

Figure 13: Land Conversion for Urbanization



Source: Authors' analysis

Without unsettling the basic arrangement, the central government periodically seeks to prune back local power and excessive development. Thus, for example, the 1998 revision of the Land Management Law mandates the Ministry of Natural Resources to set quotas for land conversion and requires that local governments preserve at least 80 percent of arable land and obtain approvals before conversion of farmland to development (Rithmire, 2015: 62). Regulating the supply of land available for conversion is intended to counter freewheeling local governments by using land policy as a means to exert macro-economic control (Rithmire, 2015: 7, 33, 61, 183). Predictably, these policies have resulted in widespread resistance among local governments, creating highly un-transparent conditions in both the real property and finance sectors, thus enabling local officials to extract rents on the basis of their authority (Brandt, Rozelle, and Turner, 2004). In one study conducted in 2004, 80 percent of illegal land-use cases were linked to local government corruption (Li, 2006: 6).

More recently, China's urbanization and its "city cluster" policy, while supportive of development, also seek to recentralize land use policy through general development planning. China's centrally planned urbanization policies are ostensibly designed to avoid uneven development that could ultimately undermine the real property sector. China's National Urban Plan (2014-2016) expanded the concept of "city clusters" - the idea that cities and towns within an urban region strategically link their development to exploit natural, labor and financial resources more efficiently and achieve enhanced levels of development and urbanization. It calls for the breaking down of "administrative barriers and monopolies" (破除行政壁垒和垄断) and promotes allocation of resources according to market forces, albeit at the central government's direction. The cluster city concept will create 19 super regions within China. The *New National Plan for Urbanization of China (2014-2020)* prioritizes the Beijing-Tianjin-Hebei, Yangtze River Delta and Pearl River Delta city clusters, covering 2.8 percent of the country's area, with 18 percent of the country's population, will account for 36 percent of the country's economy.

Decentralized Fiscal Expenditures and Policy Implementation

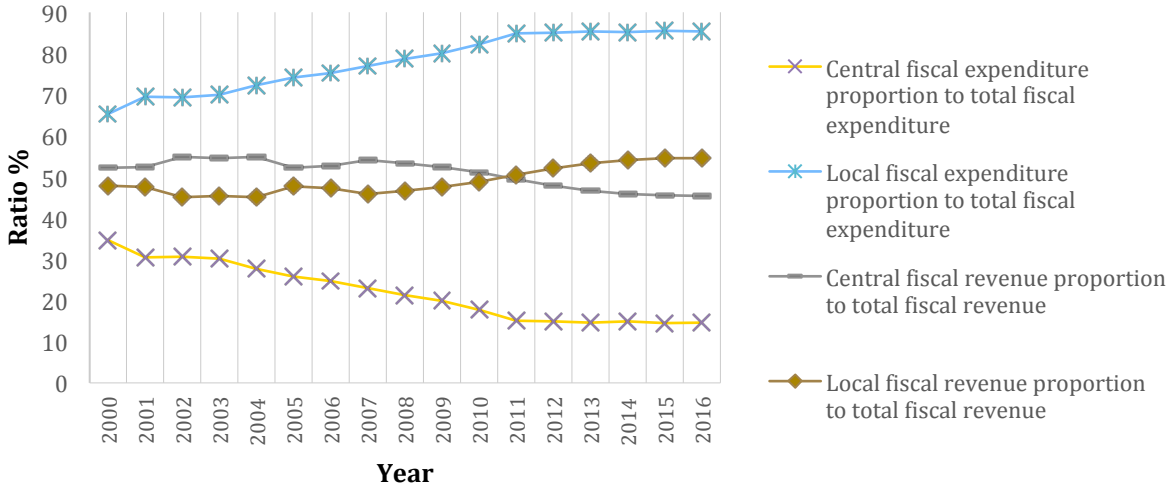
Who finances policy measures influences or even determines their implementation. Even after the tax reform of 1994, subnational governments remain a powerful locus of tax collection and budget expenditure within a complex fiscal system of decentralized tax collection, revenue sharing, and disbursement.

As previously described, decentralization was an important part of Deng Xiaoping's reforms, intended to accelerate economic development and meet local needs. Decentralization under Deng took several forms: devolution of taxation and spending authority to local government, transfer of state-owned enterprises to local government control, and the transfer of authority from government to households for market transactions.

Subnational government control over budget expenditures enables local officials to tailor the provision of government services to meet local needs, and inevitably the implementation of policy to support local interests. Under China's current system of administrative and fiscal decentralization, central and subnational authorities collect over 20 different taxes, with some tax revenues being shared, and an intergovernmental transfer system to cure fiscal gaps. Even after China's tax system was overhauled in 1994 to recentralize tax collections in favor of the central government, the central government collects just over half of all tax revenues (Shen et al., 2014).

On the expenditure side, however, local government maintains its influence vis-à-vis the central government as roughly 80 percent of all government expenditures are spent at the subnational level, as shown in the figure below. The trend of increasing levels of local expenditure started in the 1970s as local government became increasingly responsible for the provision of social services in health care, education, environmental protection, urban planning and social security (Florini et al., 2012). This movement accelerated in the 1990s due to the corporatization of state-owned enterprises, as shedding nonproductive assets, such as those relating to the provision of services to employees, was required for listing on public exchanges (Walter and Howie, 2003: 98).

Figure 14: Government Revenue and Expenditure Ratios



Source: Authors based on data from China Statistical Yearbook 2017.

Today, China possesses perhaps the highest degree of fiscal decentralization of any country in the world, which influences the incentives for local government in implementing central policies. For example, under the *Eleventh Five-Year Plan (2006-2010)*, China invested about $700 billion for environmental protection, only 10 percent of which was funded by the central government. Given the environment is more a priority for the central government, local governments typically subordinate environmental protection to economic development (Ran, 2013). Burdening local authorities with this cost creates incentives for localities to minimize expenditure and thus underinvest in protecting the environment.

8. Climate Change and Environment Policies

The Ministry of Ecology and Environment is tasked with formulating climate policies and responsibility for implementing China's nationally determined contributions under the Paris Agreement. The expansion of the MEE's responsibilities to climate policy in addition to its traditional responsibilities for developing and enforcing regulation protecting China's air, water and soil resources will require it to prioritize its policy and enforcement goals.

Bolstered by a strong mandate and enhanced authority to sanction violations of China's environmental laws, the MEE must nevertheless balance environmental objectives with economic growth, placing a premium on policies that integrate environment with economic priorities in a green development strategy. The imperative of green development aligns with the central government's broader emphasis on deepening market-based policies in environmental management and other areas.

Further, in view of the potential for environmental regulation to burden the economy and limitations in administrative capacity, the MEE must promote solutions that synergize climate and environmental policies. Decarbonization producing co-benefits of cleaner air, water and soil are essential to prioritizing climate measures. Without these co-benefits, climate change likely will be subordinated to other pressing environmental challenges.

Accordingly, this chapter examines China's climate policies, together with policies relating to air, water and soil protection. The chapter concludes with a discussion of the potential opportunities and limits for achieving synergies between climate and China's broader "War on Pollution."

China's Nationally Determined Contributions

In its *Nationally Determined Contributions*, China announced its intention to take the following actions by 2030:

- To achieve peak CO_2 emissions around 2030 and make best efforts to peak early.
- To lower carbon dioxide emissions per unit of GDP by 60 to 65 percent from 2005 levels.
- To increase non-fossil fuels' share of primary energy consumption to about 20 percent.
- To increase its forest stock volume by around 4.5 billion cubic meters from 2005 levels.

China also pledged to undertake the following actions:

- To improve fundamental research into climate change and strengthen R&D funding in order to commercialize and demonstrate low carbon technologies.
- To promote the development of the national carbon emissions trading scheme.
- To enhance resilience to climate change.

China's NDC further outlined economy-wide and sector-specific policies and measures to achieve its intended contributions (China, 2015).

Carbon Emission Trading System

Responsibility for carbon trading transferred from the NDRC to the MEE in the spring 2018 reorganization. China began experimenting with carbon emissions trading in 2011. China designated seven provinces and cities - Beijing, Shenzhen, Shanghai, Guangdong, Tianjin, Hubei, Chongqing - to carry out pilot carbon emissions trading.

- In December 2014, the NDRC issued the *Interim Measures for the Management of Carbon Emissions Trading* to promote the establishment of a unified carbon market nationwide. The provincial carbon trading authorities, in accordance with the criteria set by the NDRC, proposed emission sources in their respective administrative areas to be included in their programs.

- In November 2015, the General Administration of Quality Supervision, Inspection and Quarantine and the Standardization Administration of China issued 11 national standards including the *General Rules for Industrial Enterprises to Account and Report Greenhouse Gas Emissions. These standards and other* greenhouse gas accounting and reporting requirements cover power generation, power grid operations, magnesium smelting, aluminum smelting, iron and steel production, civil aviation, flat glass production, cement production, ceramics production enterprises, and chemical production enterprises.

- In January 2016, the NDRC issued the *Notification on Implementation of the Key Work for the Launch of the National Carbon Emission Trading Market*, specifying: (1) creation of a list of enterprises to be included in the first phase of the national carbon emissions trading system, which was then contemplated to cover the petrochemical, chemical, building materials, steel, nonferrous metals, paper, electricity, aviation and other key sectors; (2) accounting, reporting and verification standards to be based on historical carbon emissions; (3) development and selection of third-party verification bodies and personnel; and (4) strengthening of capacity building.

- Starting in 2015, the NDRC has issues a series of greenhouse gas accounting standards to support China's emissions trading system. The series mainly comprises two parts, one is the *Provincial Level Greenhouse Gas Accounting Guidance (Trial)* and its corresponding training materials, and the other is the *Industrial Level GHG Emission Accounting Method and Report Guidance (Trial).* These provide operational methods for GHG accounting to support the final provincial level GHG inventory report.

  The *Industrial Level GHG Emission Accounting Method and Report Guidance (Trial)* is actually a series of separate guidance documents for specific industrial or carbon reducing applications. Each of these *Industrial Level GHG Emission Accounting Method and Report Guidance (Trial)* defines its scope, identifies reference documents, introduces terminology and definitions, and specifies accounting boundaries, accounting methods, quality guarantee and recordkeeping requirements. Each specifies reporting content and format, and corresponding modeling and parameter default values.

- In October 2016, the State Council published the *13th Five-Year Work Plan for Greenhouse Gas Emission Control* that specifies climate and energy related measures and targets between 2016-2020 in order to ensure peaking of CO_2 emissions by 2030.

- In January 2017, the NDRC issued the *Notice on the Third Batch of National Low-carbon City Pilot Work*, which directed 45 cities (districts and counties) to carry out low-carbon city pilots starting in 2017, including carbon management and data collection regimes, as preparation for national emissions trading.

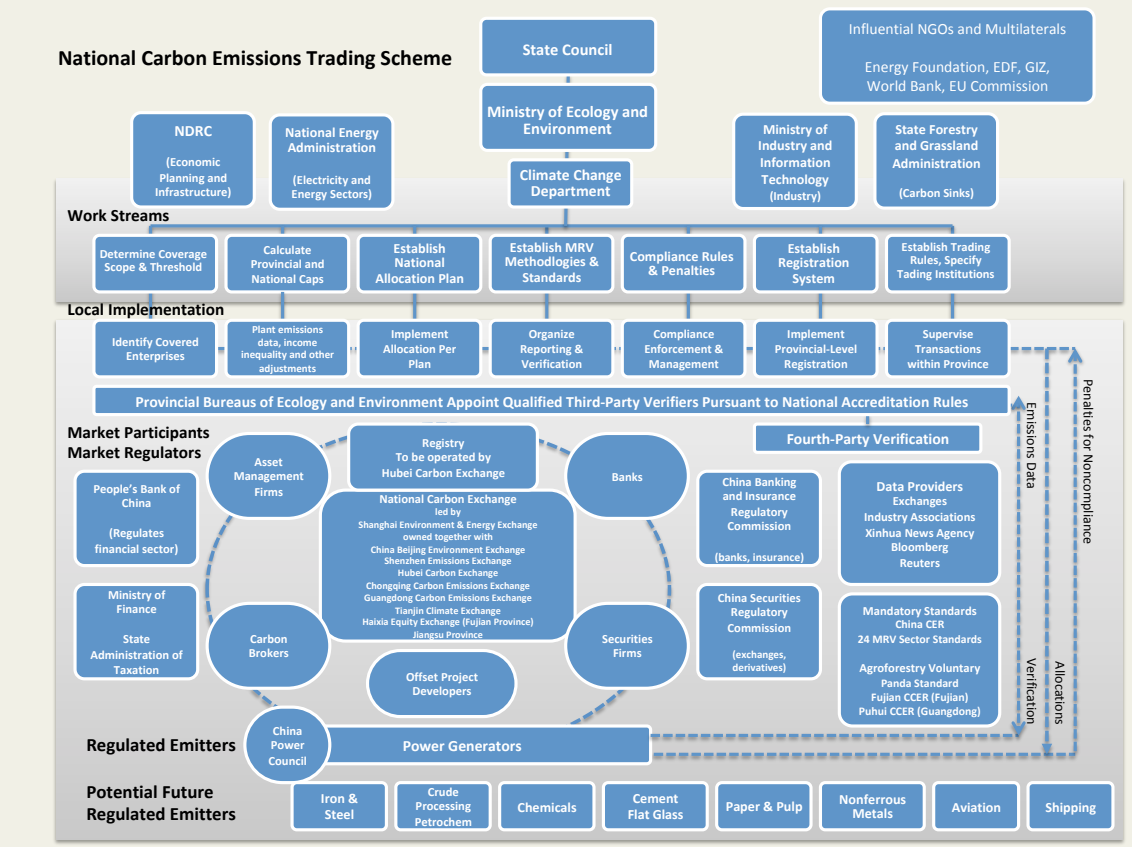
Table 2: Sector-specific MRV Methodologies

Date of Issuance	Sector or Industry
October 2013	Power-Generation
	Power Grid
	Steel Production
	Chemical Industry Production
	Electrolytic Aluminum
	Magnesium Smelting
	Plate Glass
	Cement Production
	Ceramic Production
	Civil Aviation
December 2014	Petroleum and Natural Gas Production
	Petroleum and Chemical Industry
	Independent Coking
	Coal Production
July 2015	Papermaking and Paper Products
	Other Nonferrous Metals Smelting and Rolling
	Electronics Manufacturing
	Machinery Manufacturing
	Mining
	Food, Tobacco, Beverage and Tea Refining
	Public Building Operation
	Land Transport
	Fluorination Industry
	Other Industries

From a design point of view, emissions trading markets are divided into two levels. At the primary level, a government authority issues emission rights to covered emitters, either for free or at a cost determined by the government or set by auction. In the secondary market, a broader set of covered emitters and unregulated traders may engage in trading of government allocated allowances and offset credits that may be accepted by regulators towards emission reduction obligations.

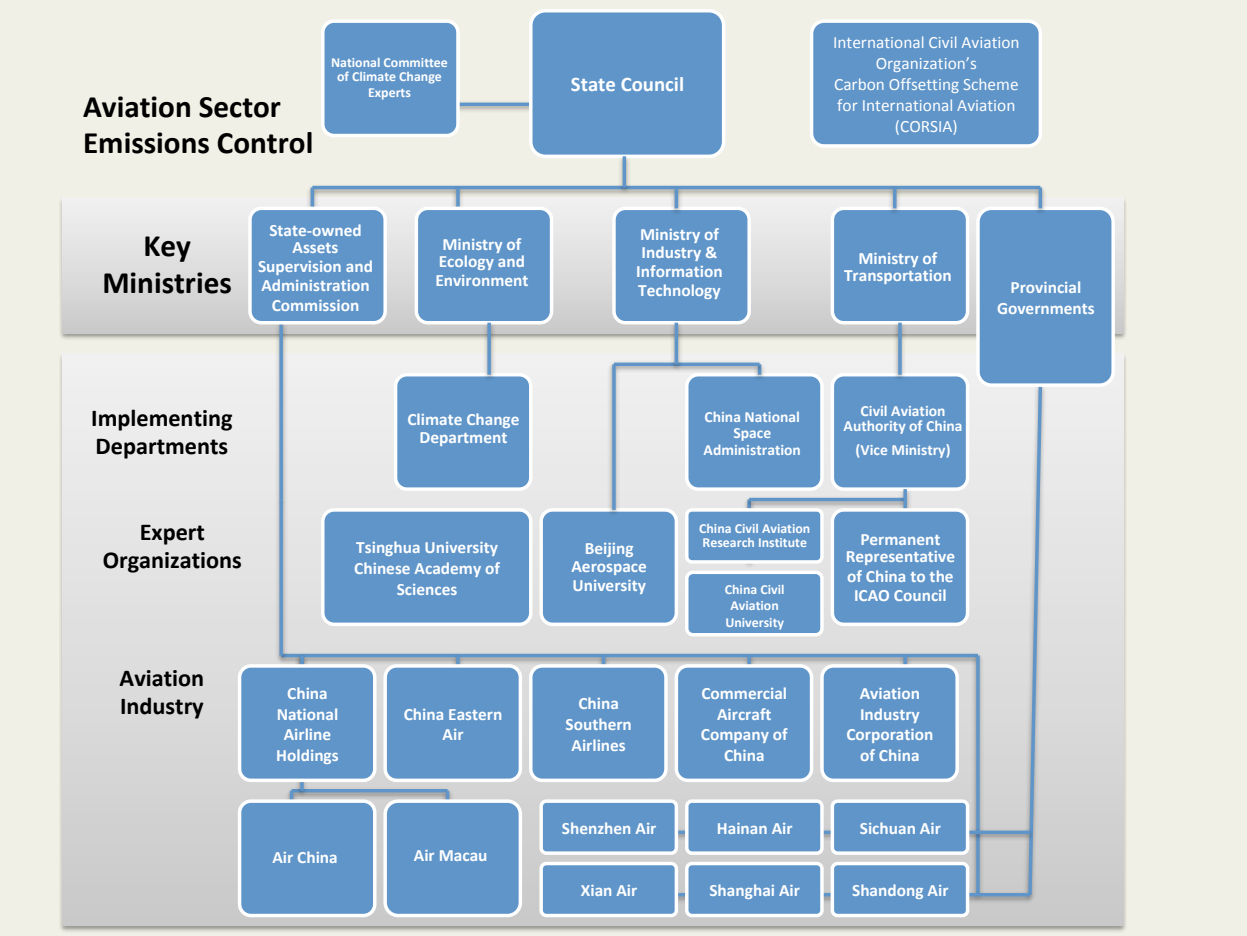
The figures below present selected stakeholders representing various interests in China's Emissions Trading System and in its aviation sector emissions control policies. The aviation sector will be subject both to China's domestic regulations, and the International Civil Aviation Organization's Carbon Offsetting Scheme for International Aviation (CORSIA), an aviation emissions cap and trade regime. China is considering whether to volunteer participation of its aviation industry into CORSIA's voluntary phase starting in 2021, which would become mandatory for China starting in 2027 based on its global share of CORSIA's revenue-tonne-kilometers criteria.

Figure 15: China's Emissions Trading System



Source: Authors' analysis

Figure 16: China's Aviation Sector Emissions Control Policies



Source: Authors' analysis

Low Carbon Cities Initiative

China's low-carbon cities initiative promotes a low-carbon economy in which citizens live a low-carbon lifestyle. Since 2010, almost 90 provinces and cities have joined the program. These cities represent at least three quarters of China's GDP (Authors' calculations).

Participating governments are required to complete five basic tasks. Each government develops a low-carbon development strategy or plan. Next, they adopt policies to implement the strategy. As part of the strategy, local governments are tasked with promoting the growth of low-carbon industries in their jurisdiction, and transitioning from traditional carbon intensive industry to strategic and newly emerging industries. Participating governments must then adopt greenhouse gas emissions data collection and statistics procedures. Finally, participants advocate a green lifestyle and sustainable consumption to its citizens (NDRC, 2010).

The low carbon cities initiative does not impose new program-specific targets, rather local officials are encouraged to prepare development plans and set targets for industry, energy, energy efficiency, transportation, construction, and other sectors that reduce greenhouse gas emissions while promoting growth (Wang et. al, 2015). As a practical matter, local government low carbon development plans incorporate targets and policies from other programs, such as the Ten-Thousand Enterprises Energy Conservation Low Carbon Program, the Northern Heating Region Existing Residential Building Energy

Conservation Retrofit Program, and the Ten Cities, Thousand Vehicles pilot program promoting electric vehicles (Lo, 2014).

Because China does not presently have a system for economy-wide greenhouse gas data collection, participants are developing methodologies independently with program support, potentially resulting in competing models that risk variations in data quality. Monitoring is also weak and subject to outright manipulation due to reliance on self-reporting. According to one study of the low carbon cities pilots, in relation to monitoring under the Ten Thousand Enterprises Program aimed at improving energy efficiency, "On-site inspection is conducted infrequently (once every three years, rather than annually). In the absence of rigorous inspection, the assessment of compliance is mainly conducted using the self-evaluation reports submitted by the enterprises themselves without serious auditing mechanisms to ensure the reliability and accuracy of the reports" (Lo, 2014).

Implementation strategies vary as suggested by the program's breadth and lack of program-specific targets. Examples include passive building heating, renewable-linked micro grids, reforestation, expanded urban green space, waste reuse, zero emissions buses, carpooling, and climate education programs (ADB, 2018). The city of Hangzhou developed its renewable energy sector as part of its low carbon development plan. The strategy employed a combination of establishing the New Energy Development Zone and other industrial parks and export zones, and subsidies to manufacturers of wind, solar photovoltaic, and other clean energy technologies (Guan and Delman, 2017).

According to low carbon cities initiative policies, China's state-owned banks through green finance programs are expected to support needed investment. Carbon trading is also expected to support development of the initiative. However, China's planned national emissions trading scheme only covers the power generation sector and thus it is not clear how carbon trading might play a meaningful role beyond that sector. Thus, the emphasis is likely to remain on debt financing. According to government policy, state banks should continue to accelerate the development of their green credit business, to provide diversified and accessible financial services for low carbon industrial customers and projects. These policies instruct banks to innovate a variety of carbon financial products linked to environmental protection and carbon emissions.

In the absence of funding by the central government, the low carbon cities initiative may be best understood as a capacity building program. As shown in the figure below, central authorities issue targets under distinct policies incorporated within local government low carbon development plans, which supplement ordinary five-year plans. Central authorities also provide training for local government officials. Local governments then monitor compliance and produce statistics demonstrating their progress towards those plans. Program results count towards officials' performance evaluation, potentially leading to promotion.

Originally developed by the NDRC's Climate Change Department, responsibility for the low carbon city initiative transferred to the MEE in the spring 2018 Party-state reorganization. Participating provinces and cities have established leading groups for addressing climate change that are meant to coordinate among government agencies in developing the low-carbon development plan. These leading groups are frequently combined Party-state leadership groups with provincial governors, city mayors or their respective Party secretaries serving as group leader.

The Bureau of Ecology and Environment for the province or city is the lead agency. Local government Development and Reform Commissions remain important as they prepare local general development five year plans and approve infrastructure projects. Associated Finance Bureaus are essential to fund implementation of low carbon cities strategies.

Planning low carbon development and data collection efforts require skills not commonly present within government, and thus Chinese universities and other expert organizations have been heavily involved in supporting the initiative. Frequent transfer and rotation among government officials also poses challenges

for capacity building that tends to localize know-how within more stable academic and research organizations.

Low Carbon Cities Program Participants

2010

Provinces	Cities	
Guangdong 广东	Baoding 保定	Nanchang 南昌
Hubei 湖北	Chongqing 重庆	Shenzhen 深圳
Liaoning 辽宁	Guiyang 贵阳	Tianjin 天津
Shanxi 陕西	Hangzhou 杭州	Xiamen 厦门
Yunnan 云南		

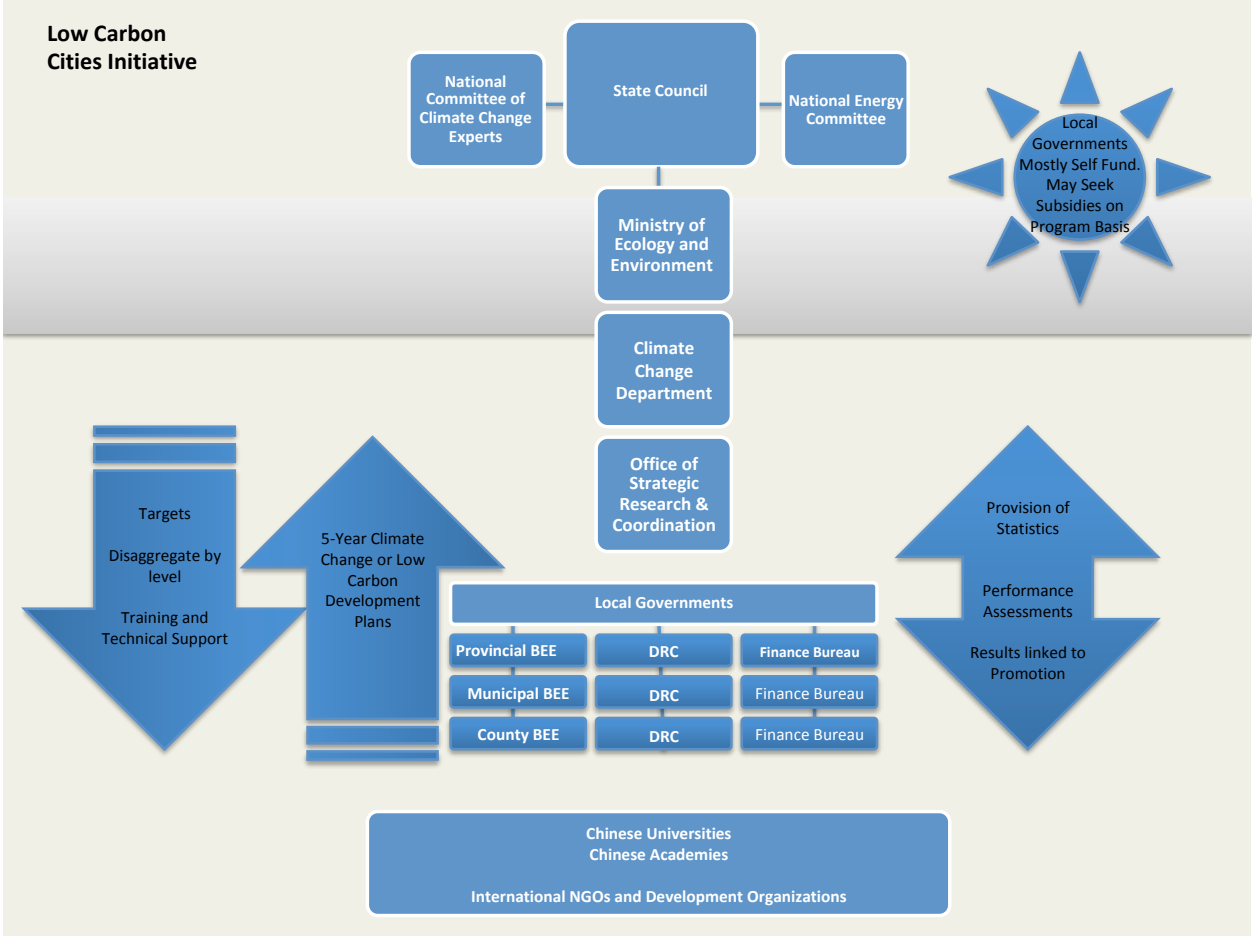
2012

Provinces	Cities		
Hainan 海南	Beijing 北京	Jinchang 金昌	Shijiazhuang 石家庄
	Chizhou 池州	Jincheng 晋城	Suzhou 苏州
	DaXingAnLing 大兴安岭地区	Jingdezhen 景德镇	Wenzhou 温州
	Ganzhou 赣州	Jiyuan 济源	Wuhan 武汉
	Guangyuan 广元	Kunming 昆明	Wulumuqi 乌鲁木齐
	Guangzhou 广州	Nanping 南平	Yan'an 延安
	Guilin 桂林	Ningbo 宁波	Zhenjiang 镇江
	Huai'an 淮安	Qingdao 青岛	Zunyi 遵义
	Hulunbuir 呼伦贝尔	Qinhuangdao 秦皇岛	
	Jilin 吉林	Shanghai 上海	

2017

Cities			
Ankang 安康	Gongqingcheng 共青城	Liuzhou 柳州	Xining 西宁
Changji 昌吉	Hefei 合肥	Nanjing 南京	Xuancheng 宣城
Changsha 长沙	Hetian 和田	Pu'er 普洱	Xunke 逊克
Changyang 长阳	Huaibei 淮北	Qiongzhong 琼中	Yantai 烟台
Changzhou 常州	Huangshan 黄山	Quzhou 衢州	Yinchuan 银川
Chaoyang 朝阳	Ji'an 吉安	Sanming 三明	Yuxi 玉溪
Chengdu 成都	Jiaxing 嘉兴	Sanya 三亚	Yining 伊宁
Chenzhou 郴州	Jinan 济南	Shenyang 沈阳	Zhongshan 中山
Dalian 大连	Jinhua 金华	Weifang 潍坊	Zhuzhou 株洲
Diyishi'alaer 第一师阿拉尔	Lanzhou 兰州	Wuhai 乌海	
Dunhuang 敦煌	Lasa 拉萨	Wuzhong 吴中	
Fuzhou 抚州	Liu'an 六安	Xiangtan 湘潭	

Figure 17: China's Low Carbon Cities Initiative



Source: Authors.

Green Finance

China adopted the goal of developing a "green finance system" in the *Ecological Civilization Reform Program* issued by Party's Central Committee and the State Council in September 2015. China's green finance program includes promoting lending to ("green credit") and investment in companies producing environmentally-friendly goods ("green investment"), encouraging the establishment stock indexes utilizing environmental criteria, encouraging banks and enterprises to issue bonds to support green projects ("green bonds"), establishing environmental development funds, requiring listed companies to disclose environmental risks, establishing environmental rating systems and cost accounting as part of an impact assessment system, and actively promoting international cooperation in various fields of environmental finance.

In August 2016, the Central Leading Group for Comprehensively Deepening Reforms adopted the *Guiding Opinion on Building a Green Finance System*, which identifies green finance not only as an important measure to achieve green development, but also as a driver of China's supply-side structural reforms. In August 2016, the PBOC, NDRC, MEP (now MEE) and seven other ministries issued the *Guiding Opinion on Building a Green Finance System*, the publication of which signaled momentum towards development of China's green finance system policy framework. In the *Guiding Opinion*, green finance encompasses financial services aimed at addressing a wide range of environmental goals,

including pollution, climate change, resource conservation, energy saving, clean energy, green transport, and green buildings.

China is seeking to expand its leadership in global environmental governance through green finance. In December 2015, China hosted the G20 Green Finance Study Group, co-chaired by the People's Bank of China and the Bank of England, with the United Nations Environment Program (UNEP) serving as the secretariat. China is also integrating green finance within its Belt and Road Initiative, primarily through four institutions: the Asia Infrastructure Investment Bank (statutory capital US $100 billion), the Silk Road Fund (US $40 billion), BRICS Development Bank (statutory capital US $100 billion), and the planned Shanghai Cooperation Organization Development Bank (SCO Development Bank). These institutions are expected to practice green finance principles in their investment decisions, and implement environmental and social risk management measures. The Green Silk Road Private Equity Investment Fund (total size of RMB 30 billion yuan) established in 2015 is the first private equity fund dedicated to investing in Belt and Road projects, and is similarly expected to adhere to green finance principles.

Below outlines the development of specific policies within green finance.

Green credit Since 2007, China has formulated a series of policies to encourage and promote financial institutions to actively carry out green credit. The framework for the green credit system comprises four parts: (1) *Green Credit Guidelines* (issued by CBRC, 2012), (2) *Green Credit Statistics System* (CBRC, 2013), (3) Green Credit Evaluation System (including *Green Credit Implementation Key Evaluation Indicators* (CBRC, 2014) and *Guidelines on the Supervision of Banking Financial Institutions* (CBRC, 2014)), and (4) green credit policies developed by the banks themselves. In 2013, 29 banks signed the *China Bank Green Credit Commitment*. In 2014, banking financial institutions jointly initiated the China Banking Association Green Credit Professional Committee. In April 2015, the Green Finance Committee (GFC) of the China Society for Finance & Banking was established.

Green bonds The People's Bank of China, NDRC, China Securities Regulatory Commission (CSRC), the three major policy agencies in the green bonds field, and other agencies and financial institutions have issued a series of policies governing green bonds, which define green projects, green bond issuance standards, and ways to raise and use funds. In December 2015, the People's Bank of China (PBOC), Green Finance Committee and NDRC separately published polices concerning green bonds. The PBOC issued *Announcement No. 39* to introduce green bonds in the inter-bank bond market, creating a financing channel for financial institutions to raise funds for green industry projects through the bond market. The Green Finance Committee released the *Green Bond Supporting Project Catalog (2015 Edition)*, which is intended to provide prospective issuers with standards for green projects. The NDRC issued the *Green Bond Guidelines* to define the scope and application of green bonds, establish bond audit requirements, and provide for guarantees, subsidies and other supporting measures. In early 2016, the Shanghai Stock Exchange and Shenzhen Stock Exchange jointly issued the *Green Bonds Pilot Notice*, promoting green bonds within the existing corporate bond framework, and further clarifying rules governing green bonds. In August 2016, the PBOC issued the *Guidelines for Establishing the Green Financial System*, approved by the State Council. Finally, in March 2017, the CSRC issued its *Guidance on Green Bond Support and Development* governing the issuance of green bonds by China's stock exchange-listed companies.

China's green bonds market has grown rapidly. By late 2018, China's issuances of green bonds reached roughly $275 billion, albeit of varying qualities, making China the world's largest green bond issuance market (Climate Bonds Initiative, 2018).

However, China's green bonds do not generally comply with international standards, thus raising concerns about the true impact of their green finance initiatives. As background, the International Capital Market Association (ICMA) has developed the *Green Bond Principles* that focus on four criteria—use of proceeds, process for project evaluation and selection, management of proceeds and reporting. The ICMA standard requires that proceeds must be used for ‘green’ projects, which are those that provide a

clear environmental benefit, but does not otherwise prescribe technologies. Under the ICMA standard, proceeds must be sequestered, tracked and audited for as long as the bond is outstanding. Reporting the use of proceeds is performed annually, identifying specific projects, amounts invested, expected impact using both quantitative and qualitative methodologies consistent with ICMA guidance, and explaining the methodology and assumptions employed. Finally, the *Green Bond Principles* recommend that issuers conduct external review to ensure bonds meet the four principles above, and the results of the review are made public.

China does not adhere to ICMA or any other international standards for green bonds. Instead, China adopted its own regulatory system, developed with input from ICMA and the Climate Bonds Initiative (Wang and Zhang, 2017). Under China's system, climate bond proposals are submitted to the PBOC, and further reviewed by the CSRC and the NDRC. The PBOC assesses the proposed bond category, criteria, procedures, management and the environmental benefits of the underlying assets or projects and either approves or rejects the application. External review is recommended, but not mandatory. Reporting is required on a quarterly basis, more frequent than the ICMA annual reporting requirement (Kidney, 2017).

Critically, China's “use of proceeds” requirements are highly permissive, allowing issuers to market bonds as "green" even when investing in projects that would be prohibited by international standards, such as “clean coal” and high-efficiency transport projects using fossil fuels. Whereas international standards require the issuer to invest at least 95 percent of proceeds in green assets or projects, China's standard allows up to 50 percent of proceeds to be invested in any type of investment, including highly polluting investments such as ordinary coal-fired power generation (Lee, 2017). Thus, in theory, the entire proceeds of a China-certified "green bond" could be invested in coal projects, provided at least half of proceeds are allocated to advanced coal technologies.

Further, a significant amount of money raised through Chinese green bonds are used to refinance existing projects, and it is not clear whether the proceeds of Chinese green bonds are in fact directed toward their intended projects (Hornby, 2017).

Finally, there is generally no third party certification of Chinese projects confirming actual use of proceeds, or follow up evaluation of the impact of the investments (Personal communications, March 2018).

In 2017, the People's Bank of China pledged to work with the European Investment Bank to strengthen its framework for green bond investment in China (European Investment Bank, 2017), which could potentially bring greater transparency and credibility to this market.

Green stock index and related products being developed and of three types: environmental, social and governance indexes (ESG), environmental protection industry indexes, and carbon efficiency indexes. By mid-2017, China had 30 green indexes (Chou, 2018). The Shenzhen Stock Exchange and Shanghai Stock Exchange have published voluntary guidance on ESG disclosure. About 20 percent of listed companies disclose ESG performance, though reporting quality varies and disclosures are generally not verified by independent third party evaluation (Ma, 2016).

At year-end 2018, 21 Chinese investment firms had joined the Principles for Responsible Investment, thereby committing to systematically employ ESG principles in investment decisions. These firms remain small relative to China's economy, and do not include key asset owners such as the National Council for Social Security Fund, the sovereign fund China Investment Corporation, or major insurance companies.

In 2018, MSCI, a leading index provider, included mainland Chinese companies in its Emerging Markets Index. Including Chinese companies, done in response to concerted requests by the Chinese government, generates demand for Chinese equities by the important passive investment sector, thereby supplying investment to China's capital markets. Yet, 37 percent of the 233 covered Chinese companies scored MSCI's lowest ESG rating of CCC, compared with 8 percent of companies in the index (Chou, 2018). While inclusion may bring greater scrutiny to ESG performance, MSCI's China index is dominated by state industry operating in a non-transparent regulatory and disclosure environment, raising concerns

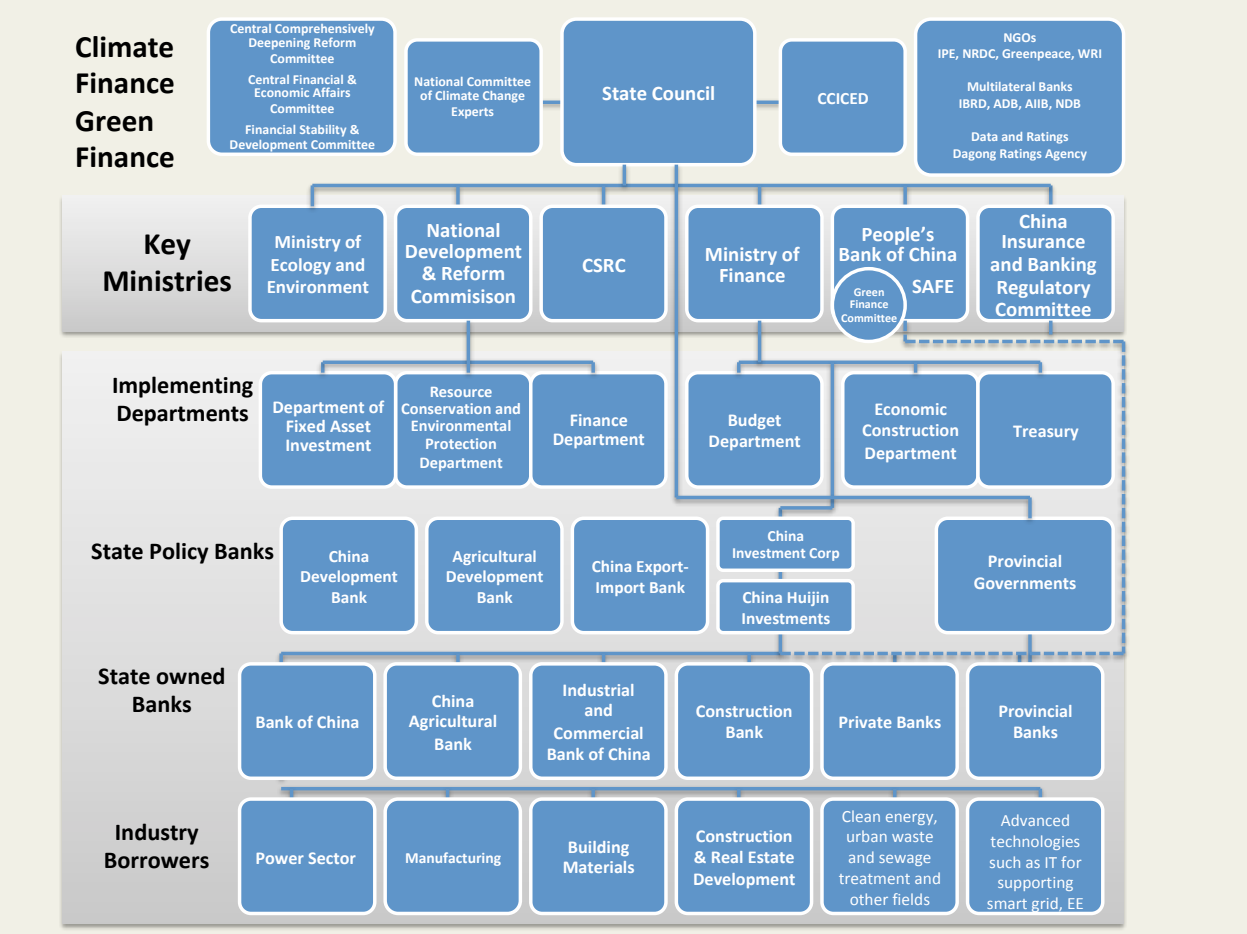
that spurring investment without improving ESG undermines corporate accountability and effectiveness of ESG. Notably, domestic ESG indexes face the same problem, are less transparent, and some suffer acute conflicts of interest due to state affiliation and their consulting to index companies.

Green industry funds should invest at least 60 percent of their assets in green investments. By mid-2017, China had 62 responsible investing funds, 46 of which devoted to green industry (Chou, 2018). The Silk Road Fund and Green Silk Road Private Equity Investment Fund have established leadership positions in the field. At the local level, Zhejiang, Guangdong, Inner Mongolia and other local governments have established local industry funds for financing energy saving enterprises.

Green insurance in China mainly refers to environmental pollution liability insurance. Environmental pollution liability insurance insures against pollution accidents that cause damage to third parties. The *Environmental Protection Law* clearly encourages the development of environmental pollution liability insurance. The *Ecological Civilization Reform Program* also proposed the establishment of a compulsory environmental liability insurance system in order to improve environmental risk management. By the end of 2015, there were nearly 4,000 companies in 17 provinces, autonomous regions and municipalities that had contracted environmental liability insurance (Ma, 2016).

The figure below presents selected stakeholders in China's green finance reforms.

Figure 18: China's Green Finance Initiative



Source: Authors' analysis

Adaptation

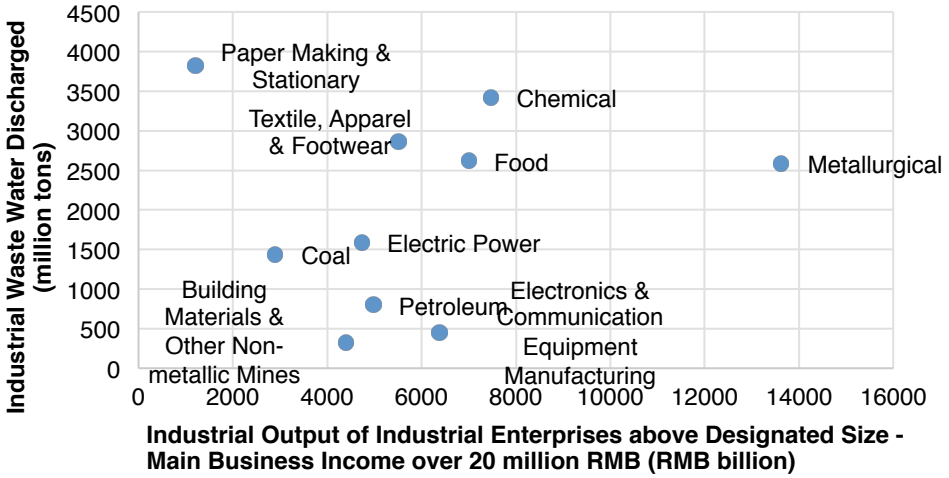
The risks posed by climate change vary across China given differences in geographic and weather conditions, water and agroforestry resources, and levels of development. Risks of drought, flood, fire, and food insecurity differ from North to South and from coastal to inland regions. Local communities will be differently impacted by climate change and thus adaptation measures must be appropriate to regional and local conditions. Local climate impacts are increasingly understood, yet monitoring and forecasting capabilities remain underdeveloped.

Figure 19: China Climate Exposure Map

Source: Authors' adaptation based on map provided by Rebecca Nadin

The water, forestry and agriculture sectors are probably most aware of the need to adapt to climate change. The power sector, which depends on water for thermal and hydropower plants, and general manufacturing industries are only beginning to understand potential constraints on their operations posed by water availability. The stringency of China's regulation of water resources has increased significantly with the introduction of water efficiency measures and tighter water pollution discharge standards on an industry sector-specific basis. The figure below illustrates the industry sectors that are most exposed to water risk based on their water pollution discharge volumes relative to value of industrial output.

Figure 20: Top 10 Most Polluting Industrial Sectors



Source: Tan, 2014; Ministry of Environmental Protection and National Bureau of Statistics, 2012; National Bureau of Statistics, 2012.

The MEE is responsible for adaptation policy and, prior to the 2018 Party-state reorganization, its Climate Change Department then part of the NDRC coordinated the development of China's National Adaptation Strategy together with 12 other ministries. The National Adaptation Strategy, described below, provides a framework for further development of urban adaptation plans and provincial adaption plans, which are coordinated by the MEE and its local Bureaus of Ecology and Environment. However, on sub-issues such as agriculture, water, forestry, and biodiversity, the Ministry of Agriculture and Rural Affairs, Ministry of Water Resources, the Ministry of Natural Resources, and the State Forestry and Grassland Administration lead policy formation efforts in their respective areas. Rural and urban adaptation efforts are not integrated, but rather distinct work streams. For urban adaptation issues, the Ministry of Housing and Urban-Rural Development co-leads adaptation efforts together with the MEE. A third work stream focuses on disaster risk management, a long-standing priority for China, which is now led by the Ministry of Emergency Management and supported by the Ministry of Civil Affairs and National Health Commission.

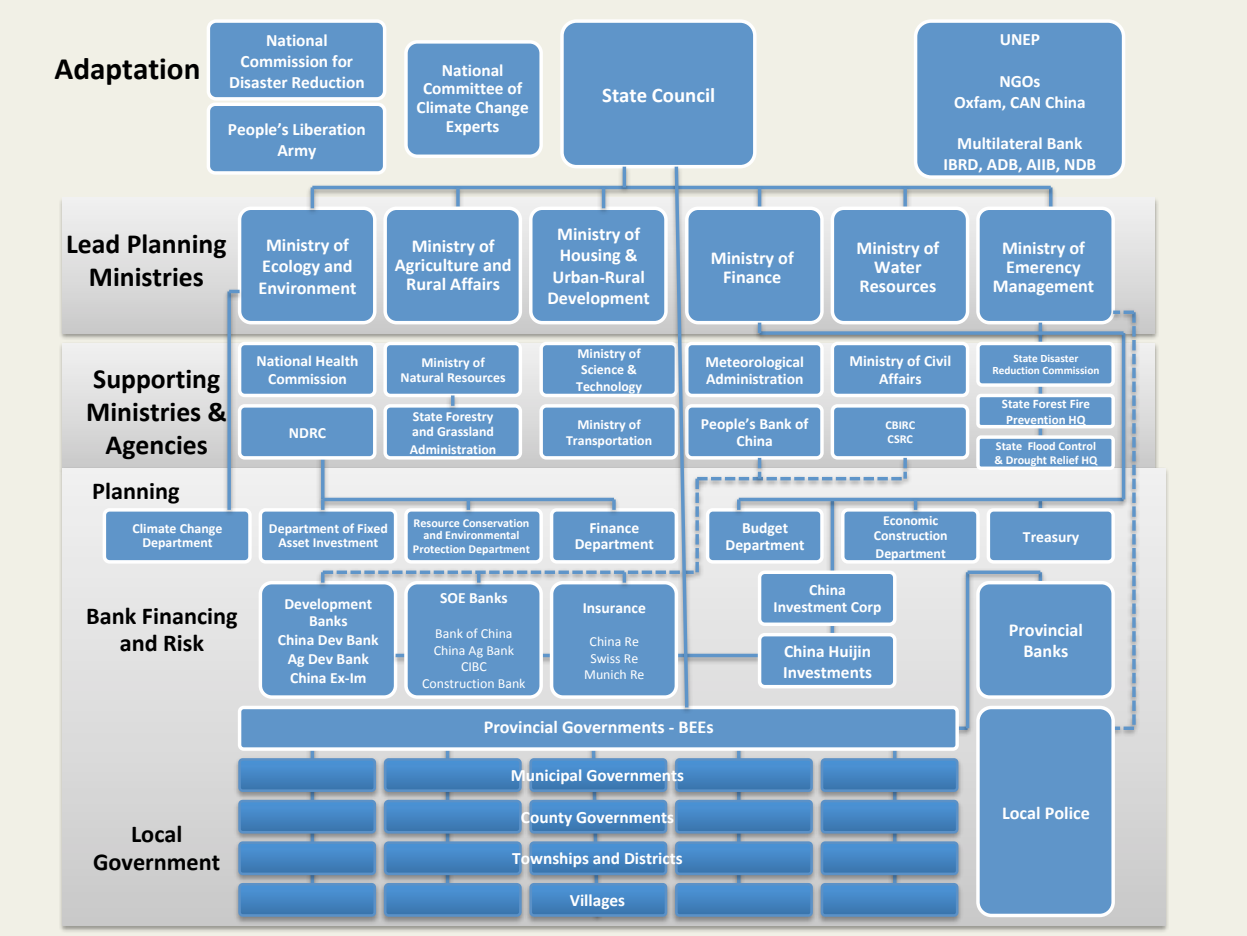
These efforts are supported by leading expert organizations working on adaptation, including the China Meteorological Administration, which operates weather monitoring and data collection stations throughout China, the State Oceanic Administration, which provides data and analysis for marine environments and coastal regions, and the Ministry of Science and Technology, which supports research in adaptation risk identification and mitigation.

Relative to mitigation, fewer academic institutions have focused on adaptation as an explicit subject. Adaptation research programs are established at the Chinese Academy of Agricultural Sciences, Chinese Academy of Social Sciences, and research institutes associated with the various ministries engaged on adaptation issues, particularly in the fields of agriculture, hydrology, health, and disease control. Provincial universities and research institutes are studying adaptation issues within the context of traditional disciplines, as local governments seek their assistance to confront challenges posed by a changing climate to agriculture, water and biodiversity. Locally developed knowledge and expertise dispersed across China's university system appears substantial yet remains fragmented.

Adaptation is experienced directly by communities and thus is a distinctly local issue. China's rural communities are especially vulnerable to climate change both because they depend on agriculture for survival, and in turn water resources and favorable weather, and are China's poorest and least

economically developed regions. Several provinces have hosted pilot programs focusing on adaptation research and capacity building, including Chongqing (Three Gorges area), Guangdong, Guangxi, Hainan, Hebei, Heilongjiang, Inner Mongolia, Jiangxi, Jilin, Ningxia, Shanghai, Sichuan and Xinjiang (Nadin, Optiz-Stapleton and Jia, 2016: 311-313). Although not formally linked in their efforts, provincial agencies and research institutions cooperate informally through adaptation research programs. Foreign governments and NGOs have funded provincial adaptation research, such as the Sino-Norwegian Biodiversity and Climate Change Project concentrating on Sichuan, and the Adapting to Climate Change in China Project supported by the Swiss and British governments. In the area of disaster prevention, China has adopted pilot programs in community-based disaster risk management (CBDRM), which are predicated on community leadership and adoption of disaster risk reduction measures. By end of 2012, over 4,100 communities had established community-based disaster relief and management organizations and mechanisms, whose activities include risk assessment and education. However, these programs do not necessarily take climate change into consideration in their assessments and planning, and their actual level of preparedness remains difficult to assess (Zhou et al., 2016, 82-86).

Figure 21: China's Adaptation Policy



Source: Authors' Analysis

The diagram above represents the government and non-government stakeholders primarily at the national level that have a direct interest in adaptation policy formation and planning. The diagram represents interests rather than degree of actual participation in the policy development process. As noted above, adaptation policy development is only at the beginning stages. Much of the activity in adaptation remains confined to research and capacity building. Further, many of the stakeholders who

should be engaged remain largely inactive, and efforts remain uncoordinated. Nor has industry been fully consulted or integrated into adaptation planning at either the national or local levels.

China's insurance industry is important but presently inactive in climate policy. Chinese insurance companies presently lack risk identification, data, and modeling capabilities to properly evaluate climate-related risks. Both Swiss Re and Munich Re operate in China and are supporting local stakeholders in developing capacity to evaluate climate risks. For example, Swiss Re has launched a pilot project with Guangdong to evaluate climate risks with the goal of establishing an indexed catastrophe bond program to insure against typhoons and extreme cold weather. China's Green Finance Committee is promoting the concept of "green insurance" that, while not specifically adaptation oriented, is intended to protect against environmental risks, and thereby promote adoption of risk monitoring and mitigation measures.

Climate adaptation will present China's Ministry of Finance and the insurance industry with significant financial challenges. Although the Emergency Response Law of the People's Republic of China adopted in 2007 requires the insurance system to insure against natural disaster losses supported by state resources, this provision has not been implemented due to lack of available funds. Similarly, provincial governments also presently lack provision of funding for climate adaptation (Nadin, Optiz-Stapleton and Jia, 2016: 316-317, 321).

Of concern, the financial condition of China's insurance industry is uncertain and not transparent. China's insurance industry invests heavily in China's securities and property development markets, which also lack transparency, and concentrates risk. Worse, investment has been financed by debt supplied by China's state banks and China's shadow banking system. In response, the China Banking and Insurance Regulatory Commission introduced financial solvency tests for China's 100+ national and provincial state insurers and private insurers, the results of which are not publicly available. A sound insurance system is a threshold requirement for mobilizing the insurance industry to support climate adaptation efforts.

As described more fully in Chapter 11, adaptation will be at the center of China's South-South climate diplomacy efforts. China intends to focus on information systems and early warning systems for extreme weather events.

China's National Adaptation Strategy

China's National Adaptation Strategy issued November 2013 identifies guiding principles, priority areas and pilot provinces for developing adaption responses. Twelve ministries and government agencies coordinated by the Climate Change Department, then of the NDRC, and joined by the Ministry of Finance, China Metrological Administration, and Ministry of Agriculture and Rural Affairs, among others, developed the strategy. Following the 2018 Party-state reorganization, the MEE assumed responsibility for coordinating its implementation.

The overall objectives of the National Adaptation Strategy are as follows:

- To increase adaptive capacity and reduce vulnerability of the main climate-sensitive sectors, areas and populations, emphasizing ‘anticipatory’ adaptation approaches supported by enhanced monitoring and early warning to mitigate all types of losses caused by climate change, and to maximize benefits and minimize risks.

- Synergy and collaboration between the central government and local authorities.

- Broad engagement focusing on raising public awareness of adaptation to climate change and international cooperation at various levels and through South-South cooperation.

The National Adaptation Strategy categorizes regions of China based on differing climate impacts on production and people's living standards, dividing China into three types of adaptation regions:

- Urban (high population density) areas in eastern, central and western areas
- Agricultural
- Ecological (e.g., northeast forest belts, the Qinghai-Tibet Plateau eco-zone)

The strategy identifies priority sectors, and mandates specific tasks be carried out within each:

- Infrastructure
- Agriculture
- Water resources
- Coastal zones and maritime waters
- Forests and ecological systems
- Tourism and other industries
- Human health

The strategy provides guidance to improve institutional arrangements supporting adaptation, including:

- Legal framework for adaptation to climate change to be developed.
- Climate change adaptation plans at all levels are to be formulated and mainstreamed into government economic and social development planning at all levels.
- Co-ordinate adaptation efforts, particularly flood and drought management, disaster prevention and mitigation, development through poverty alleviation, science and technology education, health care, forest fire prevention, pest control and infrastructure development.
- Increase financial support through climate markets and risk sharing mechanisms such as insurance.
- Strengthen technical support and capacity building, including through research; improve climate change monitoring, prediction, risk assessment; develop adaptation technologies; enhance early warning systems; and develop a database for interdisciplinary, cross-industry collaboration.

Extensive South-South cooperation shall be carried out in areas such as:

- Agricultural production
- Desertification control
- Integrated water resources management
- Disaster prevention and risk reduction, including early warning systems
- Pest monitoring, prevention and control
- Biodiversity conservation
- Coastal zone protection

Biodiversity

China is one of the word's most biologically diverse countries, yet its natural ecosystems face enormous pressure due to rapid economic growth, unsustainable agricultural practices, and a changing climate. China's urbanization is converting natural ecosystems to development and heavy pollution has further degraded water and land resources. Excessive use of inorganic fertilizers and monoculture farming has contributed to declining biodiversity. Against this background, climate change introduces new threats to China's biodiversity from rising temperatures and changing precipitation patterns.

China's current biodiversity crisis traces its origins to earlier policies. Following the founding of the new China, the government rejected ancient Taoist concepts of "harmony with nature" (天人合一), advancing the notion that man could reshape his physical environment through manual labor in order to build a socialist utopia. China's leaders implored that "man must conquer nature" (人定胜天) and "reform heaven and change the earth" (改天换地). The government declared a "war against nature," in which nature was to be "conquered" (战胜自然). These ideas were illustrated by stories of "shock troops" sewing wheat, reclaiming grasslands, scoring "victories" against floods and drought, and "wiping out" insects (Shapiro, 2001: 4-5).

Ideology thus justified various policies destructive of biodiversity, ranging from the harvesting of 10 percent of China's forests during the brief Great Leap Forward (1958-1961) to fuel China's steel mills (Liu, 2010), to constructing over 88,000 dams on most of China's rivers (Zheng and Cao, 2015). Today, an estimated 90 percent of China's grasslands and 40 percent of its wetlands are significantly degraded, and its forests continue to retreat (Zheng and Cao, 2015).

Central government agencies continue to formulate policies in top-down fashion, and manage China's biodiversity assets through their provincial, municipal and other sub-national counterparts. Critics charge that China's own bureaucracy has shut local communities out of the policymaking process, and that centralized policymakers lacking an understanding of local conditions have produced simplistic policies that often prove inefficient and ultimately ineffective, with unintended adverse consequences for biodiversity (See Zheng and Cao, 2015).

China regulates natural resources under the Forestry Law (amended 1998), Grasslands Law (2004), and Wildlife Protection Law (2009). Notwithstanding these laws, illegal logging and trade in endangered species remain commonplace.

China is party to the Convention on Biological Diversity, acceded to the Convention on International Trade in Endangered Species of Wild Flora and Fauna, and the Ramsar Convention on Wetlands of International Importance, but is not party to the Convention on the Conservation of Migratory Species of Wild Animals.

China's national biodiversity policy focuses on the protection of forests and wetlands. It established a national parks system under the Nature Reserve Development Program and the Wetland Conservation Project in the 2000s, which built on a series of prior issue-specific policies, including the Three North Shelter Belt Program (desertification, soil and water conservation, afforestation in northern China), Natural Forest Conservation Program, Green for Grain Program (banned logging in natural forests and planting forest and grasslands for soil and water conservation), Sand Control Program, and Forest Industrial Base Development Program (Zheng and Cao, 2015). China lacks comprehensive agricultural biodiversity policies, however it has policies governing genetic materials for commercial exploitation for agriculture, medicine, fuel and other applications.

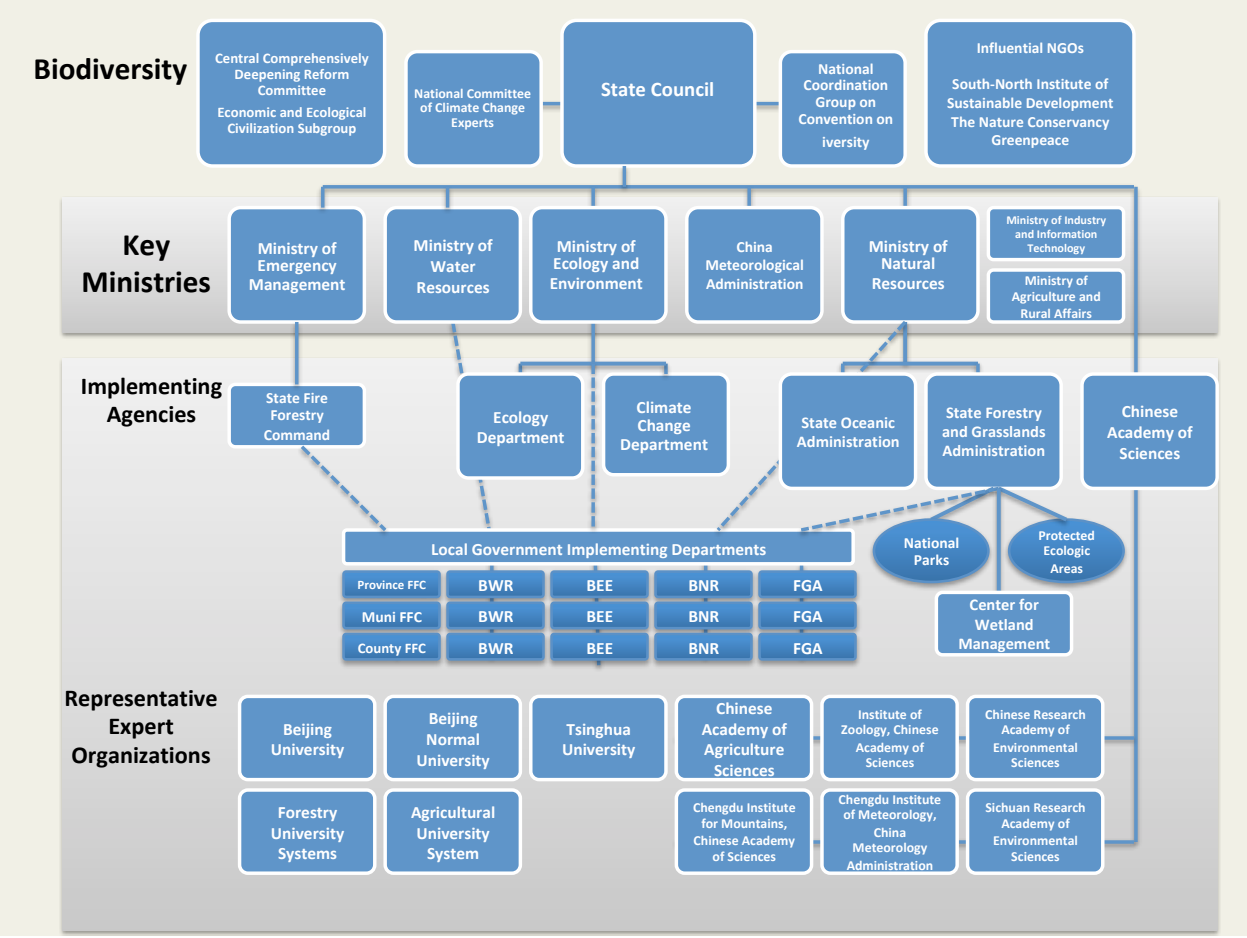
Under the Ministry of Natural Resources, the State Forestry and Grasslands Administration operates the national parks service, the Center for Wetlands Management and oversee protected ecological areas, and the State Oceanic Administration is responsible for ocean ecosystems.

In protecting biodiversity, the Ministry of Natural Resources is joined by the Ministry of Ecology and Environment, responsible for protecting the environment, and the Ministry of Water Resources, which manages water resources and infrastructure such as dams. Also, the Ministry of Emergency Management operates the State Fire Forestry Command.

The Ministry of Industry and Information Technology and the Ministry of Agriculture and Rural Affairs develop policy and standards, and support research, concerning genetic materials for commercialization.

Various specialized research institutes study regional biodiversity issues and inform policymaking, including the China Meteorological Administration, Chinese academies across various disciplines at the national and local levels, and China's universities, in particular the forestry and agricultural university systems established throughout China.

Figure 22: Biodiversity Policy



Source: Authors' analysis

Land Use Policy

China's central government is orchestrating the world's most ambitious urbanization in history - by 2030 over one billion rural residents will reside in cities according to plans prepared by China's State Council (State Council, 2016a). Simultaneously, the central government is attempting to prevent local governments from converting land to development outside of the plan. Due to budget shortfalls, land conversion finances local government operations, pitting urbanization and land protection policies in competition with each other.

In order to address this tension, the government has attempted to ensure a minimum amount of land remains dedicated to agricultural uses. The Party and the State Council updated these minimums in the 2017 *Opinions on Strengthening the Protection of Cultivated Land and Improving the Balance of Occupation and Compensation*, setting 2020 targets for arable land to be no less than 1.865 billion mu (1.24 million square kilometers), and protected farmland to be no less than 1.546 billion mu (1.03 million square kilometers).

To accomplish this, in 2017, the NDRC and the Ministry of Land and Resources, the predecessor to the Ministry of Natural Resources, published the National Land Remediation Plan (2016-2020), which promotes land reclamation and remediation in order to restore and protect the quality of farmland, return land to cultivation, and promote better planning of urban/rural interfaces. The plan is explicitly designed to prevent conversion of land and ensure China's food security. The remediation plan complements the National Land Planning Outline (2016-2030).

Loss of arable land places China's food security and its some 130 million farming households at risk (UN Food and Agriculture Organization, 2018), which intensifies as minimum and average temperatures rise due to climate change and water becomes scarce. China is expected to suffer reductions in agricultural output due to warming, by some estimates 7 percent by 2080 without adaptive measures, however the Asia region upon which China is dependent could experience much larger reductions of up to 20 percent (Cline, 2007). Regional studies of climate change suggest the impacts on China's agricultural output suggest could be much more severe on a regional basis and an even shorter timeframe of 2050 (Li et al., 2016: 136-145).

The vulnerability of China's staple crop is illustrative of these risks. Analysis of observed data collected at the International Rice Research Institute (IRRI) in the Philippines for the period 1993 to 2003 shows that rice yields decline by 10 percent for each 1°C increase in growing-season minimum temperature (night time temperature in the dry season) (Peng *et al.,* 2004). A broader study using data collected by IRRI from 1994–1999 of rice yields in 227 irrigated rice farms in six important Asian rice-growing countries also found yields declined due to increased minimum temperatures (Welch *et al.,* 2010).

Lower agricultural yields will likely cause higher prices for staple crops and livestock products by 2050 (Mendelsohn and Dinar, 2009). For low-income households, inflation can be devastating, as food represents a large portion of consumer spending, frequently over 50 percent of household expenditures in developing countries (HSBC Climate Change and World Resources Institute, 2010).

Compounding the human and climatic dimension, severe soil pollution poses both a health risk to those who live on or farm contaminated land, as well as to consumers who eat produce grown in polluted soil. Although the least detectable by ordinary citizens, China's soil is polluted from direct emissions into land, deposit of air pollutants, and leaching of water pollutants. Due to the co-location of industrial and agricultural activities along rivers and the expansion of Chinese cities, high rates of cancer are occurring in prime agricultural regions (Lu *et al*., 2015). A previously classified national survey leaked to the media estimated that 19 percent of China's arable land is contaminated with heavy metals (Hornby, 2018; Century Weekly, 2011). Solving the problem requires costly and/or time-consuming remediation, costing roughly $900,000 to $2.2 million per acre if done rapidly, or removing land from food production for up to 40 years if by natural processes. By some estimates, remediating China's soil pollution would cost US $1 trillion if pollution stopped immediately, and take 100 years at current spending levels (Hornby, 2018).

Primary responsibility for land use planning rests with the Ministry of Natural Resources, which is also responsible for land use control and ecological protection and restoration, including for forests, grasslands and water resources. The Ministry of Natural Resources necessarily coordinates with the Ministry of Housing and Urban-Rural Development and the Ministry of Ecology and Environment in relation to land use development and environmental protection. However, these ministries have counterparts that are budgeted, staffed and thus controlled by provincial and local governments, which are driven to convert agricultural land for development by budget shortfalls and mounting debt, as described in Chapter 7.

In an effort to reign in local government debt financed by land conversion, the Ministry of Finance is responsible for monitoring the financial management aspects of land use. Together with the People's Bank of China and the China Banking Regulatory Commission, the Ministry of Finance reviews budget projections for income and expenditure for land finance, including debt monitoring, bank lending and bond issuances (See *Land Reserve Management Measures* and the *Financial Management Measures for Land Reserve Fund* issued by the Ministry of Finance, January 2018).

Finally, the NDRC prepares the national land use plan, allocates land to achieve particular development programs such as major infrastructure projects, and enacts land reforms to achieve a range policy objectives including supporting economic development, marketization and promoting financial stability.

Water Policy

Although China possesses the sixth largest supply of freshwater worldwide, China possesses roughly one-third the global average renewable freshwater resources on a per capita basis (World Bank, 2018).

China's water supply is mainly located in the south, however most water is consumed in the north. Northern China has 60 percent of agricultural land and 40 percent of the population, but only has 20 percent of the country's water resources (Global Water Partnership, 2015).

For the past several decades, China's rivers have experienced reduced flows and northern China's water table has dropped continuously. For example, studies comparing river flows over several decades show that the Yellow River's flow reduced 48 percent from the 1950-1969 period compared to 1970-2008, and that the Hai River reduced 70 percent from 1951-1965 compared to the 1966-2005 period. Human demand and withdrawals accounted for the vast majority of the reduced flows, 62 percent for the Yellow River and 85 percent for the Hai River (Wang et al., 2016: 104-107).

Changing precipitation and climactic conditions have also affected flows across China's major river basins. Climatic conditions accounted for reductions of 38 percent of the flow of the Yellow River and 15 percent of the Hai River (Wang et al., 2016: 104-107). Climatic conditions have also contributed to more intense floods, mudslides, drought, and significant crop losses throughout China (Li et al, 2016).

Human and climatic conditions together have resulted in roughly two thirds of Chinese cities experiencing water shortages to varying degrees (Global Water Partnership, 2015). To address this problem, China initiated the South-North Water Transfer Project, which is constructing a system of pipelines to transfer water from the south to north. The project is controversial due to the negative impact that diversion of up to 20 percent of the flow of the Han River and the impact it may have on river ecosystems, agriculture and industry, forced resettlement of populations along the middle route, as well as perpetuating unsustainable consumption and development patterns in the north (Crow-Miller, 2014).

Water consumption in China produces low levels of economic productivity relative to other industrialized economies. In China, a cubic meter of water produced $7.57 of GDP in 2011 compared to $13.7 per cubic meter in upper middle-income countries, and $39.2 per cubic meter in high-income countries (Rutkowski, 2014). China's low water productivity is due both to low efficiency and that agriculture consumes the greatest portion of China's water. Agriculture consumes roughly 62 percent of the country's water resources, whereas industry uses 21 percent, households consume 14 percent, and ecology uses the remaining 3 percent (China Statistical Yearbook, 2018).

Although water is relatively scarce in China, China's prices for water are substantially lower than other industrialized countries, resulting in waste. For example, Chinese consumers pay half what Canadians pay for water, even though China has a fortieth of Canada's supply of renewable freshwater on a per capita basis (Ma, 2018; World Bank, 2018). China's pricing water below the level needed to service loans to water utilities subsidizes water intensive consumers and deprives those utilities of the profits necessary to cover the cost of their assets, thereby discouraging future investment (Rutkowski, 2014).

China introduced tiered water pricing in the 2010s for industry and urban households, but not for dominant agricultural or rural users. The state also promotes water recycling, however China's recycling rates remain half that of industrialized countries (Rutkowski, 2014).

Difficult to monitor by ordinary citizens, water quality holds a lower priority than air pollution with authorities and, as a result, continues to worsen (Personal communications with Ma Zhong, 2018). In 2013, 31.4 percent of river water failed to meet level III of the Surface Water Quality Standard, indicating whether water is safe for direct contact with humans and aquaculture (Ministry of Water Resources, 2013; see Ministry of Environmental Protection, 2002 for additional information on the standard).

In 2009, China adopted a water resources management strategy to enhance allocation, conservation and protection, with measures to control water quantity and quality. The strategy provided for:

- Water withdrawal licenses
- Water resource pricing and fees
- Controlling pollution discharges
- Evaluation and approval of water infrastructure projects
- Innovation and market reforms
- Capacity building

In 2011, China's central government established water resources management guidelines and adopted the "three red lines" establishing targets to control total water use, improve water use efficiency, and control water pollution. In 2012, the State Council issued the *Guidelines on Implementing Stringent Water Resources Management System*, which specified measures to ensure rational development, water use and protection, and sustainable economic and social development (Global Water Partnership, 2015).

In 2015, China's State Council released the *Action Plan on Water Pollution Prevention and Treatment*, containing ten primary action items and 35 specific measures drawing on government, the private sector and the public to launch the “war” on water pollution. The Action Plan provides for:

- Imposing pollution emissions limits for industry, urban sewage, rural areas and harbors
- Promoting transition of economic structure and recycling development
- Protecting water resources by limiting total usage and increasing water use efficiency
- Supporting the environmental technology and environmental protection industries
- Reforming water pricing and adopting environmental charges for water pollution
- Strengthening monitoring and enforcement for compliance with environmental laws
- Enhancing environmental governance through emission cap limits and permits

- Promoting water security, especially underground, rivers and ocean eco-systems
- Strengthening coordination among local and central government agencies
- Strengthening public participation and supervision through information disclosure

The plan establishes goals and indicators for ten key sectors: paper-making, coking, nitrogen fertilizer, nonferrous metals, printing and dyeing, agricultural food processing, active pharmaceutical ingredients, tannery, and electroplating (State Council, 2015b).

Table 3: China's Action Plan on Water Pollution Prevention and Treatment

	2020	2030
Main Goals	Phased improvement of China's water quality	Overall improvement of China's water quality
Main Indicators	• At least 70% water in the 7 main rivers achieve Class III or better • Less than 10% of black and odorous water in prefecture-level cities • 93% of drinking sources in cities at prefecture-level or above achieve Class III • Less than 15% of underground water classified as extremely poor • 70% coastal waters achieve Class III • 15% decrease in waste water in Beijing, Tianjin and Hebei, and eliminate waste water in Yangtze River Delta and Pearl River Delta	• At least 75% of water in the 7 main rivers achieve Class III or better • Generally eliminate black and odorous water nationwide

Source: Authors.

China's water management bureaucracy comprises several different agencies characterized by competing objectives and overlapping responsibilities. Until recently, water conservation was not a priority for China. Rather, China's water management policies aimed to construct water infrastructure to prevent flooding from its major rivers, and to divert water resources for agricultural and industrial development, consistent with the terms of China's Water Law (amended 2002).

Water policy is mainly developed by the Ministry of Water Resources, which operates China's extensive system of over 88,000 dams (Zheng and Cao, 2015). Together with the NDRC, the Ministry of Water Resources also sets national price and allocation policy, and oversees water conservation investments.

The Ministry of Water Resources develops plans for water delivery and conservation with the Ministry of Agriculture and Rural Affairs for agricultural and rural consumption, the Ministry of Construction for urban and rural infrastructure, and the Ministry of Housing and Urban-rural Development. China's Ministry of Natural Resources monitors ground water levels and approves withdrawals from aquifers and surface water sources. The Ministry of Ecology and Environment is responsible for regulation water pollution and industrial and municipal sewage treatment. The Ministry of Transportation plans water transportation infrastructure and possesses approval rights over water uses that affect transportation.

National ministries work through their provincial, municipal and other sub-national counterparts, which also have authority for setting their own priorities for water management, consumption and protection. Local government also has certain authority to approve hydropower installations based on dam height

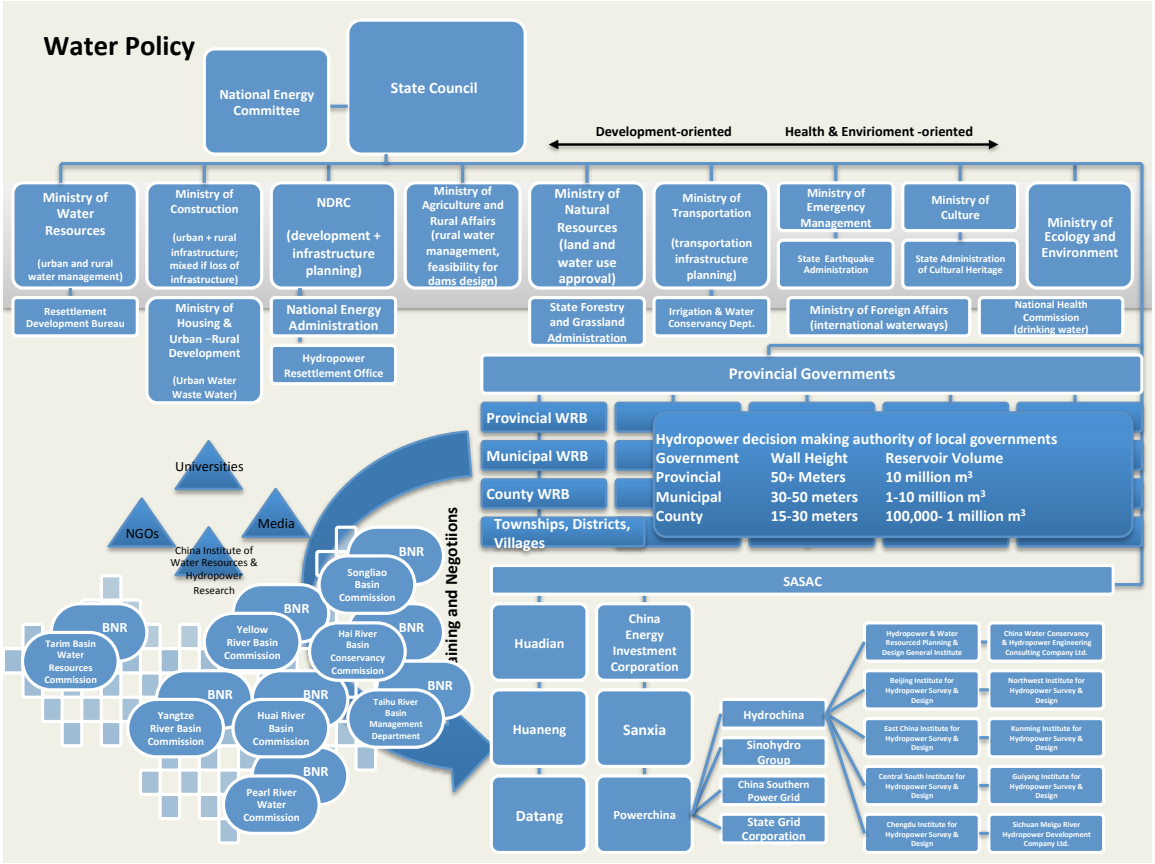
and capacity. The various ministries and their subnational counterparts may thus maintain competing goals even when drawing water from the same sources.

The Ministry of Water Resources operates basin management commissions for each of China's seven great rivers. These basin management organizations are as follows:

- Yellow River Conservancy Commission (founded in 1949)
- Changjiang Water Resources Commission (founded in 1950)
- Haihe River Water Conservancy Commission (founded in 1979)
- Pearl River Water Resources Commission (founded in 1979)
- Songliao River Water Resources Commission (founded in 1982)
- Taihu Basin Authority (founded in 1984)
- Huaihe River Commission (founded in 1990)

These commissions are limited to water conservancy and disaster prevention/mitigation. Local Bureaus of Natural Resources approve water withdrawals.

Figure 23: Water Policy



Source: Authors' analysis

Exploitation of water resources for urbanization, industrial development and power generation enfranchise various state-owned enterprises in water policy. The state grid companies and the major power

generation and investment companies are arms of the government possessing ministerial rank tasked with implementing the economic development goals of the state. They possess specialized expertise, and control commercial and financial assets conferring economic power influential with local government.

Pollution Emissions Regulation

Traditional pollution remains the MEE's highest priority. Therefore, climate change measures must produce co-benefits solving traditional pollution problems to enhance their chances of adoption.

China's government is reforming pollution control regulations by introducing market-based methods. Accordingly, this section describes the transition from the present Total Emissions Control system to a system of emissions permits potentially coupled with trading, and a transition from emissions fees and charges to environmental taxation.

Emission rights fees and pollution charges are distinct concepts. Emission rights fees reflect the use of environmental resources and embodies the "who uses a resource pays" principle. Pollution charges represent compensation for the environmental damage caused by pollutant discharge. It reflects the "polluter pays" principle according to the actual discharge amount. Following the transition from environmental charges to environmental taxes in 2018, the MEE is contemplating policy reforms introducing a pollutant emission permit model featuring elements of an emission trading system.

Total Emissions Control

China's Total Emissions Control program establishes the basic framework under which pollutants are regulated. In 1996, China's State Environmental Protection Administration (today the Ministry of Ecology and Environment) identified twelve pollutants for which it sets total emissions limits:

- Air pollutants (soot, sulfur dioxide, and industrial dust)
- Water pollutants (chemical oxygen demand, cyanide, arsenic, mercury, lead, cadmium, hexavalent chromium, and oil pollutants)
- Solid waste (industrial)

The pollutants were selected based on three criteria: (a) subject to existing pollution-control measures, (b) adequately monitored by statistical measures, and (c) designated as a grave threat to the environment.

The policy set limits for each of the criteria pollutants starting in 2000. National limits were disaggregated into quotas for provinces, which in turn assigned quotas to prefectures and large cities, which would then allocate limits to emitters. The provincial allocations required the developed eastern provinces to reduce total pollutant emissions to below the zone's 1995 level, the central provinces to reduce total pollutant emissions to at least their 1995 level, while the target for the least developed western provinces was set above the zone's 1995 level.

The province exercised broad discretion in assigning the precise quota to prefectures and cities. These allocations were based on local conditions, including population, local economic and social development, industrial and product structure, infrastructure in urban areas, pollution levels, local environmental quality targets, types of special environmental-protection districts, and the performance of industry in meeting the discharge standard.

At the final step in the quota-setting process, prefectures and cities set quotas using one of two methods: standards set in accordance with total emissions control targets assigned by the province, or regional or basin-level standards developed at the local level. Prefecture and city governments electing to develop their own allocation methodology were required to support their standard using economic and technology feasibility analysis. This election resulted in various allocation methods (Hart and Ma, 2014).

Environmental Taxes

Since 1982, China has levied charges for sewage, waste gas, solid pollutants and noise through the local environmental bureaus. However, due to lack of strict enforcement and local government intervention, uncollected charges represent a serious problem. In contrast, tax administration is more rigorous and comparatively more insulated from local government intervention, as the Ministry of Finance and the State Administration of Taxation supervises collections. Therefore, after years of evaluation and debate,[4] the National People's Congress Standing Committee approved the Environmental Protection Tax Law, effective January 1, 2018, which transitions from China's traditional system of pollution charges to a system of environmental taxes.

Under the Environmental Protection Tax Law, enterprises, institutions and other production and business operators who directly discharge air pollutants, water pollutants, solid waste, and noise to the environment are subject to environmental taxes.

The lower limit of the tax will be the prevailing pollution charge. The tax on air pollutants is between RMB 1.2 to 12 yuan for each pollution unit (每污染当量). The tax on water pollutants is between RMB 1.4 to 14 yuan for each pollution unit as defined in in the *Environmental Protection Tax Law*. The tax on solid wastes is between RMB 5 to 1000 yuan per ton depending on waste type.

The determination and adjustment of the tax amount for covered air and water pollutants is performed by provincial governments, autonomous regions and municipalities, taking into account environmental carrying capacity, the current levels of pollutant discharge and the economic and social ecological development of the region. Amounts are reported to the same level People's Congress Standing Committee for approval, and to the Standing Committee of the National People's Congress and the State Council for record keeping purposes.

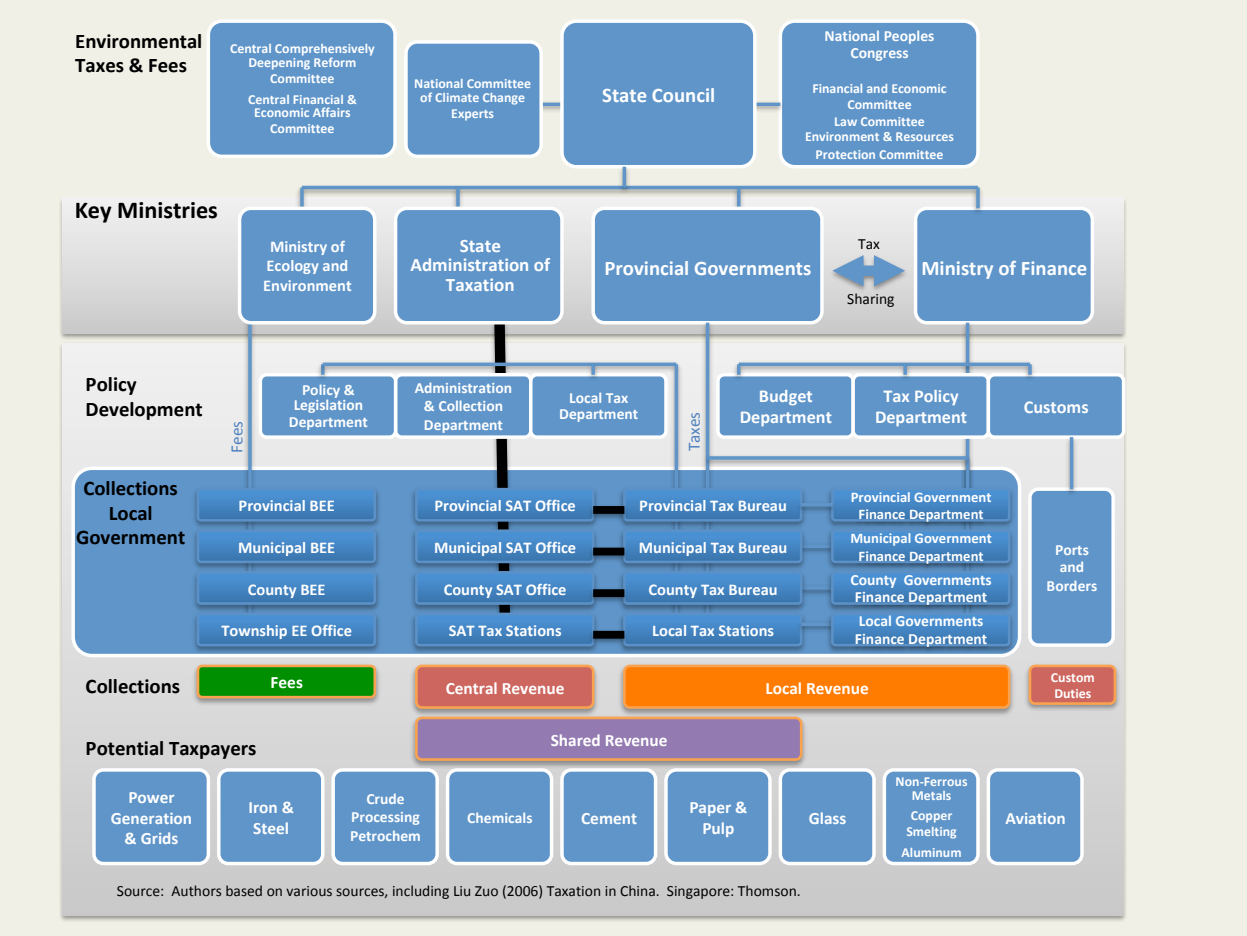
The environmental protection tax is collected and managed by the tax authorities. The local Bureau of Ecology and Environment (BEE) is responsible for monitoring and regulating pollutants in accordance with environmental protection laws and regulations. Local governments at or above the county level are to establish a working mechanism for the division of work among tax authorities, environmental protection authorities and other relevant units to strengthen the collection and management of the environmental protection tax and ensure timely and full tax payment. As the administration of pollutant discharge requires specialized expertise, tax authorities will necessarily cooperate with BEEs, and develop protocols for coordination and information sharing among tax departments and environmental protection departments.

Carbon taxes were omitted from the Environmental Tax Protection Law after vigorous debate within policy and academic circles. However carbon is de facto taxed under the current tax scheme through environmental taxes and resource taxes.

The figure below presents selected stakeholders representing various interests in China's environmental tax and fee policies.

[4] See, e.g., *Opinion on Strengthening Key Environmental Protection Work* issued by the State Council in 2011, which proposed that China “actively promote environmental tax reform, and research the introduction of an environmental tax". The Party's 18th Plenary Session also emphasized "changing environmental fees to environmental taxes" as an important element of China's tax system reform.

Figure 24: China's Environmental Taxes and Fees Regime



Source: Authors' analysis

Pollutant Emission Permits and Trading System

China has experimented with pollutant emission permits since the 1980s, with the first emission trading of COD carried out in Shanghai in 1987. In 1990, China organized pilot SOx and NOx air pollutants emission trading in 16 cities. Since 2007, the Chinese government organized pilot projects on paid use of emission permits and emissions trading in 11 provinces and cities including Tianjin, Jiangsu, Zhejiang, Chongqing, Hubei, Hunan, Guangzhou, and Inner Mongolia.

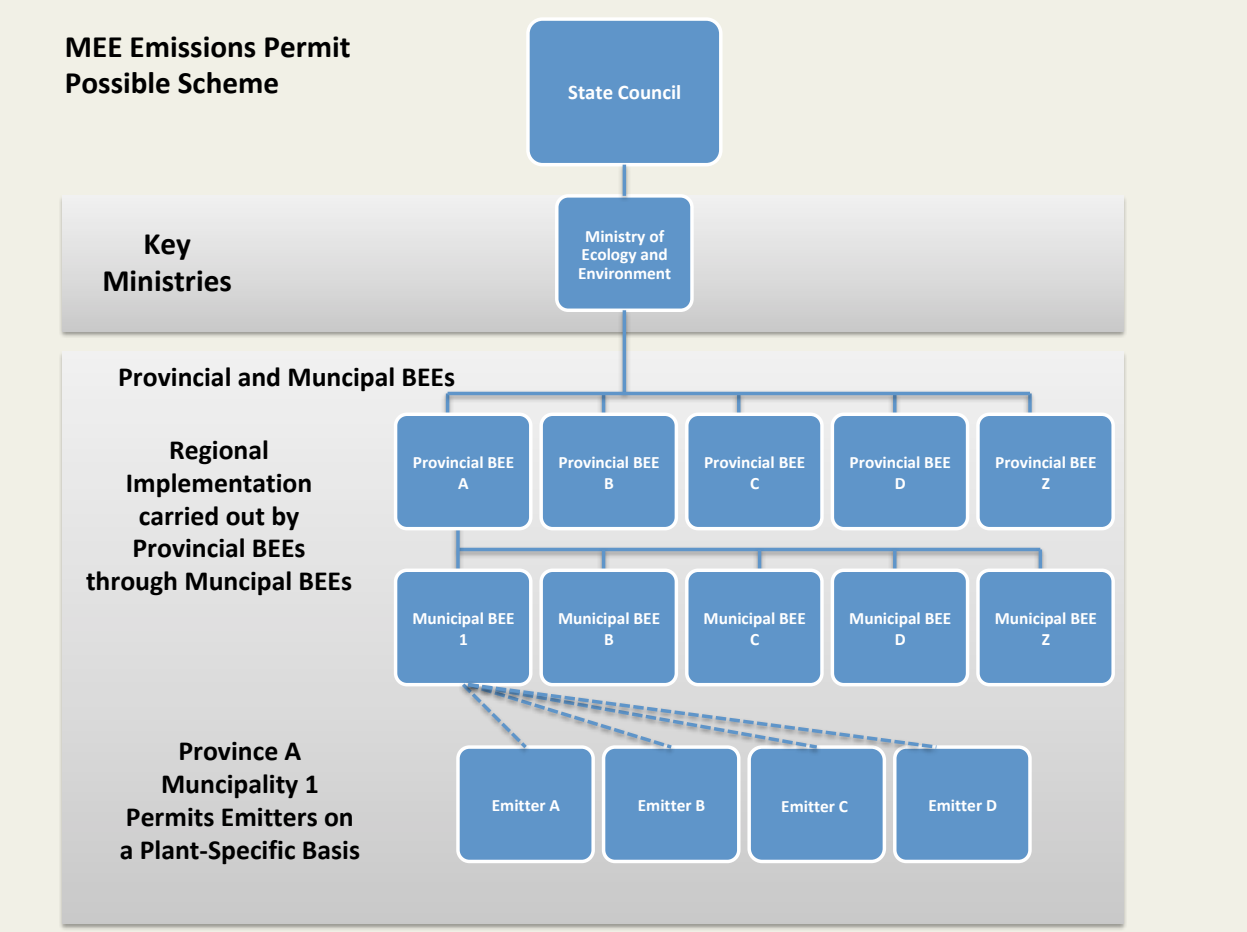
On the basis of these pilot programs and other experience, the State Council issued the *Guiding Opinion on Further Piloting the Paid Use of Emission Permits and Emissions Trading* in August 2014, which proposed that by 2017 a system of paid emission permits and emissions trading will be established in selected areas. In 2015, the Ministry of Finance, NDRC and the MEP (now MEE) jointly issued the *Interim Measures for the Administration of Emission Permits Income* to clarify the administration of income received through the emission permits system. Revenues from the emission rights programs are included in the general public budget and expected to be used for pollution prevention and control programs, however the control and use of these revenues has been a subject of contention among government ministries.

In November 2016, the State Council approved the *Implementation Scheme for Pollutant Emission Permits* as the basis to regulate enterprises and institutions' pollution emissions. Implementation is to be carried out by MEE before 2020. The document proposed the following:

- Reform China's current total emissions control system from pollutant targets set by administrative regions to be based on specific enterprises and institutions, and implement more stringent limits.
- Integrate pollutant emission permits with the environmental impact assessment system.
- Local governments at or above the county level will issue pollutant emission permits which specify pollutant types, concentrations, emission amounts, discharge direction, with related specifications governing pollution control facilities, and environmental management requirements.
- A comprehensive pollutant emission permit will cover air pollutants, water pollutants, and in accordance with the law, gradually extend to cover other pollutants.
- The government will achieve full coverage of fixed pollution sources gradually, starting with the thermal power and paper industries, and by 2020 national implementation issuing pollutant emission permits will be substantially complete.

The figure below presents one possible approach to implementation of the permit scheme.

Figure 25: Emissions Permit Scheme



Source: Authors' analysis

Climate Change and China's War on Pollution

China's "War on Pollution", prompted by severe air pollution in its large cities, encompasses responses to pollution of air, land and water. China's government is attempting to redress its environmental problems with massive investment in clean energy and in environmental remediation, making China a leader in environmental investment.

China has in the past decade emerged as the leading investor in clean energy technology, accounting for over $126 billion in new investment in renewable energy technologies in 2017, representing almost half of total global investment (REN21, 2018). The War on Pollution will further increase China's investment in environmental protection measures as China has pledged trillions of yuan of investment to support the policy (Martina et al., 2014).

China set and achieved its first air pollution targets set out in the *Air Pollution Action Plan (2013-2017)*, and has redoubled its efforts adopting the *Three-year Action Plan to Protect Blue Sky (2018-2020*) to further improve air quality. The updated plan measures total emissions, rather than emissions intensity as in previous policies, and specifies technologies and targets for concentration of pollutants for the power sector, industrial, vehicles and fuels sectors. The plan phases out inefficient coal-fired boilers for power and other applications (ERI and NCREC, 2018).

As a result of these efforts, air quality over major cities has improved, as major urban areas have been the focus of the government's air pollution control efforts. Urban areas are politically important as urban residents hold positions in government and industry, are economically and educationally advantaged, relatively outspoken, and receive strong media coverage. Government has responded by relocating dirty power generation and production outside major urban areas, and promoting of natural gas for power generation where possible. While air pollution has improved in major cities, whether air quality has improved elsewhere is unclear, as some have argued relocation has potentially worsened conditions in heavily industrialized areas (See Hornby, 2018; for the opposite view, see also ERI and CNREC, 2018).

China's *Air Pollution Control Law* effective January 1, 2016 provides that climate change and air pollution are to be addressed together. Similarly, China's *2014-2015 Action Plan for Energy Conservation, Emissions Reduction and Low Carbon Development* set goals to reduce CO_2 emissions per unit of GDP by 4 percent in 2014 and 3.5 percent in 2015. The plan also set goals to reduce the air pollutants sulfur dioxide (SO_2), ammonia (NH_3), and nitrous oxides (NO_x) per unit of GDP by 2, 2, and 5 percent, respectively, each year. However, even within the plan, there is evidence that the two objectives competed with one another. For example, in heavily polluted areas, such as in the Beijing-Tianjin-Hebei region, Yangtze River Delta, and Pearl River Delta, the plan called for reductions in PM 10 and PM 2.5 air pollutants by 25, 20, and 15 percent, respectively. These are much more ambitious goals than corresponding greenhouse gas reductions for these regions, suggesting greater emphasis on air pollutants, and the potential for conflict among these policies.

Addressing pollution and climate change simultaneously will to some extent create synergies. There is long-standing recognition that a comprehensive and combined program of air pollution and greenhouse gas emission control measures could result in cost savings (Swart et al., 2004). Chinese researchers are working on controlling certain air pollutants together with reducing greenhouse gases. Amann et al. (2008), as part of a program of study conducted by the NDRC's Energy Research Institute and Tsinghua University, developed the Greenhouse Gas – Air Pollution Interactions and Synergies (GAINS) model as a tool to identify emission control strategies. The GAINS model seeks to optimize the reduction of certain air pollutants (SO_2, NO_x, NH_3, particulates (PM), volatile organic pollutants (VOC)) and six greenhouse gases at least cost. Chinese researchers Wang et al. (2010) proposed synergistic control of N_2O and NO_x in the power, vehicle, and nitric acid sectors, as well as synergistic control of CO_2, SO_2, and NO_x in the power, industrial, vehicle, and residential coal combustion sectors. In 2015, China's environmental

regulator launched its own research program to coordinate climate change and air pollution efforts (Guo and Liu, 2015).

To the extent that renewable technologies such as wind and solar, fuel switching to natural gas or enhanced energy efficiency measures displace or reduce demand for electricity from coal-fire power generation, these efforts will benefit both climate and anti-pollution goals. These methods can be relatively inexpensive, even cost saving in the case of energy efficiency. Reducing air pollution and greenhouse gases synergistically can also be accomplished by reducing pollutants that are precursors to greenhouse gases, such as carbon monoxide (CO), VOCs, NO_x and SO_2.

Synergies between reducing greenhouse gas emissions and general pollution will eventually be exhausted, however, which could lead to conflict among objectives. Ultimately, higher cost options that lower CO_2 emissions and reduce other forms of pollution such as power plant emissions of SO_2, NO_x, ozone (O_3) and mercury will be necessary, as coal will remain part of China' energy mix for decades to come.

While China is expected to reduce its overall coal consumption due to air pollution limits, the IEA projected that China's coal consumption within the medium term could rise due to demand energy market dynamics (IEA, 2016a), which has in fact occurred (Jamasmie, 2018). China alone will continue to account for roughly half of global coal demand, according to the IEA's medium term forecasts through at least 2023 (IEA, 2016a; Jamasmie, 2018). This will present difficult choices for policymakers as China's international contributions to reducing climate change and domestic political imperatives to reduce pollution levels will require significantly more expensive technologies. For example, carbon capture and storage (CCS) using pre-combustion gasification technologies such as integrated combine cycle gasification (IGCC) can remove CO_2 and other pollutants including SO_2, NO_x and mercury efficiently relative to other options, however it remains among the most expensive carbon abatement technologies (Hart and Liu, 2010). China's government would ordinarily only adopt a high-cost technology such as IGCC with CCS if other options are unavailable or inadequate for its goals. Lower cost measures to reduce CO_2 are in fact available, however many of these do not reduce other forms of air pollution, such as forestry and agriculture carbon abatement approaches.

Likewise, outfitting power plants with scrubbers to address SO_2, NO_x, NH_3, mercury and particulate emissions do not reduce CO_2 (Karplus, 2015), except indirectly to the limited extent that certain pollutants like SO_2 and NO_x are also precursors to greenhouse gases. Yet, the use of scrubbers require power plants to generate additional energy to operate them, causing greater coal consumption, and thus increasing CO_2 emissions. These measures also increase the overall cost of power plant operations, competing for funds for investment in carbon abatement technologies. Although our discussion has been limited to air pollution, the mandate to reduce pollution of water and soil will similarly compete for investment funds among industries that must reduce emissions across all media.

Cost and limited resources will not only force difficult choices, but they may also result in other un-environmental outcomes. For example, some industries are already moving highly polluting operations to Western regions of China that have lower ambient pollution levels and are subject to relaxed regulatory thresholds for traditional pollutants and CO_2 emissions (Martina, 2015). This "solution" to air quality problems will likely lead to increases in greenhouse gas emissions.

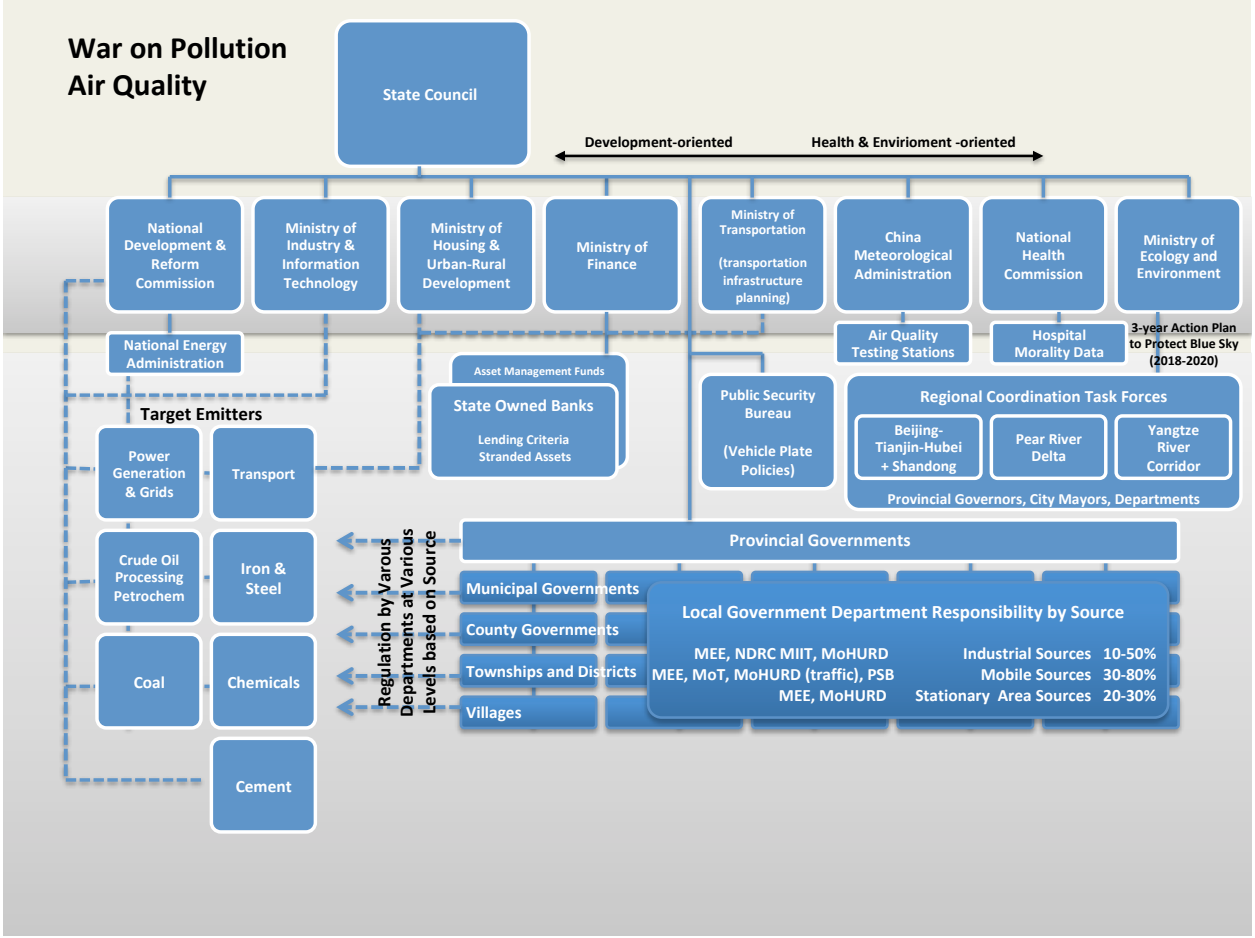
Institutional divisions of authority pose yet another challenge to addressing climate change and pollution together. The most prominent division at the national level is between the NDRC, which is responsible for economic planning and approving energy and other infrastructure development, and the Ministry of Ecology and Environment, which is responsible for regulating greenhouse gas emissions and traditional forms of air, water and soil pollution. In addition to these agencies, the Ministry of Finance and China's financial regulatory bodies will likely play a role in environmental and climate change policy under China's "Green Finance" initiatives, as well as China's ministries governing urban development, transportation and industry. Although coordination of climate change and air pollution is required by law as noted above,

and there are several inter-ministerial bodies described in this report intended to coordinate policy at the national level, there remains limited experience coordinating the actual implementation of policies on the ground among ministries.

Similarly, central government objectives, which encompass public opinion concerning government performance in addressing air pollution, often conflict with the interests of local governments. Local governments tend to be more immediately concerned with attracting industry, generating tax revenues, creating job opportunities, and their own expansion. Thus, there is an ever-present tension between central and local authorities in carrying out environmental policies.

The figure below represents key stakeholders in China's War on Pollution focusing on air pollution, reflecting divisions among national ministries and local governments.

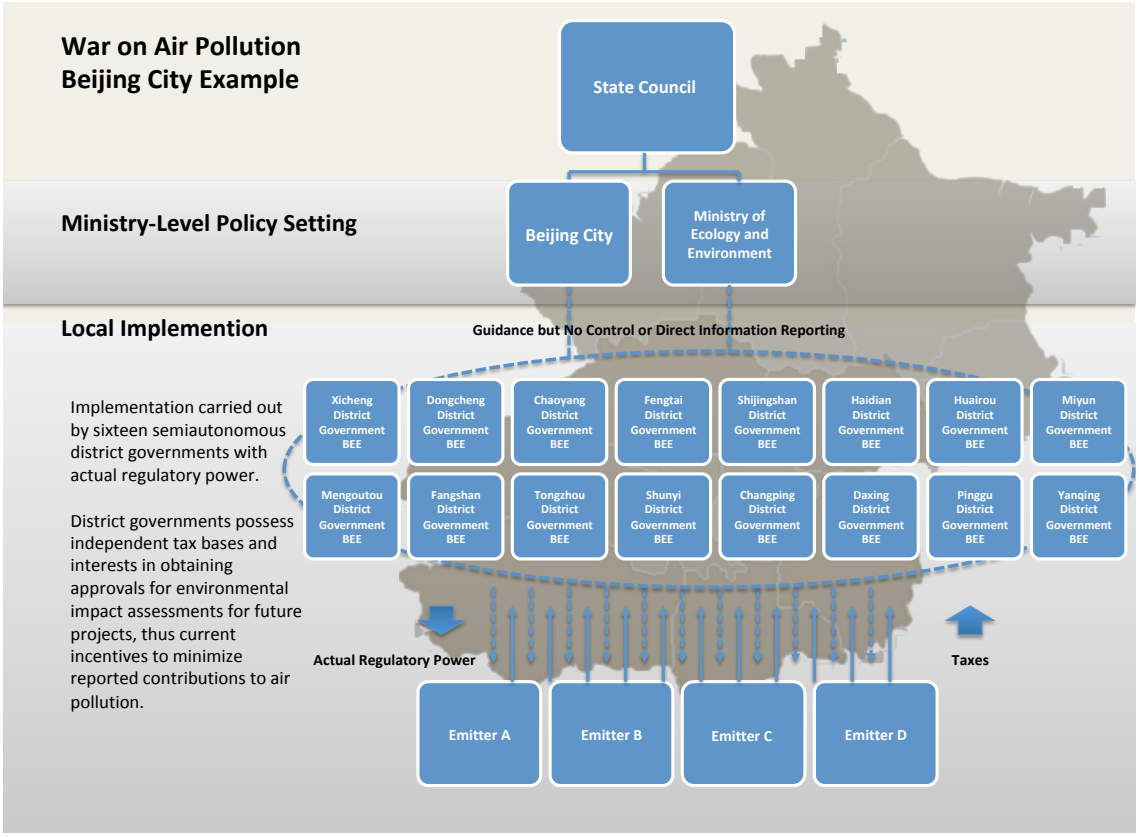
Figure 26: China's War on Pollution



Source: Authors' Analysis

Further complicating matters, similar tensions exist within provincial and municipal governments. Local government agencies representing different regulatory constituents as well as competing municipal subdivisions engage in competition for attracting industry, tax revenues and jobs. The figure below shows how Beijing's 16 semi-autonomous municipal districts, which possess independent tax bases, compete with one another to attract industry, creating incentives to minimize reported air pollution emissions by emitters in their district in order to obtain approvals under environmental impact assessment rules for future projects. These incentives undermine cooperation by local government in reporting information accurately, and in enforcing air pollution emissions limits.

Figure 27: Beijing City - War on Pollution

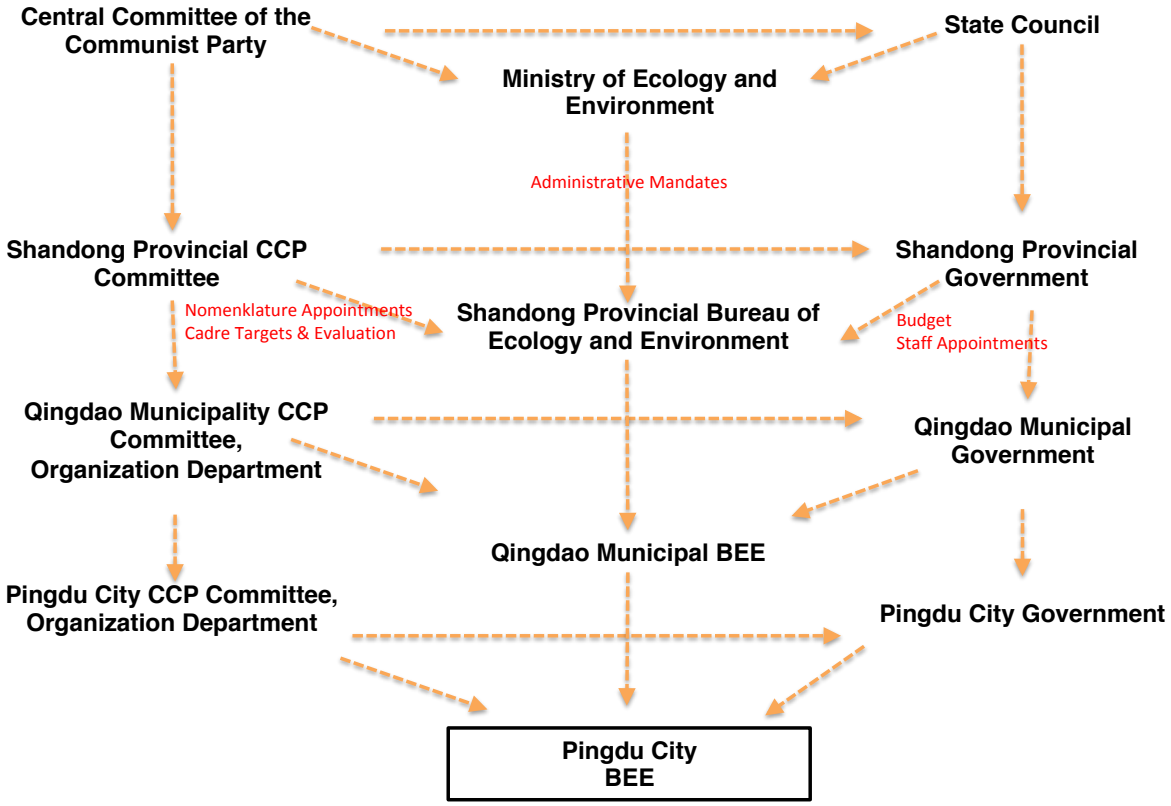


Source: Authors' Analysis

The prospects for coordination among national agencies are limited due to bureaucratic culture and limited resources. The NDRC and the Ministry of Ecology and Environment have different mandates and possess modest staffs relative to their responsibilities, several hundred in each agency, making close coordination difficult to undertake.

In implementing climate policy, the relationship between the central and local governments poses a significant barrier. China's unitary government structure features decentralized fiscal budgeting, staffing and implementation authority at the national, provincial and local levels. This frustrates policy coordination by central ministries seeking to influence local actors. To illustrate, the Ministry of Ecology and Environment at the national level can only set targets for its local counterparts. A provincial Bureau of Ecology and Environment is subordinate to the People's Congress of its province, which controls its budget and the appointment of its staff. Further, as described in Chapter 2 of this report, at each level of government a Party committee corresponding to each government agency will appoint certain positions within the government at their level and seek to direct the actions of these cadres through a separate system of Party-determined targets that are used to determine whether individuals will advance for promotion. The figure below illustrates the horizontal and vertical lines of authority.

Figure 28: Horizontal and Vertical Authority within China's Government



Source: Adapted from Lieberthal (2003).

Competing lines of authority undermine implementation of national environmental protection policies that often conflict with the immediate interests of provincial and local government officials seeking to promote economic growth and jobs creation, which in turn facilitates their own career advancement. Efforts to correct local government incentives include introducing enforcement of environmental policies as a criteria used in China's personnel performance evaluation systems (See Article 26, Environmental Protection Law of the People's Republic of China), yet this innovation may be stymied by manipulation of statistics (See, e.g., Wang, 2013), which exacerbates coordination efforts by further reducing transparency.

Importantly, the Politburo's Central Leading Group for Comprehensively Deepening Reforms' *Integrated Reform Plan for Promoting Ecological Progress* (2015) calls for centralization of authority with respect to environmental monitoring and enforcement at the provincial level. This reform would presumably delink county, municipal and township environmental bureaus from their corresponding local government counterparts, making them answerable to the provincial environmental bureau, and thereby shielding environmental enforcement from local influence. In doing so, it would also strengthen the reach of the Ministry of Ecology and Environment by creating a more direct reporting line to all enforcement branches via the provincial bureaus. It remains unclear to what extent budgeting and staffing would remain in the hands of local government authorities, however these must similarly be centralized if the reform is to work. One of the initial reforms that has followed from the Politburo's directive for institutional reform is that municipal and county water quality monitoring stations shall be moved to provincial control, and river basin management will similarly be transferred to provincial governments. As described earlier in this chapter, the MEE is also moving towards a provincial-based system of permitting for pollution emissions.

9. Energy Policies

As part of its broader economic reforms, China has launched a series of initiatives to improve energy market operations and energy supply and demand fundamentals, and promote competition.

Energy Revolution

In mid-2014, China announced its "energy revolution" that promises to address both energy security and pollution. Energy Revolution targets are significantly more ambitious than those in China's NDC. As suggested by its name, the campaign contemplates transforming society to achieve energy and associated environmental goals. The Energy Revolution encompasses the following:

- ***Energy Consumption Revolution*** aimed at industry through such methods as demand-side management and changing consumer lifestyles.
- ***Energy Production Revolution*** to enhance energy efficiency and lower greenhouse gas emissions in China's current energy infrastructure.
- ***Energy Technology Revolution*** to develop, commercialize and diffuse next-generation energy technologies through innovation.
- ***Energy Institutional Revolution*** to redefine China's institutional arrangements to ensure an enabling environment for low-carbon economic development.
- ***International cooperation*** to foster best practice, knowledge and technology transfer.

The policy adopts the following goals:

- Coal consumption to level off by 2020 and decline afterwards.
- Enhance energy efficiency based on energy consumption per unit GDP.
- Reduce carbon emissions at least by 60 percent to 65 percent per unit GDP from 2005 levels, per China's NDC.
- Increase the share of non-fossil fuels in primary energy consumption at least as ambitious as the 20 percent target by 2030 or sooner in China's NDC.
- Increase natural gas consumption by 40 billion cubic meters from 2015-2030.
- Increase targets for renewable and nuclear electricity installed capacity during the 2015-2030 period of 1200 GW, comprising 180 GW of nuclear, 110 GW of hydropower, 500 GW of wind, and 400 GW of solar (Zhang, 2015).
- As coal will remain China's primary fuel for future decades, adopt clean coal technology.
- Promote the development and adoption of electric and plug-in hybrid vehicles.
- Expand public transportation, and discourage ownership or use of private vehicles.
- Expand eco-city models to low-carbon urban planning, construction and management.
- Launch China's carbon emissions trading scheme nationwide.

China's *Energy Development Strategy Action Plan (2014-2020)* issued by the State Council emphasizes the need to transform China's energy industry development path from the traditional supply side strategy

to a total demand/consumption side strategy, and to optimize the quality of energy, representing a major shift in China's energy policies and industry practices. It calls for a shift from administrative enforcement to market-based energy pricing, reducing subsidies, and imposition of environmental taxes.

Towards energy system reform, China amended its *Electric Power Law* (amended 2018) and the NDRC and NEA are drafting revisions to the *Energy Law*. The *Electric Power Law* provides a framework to introduce economic dispatch and competition in power markets, depending ultimately on market design regulations. Drafting of the *Energy Law* began in 2005, and has proven difficult to complete due to conflicting stakeholder interests.

Improving air quality is also an important legislative priority for China's Energy Revolution. In 2015, the Standing Committee of the National People's Congress revised the *Air Pollution Control Law*, which stipulates that quality standards for coal, petroleum coke and biomass fuels should protect the environment. The *Air Pollution Control Law* requires government departments at all levels to take measures to promote the production and use of clean energy, optimize the use of coal, reduce the proportion of coal in primary energy consumption, and reduce overall air pollutant emissions from coal.

This chapter surveys and maps selected policies that are central to China's Energy Revolution.

Coal Policies

China is the world's largest coal producer and coal consumer, and is the largest generator of coal-fired electricity. As the most carbon-intensive and polluting fuel, curbing coal consumption for electricity generation is crucial to energy reform.

- In 1993, China began to gradually liberalize coal prices.
- Since 1996, China implemented guidance prices for thermal coal, establishing the thermal coal dual price system.
- From 1999, coal prices were liberalized for all industries except thermal coal.
- From 2002, China abolished thermal coal guidance prices and established a thermal coal reference price.
- After 2004, the Chinese government commenced gradually rolling back centrally organized contracting for coal. Enterprises began contracting based on supply and demand.
- In 2012, the State Council issued the *Guiding Opinion on Deepening the Reform of the Electricity Coal Market*, which cancelled key thermal coal contracts starting in 2013, and promoted the principle of a single coal price to be determined by the market. Abolishing the thermal coal dual price system 16 years after its introduction, the policy represents a significant reform. While the state retains authority to influence coal prices through industry structure and guidance, the last explicit mechanism to control the price of coal was removed, implying that the market determines prices.
- In 2014, Ministry of Finance and the State Administration of Taxation launched a reform of the coal resource tax from a volume tax to an ad valorem tax, which also advanced policies to promote a market price for coal.
- In 2016, the *Energy Development Plan of the 13th Five-Year Plan* set a goal to control the increase of absolute coal consumption from 3.96 billion tons of raw coal to 4.1 billion tons in 2020, and a mandatory goal to reduce the share of coal consumption from 64 percent in 2015 to 58 percent of primary energy consumption in 2020.

Coal Cap

China's Coal Cap Control policy is a total coal consumption limit, formally implemented through voluntary pledges by provinces and municipalities. The Coal Cap policy is closely associated with, but distinct from, two other policies - the excess capacity rationalization regulations implemented by the NDRC, and China's air pollution regulations under the leadership of the Ministry of Ecology and Environment.

In 2011, the MEP (now MEE) proposed a "total coal consumption control pilot" in the *2011 National Pollution Prevention Work Points*. In 2013, *China's Air Pollution Action Plan* outlined the concept of "formulating medium and long-term control targets for national total coal consumption and implementing the management of target responsibility." The *Air Pollution Action Plan (2013-2017)* called for Beijing and Tianjin, the Yangtze River Delta, the Pearl River Delta and other regions to achieve negative growth in total coal consumption "by gradually increasing the proportion of external electricity transmission, increasing natural gas supply, increasing non-fossil energy intensity and other measures to replace coal." This plan has been updated by the *Three-year Action Plan to Protect Blue Sky (2018-2020*).

Separately, the *12th Five-Year Coal Industry Development Plan* issued by the National Energy Administration (NEA) in 2012 imposed controls on coal consumption, limiting annual coal consumption and production to 3.9 billion tons by 2015. The *13th Five-Year Coal Industry Development Plan (2016-2020)* published in December 2015 raised the total coal consumption target to 4.1 billion tons by 2020. Similar goals are reflected in China's *Energy Development Strategy Action Plan (2014-2020)* issued by the State Council, which proposed that China's coal consumption should be about 4.2 billion tons by 2020.

The *Coal Industry Development Plan* is best understood as a state business plan that proposes coal industry rationalization measures aimed at eliminating excess production capacity and raising profits. While unrelated to MEE's air quality regulations and its coal cap policy, the rationalization policies potentially support the coal cap policy. The *13th Five-Year Coal Industry Development Plan* targets are shown in the table below.

Table 4: China's Coal Annual Production and Consumption Targets

	2015	2020
Total coal production (billion tons)	3.75	3.9
Total coal consumption (billion tons)	3.96	4.1
Eliminate excess capacity (billion tons/year)	0.8	

Source: 13th Five-Year Coal Industry Development Plan (2015)

Due largely to economic and energy system dynamics, China's coal consumption peaked at 4.24 billion tons in 2013, and declined roughly in tandem with domestic coal production until 2017, when it increased to 3.9 billion tons due to economic growth (ERI and CNREC, 2018). The IEA projected that China's coal consumption within the medium term could rise due to demand and energy market dynamics (IEA, 2016a), which has in fact occurred. Chinese policymakers actively debate weather coal consumption will resume increasing when China's economy rebounds, given the persistence of coal-based infrastructure in the power, steel and chemicals industries (Personal communications, November 2018).

Table 5: China's Historical Coal Production and Consumption

	2013	2014	2015	2016	2017
Production (billion tons)	3.97	3.87	3.75	3.41	3.52
Consumption (billion tons)	4.24	4.12	3.96	3.85	3.9

Source: National Bureau of Statistics (2018), ERI and CNREC (2018).

Achieving China's 2015 Nationally Determined Contributions (NDCs) that pledges to peak carbon emissions by 2030 depends greatly on China's coal policies. Experts have suggested more ambitious goals are possible (see NDRC, 2015), yet heightened climate targets ultimately require that China not backtrack on its commitment to reduce coal.

China's coal cap policies have been developed with the support of broad engagement with industry, government, academic and other expert stakeholders. Notably, in 2013, the Natural Resources Defense Council (NRDC), a U.S. NGO with offices in China, launched the *China Coal Consumption Cap Project* assembling over two dozen leading Chinese stakeholder institutions to research national and regional coal consumption scenarios, with attention to topics such as co-benefits analysis, sector coal consumption cap analysis, and planning.

Limits on New Coal-fired Power Generation

The *13th Five-Year Plan for Electric Power Development (2016-2020)* released in November 2016 set a 2020 cap for coal-fired generation capacity at 1,100 GW. Also, the plan requires all plants of 300 GW or more to be high efficiency, ultra-low emission units, thus requiring closure of outdated units. By 2020, China's coal-fired fleet is to consume on average no more than 310 grams of standard coal per kWh.

In order to implement the plan, the NDRC and NEA published three documents in early 2016 aiming to restrict new construction of coal-fired power generation units:

- *Notice on Promoting Orderly Development of Coal-fired Power in China* (March, 2016) imposes strict controls on new coal power projects. For provinces with electric power surplus and air pollution prevention and control priority areas, no new coal power generation will be planned or constructed as a general principle. Provinces with inadequate supply of electric power should prioritize non-fossil energy power generation.

- *Notice on Further Completing the Elimination of Backward Production Capacity in Coal-fired Power* (April, 2016) requires provinces and cities to further the goal of eliminating backward production capacity in the 13th Five-Year period. The notice set out the conditions for eliminating coal-fired generation plants, and instructed provinces, autonomous regions and municipalities to formulate local plans for the elimination of outdated coal-fired production capacity in the 13th Five-Year period as rapidly as possible, providing targets for specific enterprises and power generation units in some cases. The notice authorized local government to shut down non-compliant power generation units, and directed power grid operators to cease purchasing power from non-compliant coal-fired power plants.

- *Notice on Establishment of Risk Warning Mechanism for Coal-fired Power Planning and the accompanying Risk Warnings for Coal-fired Power Planning and Construction in 2019* (March, 2016*)* provides risk criteria and ranks each province according to this criteria, which in turn determines whether new coal power projects can be issued permits. Under the mandatory ranking matrix, each province is categorized as green (normal), orange (proper coal power projects allowed) or red (new coal power projects not allowed). Under this scheme, three provinces are green (Jiangxi, Anhui, Hainan), one province is orange (Hubei), and 26 provinces are red (Heilongjiang, Jilin, Liaoning, Inner Mongolian, Beijing, Tianjin, Hebei, Shandong, Shanxi, Shanxi, Gansu, Qinghai, Ningxia, Xinjiang, Henan, Hunan, Sichuan, Chongqing, Shanghai, Jiangsu, Zhejiang, Fujian, Guangdong, Guangxi, Yunnan, Guizhou), meaning that new planned construction of coal power generation should cease across the vast majority of Chinese provinces.

In August 2018, the NDRC and NEA ordered the shut down of non-compliant plants of 300 GW or greater that failed to meet efficiency standards (NDRC and NEA, 2018). The 2018 government work report claims 71 percent of coal-fired units achieved ultra-low emissions in 2017.

Notwithstanding these policies, China's central government has allowed several hundred previously cancelled coal-fire power plants totaling 259 GW of new installed capacity to proceed to construction, representing a 25 percent increase over China's existing 993 GW of coal-fired capacity (McGrath, 2018). These plants, justified on the grounds that demand is outpacing capacity in some provinces, are likely stimulus to counter the 2018 economic slowdown.

Capacity Rationalization for Coal Production, Iron and Steel

Simultaneous with limits on coal consumption and the construction of new coal-fired power generation, the government stepped up its efforts to rationalize the coal production sector and major coal consuming industries in the *13th Five-Year Plan* period (2016-2020). Specifically, it sought to reduce the overall productive capacity of the coal production and iron and steel manufacturing sectors (See State Council, 2016c for iron and steel policy). Aimed at eliminating excess industrial capacity and raising profits, the policy potentially produces environmental, energy efficiency and safety co-benefits.

In February 2015, the NEA issued the *Guiding Opinion on Promoting the Scientific Development of the Coal Industry*, which aims to improve standards for China's coal production enterprises, closing coal mines with production capacity under 90,000 tons per year, supporting regions required to close coal mines with capacity under 300,000 tons per year, and expediting the closure of coal mines posing serious safety hazards. In March 2015, the NEA and the National Coal Safety Supervision Bureau (NCSSB) issued the *Notice on Eliminating Backward Capacity in the Coal Industry,* which required closure of 1,254 mines by 2015 and elimination of 77.79 million tons of backward production capacity.

As noted in the prior section, China's *13th Five-Year Coal Industry Development Plan* maintains annual coal consumption and production limits of 3.9 billion tons by 2020 with the aim of rationalizing China's excess coal production capacity. The preceding 12th five-year plan proposed that by 2015 China would form ten coal enterprises with production scale of 100 million tons each, and ten coal enterprises with a scale of 50 million tons each, and that these enterprises would account for more than 60 percent of China’s coal production. Thus, China’s coal production mostly will come from large mines, the number of which will reduce through state intervention.

In February 2016, the State Council issued the *Opinion on Resolving Excess Capacity to Achieve the Development of Poverty Relief in the Coal Industry*, and proposed that from 2016, within a period of 3 to 5 years, China will eliminate 500 million tons of annual coal production capacity, and restructure an additional 500 million tons of annual coal production capacity, providing fund for restructuring and resettlement of the industry (State Council, 2016d). China's *13th Five-Year Coal Industry Development Plan* also set interim goals to eliminate 800 million tons of excess coal production capacity, while increasing advanced coal production capacity by 500 million tons of annual capacity by replacement and optimization. The revised plan allows for up to 6,000 mines, with 80 percent of total coal production coming from mines with capacity over 1.2 million tons per year, and no more than 10 percent of coal production coming from local mines with capacity below 300,000 tons per year.

In June 2016, MIIT, NDRC, NEA, and the NCSSB jointly issued the *Notice on Implementation Plan for Special Action to Eliminate Backward Capacity in the Steel and Coal Industry*. Over ten government agencies including the NEA, NDRC, Ministry of Finance, Ministry of Environmental Protection (now Ministry of Ecology and Environment), People's Bank of China, NCSSB, Ministry of Water Resources, the General Administration of Quality Supervision, Inspection and Quarantine, Ministry of Human Resources and Social Security, and State Administration of Industry and Commerce participated in this plan, which calls for the closure of coal mines with capacity under 300,000 tons per year and a history of severe accidents (重大及以上事故), coal mines with capacity under 150,000 tons per year and a history of relatively significant accidents (较大及以上事故), and coal mines using banned mining methods.

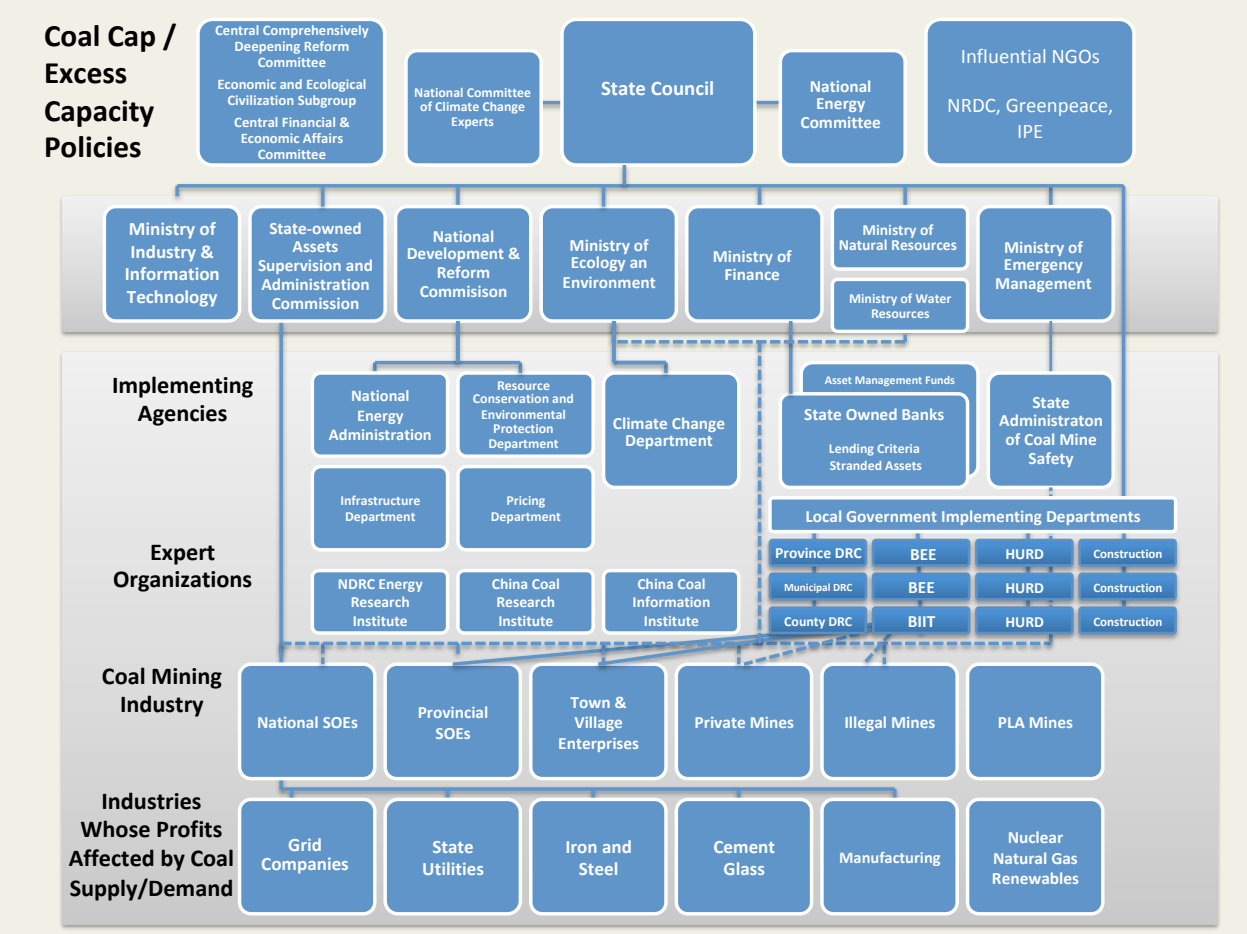
In mid 2016, the NDRC proposed that China immediately eliminate 250 million tons of coal capacity, resettling 700,000 workers (CNR, 2016a). Towards that end, China stepped up enforcement of its excess coal production capacity rationalization policies. Local government were asked to set excess production capacity goals, and to sign target responsibility letters, allocating specific tasks to local government agencies and enterprises with a specific timetable. The NDRC sought to hold local governments accountable through administrative means. At the same time, the Chinese government offered subsidies to local government that actively pursue excess coal production capacity rationalization policies, particularly to overcome resistance generated by worker layoffs. According to the *2016 Report on the*

Work of the Government, the central government earmarked RMB 100 billion yuan primarily to resettle employees laid off from overcapacity industries such as coal and steel (State Council, 2016b). While local governments have traditionally resisted central policies that harm local industry or cause job loss, where excess and backward capacity contributes little to employment opportunities and tax revenues, local governments appear eager to shed this burden. In January 2017, the NDRC announced that 250 million tons of coal capacity had been successfully eliminated as targeted (Peoples Network, 2017).

The central government and national state-owned industry possess different interests to local governments that are aligned with local coal producers. Beyond tax and employment considerations, many provincial and local governments or their government officials own and operate small-scale mining enterprises or even illegal mining operations targeted by the central government's capacity rationalization policy. In turn, the coal industry supplies power generation, iron and steel manufacturing, and other local coal-consuming enterprises, which face higher costs for coal as a result of these policies.

The figure below shows selected stakeholders representing competing interests in coal policies.

Figure 29: China's Coal Cap and Excess Capacity Policies



Source: Authors' analysis

Subsidies to Clean Coal Power Generation

Coal-fired thermal power generation receives state subsidies for employing flue gas desulfurization, denitrification, dust removal and other environmental pollution abatement measures. The standard subsidy is RMB 0.027 yuan per kilowatt-hour.[5] The grid settles the subsidies every month based on volume of power generation, and makes payment in real-time, not in arrears. In China, 4,230.7 billion kwh thermal power was produced in 2015 (National Bureau of Statistics, 2017). If every unit of electricity received subsidies in accordance with the above criteria, this amounts to about RMB 110 billion yuan (roughly US $16 billion) in subsidies to the coal industry in that year. To place this in context, renewable energy generation subsidies offered by the state potentially reach RMB 19 billion yuan, or less than a fifth of subsidies available to coal.

Perversely, the subsidies to install environmental abatement equipment to coal generation reduce the cost of burning coal, thus making it more profitable. Considering that coal remains China's lowest cost electricity resource, that coal prices have been declining both nationally and globally, subsidies especially of this magnitude incentivize dirty generation, and provide a windfall to the power generation and coal industries at taxpayer expense.

Worse, China's thermal power plants are known to install pollution abatement equipment in order to qualify for these subsidies, but to not actually use the equipment in actual operations. In the second half of 2016, spot inspections by the NDRC and MEP (now MEE) found that 605 of 759 coal-fired power generation enterprises checked, or nearly 80 percent, were not in compliance with their emissions pollution abatement obligations (CNR, 2016b).

In addition to "clean" coal power generation subsidies, the coal industry also receives other direct and indirect subsidies. According to IISD and GSI (2015), subsidies to coal production in China reached RMB 35.7 billion yuan in 2013, excluding any preferential credit support to the industry provided by the state banking industry worth an additional RMB 3.5 to 35.7 billion yuan. The study identified eighteen separate subsidies to coal extraction operations in China over the 2013–2015 period, and quantified eleven of them. The most significant subsidies by value are: temporary tax and fee relief granted by provincial and local governments, investment in fixed assets financed from the state budget, compensation for coal mines that are shut down under the coal capacity rationalization plan, value-added tax (VAT) rebates including VAT rebates for coal bed methane production, and direct subsidies to publicly-listed coal companies. Coal subsidies such as credit support, investment in fixed asset from the state budget and direct grants may be more detrimental than other subsidies (e.g., VAT rebate exemptions or compensation for the shutdown of mines) by driving investments that lock in coal use over the long-term.

Finally, as noted, China's coal capacity rationalization plan that shuts down smaller, outdated plants operates as a subsidy to the larger state-owned coal producers by reducing competition. This policy protects the prices and profits of the large, politically influential coal SOEs.

Direct and indirect subsidies contribute to coal-fired power prices not reflecting their full environmental costs to society. According to research conducted by the Ministry of Finance in 2015, the external cost of coal to the environment, ecology and public health is RMB 302 yuan per ton, and the cost of loss caused by climate change is RMB 160 yuan per ton, while China's current environmental charges and resource taxes imposed on coal use are only RMB 45 yuan per ton (Fiscal Science Research Institute, 2015; Feng, 2016).

The effects of subsidies are felt throughout the coal supply chain, not just at the power generation stage. At the mining and transportation stages, subsidies make it profitable to mine lower grades of coal and

[5] See the press conference of the NRDC on April 3, 2014 “Strengthening the Supervision of Environmental Protection Electricity Price to Promote the Improvement of Atmospheric Quality”, which stated that the standard subsidy is RMB 0.027 yuan per kilowatt-hour, comprising RMB 1.5 cents for desulfurization, RMB 1 cent for denitrification, and RMB 0.2 cents for dust removal.

from smaller mines with inadequate safety standards. Due partly to these small, often unregulated mines, China's mining industry regularly has the greatest number of accidents and worker fatalities globally.

Natural Gas

The 13th Five-Year Plan (2016-2020) calls for switching consumption from coal to natural gas, with gas achieving 10 percent of total energy consumption by 2020, and coal dropping to less than 58 percent. To achieve this goal, the government is expanding access to natural gas for urban and rural heating, and industry, focusing on the Beijing-Tianjin-Hebei region, the Yangtze River Delta, the Pearl River Delta, and northeast China.

As with crude oil, the state sets the price of natural gas using the cost plus pricing method to maintain the profits of the state oil and gas industry, balanced with consumer interests. The central government has, however, permitted experimentation with market-based approaches that may inform broader reform in the natural gas sector.

- In December 2012, the NDRC issued the *Notice of Reform of Natural Gas Price Formation Mechanism in Guangdong and Guangxi Provinces* in order to pilot a dynamic price adjustment mechanism that reflects market supply and demand fundamentals. The notice provides a formula for natural gas prices based on fuel oil and liquefied petroleum gas prices.

- In June 2013, the NDRC issued the *Notice on Adjusting the Price of Natural Gas* to link pipeline natural gas prices with fuel oil and liquefied petroleum gas prices, and to implement government-guided price ceilings.

- In January 2015, the Shanghai Municipal Government approved the establishment of the Shanghai Oil and Gas Trading Center, to be joined by companies, as an important step in promoting energy system reform and promoting the marketization of natural gas prices.

Oil

The state maintains ownership of all mineral resources, administering mineral rights through a licensing regime by the Ministry of Natural Resources. Foreign companies can enter into production sharing contracts with designated Chinese oil and gas companies for onshore and offshore oil exploration and production. Since modern China's founding, China's refined oil prices have been controlled by the central government. From 1998, the state began setting refined oil prices taking into account market-oriented price factors, yet the state retains control over pricing of this important commodity.

- In 1998, the former State Planning Commission (succeeded by the NDRC) introduced the *Crude Oil and Refined Oil Price Reform Program*, which required that both domestic crude oil and refined oil prices should follow Singapore market prices. In 2001, to further improve the domestic refined oil price mechanism, refined oil prices followed the New York and Rotterdam markets in addition to the Singapore market. When international prices fluctuated exceeding a range of 5 to 8 percent, the NDRC was then authorized to adjust China's retail price.

- From 2003 to 2008, due to price volatility and rapid price rises, NDRC frequently intervened to control the price of refined oil prices.

- In 2009, the NDRC announced a new *Refined Oil Price Formation Mechanism Reform Program*, which stipulated that when average crude oil prices fluctuate beyond 4 percent for 22 consecutive working days in the international market, it may adjust domestic oil prices accordingly. However, the adjustment cycle proved too long to keep pace with international crude oil price fluctuations at that time.

- After 2013, the NDRC announced a revised *Refined Oil Price Formation Mechanism,* which shortened the adjustment cycle for refined oil prices from 22 working days to 10 working days. It also eliminated the 4 percent average oil prices fluctuation in the international market as a threshold or trigger, and broadened the international crude oil markets that domestic refined oil prices followed.

- In 2014, the State Council issued *Guidance on Innovation Investment and Finance Mechanism in Key Areas to Encourage Social Capital Investment*, which explicitly encouraged social capital to participate in the construction and operation of oil and gas pipelines, storage facilities and coal storage and transportation. The Guidance is significant in that it invites broader participation and potentially transparency into a sector that is dominated by state-protected monopolies.

- The *Oil and Gas System Reform Program* led by NDRC and NEA, which was issued at the end of 2016 but not made publicly available, seeks to reform the entire industry supply chain, especially the oil and gas price formation mechanism, mineral rights, pipeline networks, import and export rights, use rights for crude oil, reform of government functions, and reform of state-owned enterprises operating in the sector. The program was to be implemented by 2030.

- In 2017 May, the Party Central Committee and the State Council issued Opinions on Deepening the Reform of Petroleum and Natural Gas System, which provides the guiding ideology, basic principles, themes and main tasks of deepening reform of the petroleum and natural gas system. In March 2018, the NEA issued Guidelines for Energy Work to implement this guidance. The focus of the Opinions remains rationalizing the oil and gas pipeline network, and opening oil and gas infrastructure to improve operations and investment. The reform program will commence with pilots in Sichuan, Chongqing, Xinjiang, Guizhou, Jiangsu, Shanghai and Hebei provinces.

Critics of the current system charge that the cost plus pricing method for oil protects the profits of oil refining enterprises, and do not truly reflect actual domestic supply and demand (An et al., 2015). Oil pricing is one of many subsidies that the fossil fuel industry receives from the state.

Fuel Oil Quality

In response to concern over air pollution, China sought to improve vehicle fuel quality in 2013.

In 2013, the MEP (now MEE) issued the *Limits and Measurement Methods for Pollution Emissions from Light Vehicles (Level V)* for the purpose of implementing the *Environmental Protection Law* and *Air Pollution Prevention Law*, to control pollution of motor vehicle pollutants and improve ambient air quality. Starting in 2018, China would adhere to strict Level V limit following European standards. The standard is more rigorous than is typical even compared with other developed countries, yet implementation remains a problem for China.

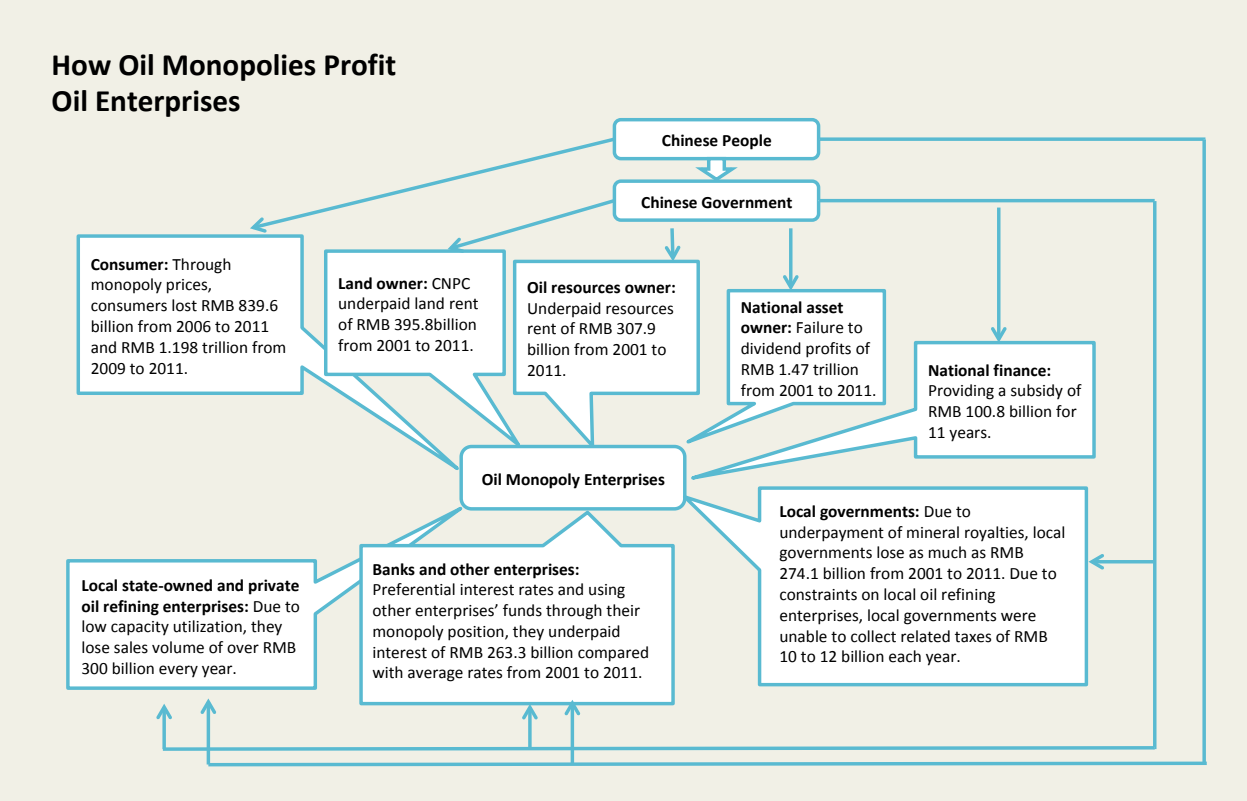
In 2015, the NDRC and other ministries jointly promulgated the *Program of Accelerating the Upgrading of Refined Oil* in accordance with the *Air Pollution Control Action Plan*. From January 1, 2016, the eastern part of China should be fully supplied with national standard Level V vehicle gasoline and diesel. The program also transitioned the entire country to Level V standards one year earlier than originally planned by January 1, 2017. At the same time, the program supports oil refining enterprises by expediting the approval of projects designed to meet these standards as well as future Level VI gasoline and diesel national standards development.

Oil Industry Subsidies

Subsidies and protectionist policies are pervasive throughout China's entire economy. From the perspective of climate policy, subsidies and protection from competition granted to the fossil fuel industry distort markets and undermine the effectiveness of market-based environmental policies. They also represent significant losses to Chinese society.

Sheng and Qian (2015: viii) estimate that the efficiency loss due to administrative monopoly in the oil industry alone cost China RMB 3.48 trillion yuan from 2001 to 2011. During this period, China's three national oil companies failed to surrender their profits of RMB 1.47 trillion yuan (Sheng and Qian, 2015: viii). Thus, from an economic viewpoint, these firms operate at a net loss, yet they continue to accumulate surplus capital, representing a transfer of wealth from citizen-consumers to state enterprises, while at the same time severing proper economic incentives for environmental protection. The diagram below represents China's subsidies to state oil enterprises based on the work of Sheng and Qian (2015).

Figure 30: Subsidies to China's State Oil Enterprises



Source: Sheng and Qian (2015).

Under the auspices of the U.S.-China Strategic and Economic Dialogue, both countries committed to undertake a peer review of their respective fossil fuel subsidies programs with the aim of eliminating these subsidies in fulfillment of pledges made at the 2009 G20 summit in Pittsburgh where leaders committed to "phase out and rationalize, over the medium term, inefficient fossil fuel subsidies". The outcome of the peer review, which was reported at the 2016 G20 meeting in Hangzhou, included assessments of the cost of fossil fuel subsidies and proposals to reform and eliminate these subsidies (Liu, 2016).

The state further subsidizes fossil fuels at other points of the fossil fuel value chain. As previously noted, IISD and GSI (2015) estimate subsidies for coal production amounted to RMB 35.7 billion yuan in 2013, excluding consideration of credit support, which could double the estimate.

Energy Conservation and Efficiency

Energy efficiency plays a central role in China's energy policy and has been elevated to a "basic national policy" (基本国策). Achieving energy security and meeting greenhouse gas emissions reductions goals require China to continue to increase energy efficiency. According to unpublished Chinese government assessments, China's energy conservation and efficiency program has driven roughly 80 percent of its carbon reductions (Personal communications, November 2018).

China's energy efficiency since the opening of its economy in the early 1980s has markedly improved. During the 1980 to 2002 period, China improved energy efficiency by 5 percent each year on average (Levine et al., 2010). During this period, China limited energy demand growth through aggressive energy-efficiency programs organized by the central government, working closely with provincial and municipal governments. According to An et al. (2015), the strategy involved:

- Oversight of industrial energy use, including monitoring requirements for large users, closing inefficient facilities, and promoting efficient technologies;
- Financial incentives for energy-efficiency investments and cogeneration;
- Information services at the national, provincial, and local levels, including the creation of over two hundred energy conservation service centers;
- Education and training; and
- Research, development and demonstration projects supported by government funds.

During the 2002-2004 period, China's energy intensity increased due to explosive electricity demand driven by rapid economic growth and urbanization. In response, in 2004 the NDRC redoubled its efforts by issuing the *Medium and Long-Term Plan for Energy Conservation*. The NDRC set a target to reduce China's energy intensity of GDP by 20 percent between 2005 and 2010, an annual average of 3.6 percent per year, and to continue to improve efficiency at this rate through 2020 (An et al., 2015). From 2004, China resumed its previous trajectory of increasing energy efficiency, achieving annual increases of 3.3 percent per year in energy efficiency from 2004 to 2010. These results were achieved in part by government closing inefficient power and industrial facilities by administrative decree. Although China later permitted new generation on condition that inefficient power production was closed, these command and control measures were costly and inefficient for communities and industry (Hart and Ma, 2014).

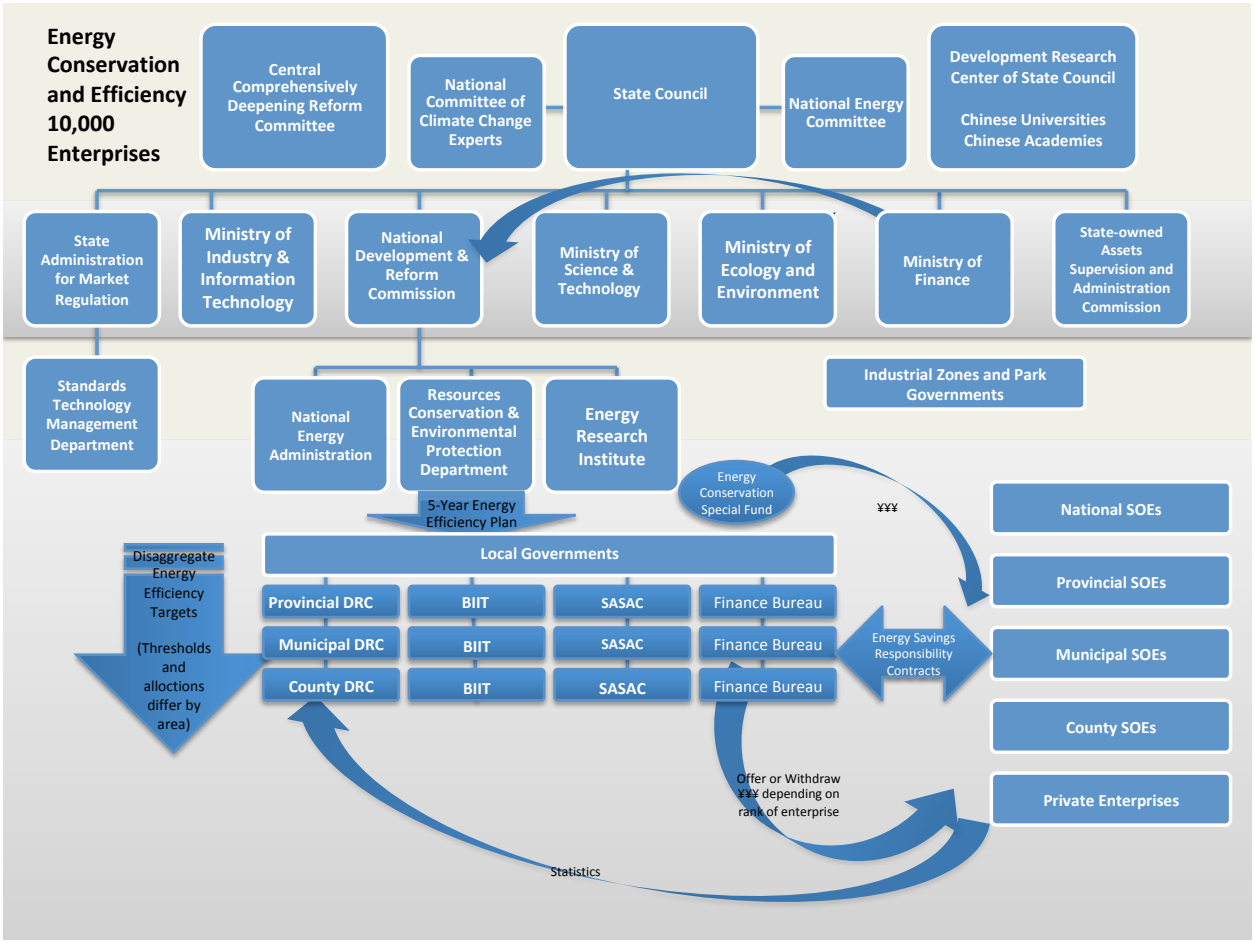
Resuming energy efficiency measures and ongoing restructuring of China's economy away from energy-intensive industry toward domestic consumption and the service sector has helped achieve recent energy efficiency goals. Since 2006, large industrial enterprises set mandatory energy consumption targets, and received financial support from the central government to implement these plans. In December 2011, the NDRC and 11 other ministries jointly launched the *Program of 10,000 Enterprises Implementing Energy-saving and Low-carbon Action*. Participating enterprises have annual energy consumption over 10,000 tons of standard coal or were identified by government for inclusion due to consumption of at least 5,000 tons of standard coal per year. In 2010, the program covered over 17,000 enterprises accounting for more than 60 percent of China's total energy consumption (NDRC et al., 2011).

Despite the reversal in the early 2000s, China's overall energy efficiency efforts have succeeded since the turn of the century. According to the IEA (2016b), from 2000 to 2015, China's energy consumption decreased 30 percent per unit GDP, or 2 percent per year on average.

The *13th Five-Year Plan (2016-2020)* seeks to reduce energy consumption per unit of GDP by 15 percent by 2020 compared with 2015 levels. The *13th Five-Year Energy Saving and Emission Reduction Comprehensive Work Plan* requires reducing pollutants as efficiency increases, setting targets for volatile organic compounds, chemical oxygen demand, ammonia nitrogen, sulfur dioxide and nitrogen oxides.

China's Energy Conservation Law (amended 2018) specifies that provincial level governments administer energy conservation targets and report progress each year. Targets are disaggregated to the county level, and apply to public institutions and all energy consuming entities in the electric power, iron and steel, non-ferrous metals, building materials, oil processing, chemical, coal, and other energy intensive industries, including transport that consume the equivalent of 10,000 tons of coal per year or more. The law prohibits use of inefficient technologies that have been identified for elimination and requires energy efficiency labels, which are also required by the Circular Economy Law. The law promotes the use of energy conservation service companies. It provides for subsidies and tax incentives to promote compliance and imposes penalties for violations.

Figure 31: Energy Conservation and Efficiency



Source: Authors' analysis

Energy efficiency targets are carried out by the NDRC. Local governments effectuate targets by entering into "energy saving responsibility contracts" with the enterprise (节能目标责任书). Although the Ministry of Ecology and Environment does not possess jurisdiction over energy conservation, energy conservation is the most effective means of cost-effectively achieving carbon and other pollution emissions reductions.

Under the Energy Conservation Law, the Ministry of Finance funds energy conservation measures, directs financial institutions to increase credit to energy conservation projects, and promotes fiscal policies to support energy conservation measures. Financial support measures are developed in coordination with the Ministry of Industry and Information Technology, which develops standards for energy efficient technologies together with the NDRC and the State Administration for Market Regulation's standards development departments. Under the Energy Conservation Law, the State Administration for Market

Regulation also polices the sale of energy-inefficient products prohibited by regulation. The Ministry of Science and Technology funds research on energy conservation technologies.

Electricity Market Reform

For over three decades, China has debated reforming its power sector. Prior to 1985, China's power industry was organized as a national power system organized as a government ministry. This centrally planned and operated system seriously hampered the development of the power industry and resulted in more than 20 years of severe power shortages.

In order to expand capacity to meet demand, in 1985, the state partially reformed the power industry, creating the potential for non-government bodies to enter the power generation business, while the power grid remained controlled by the state.

In 1998, China corporatized the operating divisions of the state power bureaucracy. In that year, China established a state-owned national power corporation, and abolished the Ministry of Power Industry, transferring regulatory functions to the State Economic and Trade Commission's power division (predecessor to the National Development Reform Commission). The new State Power Corporation controlled power generation, transmission, and distribution, and controlled the entire power grid and directly operated half of China's power plants.

Inefficiency and power shortages persisted under the State Power Corporation's monopoly, prompting the State Council to issue the *Power Sector Reform Plan* (Mandate No. 5) in 2002, which called for the debundling of grid operations, generation, transmission and distribution, and ancillary services. Its stated goal was "to break the monopoly [in the power sector], introduce competition, improve efficiency, reduce costs, improve the pricing mechanism, optimize allocation of resources, and promote power development." Accordingly, in 2002, the National Power Corporation was broken into the State Grid Corporation of China, which in turn owned five regional grid subsidiaries, and the China Southern Power Grid; the big five power generating companies; and four independent ancillary services companies.

In 2003, the State Electricity Regulatory Commission was established to separate regulatory and government functions, and issued the *Power Tariff Reform*. The commission was later merged into the National Energy Administration, becoming its Market Regulatory Department.

In 2011, two auxiliary power industry groups, the Power Construction Corporation of China Ltd. and China Energy Engineering Corporation Ltd., were separated from State Grid Corporation and China Southern Power Grid, in an effort to further debundle the sector.

China's grid companies dominate its electricity market. State Grid Corporation and Southern Grid, and their subsidiaries, not only provide transmission and distribution services, but they also act as system operators making dispatch decisions. The grid companies purchase electricity from power generators and then resell the electricity at retail prices, the difference in prices less their costs of transmission and distribution being their profits. The NDRC's Pricing Department regulates both prices using tariff schedules that vary by province, season, peak hour, plant technology, and consumer (residential, agricultural, industrial and commercial), and which in practice are negotiated between provincial government and central authorities. The grid companies also command influence with the NDRC and local governments, thus the system lacks transparency and has been subject to abuse (Goron, 2017).

Lack of transparency is compounded by the grid companies not making dispatch decisions based on economic principles of lowest-cost plants being dispatched first, and often failing to honor the dispatch priority for renewables in violation of the Renewable Energy Law (amended 2009). Instead, dispatch is based on quota allocations and "equitable factors" to ensure that each generator generates their fair share and is given a fair opportunity to make profits (Karhl *et al.*, 2013).

The lack of economic dispatch rules, differential pricing among plants without any apparent economic rationale, combination of dispatch with transmission within the grid companies, and the grid companies' own revenue model in which they buy and sell electricity at a profit pose fundamental conflicts of interest that cannot be resolved given market design.

In response, in 2015, the State Council issued the *Opinion Regarding Further Deepening of the Power Sector Reform* (Mandate No. 9) (State Council, 2015b). The 2015 mandate does not go beyond the 2002 mandate (Mandate No. 5), but enhances its operability. The 2015 version requires a distinction between competitive and monopolistic stages, and calls for expanding competitive business. Following Mandate No. 9 of 2015, the government issued six supporting policies:

- Reform prices for transmission and distribution (T&D)
- Establish spot market pilots
- Establish electricity trading exchanges
- Create bilateral markets for generation and efficiency
- Open retail electricity markets
- Regulate captive coal power plants operated by industry

The 13th Five-Year Plan (2016-2020) calls for accelerating power system reform by implementing the six policies, to promote efficient, stable, and transparent power system that features a pricing mechanism that properly prices electricity based on coal, gas and other fuels.

Implementing power sector reform in China is challenging because local governments bear responsibility for implementing and financing reforms in the context of a weak central coordination mechanism. The central government's reform program is predicated on the theory that by creating a market for electricity as a commodity, China's present oversupply conditions will resolve through price reductions imposed by market dynamics.

T&D price reforms. In 2017, the central government implemented the first of the six reform policies by adopting price reforms for transmission and distribution services throughout China. These reforms seek to transition grid companies away from pricing based on the sale of electricity to separately pricing transmission and distribution services. Reflecting the prevailing approach in other countries, grid companies will be compensated based on T&D costs plus reasonable profit, estimated according to a regulatory formula (NDRC, 2017a).

Spot market reforms. In order to establish spot markets, concurrently with the T&D price reform, the NDRC is gradually rolling back China's system of centrally planned power plant dispatch. Commencing in 2017, regulations limit coal-fired power generators' allocated guaranteed operating hours in a given year to 80 percent of the prior year (NDRC and NEA, 2017a). Coal-fired generation approved after Mandate No. 9 of 2015 does not receive any guaranteed dispatch, and thus must compete on price based on direct, monthly and annual bilateral purchase contracts (ERI and CNREC, 2018).

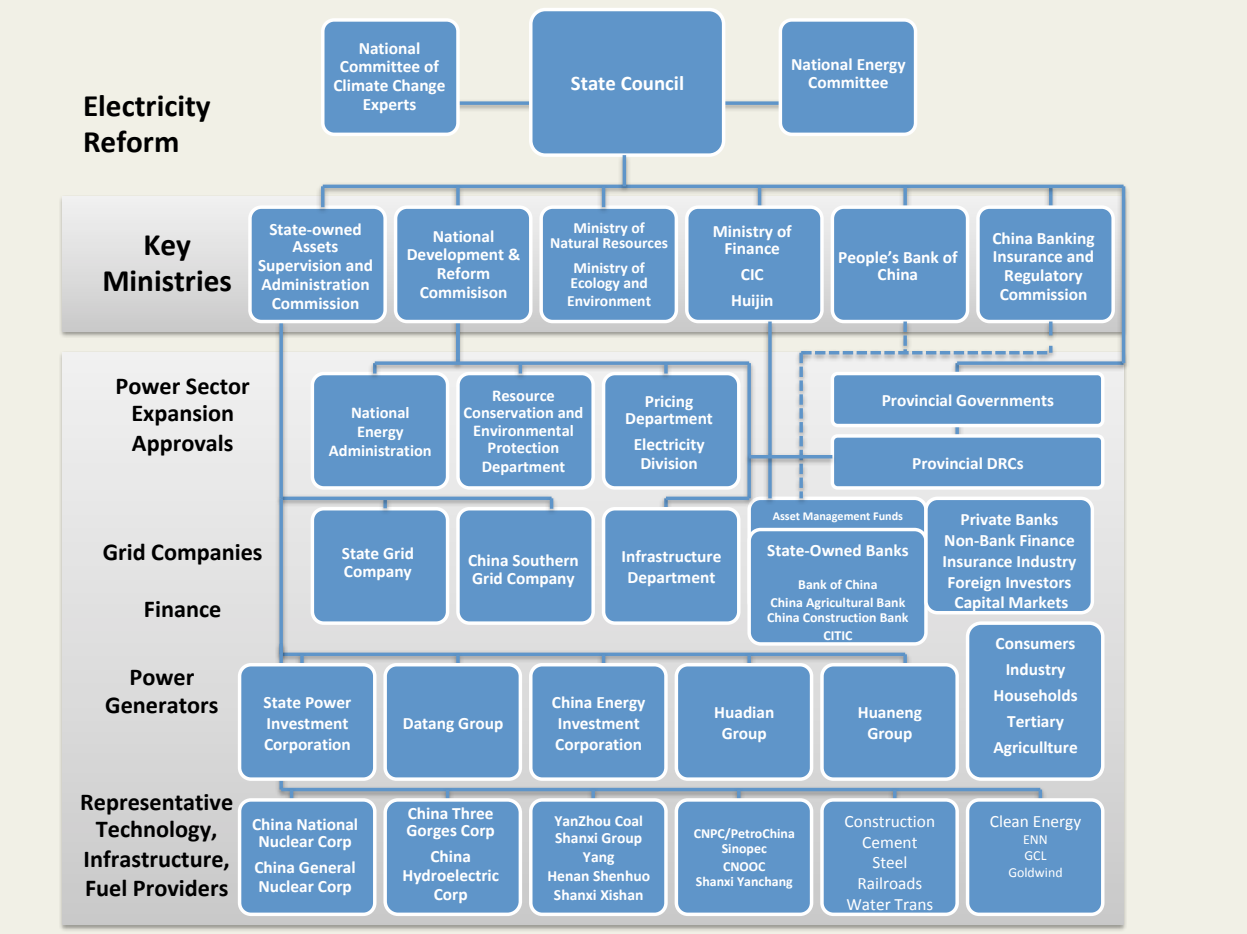
Trading already occurs among industrial and commercial power consumers connected to 110-kV or higher voltage lines. During this transitional period, some subsidy and legacy dispatch priority will persist, but as more participants trade and subsidies are gradually withdrawn, the reforms are intended to give way to market operation (ERI and CNREC, 2018).

To facilitate the development of spot markets, eight regions were selected in 2017 as the first to conduct spot market pilots: Fujian, Gansu, Guangdong (to be expanded to southern China), Shandong, Shanxi, Sichuan, Western Inner Mongolia, and Zhejiang (NDRC and NEA, 2017b).

Ancillary services market pilots. In 2017, China launched ancillary service market pilots to provide capacity reserves, frequency regulation, voltage regulation, and automatic generation control. Pilots include Guangdong, Gansu and Qinghai provinces, with each tailored to the issues prevailing in the particular province. Thus, for example, Gansu and Qinghai established capacity reserve pilots intended to help address high wind and solar curtailment (ERI and CNREC, 2018).

The figure below presents selected stakeholders representing various interests in electricity reform.

Figure 32: China's Electricity Reform

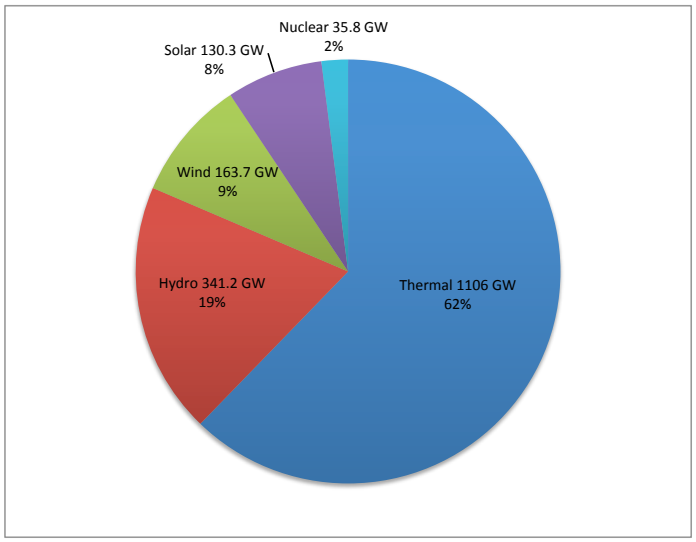


Source: Authors' analysis

Renewables Policy

China's five major power generation sources are thermal, hydro, nuclear, wind, and solar. China's thermal power units represent 62 percent of installed capacity, yet because these are predominantly coal-fired base load plants, thermal power accounts for approximately 72 percent of China's actual power generation. The graphic below shows total installed capacity and electric energy production by type as of the end of 2017.

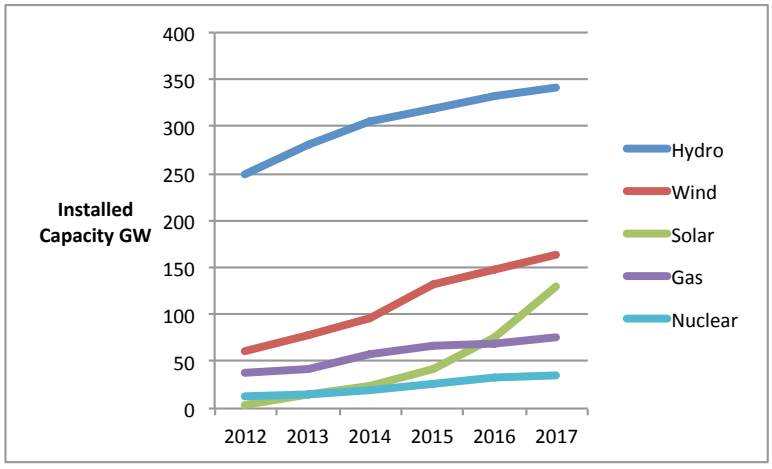
Figure 33: China's Installed Power Generation Capacity in 2017



Source: Source: National Bureau of Statistics (2018)

By the end of 2017, China had 341 GW of hydropower, 164 GW of wind power, and 130 GW of solar power. Renewables accounted for almost 37 percent of China's installed capacity. During 2017, Solar PV expanded 78.6%, followed by wind (26.3%), biomass (22.7%), nuclear (16.3%), thermal (4.6%) and hydropower (1.7%) (ERI and CNREC, 2018). China surpassed its 2020 solar PV goals by 2017.

Figure 34: Growth in Low-Carbon Power Generation - Installed Capacity



Source: Authors based on data in ERI and CNREC (2018).

China's *13th Five-Year Energy Development Plan* set a short-term energy structure goal for 2020 that conventional hydropower installed capacity will be about 380 GW, wind power installed capacity will be 210 GW, and photovoltaic installed capacity will be 110 GW. To achieve these goals, China has sought both to constrain the further growth of coal-fired thermal units, and to promote renewable energy development.

China has progressed its renewable energy goals through progressive policies and ambitious targets backed by government finance:

- China's Renewable Energy Law, adopted in 2005 and revised in 2009, directs grid operators to enable renewable generators to sell electricity to the grid, and requires state planning agencies to publish guidance for the development of renewable generation that is the foundation of China's renewable portfolio requirements. The law introduced a feed-in-tariff to support solar photovoltaic, wind, biomass and other renewables with subsidies that vary by region and technology type.

- In 2007, the NDRC published the Mid-Long Term Development Plan for Renewable Energy, which set a goal of increasing the ratio of renewable energy to total energy consumption to over 10 percent by 2010, and 15 percent by 2020.

- In 2016, the NDRC published the Renewable Energy Development Plan of the 13th Five-Year Plan Cycle (2016-2020), which set goals for the share of non-fossil energy in primary energy consumption at 15 percent by 2020 and 20 percent by 2030; and the share of power generated by renewable energy at 27 percent of total generating capacity by 2030.

China's feed-in-tariff policy and subsidies programs, described further below, have driven the aggressive expansion of renewables. Yet, overly generous incentives have incentivized marginal projects and accelerated expansion of renewables more rapidly than the grid is capable of absorbing. The rapid growth of renewables exposed shortcomings in planning and grid technical capabilities, and resulted in high curtailment rates among wind, solar and hydro projects. Subsidies have been costly to the state budget, and will be phased out by 2020.

While curtailment rates have improved, curtailment rates for wind, solar and hydro remain within the 15 to 30 percent range for some provinces, and have almost reached 50 percent in some provinces in the recent past (Goron, 2017). For wind and solar, NEA is increasingly focusing on improving planning and integration of renewable energy, as opposed to merely pursuing capacity increases, as well as upgrading to ultra-high voltage transmission lines, promoting distributed generation through higher tariffs relative to the ordinary feed-in-tariff, and allowing distributed generators to sell their output to surrounding businesses while benefiting from subsidies (ERI and CNREC, 2018).

In 2015, the NEA issued investment guidance for wind and solar, designating provinces as red, yellow, or green depending on risks such as curtailment and transmission availability. Red areas should halt all new construction and will not receive further PV subsidy quotas unless connected to ultra-high voltage lines. Yellow areas are subject to a 50 percent reduction in subsidies. Green areas are priorities for investment (NEA, 2016). In June 2018, the NDRC took further steps to control the scale of new PV projects and reduce available subsidies (NDRC, 2018).

In 2015, China launched its "top-runner" reverse auction program for solar developers to produce high-efficiency, competitively priced PV projects. Low-bid winners receive PV construction quotas, supported by government-guaranteed subsidies (NEA *et al.*, 2015). Recent top-runner auctions have driven prices down close to applicable provincial coal tariff rates, suggesting solar is approaching parity with conventional generation (ERI and CNREC, 2018).

The power sector's institutional structure presents barriers to implementing these policies. China's grid and power generation are dominated by large state-owned enterprises, operating increasingly internationally with sources of revenue independent of the state budget, influential politically, and with a

near monopoly on expertise. Thus, they possess a degree of independence from central control, frustrating reform efforts. However, efforts to reform the power sector and introduce smart grid and disruptive technologies provide the government with opportunities to recentralize control over the electricity sector (Bergsager and Korppoo, 2013).

Renewable Energy Feed-In-Tariff and Subsidies

China's central government subsidizes renewable power generation through a feed-in-tariff and provides other subsidies and tax benefits for project development and for equipment manufacturing.

Under China's feed-in-tariff, renewable energy generators receive an electricity price based on the price of coal-fired power generation, a credit for low-sulfur emissions electricity generation, and an additional subsidy that varies based on the type of renewable technology and region. The renewable subsidy component is funded by electricity price attachment fees collected from industrial and commercial power consumers, and deposited into the Renewable Energy Fund administered by the Ministry of Finance in coordination with the National Energy Administration and paid via the grid operator.

The Chinese government's support for renewable energy was strengthened by the *Notice on Enhancing the Criteria for the Collection of the Renewable Energy Fund* (January, 2016) issued by the Ministry of Finance and NDRC, which, starting January 1, 2016, increased the electricity price attachment fees collected on electricity from commercial users in most provinces and cities to RMB 1.9 cents per kilowatt-hour to fund subsidies for renewables (Note: residential and agricultural consumers are not subject to these fees). Under this policy, more than RMB 19 billion yuan of subsidies can be collected.

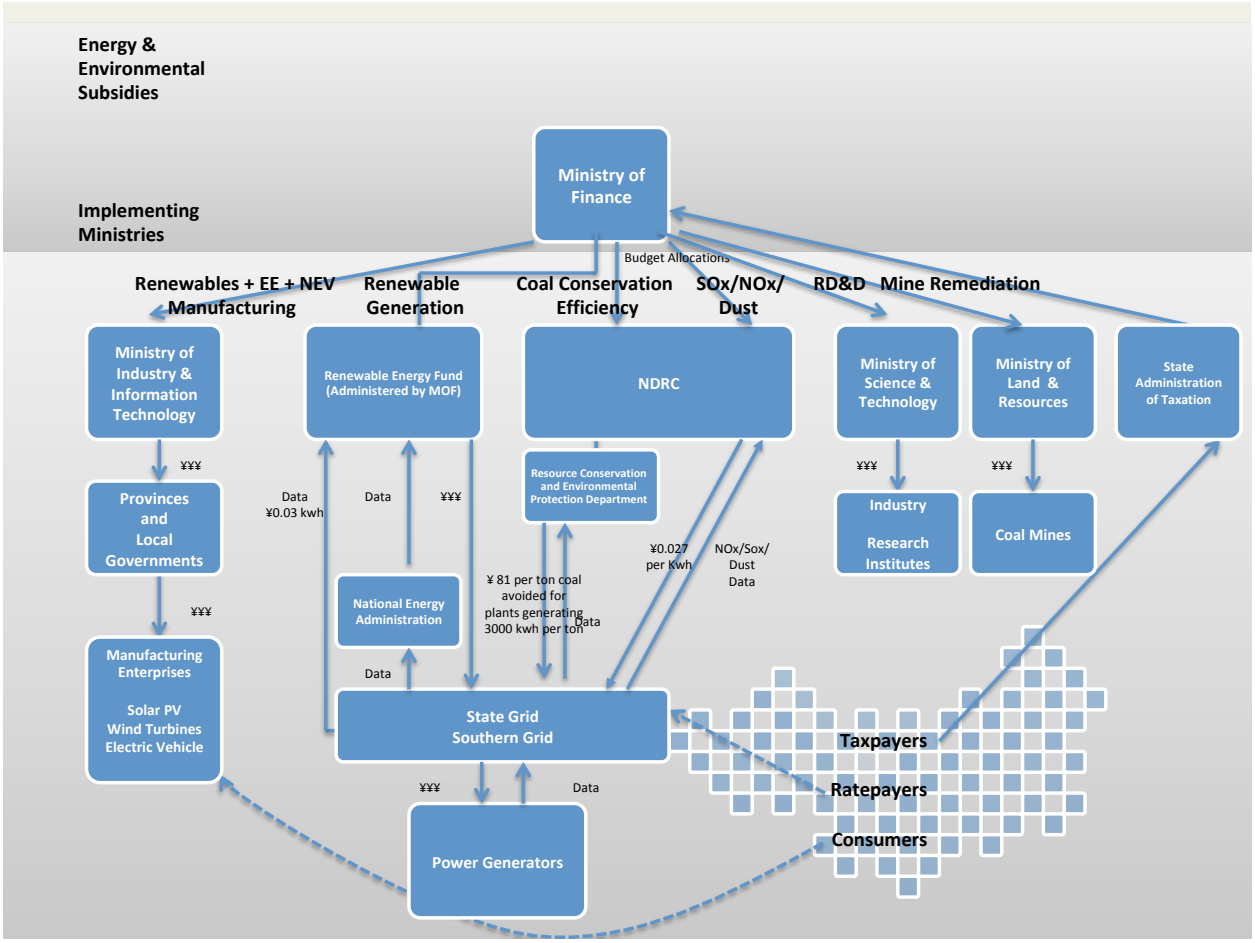
As noted above, the majority of renewable energy subsidies come from electricity price attachment fees, but power generators subject to these fees are chronically delinquent in payment, which has resulted in delays in the payment of subsidies to renewable generators. By the end of first half of 2016 a total of RMB 55 billion yuan of subsidies were owed to renewable generators but unpaid for lack of funds (China Energy News, 2016). Therefore, a large number of grid-connected power generation projects that are eligible for subsidies have not received payment for services.

Notwithstanding these problems, as a result of China's renewable policies, China has become the world's leading developer of renewable energy and associated low-emissions energy technologies in recent years. China invested US $126.6 billion in these technologies in 2017 (REN21, 2018). The International Energy Agency (IEA) projects that in the next five years China will install 36 percent of the worlds' hydro electricity generation capacity, 40 percent of world's wind energy, and 36 percent of world's solar power (IEEFA, 2017). With the launch of the Belt and Road Initiative, China' new energy industry is poised to expand even further internationally.

China's goal is that by 2020 renewable power should be market-driven with the need of state subsidies, and renewable electricity should be competitive with the price of electricity produced by coal. Since the cost of renewable energy technology is declining, the Chinese government plans to discontinue subsidies for wind power and photovoltaic power generation by 2020 (NEA, 2017).

The figure below depicts environmental and renewable energy subsidies.

Figure 35: China's Energy and Environmental Subsidies Policies



Source: Authors' analysis

Renewable Energy Certificates

As renewable energy subsidies will be withdrawn after 2020, the government is preparing to replace subsidies with policies that incentivize adoption of renewable power without government expenditure: the Green Certificate Program and the Renewable Energy Obligation.

Green Certificate Program. In 2018, the China Renewable Energy Engineering Institute launched a voluntary green certificates program under which third parties could purchase certificates of from existing wind and solar plants already approved to receive subsidies. The proceeds of the sale of certificates satisfy the government's obligation to pay subsidies, thus amounting to a gift to the government. This program does not involve secondary trading, as certificates have no value. Purchases of certificates have been weak (ERI and CNREC, 2018).

Renewable Energy Obligation. In 2019, China National Energy Administration (NEA) and the NDRC introduced a renewable energy obligation, under which the NEA will set provincial quotes for renewable energy purchases to be further allocated through the grid operator to covered entities, requiring them to source an assigned percentage of their electricity from renewable energy. Covered entities include provincial grid companies owned by the State Grid or Southern Grid, local power grid companies owned by provincial and local government, electricity retail companies with distribution grid operation permits,

independent electricity retail companies, industrial enterprises owning their own power plants, and large end-users purchasing electricity from wholesale power markets.

Under the system, the NEA sets a mandatory minimum purchase quota, and a higher incentive quota, which if met would relieve the covered entity from the obligation to comply with the annual total energy consumption and energy intensity limits to the extent it exceeds the higher target. The contemplated renewable energy obligation would not involve trading obligations, as under renewable portfolio standards coupled with tradable obligations/credits in other countries, but rather would operate as an administrative target system (Hove and Wang, 2018).

Green Consumption

China's green consumption principles are reflected in several Chinese laws and regulations. Some of these principles are general in nature, reflecting the intent to encourage sustainable behavior rather than a strict standard or requirement. However, as with other sustainability policies, the government is gradually developing increasingly detailed regulation that signals their intended direction. Green consumption operates at the government, industry and the consumer levels.

China's green consumption policy was first established in the Clean Production Promotion Law of the People's Republic of China (2002). Article 16 requires all levels of government to give priority in procurement decisions to products that are environmentally friendly and conserve resources. This encompasses products that save energy, water and promote recycling.

The Government Procurement Law, which became effective in 2003, specifically identifies government procurement as a tool to protect the environment. Article 9 stipulates that government procurement be used to support environmentally friendly production and to acquire goods that meet environmental protection standards. Goods and their suppliers that fail to meet environmental standards can be designated as ineligible for government procurement under Article 22.

The Government Procurement Law only applies government offices, public institutions and organizations, excluding state-owned enterprises from coverage. Government procurement accounted for roughly 3 percent of China's economy during the 2010s (Chinese Government Procurement Yearbook 2003-2018). The Circular Economy Law, described below, also applies to state enterprises, thus extending green consumption obligations to one third or more of China's economy (See Zweig, 2015 for proportion of state sector relative to economy).

Circular Economy

Circular economy focuses on reducing, reusing and recycling resources in the process of production, circulation and consumption. It presents an alternative to linear production models that involve making, using, and disposing resources.

China's Circular Economy Promotion Law (amended 2018) promotes the development of a circular economy by improving resource utilization efficiency, promoting recycling, and other measures. It requires county level governments and above to adopt circular economy in their development planning and establish an administrative department for implementing circular economy. The law requires these governments to use planning, fiscal, investment authority, and procurement to promote circular economy. Under the law, the central government maintains a catalogue of technologies, equipment, materials and products that are encouraged, restricted or prohibited for purchase by the government. Prohibited items may not be imported, produced or sold in China by enterprises.

The law requires information sharing, recycling, product labeling, tax and other incentives, and provides industry-specific guidance for energy-saving, water-saving and material-saving technologies. The law requires performance tracking using metrics such as waste re-utilization rates, and waste recycling rates.

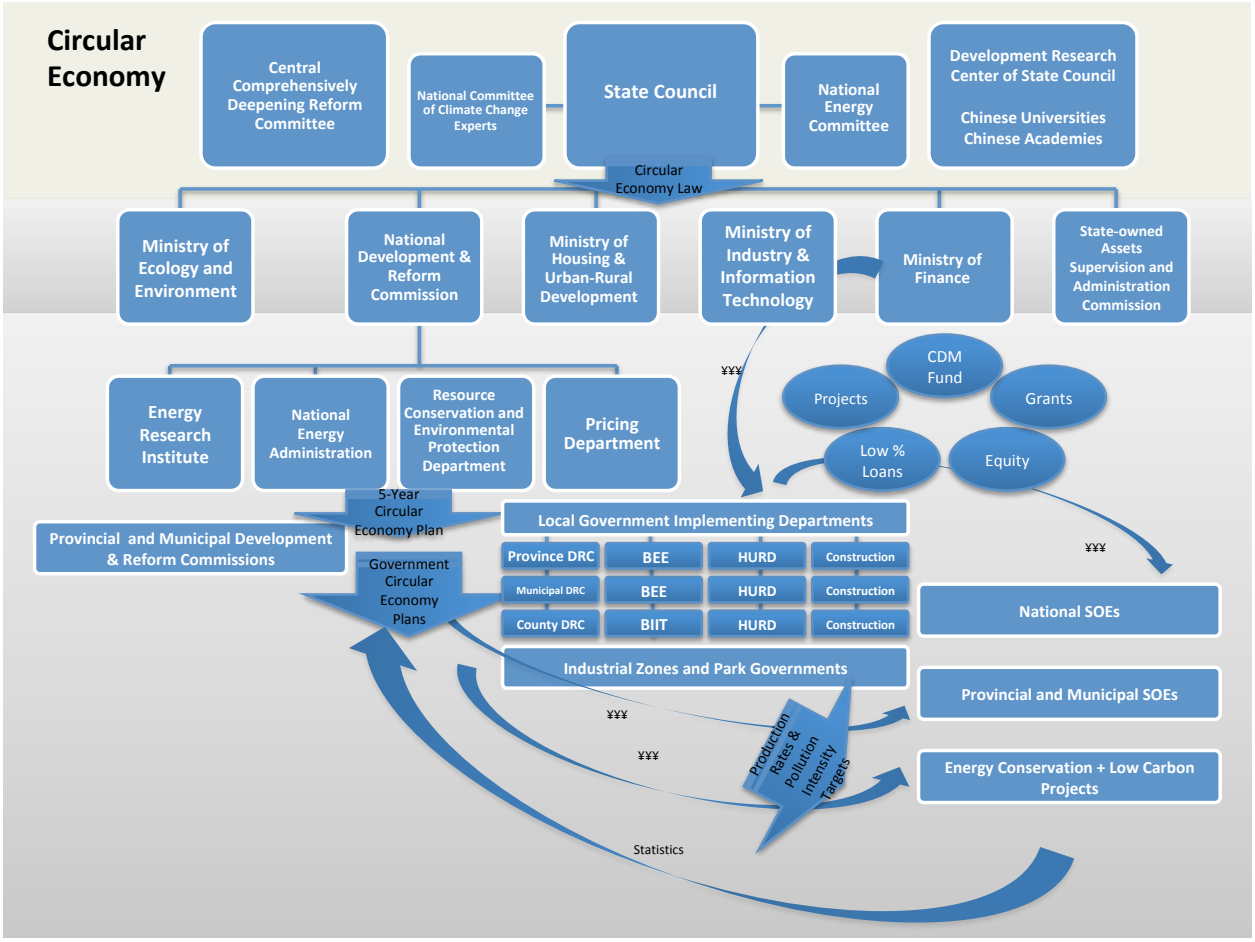
Article 10 of the law encourages citizens to embrace green consumption: "The state encourages and guides citizens to use products that save energy, water, and materials as well as environment-friendly products and recycled products so as to reduce the production and discharge of wastes."

The government implements the law's resource conservation, recycling and consumer policies through regulation (see CCICED, 2013, describing regulatory measures adopted by the Chinese government):

- Guidance on Promoting the Construction of Resource Recycling and Utilization Bases to promote waste sorting and resource recycling (NDRC, May 3, 2018).
- Circular Economy Development Evaluation Index System to scientifically evaluate the development of circular economy (NDRC, 2017b).
- Circular Development Leading Action to develop China's green recycling low carbon industry system (NDRC, 2017) sets 2020 targets for urban waste recycling and utilization rates for industrial solid waste.

Under the Circular Economy law, MEE leads in developing the national circular economy plan, performance indicators, and standards for technologies and products. NDRC will influence policy through economic planning. The Ministry of Housing and Urban-Rural Development developed circular economy pilots and is instrumental in energy and resource savings in the building sector and urban planning.

Figure 36: Circular Economy



Source: Authors' analysis

New Energy Vehicle Policies

The 13th Five-Year Plan (2016-2020) sets ambitious goals for China to accelerate its new energy consumption revolution. The 13th Five-Year Plan aims to promote the expansion of low-carbon transport, especially new energy vehicles and to develop China's electric vehicle industry. The *Made in China 2025* strategy also promotes new energy vehicle technology development and provides additional government support. *Under the Made in China 2025* program, China will support the development of electric vehicles and fuel cell vehicles, aiming to promote Chinese brands competing in the international marketplace.

In order to expand China's new energy market, China's central government began subsidizing electric vehicle purchases for government and public fleets in 2009, and individual car-buyers in 2013. Subsidies were paid directly to manufacturers, based on vehicle registration and sales, but were easily gamed resulting in over RMB 1 billion yuan in fraudulent claims (Ministry of Finance, 2016). Examples of fraud included new energy vehicle companies over-reporting the number of vehicles produced by applying for motor vehicle licenses ahead of actual production and thereby obtaining central financial assistance without having produced the vehicles, and production of low quality vehicles.

In light of the rapid development of electric vehicle technology and the widespread abuse of the subsidies program, the government revised its criteria for subsidizing new energy vehicles and, according to the *Notice on the Financial Support Policy for the Promotion and Application of New Energy Vehicles from 2016 to 2020* published by the Ministry of Finance, Ministry of Science and Technology, and Ministry of Industry and Information Technology in 2015, subsidies will progressively reduce and be eliminated altogether by 2020 in favor of non-monetary incentives such as Chinese Corporate Average Fuel Consumption and the New Energy Vehicle target/credit system described below.

Presently, subsidies remain available for NEVs with superior range and battery performance. NEVs are eligible for subsidies with range over 150 km based on the New European Driving Cycle (NEDC), which progressively increase until reaching 400 km. Similarly, batteries must have energy density over 105 Wh/kg to qualify, and achieve 140 Wh/kg to receive the full subsidy. Local governments may supplement national subsidies up to an additional 50 percent of the level of national subsidies (Hove, 2019 forthcoming).

Chinese cities have also offered non-financial incentives to promote EV adoption, including offering license plates at no cost, automatically granting plates without lottery or a special pool of EV plates, and exemptions from restrictions on driving days intended to combat air pollution. Offering license plates is a powerful incentive, as conventional vehicle plates cost over $12,000 in Shanghai, and in Beijing applications for the plate lottery exceeded 2.7 million people competing for only 90,000 plates in 2016, with the 2018 allotment reduced to 40,000 plates (Hove, 2019 forthcoming).

As previously noted, China is transitioning away from subsidies towards a dual credit policy that incorporates both the Chinese Corporate Average Fuel Consumption and New Energy Vehicle requirements. In 2018 China introduced a requirement that all manufacturers producing or importing vehicles in China produce a certain portion of their production as EVs. The EV production quota, initially set at 10 percent for 2019 to increase to 12 percent by 2020, is calculated based on overall conventional fleet fuel efficiency and NEV characteristics including range, energy efficiency, and fuel cell rated power. NEV Credits are tradable among manufacturers against their NEV targets or can be used against CAFC credit deficits (International Council on Clean Transportation, 2018). Thus, manufacturers that are unable to meet their NEV quota may purchase an NEV credit from another manufacturer that exceeded their own quota, or face penalties. The policy not only forces transition to EV technology in China, but it also forces manufacturers to transfer EV technologies to their China factories.

Energy RD&D Policy

China's 12th Five-Year Plan (2011–2015) identified seven strategic emerging industries that have become priority technologies for RD&D:

- Energy-saving and environmental technology
- New energy
- New materials
- New-energy vehicles
- Next generation information technology
- Biotechnology
- Advanced equipment manufacturing

Subsequently, the "Made in China 2025" policy, a government 10-year plan to promote innovation in certain pillar industries, promotes expansion of China's manufacturing base through innovation, focusing on ten core industries:

- Information technology
- Numerical control tools and robotics
- Aerospace equipment
- Ocean engineering equipment and high-tech ships
- Railway equipment
- Energy saving and new energy vehicles
- Power equipment
- New materials
- Medicine and medical devices
- Agricultural machinery

Made in China 2025 is the first step of a strategy to transform China into a leading manufacturing power by the year 2049, the 100th anniversary of the founding of China. It builds on earlier policies - the Medium- and *Long-Term Plan for the Development of Science & Technology* issued in 2006 promoting "indigenous innovation" (自主新) and the identification in 2010 of the seven "strategic emerging industries" (略性新兴) that were regarded as vital for China to develop into an advanced economy. Made in China 2025, however, emphasizes intellectual property and market forces to a greater extent that these earlier policies (Kennedy, 2015).

Complementing industry's expanding research capabilities, China's RD&D efforts in energy and other fields are commonly organized under state research institutes, the various academies of sciences across disciplines, and China's vast university system. The Ministry of Science and Technology funds research under the Natural Science Fund, National Major Scientific Research Program, Key Laboratories Program, the Innovation Fund, and the important "863" and "973" programs.

The High Technology Research and Development Program, more commonly known as the 863 program (representing the date of its establishment in March 1986), is intended to support the development of advanced technologies with the express goal of making China technologically independent. China's 863 program funds thousands of distinct technologies and the research laboratories dedicated to them.

China's other major research umbrella support fund is the National Basic Research Program of China, known as the 973 program. The 973 program funds basic research. As a practical matter, however, the 973 program funds a wide range of technologies at various stages of development and research institutions.

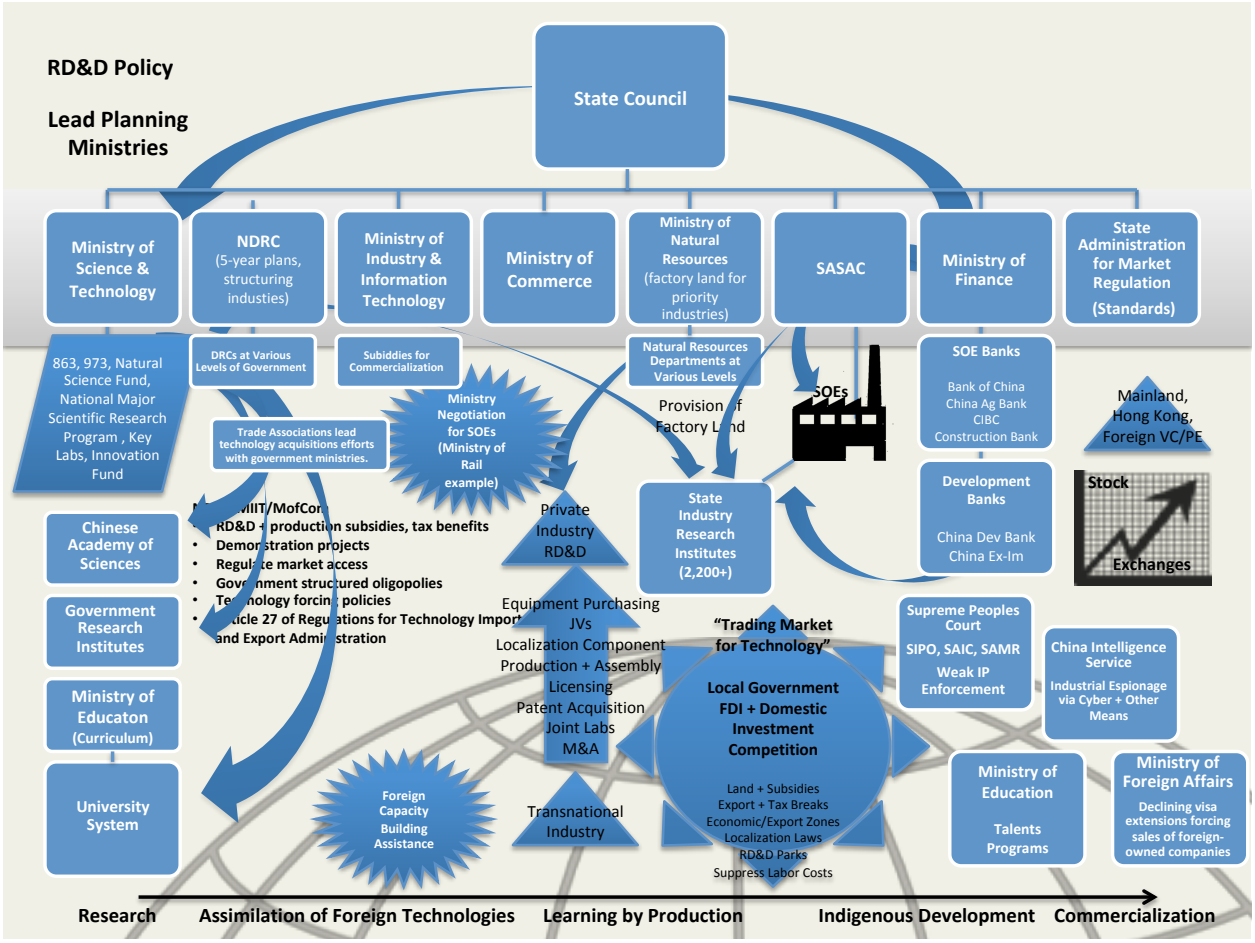
At advanced research stages, other financial support in the form of subsidies for demonstration projects or scaling up are available through the Ministry of Finance pursuant to plans guided by the NDRC. The NDRC, MIIT and the Ministry of Commerce establish technology policies and standards that direct subsidies and tax benefits.

As technologies progress towards commercialization, other ministries support RD&D through the provision of resources and policy. The Ministry of Natural Resources may allocate land for new ventures or demonstration projects. The Ministry of Finance and the state bank sector provide financing for operations and acquisition of technologies.

The NDRC, MIIT and the Ministry of Commerce regulate market access and adjust industry structure through combinations and consolidations of companies. State regulation of industry can ensure oligopoly profits, thereby ensuring a source of support for technology innovators. Chinese policies typically emphasize technology localization, such as a condition for eligibility for government procurement programs. In the energy field, the NDRC issues licenses for demonstration projects.

Finally, enforcement of intellectual property laws supports indigenous RD&D development. The NDRC, MIIT and Ministry of Commerce have conditioned the approval of mergers on observance of “fair compensation” requirements that reduce the costs for Chinese industry of licensing foreign intellectual property, or on transfer of intellectual property to domestic partners. Further, Article 27 of the Technology Import and Export Administration Regulations grants the right to improvements to the party making the improvements on the original licensed technology, a mandatory requirement that parties cannot vary by contracts governed by Chinese law.

Figure 37: RD&D Policy



Source: Authors' analysis

10. China's Positions at the UNFCCC and ICAO

This chapter examines China's positions at the UNFCCC and the International Civil Aviation Organization (ICAO). It first considers China's Nationally Determined Contribution or NDC, how it was determined, and its relationship to China's five-year planning process. It then summarizes China's recent positions at the UNFCCC and ICAO based on its interventions and written submissions. China's international negotiation positions reveal how China interprets its international contribution under the Paris Agreement, and how its contributions may evolve in the future under the Paris Agreement's stocktaking process.

Overview of China's NDC

In its Nationally Determined Contribution, China pledged to take the following actions by 2030:

- To achieve peaking of CO_2 emissions around 2030 and make best efforts to peak early.
- To lower carbon dioxide emissions per unit of GDP by 60 to 65 percent from 2005 levels.
- To increase the share of non-fossil fuels in primary energy consumption to around 20 percent.
- To increase its forest stock volume by around 4.5 billion cubic meters from 2005 levels.

China also pledged to undertake the following actions:

- To improve fundamental research into climate change and strengthen R&D funding in order commercialize and demonstrate low carbon technologies.
- To develop a national carbon emissions trading scheme.
- To enhance resilience to climate change.

China's NDC further outlined economy-wide and sector-specific policies and measures to achieve its intended contributions (China, 2015).

Contributions not Commitments in Context

Country NDCs have been carefully positioned as "contributions" rather than commitments. The concept of contributions reflects the economic and political sensitivities of certain developed countries such as the United States, Canada and Japan that cannot or will not commit their nations to binding commitments under international law, in the same manner as was contemplated under the Kyoto Protocol. The concept of contribution as opposed to commitment also mitigates the risk of failing to meet stated goals, and concerns that a legally binding "commitment" could lead to international or domestic sanction, whether legal or reputational. The notion of contributions is also compatible with the positions of China and other developing countries that rejected the proposition that developing countries should undertake obligations under the post-2020 agreement, respecting the principle of common but differentiated responsibilities. The concept of "contribution" furnished an alternative to rejecting any role to mitigate emissions, enabling them to adopt a nuanced position that embraced a role, albeit an entirely voluntary one under their control.

Implicit in the Paris Agreement's contributions approach is the positioning of developed and developing countries on an equal and voluntary basis, while preserving the principle of common but differentiated responsibility. For the United States in particular, political will to reduce emissions was conditioned on other major emitters including China taking action, reflecting concerns that effective collective measures required reductions by developing countries as well, in particular China and India, and that uneven efforts would be costly to those who acted, disadvantaging economic growth and trade.

For developing countries, the placement of the United States, European Union and other OECD countries on an equal footing with developed countries within a common framework is significant politically, particularly for China. The Paris Agreement represents formal recognition that China's climate efforts are as substantial as those of the United States and European Union, and that China has emerged as an equal partner in international environmental governance. Finally, the contribution concept also fit well with China's concerns about accepting any restriction on its sovereignty or intrusion into internal affairs, a concern shared by other developed and developing countries.

The Paris Agreement contributions and stocktake provisions established a framework for competition among countries to tackle the global climate change challenge. Without any enforcement or sanctions mechanism in the Paris Agreement, the rewards and penalties in this competition are purely reputational.

China's NDC is clearly understood by Chinese officials to represent a means to negotiate with other countries within an ongoing, competitive negotiation process. During the negotiation of the Paris Agreement, Chinese negotiators publicly advanced the proposition that the NDCs of all countries should be designed to hold global warming to a temperature rise within 2ºC of pre-industrial levels, a threshold reflected in Article 2 of the Paris Agreement as the upper acceptable limit and widely regarded as essential to avoid "dangerous climate change" as provided under UNFCCC Article 4(2). While no country's NDC pledges are presently adequate to meet that goal on a collective basis, it is expected that countries would negotiate under the Paris Agreement's global stocktake process (Paris Agreement, Article 14) to gradually increase individual and thus collective levels of ambition. China's own efforts reflected in its NDC provide a basis upon which it can demand appropriately ambitious efforts by others, and to resist pressure to pledge greater action without commensurate measures by others.

Process of Developing China's First NDC

Notwithstanding the positioning of the NDC as a contribution, failure to achieve any stated pledge would still present reputational risks for China. Based on interviews with Chinese officials, the quantified targets outlined in the NDC were calibrated to be achievable with a high degree of confidence.

China's NDC was developed through a consultative approach that was designed to identify targets and activities to report to the UNFCCC. The process of developing the NDC followed a highly centralized and linear approach. The initial stage of the process was mainly technical in nature, relying predominantly if not exclusively on technical expertise within government and academia. The process relied heavily on highly specialized expertise in modeling within the NDRC's Energy Research Institute and the NCSC, the latter affiliated with MEE since spring 2018. The NDRC coordinated an external review process of possible NDC content. During the middle phase, a broader group of stakeholders were consulted comprising central government ministries and experts, such as those on the National Committee of Climate Change Experts. Local government, industry stakeholders or civil society groups were not consulted, except to the extent that they were represented on expert committees or through relationships with the ministries that were consulted. In the final phase, the process became essentially political as the review process proceeded to the State Council and then to the Politburo Standing Committee.

Although China's process for developing its NDC was a strictly internal process, the NDRC and the United States' State Department held extensive bilateral discussions in order to better understand each other's positions before submitting their respective NDCs. These discussions were part of the two countries' broader engagement on climate change that produced the U.S.-China Climate Change Accord announced in Beijing in November 2014 by President Xi and President Obama. Although China's NDC was not coordinated with that of the United States, and China would not allow foreign relations with any particular country to drive its multilateral pledges or domestic climate policies, China's broader engagement with the United States on climate change provided information that helped it calibrate its NDC to reflect a level of ambition commensurate with that of the United States and appropriate for a country assuming a leading role in international environmental governance.

China's NDC and the Five-Year Planning Cycle

China's first NDC was developed towards the latter part of the period covered by the 12th Five-Year Plan, corresponding to the end of the process of developing the 13th Five-Year Plan. As a result, development of China's first NDC was not integrated with China's 13th Five-Year Plan development process. Nevertheless, the development of the NDC informed the five-year planning process, as explained below.

As China's NDC targets are regarded as achievable with a high degree of confidence, experts interviewed do not expect the NDC to lead behavior on the ground. Significantly, planning for China's Energy Revolution contemplates significantly more aggressive targets and reductions beyond China's NDC.

Notwithstanding the conservative approach used in its development, China's NDC targets and actions meaningfully raised China's stated goals, and the process of developing the NDC contributed to informing viewpoints of those involved in the five-year planning cycle for energy and climate issues within the NDRC.

In the immediate term, China's NDC targets can be used by the central government to guide local government efforts on climate change. Failure to achieve internationally announced NDC targets or actions carries reputational risk. In that sense, China's NDC may come to represent a minimum requirement for government officials to achieve.

In the longer term, under the pledge and review process of the Paris Agreement, which commences in 2023 and then every five years thereafter (Paris Agreement, Article 14), any future iterations of China's NDC will be analyzed and debated by both domestic and international stakeholders. As it represents China's leadership efforts on climate change, China's NDC may emerge as a driver of domestic policy.

Towards that end, the 14th Five Year planning cycle and subsequent cycles could more fully consider the role of the NDC in domestic planning.

China’s Positions at the UNFCCC Negotiations

As the largest emitter of greenhouse gases, China’s negotiation positions in the international climate negotiations are critical to global efforts to address climate change. At COP 21 in Paris in 2015, China emerged as a more positive participant in the negotiations, in contrast to its positions at COP 15 in Copenhagen in 2009 that carefully avoided embracing international obligations (Li, 2016; Ye and Wu, 2015). For the first time China was willing to commit to an absolute cap on emissions subject to international measurement, reporting and verification (MRV), which will be facilitated by China’s transition from energy-intensive growth to balanced economic consumption (Hilton and Kerr, 2017). However, as a developing country, China strongly insists on economic growth that will be challenging to achieve while reducing its emissions (See Gupta and Wong, 2014 for a discussion of this issue). Given the tension between emissions limits and growth, China's positions demand careful consideration.

This chapter provides a comprehensive summary of China's positions on key issues in the climate negotiations relevant to the Paris Agreement, as well as negotiations at the International ICAO to reduce aviation emissions through global market-based measures (GMBM), an aviation emissions cap and trade program. In brief, China's positions are:

- China insists that "common but differentiated responsibilities" (CBDR; expressed as "common but differentiated responsibilities and respective capabilities" under the Paris Agreement (CBDR-RC)) must be preserved as a general principle, and taken into account in all key issues under the Paris Agreement and GMBM of ICAO; CBDR-RC should be fully implemented *without* any renegotiation or reinterpretation of their principles and provisions.

- As an extension of CBDR, China stresses *flexibility* towards developing countries on important topics like adaptation, nationally determined contributions, accounting and transparency.

- China insists on country-determined approaches in general, and stresses *diversity* in considering the specific needs, concerns and circumstances of developing country Parties.

- China stresses the inextricable relationship between pre- and post-2020 actions. Expressing concern over the growing gap between mitigation targets and trajectories to achieve 1.5 and 2 degrees goals, current 2020 mitigation pledges of Annex 1 Parties must increase.

- China emphasizes adaptation continues to be the *key priority* for developing countries, as developing countries are particularly vulnerable to adverse impacts of climate change. China calls for strengthening information sharing to understand climate change impacts and the *loss and damage* suffered.

- China underscores that developed countries shall provide both financial and technical support to developing country Parties, and play a leading role in implementing the Paris Agreement.

- China emphasizes the lack of adequate financial support for developing countries in adaptation and mitigation efforts, and calls for urgent and enhanced support, which must be additional, adequate and predictable finance from developed country Parties.

- Funds under the guidance of the COP demand additional unwarranted requirements that have *not* been agreed under the Convention, thus placing additional burdens on developing countries. China advocates that access to financial resources must be granted to *all* developing countries. Specifically, the Green Climate Fund's practices of categorizing developing countries and some developed countries practices of *unilaterally* applying new eligibility criteria limits access and are not compatible with guidance from the COP, the terms of the UNFCCC and the Paris Agreement.

- China calls to strengthen linkages between the Technology Mechanism and Financial Mechanism.

- China calls for scientific models that reflect the circumstances and context of developing countries.

- China calls for establishment of a public registry for NDCs and adaptation measures.

This chapter tracks China's positions both as a country Party and as a member of the G77 and China negotiation group, as indicated in the text below.

The table below provides a summary of China's positions on selected issues under the Paris Agreement, followed by detailed analysis of each topic.

Table 6: Summary of China's Positions over Key Issues in the Paris Agreement

Part I: Specific Issues								
	CBDR	*Flexibility*	*Diversity*	*Developed Countries Lead*	*Support for Developing Countries*	*Party-driven*	*Manner Key Points*	*Other Key Points*
Pre-2020 Action	√			√	• Need plan to scale up finance commitments and mobilize resources to reach USD 100 billion per year by 2020, committed by developed countries.		Developed countries should raise pre-2020 ambition to 40% of 1990 level by 2020.	• Gap between mitigation targets and trajectories to 1.5 and 2 degree goals growing.
Transparency	√	√			• More focus on transparency of support. • Provide support on continuous basis. • Coherence of work among developing countries essential.		Facilitative, non-intrusive, non-punitive.	• Three principles: no backsliding; flexibility for developing countries; enable gradual improvement. • Transparency framework based on existing transparency. • Modalities, procedures and guidelines developed separately for developed and developing countries.
Capacity Building	√		√		• International Consultation and Analysis, Capacity-building Initiative for Transparency to provide needed support. • Additional funding support by GEF.	√	To be based on and responsive to national needs and foster country ownership.	• Process participatory, Party-driven, cross-cutting. • Balanced, equitable geographically and gender. • Capacity building based on economic models.
Nationally Determined Contributions (NDCs)	√	√	√	√	• Developed Parties to provide finance, technology and capacity building to developing country Parties for preparing, communicating and implementing NDCs. • Developing country implementation conditioned on adequate finance, technology and capacity building support by developed country Parties.	√	Nationally determined is most crucial feature of NDCs.	• Developed Parties should have higher information requirements for NDC implementation. • NDCs to include mitigation, adaptation, implementation. • Further guidance for NDCs needed. • Call for NDC public registry with three functions: record NDCs communication by Parties; make NDCs available to public; ensure consistency with "nationally determined" nature of contributions.
Accounting	√	√	√	√	Not mentioned	√	Accounting should ensure transparency, accuracy, completeness, consistency, and comparability.	• Modalities for accounting of financial resources by developed country Parties to developing country Parties must provide *transparency* and *consistency.* • Developing country Parties should choose, in a nationally determined manner, the sectors and gases covered in their NDCs and specific methodologies for accounting.
Global Stocktake (GST)	√		√		Not mentioned	√	Comprehensive, facilitative, transparent, balanced, and holistic.	• GST should cover mitigation, adaptation and means of implementation and support. • GST to conducted in light of equity, best available science. • GST not lead to mandatory approach to increase ambition.
Adaptation	√	√	√		• Adaptation Fund crucial for adaptation yet funding for developing countries insufficient. • Urgently enhance support for developing countries to formulate and implement NAPs. • Scale up adaptation finance, particularly for increasing climate risks facing developing countries, balancing mitigation and adaptation. • Enhance access to finance and tech support. • GCF slow progress to operationalization.	√	Adaptation is key priority for developing countries	• Guidance not to add burden to developing Parties. • Record adaptation communications in public registry. • Strengthen loss and damage provisions in Warsaw International Mechanism for Loss and Damage (WIM). • WIM Executive Committee "five-year rolling work plan" basis for progressing WIM. • Developed country Parties to provide resources to WIM. • Appropriate method to recognize and register efforts. • Agriculture critical.

Mitigation and Article 6	√		• Scale-up financial resources, technology and capacity building for adaptation and mitigation.	√	Party-driven, coherent, balanced approach to Article 6 sub-items.	• Enhance balance mitigation and adaptation. • Paris Agreement Article 6 sub-items (Articles 6(2), 6(4), 8) equally important.
Article 8 (Loss and Damage)	√		• Loss and damage should be permanent agenda item for subsidiary bodies. • Call to fully implement Article 8. • Special financial resources from developed country Parties for activities and actions in developing countries needed urgently.			• Broader and more inclusive inputs from all parties to be available at meetings of subsidiary bodies, including WIM for Loss and Damage and its 5-year work program.
ICAO GMBM	√	√	• Urges ICAO to develop climate change measures consistent with the principles of CBDR-RC. • Proposed Global Market Based Measures (GMBM) may impose inappropriate economic burden on developing countries. • Some developed countries' intention to impose unilateral actions against global consensus hamper international collaboration. • ICAO's GMBM and its implementation must fully align with and support implementation of Paris Agreement. • Unacceptable to use international civil aviation as potential revenue source to finance climate activities in other industrial sectors.			
Part II: General Principles, Technology and Financing Mechanisms, and Compliance						
Equity / CBDR	• Equity and common but differentiated responsibilities (CBDR) must be preserved as general principles and taken into account in all aspects. • CBDR-RC should be fully implemented without any renegotiation or reinterpretation of their principles and provisions.					
Technology Framework	• Emphasize the importance of technology development and transfer. • Strengthen linkage between Technology Mechanism and Financial Mechanism. • Stress the importance and strategic role of Technology Framework. • Strengthen periodic assessment of the Technology Mechanism to provide developing countries effective and adequate support. • Guidance to the Technology Mechanism should be flexible, considering needs of developing countries. • Develop models that reflect the circumstances and context of developing countries.					
Finance	• Rapidly declining flows to finance adaption and lack of response by GEF raise concerns. • Finance negotiations should not be about rewriting the Paris Agreement or dilute support from developed countries. • Funds under COP impose additional unwarranted requirements not agreed under UNFCCC and come developed countries impose criteria unilaterally. • Avoid unilateral eligibility criteria: all developing countries must be eligible to receive financial support for enhanced climate change actions. • Finance is of utmost priority: call for additional, adequate and predictable finance from developed country Parties. • Need further clarity and robust methodologies to track and account for the provision of finance by developed countries. • Oppose use of per capita GDP as criteria for funding developing country Parties. • Accounting for financial resources must provide transparency and consistency - reported information must be comparable and verifiable.					
Implementation and Compliance	• Compliance Mechanism to be facilitative in nature and function in a manner that is *transparent*, *non-adversarial and non-punitive* as per Article 15 of Paris Agreement. • Urgency of accelerating implementation of pre-2020 commitments. • Implementation of Paris Agreement shall reflect CBDR, take into account the respective national capabilities and circumstances of Parties. • Help developing countries to avoid negative economic and social effects in implementation. • Enhance training, public awareness, public participation and access to information.					

Source: Authors' analysis of UNFCCC proceedings

The following terms are used frequently:

Term	Full Name	Date	Location
COP 15	Fifteenth session of the Conference of the Parties to the UNFCCC	7-18 Dec 2009	Copenhagen, Denmark
COP 21	Twenty-first session of the Conference of the Parties to the UNFCCC	30 Nov – 11 Dec 2015	Paris, France
COP 22	Twenty-second session of the Conference of the Parties to the UNFCCC	7-18 Nov 2016	Marrakech, Morocco
COP 23	Twenty-third session of the Conference of the Parties to the UNFCCC	6 Nov 2017 - 17 Nov 2017	Bonn, Germany
COP 24	Twenty-fourth session of the Conference of the Parties to the UNFCCC	2 Dec 2018 - 14 Dec 2018	Katowice, Poland
APA 1	First session of the Ad Hoc Working Group on the Paris Agreement (APA)	16-26 May 2016	Bonn, Germany
APA 1-2	Resumed session of APA	7-14 November 2016	Marrakech, Morocco
APA 1-3	Ad Hoc Working Group on the Paris Agreement (APA)	8 May 2017 - 18 May 2017	Bonn, Germany
APA 1-4	Resumed session of the Ad Hoc Working Group on the Paris Agreement (APA)	7 Nov 2017 - 15 Nov 2017	Bonn, Germany
APA 1-5	Resumed session of the Ad Hoc Working Group on the Paris Agreement (APA)	30 April to 10 May 2018	Bonn, Germany
APA 1-6	Resumed session of the Ad Hoc Working Group on the Paris Agreement (APA)	4 Sep 2018 - 9 Sep 2018	Bangkok, Thailand
APA 1-7	Resumed session of the Ad Hoc Working Group on the Paris Agreement (APA)	2 Dec 2018 - 8 Dec 2018	Katowice, Poland
SBI 44	Forty-fourth session of the Subsidiary Body for Implementation (SBI)	16 - 26 May 2016	Bonn, Germany
SBI 45	Forty-fifth session of the SBI	7 to 14 November 2016	Marrakech, Morocco
SBI 46	Forty-sixth session of the SBI	8 May 2017 - 18 May 2017	Bonn, Germany
SBI 47	Forty-seventh session of the SBI	6 to 15 November 2017	Bonn, Germany
SBI 48	Forty-eighth session of the SBI	30 April to 10 May 2018	Bonn, Germany
SBI 49	Forty-ninth session of the SBI	2 Dec 2018 - 8 Dec 2018	Katowice, Poland
SBSTA 44	44th session of the Subsidiary Body for Scientific and Technological Advice (SBSTA)	16 to 26 May 2016	Bonn, Germany
SBSTA 45	45th session of the SBSTA	7 to 14 November 2016	Marrakech, Morocco
SBSTA 46	46th session of the SBSTA	8 May 2017 - 18 May 2017	Bonn, Germany
SBSTA 47	47th session of the SBSTA	6 Nov 2017 - 15 Nov 2017	Bonn, Germany
SBSTA 48	48th session of the SBSTA	30 April to 10 May 2018	Bonn, Germany
SBSTA 49	49th session of the SBSTA	2 Dec 2018 – 2 Dec 2018	Katowice, Poland
CMP 12	12th session of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol	7 - 18 November 2016	Marrakech, Morocco
CMA 1	First session of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement	7 - 18 Nov 2016	Marrakech, Morocco
HLM-GMBM	High-level meeting on a global market-based measure scheme under ICAO	11 to 13 May 2016	Montreal, Canada
BUR	Biennial Update Report		
CBDR-RC	Common but differentiated responsibilities and respective capabilities		
GCF	Green Climate Facility		
GEF	Global Environment Fund		
ICA	International Consultation and Analysis		
(I)NDC	(Intended) Nationally Determined Contribution		
NAMAs	Nationally Appropriate Mitigation Actions		
Party	A Party to the UNFCCC, Kyoto Protocol or Paris Agreement, as the context requires		

Pre-2020 Action

China's key positions on the Pre-2020 Action include:

1. Post-2020 ambition and action is inextricably linked to Pre-2020 action

The G77 and China think enhanced post-2020 ambition and action are inextricably linked to enhanced pre-2020 ambition and actions. Thus, there is an *urgent* need to enhance pre-2020 action, as well as provide support for finance, technology development transfer, and capacity building (Joint closing plenary of APA 1-5, SBI and SBSTA 48).

2. China has responded actively to decision 1/cp.21: enhanced action prior to 2020

In China's submission in COP 24 on enhanced action prior to 2020, China reported:

1) China officially accepted and ratified the Doha agreement in June, 2014.

2) Submitted its first biennial update report on January 2017 in the ICA process.

3) Progress in implementing NAMAs: As of 2016, China's CO_2 emission per unit GDP decreased 43 percent compared with 2005 levels, non-fossil fuel share of primary energy consumption increased to 13.3 percent, forest coverage increased 32.78 million hectares and forest stock increased by 2.68 billion cubic meters since 2005.

3. Annex 1 Parties 2020 mitigation targets must increase to close gap in mitigation

The G77 and China express great concern that the gap between mitigation targets and trajectories to the 1.5 and 2 degree goals is growing. Enhanced action and ambition is required immediately to achieve the long-term goals set out in the Paris Agreement (G77 and China submission on Pre-2020 Action in COP 24).

Developed countries must lead per their historical responsibilities, including educing emissions and providing support to developing countries (APA 1-3 opening plenary).

Specifically, developed countries should revise their targets to at least 40 percent below 1990 levels by 2020. Also, commitments in the Doha Amendment to the Kyoto Protocol should be fulfilled by developed countries to ensure no undue burden to developing countries in the post-2020 period (G77 and China submission on Pre-2020 Action in COP 24).

4. Gaps exist in finance and other support from developed countries

The G77 and China address the huge gap in promised pre-2020 finance and other means of implementation by the developed countries (G77 and China submission on Pre-2020 Action in COP 24, Joint opening plenary of COP 24, CMP 14, Third part of CMA 1).

A plan on how to scale up finance commitments and to mobilize further resources to reach USD 100 billion per year by 2020 committed by developed countries is needed.

For developing countries, there is an *urgent* need to enhance pre-2020 action, and support in terms of finance, technology development and transfer, and capacity building from developed countries to developing countries, as a solid foundation for post-2020 implementation (G77 and China submission on Pre-2020 Action in COP 24).

Transparency

China's key positions on transparency in Article 13 of the Paris Agreement include:

1. Three principles to support the Enhanced Transparency Framework

At COP 24, G77 and China proposed three principles for Enhanced Transparency Framework for Action and Support (ETF) (Joint opening plenary of COP 24, CMP 14, Third part of CMA 1).

1) No backsliding: Parties should build on their current standard of transparency. ETF to build on and enhance existing transparency mechanism under UNFCCC.

2) Recognize that developing country Parties have different starting points and modalities, procedure and guidelines (MPGs) should have built-in flexibility and allow developing country Parties to self-determine which flexibilities we will apply.

3) Enable improvement over time: ETF should ensure that all Parties improve over time and developing country Parties this will require support.

ETF to facilitate *universal* participation and reflect developing country Parties' different capacities and national circumstances. Article 13.14 of the Paris Agreement clearly stipulates that "support shall be provided to developing countries" for the implementation of the ETF (Joint plenary of APA 1-7, SBI 49 and SBSTA 49).

2. Differentiated information obligations of Parties in transparency framework

China asks to recognize *differentiated obligations* of developed and developing country Parties in the Paris Agreement, and their *differentiated* information requirements. Modalities, procedures and guidelines of the transparency framework should reflect such differentiation accordingly (APA 1 opening plenary, China's submission of APA 1-2).

The G77 and China reiterate that the transparency framework should take into consideration the national circumstances and limited capacities of developing countries.

3. Flexibility should be given to developing countries in a comprehensive manner

The G77 and China stress the relevance of flexibility for developing countries in the modalities, procedures and guidelines to be negotiated (APA 1 closing plenary). China's submissions for APA 1-2 and APA 1-3 states that flexibility should be provided to developing countries in a *comprehensive* manner, including for reporting and review.

The G77 and China highlight that flexibility applies to all aspects of the enhanced transparency framework – reporting, technical expert review, and multilateral consideration – for developing countries in light of their capacities (APA 1-2 opening plenary, APA 1-3 opening plenary).

In APA 1-4, China stresses that during the implementation of the provisions, flexibility should be provided to developing country Parties to follow modalities, procedures and guidelines in an optional manner in the light of their national circumstances and capacity.

4. *Additional, continuous and adequate support is needed for developing countries in transparency-related capacity building*

At the APA 1 opening and closing plenary, the G77 and China stated that support shall be provided to developing countries for implementing Article 13 and for building transparency-related capacity on a continuous basis. China reiterates in submissions to APA 1-2, APA 1-3 and APA 1-4 that increasing capacity of developing countries is key to enhance transparency.

The G77 and China emphasize the inter-linkage of the transparency framework with other support and actions under the Paris Agreement, and coherence among them is necessary (APA1 closing plenary; APA 1-2 closing plenary).

At the COP 22 joint plenary and APA 1-2, the G77 and China stated that more focus on *transparency* of support is warranted as it immediately relates to transparency of actions.

In the opening plenaries of COP 23, the BASIC countries (Brazil, South Africa, India and China), reflecting G77 and China positions, urged developed country Parties to provide *additional, continuous* and *adequate* support to developing countries for enhancing their capabilities on transparency of action and support.

5. Transparency framework shall be based on existing transparency arrangements

At APA 1 opening plenary, the G77 and China stated that modalities, procedures and guidelines under Article 13 should be based on and draw from experiences from *existing* arrangements related to transparency under the UNFCCC and ensure balanced treatment of all areas indicated thereunder.

China restated the transparency framework shall build upon existing transparency arrangements under the UNFCCC, including national communications, biennial reports and biennial update reports, international assessment and review and international consultation and analysis (China's submission to APA 1-2, APA 1-3, APA 1-4). Also, transparency of the Paris Agreement shall build upon arrangements and modalities under the UNFCCC focusing on pre-2020 actions by Parties (APA 1-3).

Further, in its submission to APA 1-3, China proposed the following three steps to be included in the transparency framework:

> 1) *Reporting*: each party shall report information necessary to track progress in implementing and achieving its NDC. Developed countries shall provide information on financial, technology transfer and capacity-building support provided to developing countries; developing countries should also provide information on barriers and constraints, financial, technology transfer and capacity-building support they needed and received.
>
> 2) *Technical expert review*: the information submitted by each Party shall undergo a technical expert review, and the composition of experts should be balanced and representative between developed and developing countries.

3) *Multilateral consideration*: all Parties shall actively participate in multilateral consideration, to share their policies, actions and achievements on climate change and low-carbon development in an encouraging and facilitative manner, and to exchange experience and best practice.

6. *Modalities, procedure and guidelines (MPGs) shall be developed separately for developed and developing country Parties*

In China's submission to APA 1-4 gives two rationales for separately developed MPGs:

1) *Separate MPGs correspond to respective obligations and contributions of developed and developing countries Parties under the Paris Agreement.*

2) Due to some Parties to the UNFCCC may not ratify the Paris Agreement and some may withdraw from the Paris Agreement, new MPGs should be supplementary to MRV provisions under the UNFCCC to ensure information reported by those Parties under the UNFCCC is comparable to others.

7. *Transparency framework to be facilitative, non-intrusive, and non-punitive*

China emphasizes in its submission to APA 1-2 and APA 1-3 that the transparency framework should be implemented in *a facilitative, non-intrusive, non-punitive* manner, respectful of national sovereignty and avoid placing undue burden on Parties.

In APA 1-3, China further states that the transparency framework under the Paris Agreement should be operationalized and applied in a concise, pragmatic and implementable manner.

Capacity Building

China's key positions on capacity building in Article 11 of the Paris Agreement include:

1. *Specific needs, concerns and circumstances of Developing Country Parties should be considered in capacity building*

The G77 and China stated in the SBI 44 opening plenary that they would like to see the composition of the Paris Committee on Capacity Building (PCCB) to be *balanced, equitable* in terms of *geographical representation and gender*, including a wide range of Parties to reflect the diversity of capacity building providers and recipients, and take into account the specific needs, concerns and circumstances of developing country Parties.

China emphasized similar positions in its submission to APA 1-2, in which it stated the Capacity-building Initiative for Transparency (CBIT) should follow a country-driven approach, in line with national circumstances and specific needs of developing countries.

The G77 and China at COP 22 stated that capacity building should be based on and responsive to *national needs* and fostering *country ownership*, and the process must be *participatory, Party-driven and cross-cutting*.

2. International Consultation and Analysis (ICA) should be facilitative and lead to identification of capacity building needs of developing countries

At both SBI 44 Resumed 3rd meeting and SBI 45, SBI 46, the G77 and China stated that ICA should be facilitative and lead to identifying capacity building needs of developing countries to support reporting information in subsequent Biennial Update Reports (BURs).[6]

3. Capacity-building Initiative for Transparency (CBIT) support developing countries

In its submission to APA 1-2, China stated CBIT should provide support developing countries, including:

- Training and facilitating dialogues between international and domestic experts from developing countries.
- Supporting developing countries to implement transparency provisions, which will help developing countries identify their capacity-building needs.
- Encouraging Consultative Group of Experts on National Communications from Parties not included in Annex I to the Convention (CGE) to provide its expertise on MRV to developing countries, and the CGE could assist the CBIT to design capacity-building initiatives.
- Developed countries providing additional financial resources to the GEF to support the operation of the CBIT.

4. Calls for capacity building with the use of the economic models

- G77 and China state building capacity using economic models is integral to capacity building. Necessary capacity and knowledge transfer should accompany their proper use, implementation, and decision-making.
- Minimal work has been undertaken by researchers and international organizations to use modeling tools to inform actions on economic diversification (ED) and just transition (JT) in implementing climate change mitigation policies and actions and sustainable development (SD).

5. Three pivotal capacities must be increased urgently

- Enhanced Human Capacity

1) Develop and create capacity to analyze, develop and implement climate policy; 2) Capacity to develop a baseline of capacities (among public actors and other stakeholders), identify technical gaps and prioritize action areas for capacity building; 3) Promote creation of institutional and human resilience programs; 4) Harness and learn from best practices on institutional knowledge for identifying mitigation actions in

[6] BURs are reports to be submitted by non-Annex I Parties containing updates of national Greenhouse Gas (GHG) inventories, including a national inventory report and information on mitigation actions, needs and support received. BURs provide updates on actions undertaken by a Party to implement the UNFCCC, including its GHG emissions and removals by sinks, and actions to reduce emissions or enhance sinks.

relevant government bodies; 5) Promote gender-base, human rights approaches as tools to achieve inclusive and transformative outcomes; 6) Promote alignment with existing instruments, including the Gender Action Plan and the Local Communities and Indigenous Peoples Platform in developing countries.

- Institutional Arrangements for Communication and Information Sharing

1) Promote specialized dialogue and build awareness on the need for, and benefits of, coordinated action among stakeholders, between key government ministries, climate change policy coordinating bodies, private sector and national focal points; 2) Mainstream and integrate climate change into national and local planning, budgets and development processes, at least up to 2050 horizon; 3) Strengthen links between regional, national and subnational government policies, plans and actions on climate change; 4) Establish processes of public awareness, participation and access to information; 5) Promote knowledge sharing and open communication platforms that enhance public engagement.

- Measuring, Reporting and Verification

1) Support development of systems to track implementation and application of lessons learned, thus enhancing analytical capacity and understanding of policies and actions that work best, and why; 2) Enhance transparency in measuring, reporting and verification systems; 3) Explore potential ways to further enhance monitoring and review effectiveness of capacity building with a view to achieve enhanced transparency.

Nationally Determined Contributions

China's positions on NDCs in Article 4 of the Paris Agreement include:

1. Implementation of NDCs should reflect the principle of CBDR-RC; flexibility should be provided to developing countries

The G77 and China state at APA 1-2 opening plenary that implementation of NDCs should reflect the principle of common but differentiated responsibilities and respective capabilities, in light of different national circumstances. China made the same statements in its submission to APA 1-2, APA 1-3, APA 1-4.

The group reiterates the importance of CBDR-RC in NDCs in COP 24 (Joint opening plenary of COP 24, CMP 14, Third part of CMA 1, APA 1-5), as well as other negotiations (Joint plenary of APA 1-7, SBI 49 and SBSTA 49).

The G77 and China stress that guidance for NDCs should be developed in a flexible manner to accommodate the diversity of NDCs and the national circumstances of developing country Parties (APA 1-2 opening plenary, COP 23 opening plenary).

The group always reiterates that national determination is the fundamental characteristic of NDCs (APA 1-3). In its submission to APA 1-4, China further states that flexibility should be provided to developing country Parties, in particular those with least capacities.

2. NDC scope should include mitigation, adaptation and means of implementation

China's submission to APA 1-2 states that the scope of NDCs is defined in Article 3 of the Paris Agreement, which should include mitigation, adaptation and means of implementation (finance, technology development and transfer, and capacity-building). The NDCs *should not* be mitigation only or mitigation-centric.

G77 and China reiterate the importance of maintaining comprehensive scope of NDCs in China's submission to APA 1-3, Joint plenary of APA 1-7, SBI 49 and SBSTA 49. Specifically, G77 and China recognize NDCs as a *key vehicle* to deliver enhanced action under Paris Agreement and to achieve long-term goals on all issues, including mitigation, adaptation and means of implementation in support to developing countries (APA 1-3).

3. Higher requirements should be applied to developed country Parties in providing information on their NDCs implementation

In its submission to APA 1-2, China advocates more strict information disclosure requirements for developed country Parties. Developed country Parties shall:

- Provide all information related to emission reduction listed in paragraph 14[7] of decision 1/CP.20 and paragraph 27[8] of decision 1/CP.21.
- Provide quantitative and qualitative information regarding providing and mobilizing finance, technology development and transfer and capacity-building support to developing country Parties, including in particular relevant targets, roadmaps and policies.

For developing countries:

- Paragraph 14 is for reference. Specific information on developing country Parties' NDCs should take into account their diversified climate actions, different national circumstances and capacities, and support received.
- Developing countries are encouraged to provide information on costs of their mitigation actions, needs for adaptation actions, barriers in implementing their NDCs and needs for finance, technology and capacity-building support.

[7] Paragraph 14 of Decision 1/CP.20: Agrees that the information to be provided by Parties communicating their intended nationally determined contributions, in order to facilitate clarity, transparency and understanding, may include, as appropriate, inter alia, quantifiable information on the reference point (including, as appropriate, a base year), time frames and/or periods for implementation, scope and coverage, planning processes, assumptions and methodological approaches including those for estimating and accounting for anthropogenic greenhouse gas emissions and, as appropriate, removals, and how the Party considers that its *intended* nationally determined contribution is fair and ambitious, in light of its national circumstances, and how it contributes towards achieving the objective of the Convention as set out in its Article 2.

[8] Paragraph 27 of 1/CP.21: Agrees that the information to be provided by Parties communicating their nationally determined contributions, in order to facilitate clarity, transparency and understanding, may include, as appropriate, inter alia, quantifiable information on the reference point (including, as appropriate, a base year), time frames and/or periods for implementation, scope and coverage, planning processes, assumptions and methodological approaches including those for estimating and accounting for anthropogenic greenhouse gas emissions and, as appropriate, removals, and how the Party considers that its nationally determined contribution is fair and ambitious, in the light of its national circumstances, and how it contributes towards achieving the objective of the Convention as set out in its Article 2.

4. Call for support from developed countries in NDCs

At the opening plenary of the third part of APA 1-3, G77 and China urge developed Parties to provide finance, technology development and transfer and capacity building support to developing country Parties for preparation, communication and implementation their NDCs. China's submits same points to APA 1-3 and opening plenary of APA 1-5.

Further, the G77 and China stress importance of support from developed countries: The extent to which developing country Parties would effectively implement their NDCs will depend on the adequate provision of finance, technology and capacity building support by developed country Parties, recognizing that enhanced support for developing countries will allow for higher ambition in their actions (China's submission to APA 1-3, China's submission to APA 1-4).

5. Call for Public Registry for NDCs

In China's submission on SBI 47, China states that the NDCs public registry is closely related to the SBI Item on a registry for adaptation communication. These two issues could be considered in a comprehensive and holistic manner. Joint consultation between the two items should be convened, without prejudice to the outcomes of the negotiations.

China proposes the public registry of NDCs have the following three functions:

- NDCs communicated by parties, including the adaptation component, should be recorded in the public registry maintained by the secretariat.
- Its function and purpose is to register Parties' NDCs and make them available to the public, enabling Parties and other stakeholders to review NDC documents.
- NDCs registry should respect the integrity of the NDC documents, in order to ensure consistency with "nationally determined" nature of Parties' contributions.

6. Further guidance for NDCs needed

In its submission to APA 1-3, China states that guidance for NDCs should respect the nationally determined nature of Parties' contributions. Such guidance should be concise, feasible, pragmatic and facilitative, providing flexibility to developing country Parties, in particular those with least capacities. China' submission to APA 1-4 reiterates this point.

G77 and China look forward to further guidance for NDCs and for adaptation communication, including as a component of NDCs. Guidance should be developed in a *flexible* manner to accommodate diversity of NDCs, their nationally determined nature, and national circumstances of developing country Parties. In applying guidance for information, developed country Parties to take the lead (Opening plenary of APA 1-5).

The group further explains that guidance shall be developed with respect to the features, information and accounting of NDCs, reflecting the Paris Agreement and the principles under which it was developed (Joint plenary of APA 1-7, SBI 49 and SBSTA 49).

Accounting

China's positions on accounting principles in Articles 4 and 13 of the Paris Agreement include:

1. Modalities for accounting and financial resources to allow for clearer accounting

G77 and China state the accounting work should aim at ensuring transparency, accuracy, completeness, consistency, and comparability of data and provide more clarity on what is being accounted as climate finance, mechanisms and instruments; avoid double counting; and draw from work already undertaken under UNFCCC and lessons learned from National Communications (SBSTA 46 opening plenary).

At opening plenary of APA 1-3, G77 and China reaffirm that modalities for accounting of financial resources by developed country Parties to developing country Parties must aim to provide transparency and consistency. Information must be comparable and verifiable.

2. Guidance for accounting should not be common accounting rules, but should be consistent with the nationally determined nature of Parties' contributions

China advocates that guidance for accounting take into consideration different content of NDCs by all Parties and accommodate various types of NDCs.

The purpose of elaborating guidance for accounting is not to impose detailed common accounting rules or transform Parties' NDCs into a unified form of absolute quantified emissions reductions, but is to develop general and technical guidance for Parties' reference when they are preparing, communicating and implementing their NDCs, with a view to facilitating transparency and understanding (China's submission to APA 1-2).

3. Developed country Parties should lead in applying the guidance for accounting

China states developed country Parties should lead in applying guidance for accounting, in particular avoiding double counting in reducing emissions and providing finance.

In accounting for their mitigation component of NDCs, the key issue is to determine the relation between the emission reduction target and their domestic emissions, carbon sinks and international transferred mitigation outcomes (China's submission to APA 1-2).

4. Flexibility should be provided to developing country Parties in applying guidance

Developing country Parties should be allowed to choose, in a *nationally determined* manner, the sectors and gases covered in their NDCs and specific methodologies on accounting, in line with the content of their NDCs and in light of their national circumstances and capacities (China's submission to APA 1-2).

In APA 1-3 opening plenary and the opening plenary of SBI 46, G77 and China state no developing countries are to be excluded from financial support for their enhanced climate change actions whether they have or have not ratified the Paris Agreement.

Global Stocktake

China's positions on the Global Stocktake (GST) in Article 14 of the Paris Agreement include:

1. Comprehensive and facilitative, Party-driven, transparent, balanced, holistic

The G77 and China advocate that the Global Stocktake shall *be comprehensive and facilitative*, covering *mitigation, adaptation* and the means of *implementation and support*, in light of *equity* and *best available science* (APA 1 opening plenary; SBSTA-IPCC special event on May 18, 2016 at SBI 44; APA 1 closing plenary; APA 1-2 opening plenary; China's submission to APA 1-2; APA 1-3 opening plenary).

China elaborates that GST is to be undertaken in a *facilitative manner*, *consistent with the nationally determined nature of Parties' contributions.* GST should be conducted in a Party-driven, transparent, balanced and holistic manner (China's submission to APA 1-2).

In COP 24, the G77 and China further state that the modalities for GST should ensure that *Parties have control* over the GST process and that GST outputs and outcome are developed within an appropriate timeframe that allows Parties to effectively consider the information inputs for the GST and take stock of the collective progress towards achieving long term goals, thereby having the GST outcome inform Parties with respect to their future climate actions and international cooperation under the UNFCCC and Paris Agreement (Joint opening plenary of COP 24, CMP 14, Third part of CMA 1).

2. GST should be conducted in accordance with CBDR

G77 and China advocate GST should be conducted in accordance with the principles and provisions of the UNFCCC and Paris Agreement, in particular principles of equity and common but differentiated responsibilities. GST should also be conducted in the context of climate justice, sustainable development and best available science.

GST modalities and procedures should consider *differentiated responsibilities* and roles between developed and developing country Parties (China's submission to APA 1-2).

3. GST must be conducted in the light of equity and the best available science

In the opening plenary of APA 1-3, APA 1-5, G77 and China further state GST must be conducted in the light of the equity and the best available science, and continuing to recognize the transparent, comprehensive and facilitative nature of GST.

4. No mandatory approach to increase ambition

The Group strongly insists that the GST process in its role of informing the updating and enhancing Parties actions shall *not* lead to any type of mandatory approach to increase ambition (APA 1-5).

5. Operationalization of equity and scope of GST should also reflect loss and damage and impacts of response measures and economic diversification

G77 and China expect operationalization of equity and the scope of the GST will reflect loss and damage and impacts of response measures and economic diversification.

Adaptation

China's positions on adaptation in Article 7 of the Paris Agreement include:

1. Adaptation continues to be the key priority for developing countries

G77 and China emphasize the importance of adaptation, as developing countries are particularly vulnerable to adverse impacts of climate change (SBSTA 44; APA 1; CMP 12 and CMA 1), especially in context of increasing occurrence and severity of extreme weather events and costs involved (COP 23 mid-term Stocktake session, CMP 13, APA 1-3, CMA 1.4, SB 147, SBSTA 47 and APA 1.4, APA 1-5, SBI and SBSTA 48).

The group reiterates adaptation is of utmost importance to all developing countries (Joint plenary of APA 1-7, SBI 49 and SBSTA 49). Adaptation planning plays an important role in reducing climate vulnerabilities of local communities (SBI 45). Risk and vulnerability assessments are critical in the light of the adverse effects of climate change in existing and planned productive systems (like agriculture) (SBSTA 46 opening plenary).

In COP 24, G77 and China state that adaptation be given a *key* role in line with their challenges; support for preparation of their adaptation communications, for preparation and implementation of national strategies, and for plans and programs in accordance with the *nationally determined* needs of developing countries is critical element of an acceptable outcome (Joint opening plenary of COP 24, CMP 14, Third part of CMA 1).

2. Adaptation guidance shall reflect county-driven nature of adaptation, aim to avoid creating addition burden for developing country Parties, and provide flexibility

The G77 and China advocate that further guidance in relation to adaptation communication should reflect the county-driven nature of adaptation. Guidance shall enhance the adaptive capacity of developing country Parties *without* creating additional burdens (APA 1 closing plenary; APA 1-2 opening plenary; APA 1-2 closing plenary).

Importance of implementing guidance providing flexibility as reflected in the Paris Agreement. Parties need flexibility in order to accommodate their different capacities and circumstances, as well as avoiding generating additional burden for developing countries (APA 1-2 closing plenary).

3. Adaptation Fund crucial for adaptation actions, yet current funding insufficient

G77 and China emphasize that Adaptation Fund plays key role in contributing to implementing adaptation actions of developing countries, especially preparing National Adaptation Plans (NAPs), providing direct access to funding for developing countries, and financing concrete adaptation actions by developing countries (SBSTA 44, COP 22).

Funding remains inadequate, particularly due to slow progress of operationalizing Green Climate Fund (GCF) to secure support for formulation and implementation of NAPs (SBI 44 opening plenary). Current financial resources available for Adaptation Committee (AC) and Least Developed Countries Experts Group (LEG) inadequate to implement activities under NAPs (SBSTA 45 opening plenary; COP 22 plenary). Adaptation finance provided to developing countries remains insufficient (joint plenary of COP 22 and CMP 12).

Thus, G77 and China emphasize the need to scale up adaptation finance, particularly in the context of increasing climate risks faced by developing countries and ensuring the balance between financing for mitigation and adaptation (COP 22 joint plenary).

G77 and China also call for Adaptation Fund to serve the Paris Agreement (COP 23 Opening Plenary, CMP 13, CMA 1-2). In COP 23, G77 and China regret lack of decision stating the Adaptation Fund shall serve the Paris Agreement, particularly taking into account its importance to developing countries and SIDS in particular (COP 23 mid-term Stocktake session, CMP 13, CMA 1.4, SB 147, SBSTA 47 and APA 1.4). G77 and China urge developed countries to provide adequate support to developing countries in meeting cost of their adaptation actions in APA 1-3.

4. Developing countries require urgent and enhanced support to implement NAPs

G77 and China reiterate that developing countries require urgent and enhanced support as they formulate and implement NAPs (SBSTA 45; APA 1 closing plenary; COP 22 joint plenary, SBI 46). Required support includes enhanced access to finance and technical support for the formulation and implementation of NAPs (SBI 45 closing plenary).

5. Ensure party-driven adaptation process and balance with mitigation actions

G77 and China reiterate that balance between adaptation and mitigation should continue to be pursued in the implementation of the Paris Agreement (APA 1-2 opening plenary), and balance between financing for mitigation and adaptation (COP 22 joint plenary).

6. Call for recording adaptation communications in public registry

G77 and China recommend recording adaptation communications in public registry maintained by the UNFCCC Secretariat to record NDCs of Parties (SBI 44, SBI 46).

In SBI 47, China stated purpose of registry is to record and publish documents related to Parties' actions to be implemented in future, including adaptation communications submitted and updated by Parties. Registry should categorize communications by report, by country, by vehicle used for submission, to best organize information available.

BASIC group, G77 and China reiterate importance of global adaptation and adaptation communication as component of NDCs to achieve Paris Agreement goals (COP 23).

China's submission to APA 1-4 provides detailed guidance for adaptation communication:

- Paris Agreement shall be implemented to reflect the principle of equity and common but differentiated responsibilities and respective capabilities, in light of different national circumstances as Parties agreed in Article 2.2 of the Paris Agreement and Article 3.1 of the UNFCCC.

- Support and international cooperation is fundamental for developing country Parties to adapt to climate change and their needs should be fully taken into account.

- Additional burden to be avoided for developing countries in preparing, submitting and updating Adaptation Communication per Article 7 of Paris Agreement.

7. Inter-linkages between NAP and Means of Implementation expected

G77 and China expect to explore inter-linkages between NAPs (item 9) and Means of Implementation (MOIs), particularly for financial resources for planning and implementing adaptation actions, evaluating and determining priorities, and developing country need.

8. Agriculture to be addressed to enhance developing Parties adaptive capacity

China's submission to SBI 48 stresses importance of agricultural issues to improve developing countries adaptive capacity. China proposes modalities for implementation: 1) establish web platform to facilitate the exchange and sharing of knowledge and information; 2) provide financial, technologies and know-how, and capacity-building support; 3) promote technological development and transfer; 4) enhance international and regional cooperation on climate change adaptation in agricultural sector.

Also, China advocates improved agricultural practices on grassland, cropland, livestock and manure management to enhance the resilience of agriculture, and calls for methods and approaches for assessing adaptation, adaptation co-benefits, and resilience.

Loss and Damage (Article 8)

1. Loss and damage provision are critical to developing country Parties

G77 and China state in APA 1 Opening Plenary that the issues of *adaptation and loss and damage* are critically important to developing country Parties. China calls for strengthening Warsaw International Mechanism on Loss and Damage in its 2015 NDC.

In COP 24, G77 and China call for strengthening the information base to understand climate change impacts and loss and damage (Joint opening plenary of COP 24, CMP 14, Third part of CMA 1).

2. "Five-year rolling work plan" is basis for progressing Warsaw International Mechanism for Loss and Damage, with focus on needs and challenges faced by developing countries

G77 and China consider the five-year rolling work plan as the basis for developing corresponding activities. To be meaningful, it must address the needs and challenges faced by developing countries affected by extreme and slow-onset of climate change (COP 22 Joint Plenary). Urge developed country Parties to provide resources to support activities under the five-year rolling work plan (joint plenary of COP 22 and CMP 12).

In COP 24, G77 further stated they are prepared to consider the matter of future governance of the WIM while not prejudging outcomes (Joint opening plenary of COP 24, CMP 14, Third part of CMA 1).

Mitigation and Article 6

China's positions on mitigation in Article 6 of the Paris Agreement include:

1. Emphasis on Adaptation

While G77 and China recognize the urgency of mitigation with leadership by developed countries, adaptation must be emphasized, especially since developing countries are particularly vulnerable to adverse impacts of climate change (APA 1 closing plenary).

2. Ensure balance between mitigation and adaptation

G77 and China reiterate that balance between adaptation and mitigation should continue to be pursued in implementation of the Paris Agreement (APA 1-2 opening plenary), including balance in financing for mitigation and adaptation (COP 22 joint plenary).

China advocates that all elements including mitigation, adaptation, and the means of implementation and support be accessed in a holistic way to ensure the linkage between action and support (China's submission to APA 1-2).

G77 and China reiterate the need to ensure a party-driven process in adaptation and to balance mitigation activities described in the three sub-items of Article 6, namely the guidance on cooperative approaches; the rules, modalities and procedures for the mechanism to contribute to mitigation and support sustainable development established by Article 6, paragraph 4 of the Paris Agreement; and the work programme under the framework for non-market approaches (SBSTA 44 closing plenary; SBSTA 45 opening plenary; SBSTA 45 closing plenary).

3. Scale up finance, technology and capacity building for adaptation and mitigation

G77 and China express that effective mitigation and adaptation actions will depend on access to technology, including development of endogenous technologies by developing countries (COP 22 joint plenary). Enhanced action requires enhanced support in the provision of scaled-up financial resources, technology and capacity building. Action must cover both adaptation and mitigation (COP 22 Closing plenary).

4. Party-driven, coherence and balance among the three sub-items in Article 6

At SBI 44 Opening Plenary, G77 and China expect enhanced actions via strengthening *institutional arrangements* and establishing cooperative mechanism to address negative economic and social consequences of response measures on developing countries.

Article 6 of the Paris Agreement encompasses three components of *equal* importance: guidance on cooperative approaches; rules, modalities and procedures for the mechanism established by Article 6, paragraph 4 of the Paris Agreement, and work programme under the framework for non-market approaches. Work on these must proceed in *a coherent and balanced* manner, without neglecting any component.

In SBI 44 Closing plenary, G77 and China reiterated need to ensure a *party-driven* process as well as *balance* among all three sub-items. Action under Article 6 should preserve national policy space (SBSTA 46 opening plenary).

General Principles, Technology and Financial Support, and Compliance

Equity and CBDR-RC

China's positions on Equity and CBDR-RC in Article 2(2) of the Paris Agreement include:

1. Equity and CBDR-RC preserved as general principles and taken into account

G77 and China emphasize that Paris Agreement provisions and principles, *in particular equity and common but differentiated responsibilities and respective capabilities*, must be preserved (SBSTA 45 opening plenary).

Equity and common but differentiated responsibilities and respective capabilities must be taken into account especially in relation to enhancing the implementation of the UNFCCC, its provisions and principles (COP 22 joint plenary).

2. CBDR-RC should be fully implemented without any renegotiation or reinterpretation of their principles and provisions

BASIC countries aligned with G77 and China reaffirm the Paris Agreement is a hard-won achievement that reflecting equity and common but differentiated responsibilities and respective capabilities, in the light of different national circumstances. "Developed countries must take the lead towards closing the ambition gap so as to avoid transferring the burden to developing countries and from the pre-2020 to the post-2020 period."

They state the Paris Agreement should be carried in a manner that reflects CBDR-RC principle, while continuing to enhance the full implementation of the UNFCCC and its Kyoto Protocol, *without* any renegotiation or reinterpretation of their principles and provisions (COP 23 opening plenary, CMP 13, CMA1-2). Similar statements made at Joint opening plenary of COP 24, CMP 14, Third part of CMA 1.

Technology Framework

China's positions on the Technology Framework in Article 10 of the Paris Agreement include:

1. Importance of technology development and transfer

The G77 and China state that technology development and transfer is a *key* component for developing countries to effectively address climate change (joint plenary of COP 22 and CMP 12). Effective mitigation and adaptation depend on access to technology, including development of endogenous technologies by developing countries (COP 22).

BASIC countries, G77 and China underscore the operationalization of long-term vision on technology development and transfer, as set out in the Paris Agreement. They call for accelerating the work on elaborating the new technology Framework, including its guidance to the Technology Mechanism. (COP 23).

In COP 24, G77 and China state technology development and transfer is vital for the implementation of mitigation and adaptation actions under the Convention and its Paris Agreement (Joint opening plenary of COP 24, CMP 14, Third part of CMA 1).

2. Strengthen linkage between Technology Mechanism and Financial Mechanism

G77 and China state that it is crucial for the Technology Mechanism to strengthen its effective linkages with the Financial Mechanism (COP 22 joint plenary), in practically operational ways to support endeavors to enable concrete and scalable adaptation and mitigation results (Joint opening plenary of COP 24, CMP 14, Third part of CMA 1, SBI 46; SBSTA 46 opening plenary).

3. Emphasize Importance and strategic role of the Technology Framework

China emphasizes the importance of the Technology Framework established under Article 10 of the Paris Agreement to provide overarching guidance to the work of the Technology Mechanism under the Convention.

In SBSTA 44 opening plenary, G77 and China advocate that the Technology Framework can provide *much needed guidance* to the Technology Mechanism in facilitating actions on technology development and transfer under the UNFCCC and Paris Agreement.

The group expects the Technology Framework to facilitate the four working areas identified in decision 1/CP.21, Para. 67[9], as well as other areas, including *establishing linkage with the Financial Mechanism* and *supporting the implementation of NDCs*.

Also, the group thinks the Technology Framework should play a *strategic* role in the implementation of the Paris Agreement (SBSTA 45 opening plenary). They reiterate that the Technology Mechanism will support the *rapid transfer* of technologies to developing countries, helping them innovate and develop their own technologies (COP 22).

4. Periodic assessment of Technology Mechanism to strengthen effective and adequate support

G77 and China state that periodic assessment of the Technology Mechanism should focus on providing developing countries with access to *effective and adequate support* for the development and dissemination of environmentally and socially sound technologies, and facilitate the Technology Mechanism to better serve implementation of the UNFCCC and Paris Agreement (SBI 44 opening plenary).

Assessment of adequacy of support, namely the gap between the support needed by the Technology Mechanism to support the implementation of Paris Agreement on Technology development and transfer, and the scale of the existing support received, is the *core* of the Periodic Assessment and essential to inform future flow of sustainable and enhanced support to enable a concrete outcome in realizing the shared long term Vision on Technology Development and Transfer (Joint plenary of APA 1-7, SBI 49 and SBSTA 49).

[9] The four working areas identified in decision 1/CP.21, Para. 67 are: (a) The undertaking and updating of technology needs assessments, as well as the enhanced implementation of their results, particularly technology action plans and project ideas, through the preparation of bankable projects; (b) The provision of enhanced financial and technical support for the implementation of the results of the technology needs assessments; (c) The assessment of technologies that are ready for transfer; (d) The enhancement of enabling environments for and the addressing of barriers to the development and transfer of socially and environmentally sound technologies.

5. *Guidance to Technology Mechanism to be flexible, balanced, systematic and comprehensive,* consider evolving needs

G77 and China state that guidance to Technology Mechanism should be *flexible, balanced, systematic and comprehensive* to respond to evolving needs of climate technology development and dissemination in developing countries (SBSTA 45 opening plenary).

Technology Framework, as overarching guidance to the Technology Mechanism, must reflect the *special* needs of the developing country Parties, and facilitate the enhanced support provided to them for strengthening cooperative actions on technology development and transfer (Joint plenary of APA 1-7, SBI 49 and SBSTA 49).

6. Elaborate models to reflect circumstances and context of developing countries

On its submission to SBI 46 and SBSTA 46, G77 and China expressed concern over lack of support for modeling that captures the uniqueness of national characteristics, taking into account social and socio-economic factors and specific national priorities, conditions and needs and capacity to use modeling tools. There is no existing work on assessment of cross-border impacts including on the use of modeling tools for developing countries to learn from; and developing countries lack capacity to undertake such assessments.

It is essential to elaborate models that reflect the circumstances and contexts of developing countries, by accommodating variables that capture the uniqueness of national characteristics, taking into account their social and socio-economic factors and specific national priorities, conditions and needs.

Financing

China's positions on finance in Article 9 of the Paris Agreement include:

1. *Rapid decline in flows to finance adaptation, no response from GEF*

In COP 23, the G77 and China express concern that flows to finance adaptation actions through specific multilateral funds are *rapidly declining*. Funds under the guidance of the COP are demanding *additional unwarranted* requirements not agreed under the UNFCCC that place additional burden on developing countries. Several developing countries face *increasing difficulties and conditions* in accessing financial resources from the GEF (COP 23 Opening Plenary, CMP 13, CMP 1-2).

In COP 24, G77 and China expressed *deep concern* over resource shortfall within Green Climate Fund (Joint opening plenary of COP 24, CMP 14, Third part of CMA 1, APA 1-5).

Lack of clarity on resources for the Adaptation Fund and delay in Green Climate Fund's replenishment do not reflect ambition of COP decisions and Paris Agreement (APA 1-5).

G77 and China *greatly concerned* over lack of progress on all finance issues (COP 23 mid-term Stocktake session, CMP 13, CMA 1.4, SB 147, SBSTA 47 and APA 1.4).

2. Finance negotiations should not rewrite Paris Agreement or dilute support

G77 and China state that the Paris Agreement is about enhancing implementation of the UNFCCC and its objectives, and finance negotiations should *not* seek to rewrite the Paris Agreement, nor be an opportunity to dilute developed country obligations to provide new and additional finance, nor to reinterpret established obligations (Joint plenary of APA 1-7, SBI 49 and SBSTA 49).

Obligations to communicate indicative information under Article 9.5 and to report support provided and mobilized under Article 9.7 of the Paris Agreement are core to the Paris Agreement Work Programme and their implementation should *not* be contingent on the availability of resources nor be tied to an imposition of a fragmented view of the Paris Agreement.

3. Avoid unilateral eligibility criteria attempted by some developed countries

In COP 23 opening plenary, BASIC countries, G77 and China express *deepest* concern over attempts by some developed countries to *unilaterally* apply new eligibility criteria for developing countries' access to funding under the GEF and GCF.

G77 and China criticize such criteria as incompatible with guidance from the COP and *a clear departure* from the letter and spirit of the UNFCCC and Paris Agreement. These attempts have no legal basis and are tantamount to renegotiating the Paris Agreement. This may undermine the level of ambition of developing countries in the global effort against climate change (COP 23 Opening Plenary, CMP 13, CMP1-2, APA 1-5).

Instead, the group insists that access to financial resources must be granted to *all* developing county parties. The GCF board has started to *apply categories* of developing country Parties that are neither recognized by the UNFCCC nor within the scope of the governing instrument of the GCF. G77 and China insists this be solved in GCF guidance and reject this behavior (COP 23 mid-term Stocktake session, CMP 13, CMA 1.4, SBI 47, SBSTA 47 and APA 1-4, APA 1-5, SBI and SBSTA 48, Opening Plenary of APA 1-5).

In GOP 24, the G77 and China reiterate deep concern at the lack of response from GEF to communications from parties, insist on the necessity of making all financial resources accessible to all eligible country parties, and object to application of *unilateral* coercive economic measures that affect the capabilities of developing countries to finance their efforts in mitigation and adaptation to climate change (Joint opening plenary of COP 24, CMP 14, Third part of CMA 1).

Specifically, G77 and China oppose exclusion of developing countries from financial support for enhanced climate change actions on basis of whether they ratified the Paris Agreement (SBSTA 45). Adaptation funding shall not exclude enhanced actions of developing country Parties to UNFCCC and non-Parties to Paris Agreement (APA 1-2 closing plenary). Scaled-up financial resources to include all developing Parties taking climate change actions under UNFCCC (Joint plenary of COP 22 and CMP 12, CMA 1).

4. Call for additional, adequate and predictable finance from developed Parties

G77 and China emphasize access to adequate finance, especially from financial-related constituted bodies serving the UNFCCC and stress linkage to both pre-2020 actions and successful preparation for the Paris Agreement (APA 1 closing plenary). Enhanced financial support from developed countries will enable effective implementation and enhanced ambition of developing countries (APA 1-5, SBI and SBSTA 48).

In relation to achieving the international community's US $100 billion goal per year by 2020, G77 and China emphasize the need for additional, adequate and predictable finance and call on developed country Parties to enhance the provision and mobilization of financial support (joint plenary of COP 22 and CMP 12, APA 1-5, SBI and SBSTA 48).

In the opening plenary of COP 23, BASIC countries, G77 and China urged developed countries to honor prior commitments to increase climate finance at least USD 100 billion per annum goal by 2020, to be scaled-up thereafter. In the post-2020 period, they call upon developed countries to provide financial resources to assist developing countries with respect to both mitigation and adaptation in continuation of their existing obligations under the UNFCCC. Further, they call for collaboration among various mechanisms on adaptation, finance, technology and capacity-building, as well as the WIM on loss and damage (See also opening plenary of APA 1-3).

G77 and China expect to discuss long-term finance goals, including a new collective quantified goal beyond the already committed yet insufficient floor of USD 100 billion per year, in line with decision 1/CP.21 (COP 23 opening plenary, CMP 13, CMA1-2).

In COP 24, G77 and China reiterate it is critical to agree process for establishing *a new global goal* on finance. Finance is an *utmost priority* and addressing it in a comprehensive, satisfactory manner will create favorable conditions that could potentially unlock a broad array of related and linked issues under negotiation (Joint opening plenary of COP 24, CMP 14, Third part of CMA 1).

5. Clarity and robust methodologies to track finance by developed countries needed

BASIC, G77 and China emphasize need for clarity and robust methodologies to track and account for finance provided by developed countries (COP 23 opening plenary).

6. Per capita GDP not to be criteria for funding developing country Parties

G77 and China state that the practice of basing funding for developing country Parties on per capita GDP, which has not been decided by the COP, adversely affects some of the most vulnerable developing country Parties (SBI 45 closing plenary).

7. Accounting of financial resources must aim to provide transparency and consistency, reported information must be comparable and verifiable

G77 and China emphasize modalities for accounting for financial resources by developed country Parties to developing country Parties, mobilized through public interventions per Article 9 paragraph 7 of Paris Agreement, must aim to provide transparency and consistency. Information reported must be comparable and verifiable (SBSTA 44 opening and closing plenary, SBSTA 45 opening and closing plenary, SBI 46).

8. Welcome innovative funding mechanisms like REDD+ Results based payment

BASIC countries, G77 and China welcome adoption by the Green Climate Fund of a pilot program for REDD+ results-based payments, noting the need for adequate and predictable support for the implementation of all REDD+ activities. REDD+ must ensure environmental integrity and thus results-based payments shall not be used to offset mitigation commitments by developed countries (COP 23 Opening Plenary).

Implementation and Compliance

China's positions on implementation and compliance in Article 15 of the Paris Agreement include:

1. *Compliance mechanism to be facilitative, transparent, non-adversarial, non-punitive*

G77 and China recognize compliance mechanism's importance to implement Paris Agreement. Mechanism shall be facilitative in nature and function in a transparent, non-adversarial and non-punitive manner per the Paris Agreement, while taking into account respective national capabilities and circumstances of Parties (APA 1 Closing Plenary; APA 1-2 Opening Plenary; APA 1-3 China's Submission; APA 1-3 opening plenary).

2. *Urgency of accelerating implementation of pre-2020 commitments.*

BASIC countries, G77 and China stress urgency of accelerating implementation of pre-2020 commitments and increasing pre-2020 ambition. Thus, Doha Amendment to Kyoto Protocol should enter force without delay (COP 23 opening plenary, CMP 13, CMA 1-2)

3. *The implementation of the Paris Agreement shall reflect CBDR-RC*

At the opening plenary of the third part of APA 1-3, G77 and China reiterate that implementation of Paris Agreement will reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances. Similar statements in China's submission to APA 1-4.

4. *Help developing countries avoid negative economic and social effects*

G77 and China stress the importance of giving full consideration to identifying necessary actions to meet specific needs and concerns of developing country Parties arising from the impact of implementation of response measures and *avoid* the negative economic and social consequences of response measures on developing countries (APA 1-3 opening plenary). Same statement at the opening plenary of SBI 46.

Enhanced actions through strengthening institutional arrangements and establishment of a cooperative mechanism to address the adverse impacts of the implementation of response measures on developing countries needed (APA 1-3 opening plenary).

The group expects the Article 15 committee can take effective facilitation measures to assist parties in implementation (Joint plenary of APA 1-7, SBI 49 and SBSTA 49).

5. *Article 15 committee to operate transparent, facilitative, non-adversarial, non-punitive way*

China's submission to APA 1-4 stresses that the committee under Article 15 of the Paris Agreement shall have dual functions to facilitate implementation and promote compliance. The Committee shall stress the potential linkage to other arrangements under the Paris Agreement, including transparency framework, global stocktake, finance, technology and capacity building mechanisms, and the Article 6 mechanism.

In evaluating implementation and compliance, committee shall take into account: (a) the legal status of relevant provisions concerned, (b) factors such as the cause, type, degree and frequency, (c) the capacity and national circumstances of developing country Parties.

Developing country Parties should be given more *flexibility* in some procedural requirements such as time for the Party concerned to respond or provide information. Assistance could be provided to a developing Party in the process before the committee.

6. Enhance training, public awareness, public participation, access to information

In its submission to SBI 47, G77 and China reaffirmed the importance of exploring ways to enhance training, public awareness, public participation and public access to information to enhance actions in the implementation of the Paris Agreement, and NDCs.

ICAO Global Market-based Measures

- The 38th session of the ICAO Assembly (24 September to 4 October 2013) resolved to develop a global market-based measure (GMBM) scheme for international aviation, requesting the ICAO Council, with the support of States, to progress the matter.

- On 6 April 2016, the Presidents of China and the United States pledged to work together and with other countries to achieve a successful outcome on GMBM under ICAO.

- A High-level Meeting on a Global Market-Based Measure Scheme was held at ICAO Headquarters in Montréal, Canada from 11 to 13 May 2016. At this meeting, China submitted its perspective on GMBM. G77 and China expressed views on ICAO's GMBM in UNFCCC meetings.

- The 39th session of the ICAO Assembly was held 27 September to 4 October 2016. China further expressed reservations to the consolidated statement of continuing ICAO Policies and Practices related to Environmental Protection – Climate Change and on the Consolidated Statement of Continuing ICAO Policies and Practices related to Environmental Protection – Global Market-Based Measure (MBM) scheme.

- Pursuant to the GMBM negotiations, ICAO developed the Carbon Offsetting Scheme for International Aviation (CORSIA), an aviation emissions cap and trade regime that countries volunteer the participation of their aviation industry into starting in 2021, and thereafter becomes mandatory for certain states based on share of global revenue-tonne-kilometers. China is expected to volunteer to participate at the outset of CORSIA starting in 2021 and would, in any event, be mandatorily required to participate starting in 2027 based on its global share of CORSIA's revenue-tonne-kilometer criteria.

- 40th ICAO Assembly convenes in Montreal 24 September to 4 October 2019.

China's key positions on GMBM

1. GMBM and climate measures to accord with principles of equity and CBDR-RC

China states in its submission to the High-level Meeting on a Global Market-Based Measure Scheme in May 2016 that the GMBM resolution to be reached by ICAO shall full accord with the principles of CBDR-RC (ICAO, 2016a).

The differentiation between developed and developing countries should be reflected in *each crucial component* of the resolution.

Also, China and other developing countries urge ICAO to develop *climate* change *measures* in a manner that is consistent with the principles of CBDR and RC, and to align the GMBM with the relevant provisions of the Paris Agreement (ICAO, 2016a).

This position is also reflected in the Joint Statement of Argentina, Brazil, China, India, Panama, Russian and Saudi Arabia on International Aviation and Climate Change, in which they also indicate that the implementation of a GMBM shall not lead to discrimination against the sustainable development of international aviation of countries, in particular developing countries (ICAO, 2016b).

2. *GMBM shall not impose inappropriate economic burdens on developing countries and not distort international trade*

In its submission to ICAO in 2016, China recognizes that the draft proposal presented by the Council President on GMBM may impose inappropriate economic burdens on developing countries where the international aviation market is still maturing (ICAO, 2016a). The same view is reflected in the Joint Statement of Argentina, Brazil, China, India, Panama, Russian and Saudi Arabia on International Aviation and Climate Change (ICAO, 2016b).

G77 and China make this point in the opening plenaries of COP 23: the measures under ICAO and IMO must not place undue burdens on developing countries and not create distortions to international trade.

3. *Developed countries should take the lead in the post-2020 period, commit and implement absolute quantified aviation emission reduction targets*

China states in its submission to ICAO that developed countries should take the lead in the post-2020 period, by committing and implementing more ambitious*, absolute* quantified aviation emission reduction targets, while developing countries enhance their efforts to develop sustainable aviation (ICAO, 2016a).

4. *Carbon neutral growth should not be based simply on incremental emissions from civil aviation*

China's submission to 39th ICAO Assembly states the current objective of carbon neutral growth by 2020 is *short of scientific justification, fairness and feasibility*.

Given that developed countries have reached the peak of emissions from their international aviation or have limited further growth in international aviation, whereas developing countries have not fully developed their international air transport, an objective based on incremental emission from international aviation fails to explicitly require developed countries to lead in significant emission reduction and to leave adequate space for development and emissions by developing countries, thus constituting de facto prejudice against developing countries in their future growth of international air transport (ICAO, 2016c).

5. *ICAO lacks mandate to develop compulsory standards/principles for emission units or to artificially restrict emission units in international aviation*

China's submission to the 39th ICAO Assembly notes that, while its purpose is to develop principles and techniques for international air navigation and foster development of international air transport, ICAO lacks mandate to develop compulsory standards/principles for emission units.

Moreover, the practice of artificially restricting the range of emission units available for international aviation will most likely *push up the cost of emission reduction* and provoke *unfair* competition in the international aviation industry.

The Council has yet to finalize the process of elaboration and approval of emission unit criteria. States cannot approve or commit to compliance before reviewing criteria (ICAO, 2016c).

6. *Multilateral solutions should be employed*

G77 and China reiterate the importance of multilateral solutions when addressing emissions from fuel used for international civil aviation and maritime transport, taking into account the principles and provisions of the UNFCCC, not unilateral measures (SBSTA 46 opening plenary).

7. *Unilateral acts by certain developed countries hamper international collaboration*

China notes with concern the reluctance of some developed countries lead in reducing their international aviation emissions to leave room for growth by developing countries, and certain developed countries imposing unilateral actions on aviation emissions against global consensus that will hamper international collaboration to limit and reduce aviation emissions (ICAO, 2016a).

G77 and China make similar statements at UNFCCC regarding supporting multilateral solutions when addressing emissions from fuel used for international aviation and maritime transport, while taking into account the principles and provisions of the UNFCCC, not on the basis of unilateral measures (SBSTA 44 opening and closing plenary; SBSTA 45 opening and closing plenary).

8. *ICAO GMBM should be fully aligned with implementation of Paris Agreement*

China and six other countries concur that the GMBM scheme and its implementation must be fully aligned with and support the implementation of the Paris Agreement, with a view to avoid possible incoherence between two intergovernmental organizations under the United Nations. The technical work being undertaken by ICAO should be aligned with the principles and provisions of the Paris Agreement (Joint Statement of Argentina, Brazil, China, India, Panama, Russian and Saudi Arabia on International Aviation and Climate Change (2016)).

G77 and China expect efforts to follow parallel tracks, specifically IMO and ICAO to complement and support UNFCCC, and not to conflict with or distort climate discussions. Parallel discussion at IMO and ICAO must remain faithful and consistent with UNFCCC, Kyoto Protocol and Paris Agreement, conforming to their key principles (Joint closing plenary of APA 1-5, SBI, SBSTA 48).

G77 reiterated these concerns at the opening plenary of SBSTA 48, stressing ICAO and IMO must reflect the principles of the UNFCCC and Paris Agreement, and secure adequate means for developing countries to implement policies in the international civil aviation and maritime sectors.

9. *Paris Agreement market mechanism to be applied to ICAO GMBM*

2016 Joint Statement by China and six countries states UNFCCC mechanism credits should be automatically eligible for ICAO GMBM and given preference.

10. *Aviation not to subsidize other sectors*

Using international civil aviation as a potential source of revenue to finance climate activities in other sectors is unacceptable (Joint Statement of Argentina, Brazil, China, India, Panama, Russian Federation and Saudi Arabia on International Aviation and Climate Change (2016)).

11. Climate Policy as Foreign Relations

China's positions in the international climate negotiations have evolved since the Kyoto Protocol to the Paris Agreement. During earlier rounds of negotiation, China justified its positions on the grounds that it is a developing country that should focus on development, and that developed countries must take the lead in reducing its greenhouse gas emissions. Now, although it retains its developing country status under the UNFCCC and continues to insist that developed countries must act most aggressively in reducing emissions, China now recognizes that it must take a leading role among global actors in actively seeking to reduce its emissions. As reflected in its NDC, which is perhaps the strongest statement to date of China's pledge to the international community of its actions on climate change, China expects to increasingly focus on climate change as a cornerstone of its international relations.

This chapter explores possible reasons why China's positions have evolved in the international negotiations, considering both broader international relations and climate-specific factors.

China's Foreign Relations Objectives

Chinese and foreign policymakers and academics debate China's objectives and decision-making process in its increasingly active engagements with the international community on global issues. The realist view of state competition holds that China's participation in the international system, like all other great states, is motivated by the pursuit power, wealth and ultimately hegemony (Mearsheimer, 2014: 12-22). An alternative view contends that shared culture or the erosion thereof determines the viability of the international system, and that the integration of emerging countries into the international order, such as China's adoption of market-based economic principles, is evidence that China is adapting to the core principles of the international system, albeit perhaps selectively (Buzan, 2010), and primarily if not exclusively for utilitarian reasons (Kent, 2007: 242-243). The constructivist school views China's efforts to integrate with the international system as transformative, resulting in China ultimately becoming a status quo power in the process (Johnston, 2008). A fourth view advanced by Chinese scholars explains that China's engagement with the international system is not as a unitary rational actor, but rather determined by the aggregate of Chinese domestic stakeholders and their myriad sometimes competing interests; yet China's engagement influences the international status quo due to its sheer cultural, economic and political importance (Zhang, 2002).

Each of these theories offers insight into how China's climate change policies relate to its foreign relations objectives. China's climate diplomacy is migrating from the domestic stakeholder viewpoint towards the realist view. In domestic policy settings, Chapter 6's cluster analysis is suggestive of the stakeholder view espoused by Chinese academics explaining state behavior. Yet, evidence increasingly points to a more unitary approach, consistent with a realist viewpoint, particularly when China's top leaders champion climate as an exercise in foreign relations.

China's foreign policy is aimed to secure international recognition of its status as a global power and its leadership in international governance. China's initiatives in addressing climate change place it on an equal footing in terms of effort with developed countries, and more broadly establish its role in the international system as an essential party among major powers. China's efforts are also designed to maintain its relations among G-77 countries, its traditional negotiating alliance in climate negotiations, as both a leader by example and as a provider of assistance. Moreover, China's climate policies serve to advance a broader economic agenda supporting Chinese companies trading abroad, revealing how it goes about achieving complementary political and economic objectives in the energy, environmental, and climate spheres.

China's Global Role and Climate Change

Since it's founding, modern China sought to ally itself with other developing countries liberated from colonialism. Rejecting the bi-polar political order dominated by the United States and the former Soviet Union, China set out to define its own role through the non-aligned movement, an alliance grounded in the common experience it shares with other developing countries. In 1954, China's Premier Zhou Enlai enunciated the "Five Principles of Peaceful Coexistence," which would be adopted as the foundation of the non-aligned movement by leaders representing over half the world's population at the Afro-Asian People's Solidarity Conference convened in Bandung, Indonesia the following year (Brautigam 2009: 30):

- Mutual respect for each other's territorial integrity and sovereignty;
- Mutual non-aggression;
- Mutual non-interference in domestic affairs;
- Equality and mutual benefit; and
- Peaceful co-existence.

The Five Principles continue to serve as the foundation of China's foreign policy. China's approach to foreign aid, and economic and technological cooperation with developing countries, are based on the Five Principles. As the world's most populous and among the most institutionally capable of the developing countries, China uses these principles to position itself as a leading voice for the concerns of the developing world.

On most issues, China's population and resources have enhanced China's efforts in advocating for the developing world. However, China's own development and greenhouse gas emissions trajectory threaten to undermine its role as a voice for the developing world. Since the 2000's, China's emissions began to rapidly increase, transforming its profile from a country emitting roughly the global average per person, to that of an industrial economy.

China's economic growth places it among other large or fast-growing non-OECD economies, specifically Brazil, Russia, India, and South Africa, known as the BRICS countries. China together with the other BRICS account for greater than 42 percent of the world's population and almost 24 percent of global GDP in 2018 (International Monetary Fund, 2018).

Among the BRICS, China is the dominant country. China accounts for two thirds of the aggregate GDP of all BRICS countries. China's GDP on both an absolute and per capita basis is five times larger than that of India, the next largest BRICS country by GDP, with comparable population. While its per capita GDP is similar to that of the other BRICS, China's economy is five to 36 times that of the other BRICS.

Most importantly, however, China's greenhouse gas emissions, both in absolute magnitude and on a per capita basis, exceed that of the vast majority of other developing countries. For example, China's emissions at 9.0 tonnes per person are four times that of India (2.3 tonnes), arguably its most comparable developing country peer in terms of population and economy.

When compared to the much broader group of developing countries, however, the differences between China and the rest of the G-77 become much more stark. China's carbon dioxide emissions of 9.0 tonnes per person are 25 percent greater than the global average of 7.2 tonnes per person, and many more times those of the poorest and most vulnerable developing countries. Relative to non-OECD countries excluding China and the other BRICS, China's emissions are almost double (88 percent) on a per capita basis.

Table 7: China Compared to BRICS and Other Countries

	GDP US$ 2018 (millions)	GDP US$ 2018 per capita	Population 2015	Greenhouse Gas Emissions Territorial Basis 2015	
				Tonnes CO_2/Year	Tonnes CO_2/Person
China	13,457,270	$9,633	1,397,029,000	12,586	9.0
India	2,689,990	$2,016	1,309,054,000	3,044	2.3
Brazil	1,909,390	$9,127	205,962,000	1,959	9.5
Russia	1,576,490	$10,951	143,888,000	2,706	18.8
South Africa	376,679	$6,560	55,291,000	535	9.7
OECD				19,008	12.5
United States				6,285	19.6
European Union (28)				4,374	8.5
Non-OECD				34,172	5.8
Non-OECD w/o China				21,587	4.8
Non-OECD w/o BRICS				13,342	4.8
Global				53,180	7.2

Data Sources: IMF; UN Population Statistics; C-Roads.

China's rising emissions inevitably will have repercussions for it relations in the United Nations and other international fora, especially in relation to countries especially vulnerable to climate change. China's development and emissions trajectory puts it in conflict with the interests of the vast majority of other developing countries that negotiate under the G77 plus China umbrella at the UNFCCC. As countries increasingly experience the impacts of climate change on their populations and natural resources, particularly water and agriculture, China's emissions could divide it from its traditional developing country partners.

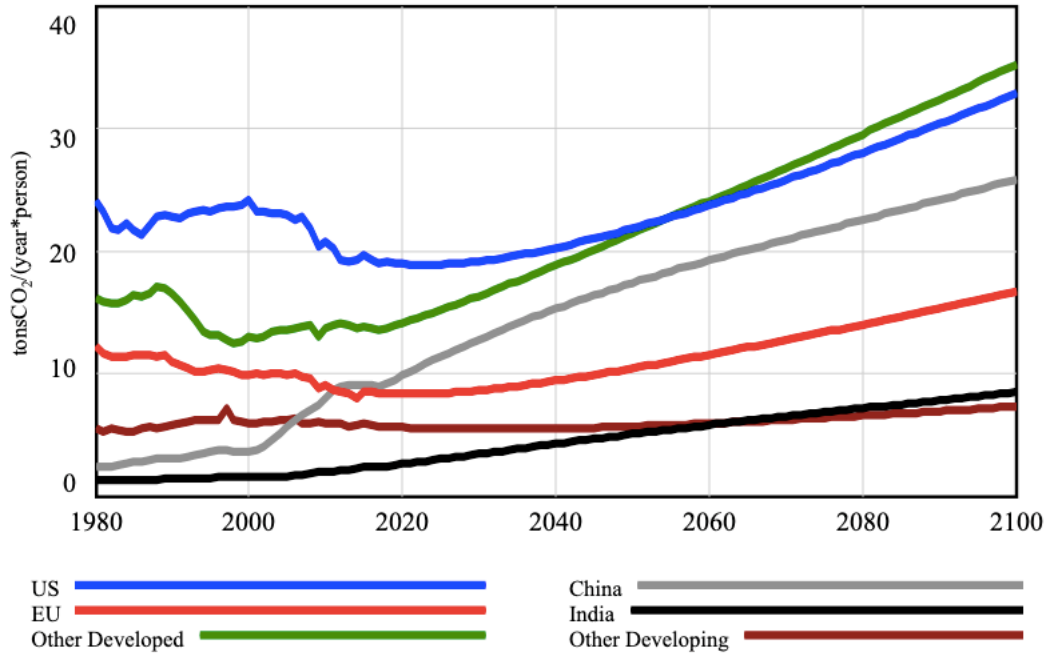
China's emissions profile has already evolved to the point that its peer group is other industrialized countries. In 2008 China surpassed the United States as the world's largest emitter of CO_2 on an annual basis. Becoming the world's largest emitter in absolute terms drew heightened attention to China's emissions profile, and China's emissions weigh heavily with the least developed countries and small island developing states who are most affected by greenhouse gas emissions, regardless of their source.

China has long argued that absolute emissions statistics fail to take its large population and developing status into account as reflected by its lower historical emissions. However, China's current emissions and future trajectory place it squarely among the European Union and United States as peer countries, even on a per capita or historical basis. China's 9.0 tonnes per person in 2015 already surpasses the European Union's 8.5 tonnes per person, and is rapidly approaching the OECD average of 12.5 tonnes per person. If China's population stabilizes as is expected, and its emissions continue unchecked, China's emissions will approach 20 tonnes per person by mid-century, placing it firmly among large emitting developed country emissions on a per capita basis, and significantly in excess of the emissions of numerous OECD countries.

China's rapidly increasing emissions is driven by it's extraordinary wealth generation and the resulting change in lifestyles, as well as the challenges China faces in improving inefficiency in its energy complex. It reveals the urgent need for China to take aggressive action on climate to preserve its traditional negotiation alliances as well as protect the global environment. China's per capita emissions already exceed those of the European Union, and are trending towards its primary competitor in the climate negotiations and in international relations – the United States. These scenarios forecast over multiple

decades, too long a period to be precise, and represent business-as-usual "no policy" scenarios and thus do not take account Paris Agreement pledges. Yet these projections strongly indicate China's and other countries' emissions paths without immediate action being taken.

Figure 38: Per Capita Greenhouse Gas Emissions Business-As-Usual Scenario



Source: C-Roads, 6 Region Reference Scenario (RCP 8.5), December 31, 2018.

China's emissions path undermines its historical arguments that the western world is primarily responsible for global greenhouse gas emissions. If China's emissions continue unabated, within the next twenty years China becomes the largest cumulative emitter of the industrial era. Thus, at China's current rate of CO_2 emissions growth, by 2040 China will have surpassed all other countries in CO_2 emissions since the industrial era. Because China already accounts for roughly 30 percent of global emissions annually, twice that of United States, this outcome is inevitable.

Given that countries negotiate the terms of future climate agreements five to ten years in advance, negotiators necessarily consider near-term future emissions trajectories. Thus, China's ability to preserve the arguments that responsibility lies primarily with the developed world for damage to the climate greatly depends on its taking aggressive action now. China's changing emissions profile has implications for the way it negotiates with G77 countries, and its contribution to overall climate change could impact its traditional foreign policy alliances beyond the climate negotiations.

Given China's changing emissions profile, Chinese government officials and academics have argued that as manufacturer of products to the world, China's territorial emissions overstate its actual emissions. Accordingly, a more appropriate measure would be based on national consumption. This argument requires changing the commonly accepted accounting approach upon which global emissions have been calculated, and would do nothing to solve the underlying problem. Because it does nothing to address climate change, developing countries most at risk by climate change are likely to find it unpersuasive.

The argument is also flawed in at least two other respects. China is a leading importer of raw materials, which have significant environmental impacts that are not accounted for in China's territorial emissions profile. China's demand for raw resources has been cited as a key driver for deforestation and planting of palm oil and biofuel crops in Southeast Asia (World Watch Institute, 2017). The activities of Chinese

companies have raised concerns over their treatment of the local environment in Africa, the impacts of which are externalized to local communities (See Brautigam 2009). China's demand for meat and soy products is contributing to fueling the destruction and degradation of the Amazonian rain forest, helping push it to a tipping point beyond which the planet could lose its single most important terrestrial carbon sink and the supplier of rainwater to the South American and African continents (Brown, 2009). China alone accounts for over 40 percent of the emissions caused by Brazilian soybean exports (Karstensen et al., 2013). If China's emissions were accounted for on a consumption basis, and if such calculation was performed on a life cycle basis across global supply chains, China would be required to account for a sizable portion of other country's emissions associated with its own imports of raw materials and other inputs.

Finally, even changing the accounting method does not significantly alter China's emissions profile. Measured by consumption, China's carbon dioxide emissions from fossil fuels on both an absolute and per capita basis only would reduce roughly 11 percent (authors' calculations based on 2015 fossil fuel data from the Global Carbon Project). Significantly, China's government is attempting to increase consumption in order to stabilize its own economy and shield it from external risks associated with its dependence on exports. Thus, even under new accounting rules China's emissions are still higher than the vast majority of other developing countries, and will continue to grow due to China's rapidly increasing domestic consumption. Thus, at best, this argument serves to delay what must be done to prevent dangerous climate change, when there is no longer time for delay.

The OECD, China and other countries must all reduce their emissions by at least 85 percent or greater by mid-century and eventually maintain negative emissions to prevent dangerous climate change. Because China accounts for a third of global emissions, it must reduce its emissions by these amounts to achieve global climate goals. Whatever equitable arguments may have applied in the past, the equities now clearly support the positions of the most vulnerable countries - the least developed countries and small island developing states - that must see action by all major emitters including China if they are to have the opportunity to continue to develop or, in the case of many of the most vulnerable, survive.

China's Bilateral Climate Agreements and Trade

The Xi-Li Administration has adopted climate change as a major platform on which to advance China's foreign policy agenda and assume a leading role in international governance. In doing so, the Chinese government is transforming a potential liability to a political advantage. President Xi and Premier Li began making public statements on climate change, emphasizing it is a priority for China, commencing with the preparation for the negotiation of the Paris Agreement at COP 21 (30 November - 11 December 2015):

- In June 2014 in London, China and the United Kingdom issued a joint climate change statement pledging to intensify their bilateral policy dialogue and undertake practical collaboration through the China-UK Working Group on Climate Change.

- President Xi's September 2014 visit to India to promote China-India bilateral cooperation resulted in the *Joint Statement between the Republic of India and the People's Republic of China on Building a Closer Developmental Partnership*. It states “The two sides believe that the 21st century should be marked by peace, security, development and cooperation. As developing countries, India and China have common interests on several issues of global importance like climate change, Doha Development Round of WTO, energy and food security, reform of the international financial institutions and global governance…” (Joint Statement, Paragraph 21).

- In October 2014, Premier Li Keqiang and Germany's Chancellor Merkel signed the *Action Framework for German-Chinese Cooperation on Shaping Innovation Together*.

- President Xi's November 2014 received President Obama in Beijing announcing the *U.S.-China Climate Change Accord* which calls for cooperation across a wide range of technologies including energy-efficient buildings, smart grid, electric vehicles, carbon capture and storage (CCS) and other technologies (The White House, 2014).

- China's announced during the COP 20 meetings in December 2014 in Lima that it will establish its own bilateral South-South climate fund.

- At Premier Li's May 2015 summit with Prime Minister Modi in Beijing, the two countries issued the *Joint Statement on Climate Change between the Government of the Republic of India and the Government of the People's Republic of China*, promoting bilateral partnership on climate change, reaffirming their commitment to engage through the UNFCCC process, and further strengthening practical bilateral cooperation, including in clean energy technologies, energy conservation, energy efficiency, renewable energy, sustainable transportation including electric vehicles, low-carbon urbanization and adaptation.

- In May 2015 in Brasilia, China and Brazil issued a *Joint Statement on Climate Change* between the two governments recognizing the importance of their cooperation and coordination on climate change in the context of the China-Brazil Global Strategic Partnership and through the China-Brazil High Level Coordination and Cooperation Committee, in such areas as renewable energy, forest sinks, energy conservation, energy efficiency, adaptation, and low-carbon economy.

- In June 2015 in Brussels, China and the European Union issued the *EU-China Joint Statement on Climate Change*, agreeing to cooperate in developing a cost-effective low-carbon economy while maintaining robust economic growth, intensify bilateral and multilateral dialogue, and continue cooperation on various technologies and policies.

- In June 2015, the same day China submitted its *Enhanced Actions on Climate Change China's Intended Nationally Determined Contributions*, Premier Li met with the President of France in Paris where he emphasized that China supports France in hosting COP 21, and will promote a positive outcome at the conference.

- President Xi's September 2015 announcement in the United States that China will establish a national carbon emission trading system and committed $3.1 billion to establish a bilateral South-South climate fund to assist developing countries.

- In September 2015, President Xi attended the Leaders Working Lunch on Climate Change of the United Nations in New York, where he pledged that China will seek to further intensify control over its greenhouse gas emissions and renewed China's 2009 pledge announced before the Copenhagen climate summit to seek to reduce its carbon intensity by 40 to 45 percent by 2020, compared to 2005 levels. President Xi also stressed that China is willing to continue taking international responsibilities consistent with its own national conditions, development stage and capability, and China is willing to cooperate with countries around the world to deal with climate change in the process of implementing its development agenda.

- In November 2015, President Xi hosted the President of France in Beijing where both countries pledged to cooperate on technology development and transfer to support solutions to climate mitigation and adaptation, support countries vulnerable to climate change in their adaptation efforts, and stated that country NDCs should be reviewed and evaluated every five years in a transparent process.

Since immediately prior to the Paris COP, China has signed bilateral and multilateral agreements with over 50 countries containing provisions calling for cooperation on climate change.

Combining Climate and Commercial Opportunity

Significantly, the bilateral climate declarations between China and each of Brazil, the European Union, Germany, India, the United Kingdom and the United States as well as the agreements signed after the Paris COP all promote cooperation to secure co-benefits of actions on climate, principally investment and trade opportunities, and technology development. For example, China's Joint Statement with Brazil pledges "to foster cooperation and enhance their knowledge on photovoltaic panels and cells industry and explore business opportunities in this area, including mutual exchange of policy, planning, technology and standards, testing and certification and personnel training, and to promote investment projects and the establishment of related production facilities in Brazil by solar energy enterprises from China." This strongly suggests that climate change will be an important vehicle for China's diplomats to advance commercial interests as well as environmental goals.

China's bilateral agreements with developed countries presents an alternative to multilateral assistance because China may be unwilling to receive assistance from UNFCCC institutions as it seeks to establish its role as a "donor" country. To accept UNFCCC assistance would put China in competition with other developing countries it is seeking to assist. In contrast, developing commercial opportunities through bilateral agreements does not pose such conflict.

China has also used climate change to advance its scientific and geographic data gathering activities in the climate-sensitive polar regions for natural resources exploration that may support commercial opportunities as a co-benefit. In 2014, following a decade of lower level officials and scientists acknowledging such a goal, President Xi announced China would soon "be joining the ranks of the polar great powers," a nation capable of projecting maritime power from pole to pole (Brady, 2017: 3). For China, the polar regions present both military and economic opportunities, which will be enhanced due to climate change: expanded shipping and air routes, access to fossil energy and mineral resources, opportunities for tourism, and scientific and military bases (Brady, 2017: 256). China's three-step strategy to pursue these objectives, as outlined by the State Oceanic Administration in October 2008, first involves expanding its knowledge of Arctic and Antarctic oil, natural gas and other resources and the impact of climate change on the region; expanding its presence in the polar regions, especially through scientific activities; and ultimately establishing its role among nations in polar governance (Brady, 2017: 221). Climate change research thus provides both an opportunity to gather information and cover for pursuing commercial and geopolitical objectives. China acknowledged its use of climate for these purposes its *2014 Annual Report on Polar Policy Research*, which explained climate change research is a funding priority for polar scientific funding because it engenders "low political sensitivity" and helps "ease the suspicion and resistance of the major powers against China and make them more supportive and cooperative towards China’s polar activities" (Brady, 2017: 35).

China's Institution Building

Climate change and climate finance provides China with a platform on which to expand its efforts to build international institutions. From China's gradual yet remarkable evolution from isolation to active engagement with the international community, China's efforts to reshape the international order have reached a milestone in that it no longer merely participates in international organizations, it is establishing new ones that it controls or strongly influences.

In the mid-2010s, China established the Silk Road Fund, a state-owned investment fund of the Chinese government, and led the international community in establishing the Asian Infrastructure Investment Bank (AIIB), both based in Beijing. The Silk Road Fund is dedicated to supporting China's Belt and Road Initiative announced in 2013, the stated goal of which is to promote the economic prosperity of Asian countries along the land and maritime routes comprising the ancient Silk Road. The strategy aims to secure China's supply of energy, ensuring geopolitical stability along its borders, and supports domestic growth by redeploying its excess productive capacity to Asia and beyond to support their development.

Reminiscent of Japan's Greater East Asia Co-Prosperity Sphere, the strategy signals China's intentions to play an expanded role in Eurasia.

China's multilateral institution building efforts are undoubtedly one of the most important developments in its engagement with the international community. Climate and development themes play an especially important role in these efforts. China led a group of over 50 founding countries in establishing the AIIB, a multilateral bank that will focus on supporting infrastructure development in the Asia-Pacific region. Based in Beijing, the AIIB executes infrastructure projects in various fields including energy and power, transportation and telecommunications, rural infrastructure and agricultural development, water supply and sanitation, environmental protection, and urban development (AIIB, 2017). Although the AIIB is governed by an international board comprised of its government shareholders, its achievement represents the maturation of China's foreign policy in securing its role in international governance, as well as shifting the balance of influence by establishing alternative institutions in which China's voting privileges, control over agendas and implementation are commensurate with its stature in the global economy.

China has led developing countries in building their own institutions to address climate, development and other common challenges. The BRICS group comprised of China, Brazil, Russia, India and South Africa established its own development bank, the BRICS New Development Bank based in Shanghai. The BRICS Contingency Reserve Arrangement and the Chiang Mai Initiative Multilateralization, both established in 2014, offer crisis liquidity to their members, as an alternative to the International Monetary Fund. In the area of defense, China sponsors the Shanghai Cooperation Council that acts as a forum for convening discussions on political, economic and military matters among Eurasian countries. China is also increasing its participation in the Conference on Interaction and Confidence-Building Measures in Asia, whose membership is more broadly inclusive across Asia, as a possible platform for advancing the Belt and Road Initiative and other policies (Heilmann et al., 2014).

The BRICS New Development Bank, Silk Road Fund and the AIIB expand upon China's long-standing practice of providing an alternative to the western development model exemplified by the Bretton Woods system, which China itself joined in 1980, replacing Taiwan. Unlike the World Bank, which focused on development, and the International Monetary Fund, which focuses on monetary and macroeconomic policy, and condition the provision of financial support on meeting project-specific social and environmental safeguards and embracing their economic policies, China's bilateral assistance to other countries imposes no such conditions. China and other developing countries commonly regard World Bank and IMF conditions as interference motivated by political objectives. Thus, China's support emphasizing investment in infrastructure without such policy conditions is particularly attractive to developing countries.

Although Chinese aid carries fewer conditions than assistance from other donors, China imposes at least one requirement - recipients must accept the One-China principle and withdraw recognition of Taiwan. Thus, while refraining from imposing conditions that constrain recipients, China's aid policies have profound geo-political ramifications. China's bilateral aid policies allegedly secure votes among developing countries in the United Nations General Assembly, and maintain China's influence among the over 130 G-77 countries in international negotiations. During the 2010 to 2014 period, China provided development assistance to over 135 countries, almost two third of which are located in Asia or Africa (AidData, 2017). For example, China provides aid to every single sub-Saharan African country that accepts the One-China policy (Brautigam 2009: 278), a key block of countries critical to China in the United Nations.

China's South-South Climate Initiatives

China's evolution of leadership is especially significant as a donor country assisting G-77 members with mitigation and adaptation efforts. In November 2015, China's Special Climate Change Envoy and lead negotiator Xie Zhenhua emphasized China's focus on assisting other developing countries in stating, "Climate change adaptation will be at the center of our future cooperation with other developing nations." Priorities include strengthening developing countries' early warning systems to enable them to prevent natural disasters and cope with extreme weather events (Liu, 2015).

The MEE leads China's South-South cooperation with respect to climate change. China's climate assistance builds on its broader foreign assistance programs. As of 2018, China has signed memorandums of understanding with 30 developing countries and donated materials to them to address climate change, and the Ministry of Commerce has offered technical assistance and material aid to more than 80 countries for low-carbon, agricultural, and soil and water conservation technologies (Ministry of Ecology and Environment, 2018). At the end of 2016, China announced the launch of its South-South Climate Cooperation Fund pledging RMB 20 billion yuan, and launched the Ten, Hundred, Thousand Project, launching 10 low-carbon demonstration zones, 100 mitigation and adaptation projects, and cooperation projects providing 1,000 people training in developing countries (China's Policies and Action for Addressing Climate Change 2016). The South-South Cooperation Fund has not resulted in the establishment of a formal organization, however budget has been allocated, which is disbursed primarily on a bilateral basis with the support of the MEE's Climate Change Department and the NCSC. Some of these funds are disbursed through United Nations organizations (Personal communications, November 2018).

China's bilateral South-South assistance is perhaps the most concrete example of how China is engaging climate change issues beyond its borders and redefining the way in which China relates to and helps its developing country partners. How specific countries and projects will be chosen to receive funding, the extent to which bilateral funding adheres to international safeguards for social and environmental impacts, and whether China will seek to achieve subsidiary objectives such as promoting Chinese companies as solutions providers as suggested by China's bilateral climate cooperation agreements, will shape the specific nature of China's climate diplomacy.

Through government to government assistance coupled with commercial projects, China is seeking to expand its influence abroad. China has long been a leading investor in developing countries, particularly in Africa. As noted above, China's leadership in establishing the AIIB based in Beijing institutionalizes its role in development assistance on a multi-lateral basis. Further, China's Ministry of Science and Technology has established a South-South cooperation center through which Chinese enterprises assist other developing countries by facilitating their adoption of low-carbon emissions technology in collaborative relationships, thereby mobilizing China's commercial sector resources in international climate efforts.

Climate change is integrated with China's broader foreign policy engagements with respect to G-77 countries that are the core of its climate negotiations alliance, especially in the context of China's Belt and Road Initiative. According to the *Vision and Actions on Jointly Building Silk Road Economic Belt and 21st-Century Maritime Silk Road* issued in March 2015, the Belt and Road Initiative contemplates joint actions on climate change. According to the document, “We should promote ecological progress in conducting investment and trade, increase cooperation in conserving the eco-environment, protect biodiversity, tackle climate change, and join hands to make the Silk Road an Environment-friendly one.” More specifically, “efforts should be made to promote green and low-carbon infrastructure construction and operation management, taking into full account the impact of climate change."

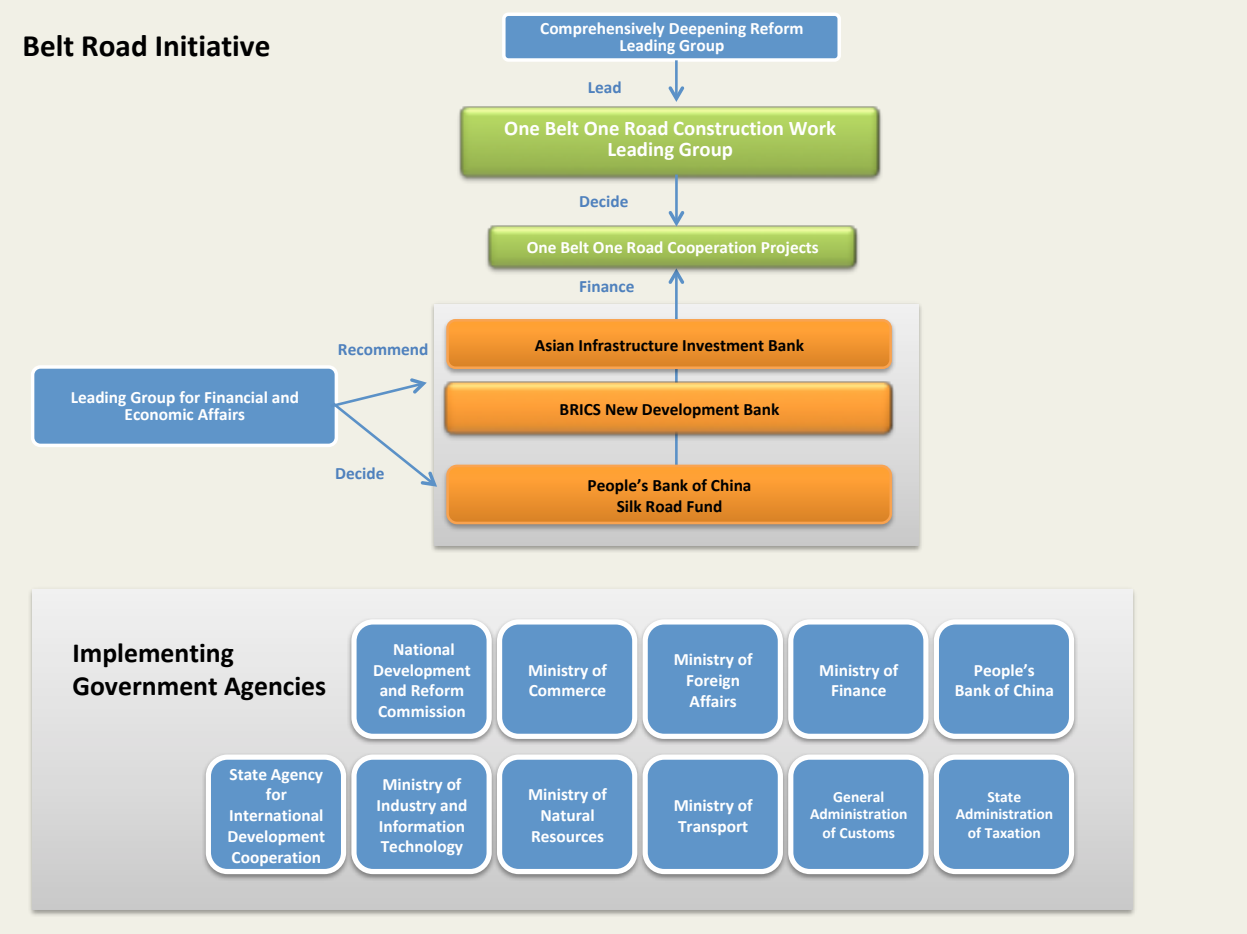
In order to better realize the Belt and Road Initiative's goals, Chinese policy documents call for both China's Silk Road Fund and the multilateral AIIB to integrate climate themes in their work programs.

According to the AIIB's website, its "modus operandi will be lean, clean and green" and it is an institution "built on respect for the environment."

China is second only to the United States in overseas investment, and the largest investor in least developing countries and developing Asia, making its foreign investment decisions critical to achieving climate objectives. Notwithstanding China's significant investment in clean energy projects, its investments in fossil fuel generation dwarfs renewables investments, leading critics to charge that the Belt and Road Initiative is a conduit for polluting investment. This claim is backed up by hard data: from 2000 to 2016, China's global energy investments in fossil infrastructure totaled $116.9 billion compared to $29 billion in renewables, with almost half of fossil investment in coal-fire power generation, the majority of which is lower efficiency sub-critical plants (Gallagher, 2018). Significantly, while the Silk Road Fund and the AIIB are relatively transparent, China's state banks are more difficult to monitor and these banks have emerged as the leading underwriters of new coal-fired power generation globally. Although not the top direct lenders, Chinese state banks raised capital for 73 percent of coal-fired power generation at the end of 2018 (BankTrack and Urgewald, 2018).

The diagram below, which was adapted from Chinese government documents, illustrates how the government views the AIIB, BRICS New Development Bank, Silk Road Fund in supporting its Belt and Road Initiative and broader foreign policy objectives.

Figure 39: China's Belt and Road Initiative



Source: Government of the People's Republic of China

12. Future Directions

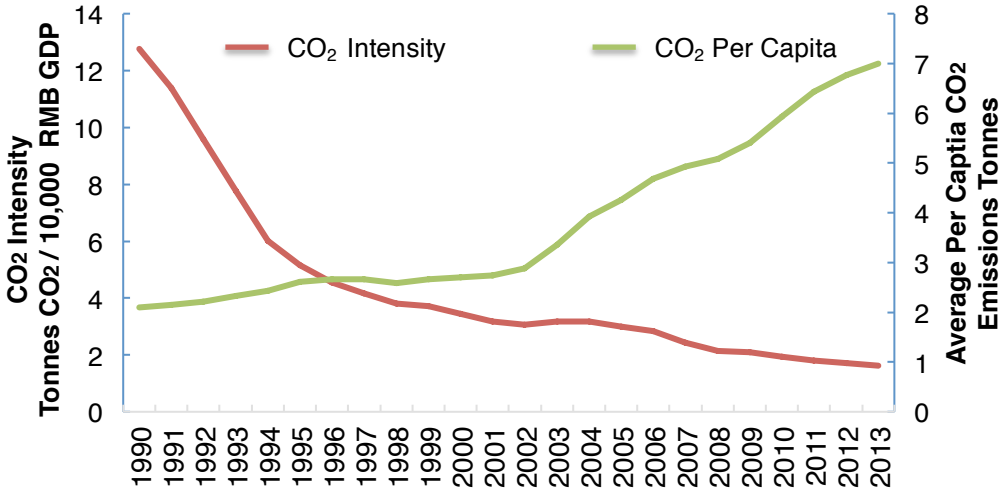
This concluding chapter looks to the future of China's climate policy formation process. It considers how China's climate policies might influence its broader reform agenda in both the environmental field and the economy generally, how achieving its NDC pose challenges in gaining cooperation at the local level, and how China's climate diplomacy is emerging as a tool of foreign relations.

Climate and Environmental Policies Leading Broader Reform Agenda

Since new China's founding in 1949, the central government has relied on command-and-control measures to direct the country's development. Implemented through a series of five-year plans, for the first three decades China's policies focused on reorganization of the economy under centrally controlled state-owned enterprises. With the government and market reforms instituted by Deng Xiaoping starting in 1978, the central government began introducing markets as a feature of the economy, and since the latter part of the Hu-Wen administration (2003-2013) stepped up its efforts to "marketize" the economy.

Yet, China's climate change and environmental protection policies generally reflect traditional command-and-control pattern regulation that remains the foundation of economic and political organization. Pollution control policies such as forcing the closure of small, highly polluting and inefficient coal-fired power plants and manufacturing facilities, which started in the 11th Five-Year Plan cycle and continue today, exemplify this approach. These policies have been effective to a point. However, the government has recognized the inherent limits of command-and-control policies both in terms of cost to the economy and results in reducing CO_2. The government understands it must expand its arsenal of policy options by embracing market-based approaches to help solve the country's environmental problems (Hart et al., 2015). As shown in the figure below, China's reductions in its carbon intensity, which sharply decreased in the 1990s, started to level off in the past decade as China's emissions per person continue to rise, necessitating new policy approaches. Some Chinese policymakers believe that China is experiencing a recoupling of GDP to energy use, due in part to increasing household energy consumption, resulting in increasing carbon intensity per unit of GDP (Personal communications, November 2018).

Figure 40: China's CO_2 Intensity and Per Capita Emissions



Source: National Bureau of Statistics and Global Carbon Project.

China's environmental policymakers are now at the beginning of regulating greenhouse gas emissions and pollution of air, water and land through market signals. Market-based measures represent a new breed of policy for China, premised on the principle that regulation must internalize the cost of pollution and thereby provide an incentive to reduce emissions. These policies operate by increasing the costs of operation for polluters, and by generating revenue for those that produce environmentally superior products or produce products more efficiently and with less pollution.

The movement towards market-based approaches was strengthened in 2011 when China issued the 12th Five-year Plan (2011-2015) and China's State Council issued the *Decision to Strengthen Priority Work of Environmental Protection*, which reiterated its policy to establish environmental markets as a means to achieve environmental goals. China's *13th Five-year Plan (2016-2020)* similarly emphasizes integrating development with environmental goals in green growth and green finance strategies, and calls on regulators to use market approaches for environmental and energy management. Accordingly, China has embarked on a reform agenda embracing market-based approaches in the climate and environmental field, which include:

- A national greenhouse gas emissions trading market;
- Environmental taxes including resource taxes, pollution emissions fees, fuel tax, vehicle and vessel sales and operating taxes;
- Green credit systems by which banks and other financial institutions reflect sustainability in their lending criteria;
- Green government procurement and consumer policies, such as energy efficiency and sustainability labeling through which ordinary consumers can exert influence through purchasing decisions; and
- Quotas for vehicle manufacturers to produce a certain percentage of electric vehicles, allowing manufacturers who exceed their targets to apply the "credit" against another regulatory regime or sell them to other manufacturers.

For China to be successful with its market-based climate and environmental policies, embracing market principles in the operation of its economy more broadly is essential. Market-based environmental policies do not operate in a vacuum, unaffected by the larger economy. For market-based environmental policies to work effectively, the broader economy must allocate capital, raw materials and labor based on market signals. Moreover, market-based environmental policies should accelerate the adoption of market principles throughout the economy. Yet, China's commitment to market-based environmental policies will be tested by the continuing pervasiveness of traditional command and control approaches, which remain entrenched within China's planning and administrative institutions.

China's NDC from Central Planning to Local Implementation

China has initiated a long-term transition toward greater centralization over environmental policy in general and climate change in particular. President Xi and Premier Li’s personal participation in leadership summits focusing on climate change, announcing initiatives such as China’s War on Pollution, and endorsing China's national carbon market demonstrate that the center leads on these issues. The personal involvement of China's top leaders signals their commitment to these policies and ensures that efforts to achieve environmental goals will be directed by the center.

At the same time, China's central government relies upon provincial and ultimately local government to execute laws, regulation and policies. While the central government sets general policies and targets, provides funding and creates incentive systems to influence the behavior of emitters, the vast majority of

China's greenhouse emissions are generated by industry, households and government sectors controlled by the provincial and subordinated local governments. Thus, cooperation of industry and local government will be essential to implementing central government climate policies.

As described previously, in practice, provincial and local government resist policies imposed by the center in order to protect investment opportunities and local economic interests. This central-local dynamic, which has played out in various policy fields including environmental protection, suggests that the implementation of China's climate policies will require the central government to focus its attention on implementation at the local level. Historically, coordination between the central and local governments has not been strong in the environmental field, resulting in the current environmental crisis.

Overcoming local resistance will require setting targets that take into account local conditions and the concerns of local stakeholders in the planning and implementation process. As cost is likely to be a primary concern among key industry stakeholders, soliciting buy-in by provincial authorities and enterprises will require financial arrangements between the central and local governments to ensure the latter's support. Financial incentives must also be backed by credible emissions monitoring, reporting and verification systems, and robust enforcement in cases of non-compliance.

With China's top political leaders personally committing the nation to take action on climate change and international oversight of China's national contributions through a UNFCCC review mechanism, ensuring success requires that the central government engage effectively with local government and stakeholders. This challenge will test China's fundamental governance institutions.

A fuller discussion of the challenge China faces in implementing its climate and energy policies at the sub-national level is available in Hart (2019).

Climate as a Platform for Expanding China's Foreign Policy Influence

China has deftly transformed a political liability in its rapidly rising greenhouse gas emissions into a vehicle for expansion of its foreign policy goals centered on climate diplomacy. In doing so, China has positioned itself simultaneously as a leader among developing countries and a rising great power. China's leadership in climate focuses heavily on South-South cooperation, which solidifies its ties to the G77 and aligns itself with rapidly growing developing economies, thereby enhancing both the political and economic value of its climate leadership. Under the Belt and Road Initiative, China is engaging developing countries through government-to-government, commercial, and multilateral institutions, principally the AIIB and the BRICS New Development Bank, to pursue both climate-related and economic objectives abroad.

Thus, climate has emerged as a new platform for global competition. China is mastering this opportunity by bolstering its efforts to develop international institutions and to claim its role in global environmental governance, potentially reordering international leadership in climate and beyond in the process.

References

AidData (2017) Global Chinese Official Finance Dataset, 2000-2014, Version 1.0.

Amann, M., Imrich Bertok, J. Borken-Kleefeld, Adam Chambers, Janusz Cofala, Frank Dentener, Chris Heyes et al. (2008) *Gains-asia: A tool to combat air pollution and climate change simultaneously.* Austria: International Institute for Applied Systems Analysis. *ResearchGat*e [Online] Available at: http://www.researchgate.net/publication/ 230709499_GAINS-sia._A_tool_to_combat_air_pollution_and_climate_change_simultaneously (Accessed: 18 March 2017).

An, B., Weibin Lin, Aiming Zhou, and Wei Zhou (2015) *China's Market-Oriented Reforms in the Energy and Environmental Sectors*. Pacific Energy Summit, National Bureau of Asian Research.

Asian Development Bank (ADB) (2018) 50 Climate Solutions from Cities in the People's Republic of China: Best Practices from Cities Taking Action on Climate Change

Asian Infrastructure Investment Bank (AIIB) (2017) Available at: https://www.aiib.org/en/about-aiib/index.html (Accessed: 18 March 2017).

BankTrack and Urgewald (2018) *COP 24: New research reveals that banks and investors financing the expansion of the global coal fleet*, December 5, 2018.

Bergsager, H. and Anna Korppoo (2013) *China's State-Owned Enterprises as Climate Policy Actors: The Power and Steel Sectors.* Copenhagen: Nordic Council of Ministers.

Boden, T.A., G. Marland, and R.J. Andres (2016) Global, Regional, and National Fossil-Fuel CO2 Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. doi 10.3334/CDIAC/00001_V2016.

Brady, Anne-Marie (2008) *Marketing Dictatorship: Propaganda and Thought Work in Contemporary China.* Lanham, Maryland: Roman & Littlefield Publishers, Inc.

Brady, Anne-Marie (2017) *China as a Polar Great Power*, Cambridge University Press.

Brandt, L., Scott Rozelle and Matthew A. Turner (2004) Local Government Behavior and Property Right Formation in Rural China, *Journal of Institutional and Theoretical Economics JITE*, Vol. 160, No. 4, pp. 627-662.

Brautigam, D. (2009) *The dragon's gift: the real story of China in Africa*, Oxford University Press.

Brown, L. (2009) "Soybeans threaten Amazon rainforest". *Grist,* 31 December. [Online]. Available at: http://grist.org/article/growing-demand-for-soybeans-threatens-amazon-rainforest/ (Accessed: 18 March 2017).

Buzan, B. (2010) "Culture and International Society." International Affairs, 86(1), pp.1-25.

Century Weekly (2011) "Cadmium Rice Murder" [镉饭杀机], February 14, 2011. [Chinese]

Chen, Liang-Yu (2017) "How Do Experts Engage in China's Local Climate Governance? A Case Study of Guangdong Province," *Journal of Chinese Governance* 2.4, 360-384.

China (2007) *Notice of the State Council on Establishing the Leading Group in Charge of Climate Change and Energy Saving and Emission Reduction*, *Guo Fa [2007] No.18, 12 June 2007.*

China (2011) *The Outline of the 12th Five-Year Plan for Economic and Social Development of the People's Republic of China.*

China (2015) *Enhanced Actions on Climate Change: China's Intended Nationally Determined Contributions.*

CCICED (China Council for International Cooperation on Environment and Development) (2013) *Sustainable Consumption and Green Development.* Beijing: CCICED.

China and France Joint Presidential Statement on Climate Change, Beijing, 2 November 2015. Available at: http://www.diplomatie.gouv.fr/en/french-foreign-policy/climate/2015-paris-climate-conference-cop21/article/china-and-france-joint-presidential-statement-on-climate-change-beijing-02-11 (Accessed: 18 March 2017).

China Carbon Forum (2016) 2017 China Carbon Pricing Survey Roundtable on Permit Allocation: Summary of Discussion, 12 December 2016 (on file with the authors).

China Daily (2014) "China's foreign aid helps developing countries", 11 July. [Online] Available at: http://usa.chinadaily.com.cn/epaper/2014-07/11/content_17729005.htm (Accessed: 18 March 2017).

China Energy News (2016) "As of the first half of 2016, the cumulative gap in subsidies for renewable energy up to 55 billion yuan", 9 August. Solarzoom. [Online]. Available at: http://www.solarzoom.com/article-88459-1.html (Accessed: 20 March 2017).

China Water Risk (2015) "New 'Water Ten Plan' to Safeguard China's Waters", 16 April. [Online]. Available at http://www.chinawaterrisk.org/notices/new-water-ten-plan-to-safeguard-chinas-waters/ (Accessed: 4 January 2019).

Chou, Huichen (2018) "ESG: China gets serious about ESG", Funds Global Asia [Online]. Available at: http://www.fundsglobalasia.com/june-2018/esg-china-gets-serious-about-esg (Accessed: 20 July 2018).

Chu, Yin-wah and Alvin Y. So (2010) "State Neoliberalism: The Chinese Road To Capitalism", in Yin-wah Chu, ed, *Chinese Capitalisms: Historical Emergence and Political Implications*. Basingstoke: Palgrave Macmillan.

Climate Bonds Initiative (2018) *Bonds and Climate Change: State of the Market 2018*.

Climate Group (2013) *Shaping China's Climate Finance Policy*. Beijing, China: The Climate Group.

Cline, W. (2007) *Global Warming and Agriculture: Impact Estimates by Country*, Washington, DC: Petersen Institute for International Economics.

CNR (2016a) "NDRC: China will reduce coal production capacity more than 250 million tons in 2016", 22 July. Sina Finance [Online]. Available at: http://finance.sina.com.cn/china/gncj/2016-07-07/doc-ifxtwiht3310960.shtml (Accessed: 20 March 2017).

CNR (2016b) "In the background of environmental subsidies, 80% of coal-fired power generation enterprises are still sewage illegally", 29 December. Caijing Finance [Online]. Available at: http://politics.caijing.com.cn/20161229/4218525.shtml (Accessed: 20 March 2017).

Crow-Miller, Britt (2014) China's South-North Water Transfer Project: An Unsustainable Diversion. China-US Focus. Available at: https://www.chinausfocus.com/energy-environment/chinas-south-north-water-transfer-project-an-unsustainable-diversion/ (Accessed: 31 December 2018).

Energy Research Institute of Academy of Macroeconomic Research/ NDRC (ERI) and China National Renewable Energy Centre (CNREC) (2018) *China Renewable Energy Outlook 2018*.

Environmental Protection Law of the People's Republic of China, Available at: http://language.chinadaily.com.cn/trans/2014-05/20/content_17522868.htm (Accessed: 1 November 2015).

EU-China joint Statement, Brussels, 29 June 2015. Available at: http://www.consilium.europa.eu/en/press/press-releases/2015/06/29-eu-china-climate-statement/ (Accessed: 20 March 2017).

European Investment Bank. (2017). *New People's Bank of China and EIB initiative to strengthen green finance, 22 March.*

Feng, Hao (2016) "China coal subsidies undermining renewables investment" Chinadialogue, 5 December. Chinadialogue [Online]. Available at: https://www.chinadialogue.net/article/show/single/en/9458-China-coal-subsidies-undermining-renewables-investment (Accessed: 20 March 2017).

Ferri, Giovanni and Li-Gang Liu (2009) Honor Thy Creditors Beforan Thy Shareholders: Are the Profits of Chinese State-Owned Enterprises Real? HKIMR Working Paper No.16/2009. Hong Kong Institute Monetary Research.

Fiscal Science Research Institute, Ministry of Finance (2015) Research of Fiscal and Taxation Policy of Total Coal Consumption Control. Available at: http://coalcap.nrdc.cn/coalcap (Accessed: 29 October 2015).

Florini, A., Hairong Lai, and Yeling Tan (2012) *China Experiments: From Local Innovations to National Reform.* Washington, DC: The Brookings Institution.

Gallagher, Kelly Sims (2018) "China's Belt and Road is conduit for polluting investments," *Financial Times*, 9 August.

Gallagher, M.E. and Baohua Dong (2011) "Legislating Harmony: Labor Law Reform in Contemporary China" in Sarosh Kuruvilla, Ching Kwan Lee, and Mary E. Gallagher, eds., *From Iron Rice Bowl to Informalization*, Ithaca and London: ILR Press.

Gao, C., Yin, H., Ai, N., Huang, Z. (2009) "Historical Analysis of SO_2 Pollution Control Policies in China," *Environmental Management*, 2009, 43:447–457.

Global Water Partnership (2015) *China's water resources management challenge: The 'three red lines'.*

Goron, Coraline (2017) *Climate Revolution or Long March? The Politics of Low- Carbon Transformation in China (1992-2015): The Power Sector as Case Study.* Ph.D. Dissertation, Universite Libre de Bruxelles and University of Warwick.

Guan, Ting and Jorgen Delman (2017) “Energy Policy Design and China’s Local Climate Governance: Energy Efficiency and Renewable Energy Policies in Hangzhou,” *Journal of Chinese Governance* 2.1, 68-90.

Guo, W. and Xiaoxing Liu (2015) “Research Project of Coordination Control between Climate change and Air Pollution Launched”, *China Environment News*, 6 March. Flickr [Online]. Available at: http://www.cenews.com.cn/xwzx2013/hjyw/201503/t20150309_788913.html (Accessed: 20 March 2017). [Chinese]

Gupta, J. and King Yip Wong (2014) China’s evolving development dilemma in the context of the north-south climate governance debate*. Perspectives on Global Development and Technology*, 13(5-6), pp.699-727.

Hart, Craig (2019) *From Paris to Beijing: Implementing the Paris Agreement in the People's Republic of China*, Washington, D.C.: The Atlantic Council.

Hart, Craig and Hengwei Liu (2010) "Advancing Carbon Capture and Sequestration in China: A Global Learning Laboratory*", China Environment Series,* Washington, D.C.: Woodrow Wilson Center for Scholars.

Hart, Craig and Zhong Ma (2014) “China's Regional Carbon Trading Experiments and the Development of a National Market: lessons from China's SO2 Trading Programme”, *Energy & Environment*, Vol. 25, No. 3 & 4.

Hart, Craig, Zhong Ma, Jiahui Ying and Jiayan Zhu (2015) *Corporate Strategy and Competitive Advantage in China's War on Pollution*. Beijing: China Carbon Forum.

He, Wei Ping (2014) *Banking Regulation in China: The Role of Public and Private Sectors*. New York: Palgrave MacMillan.

Heilmann, S., Moritz Rudolf, Mikko Huotari and Johannes Buckow (2014) “China's Shadow Foreign Policy: Parallel Structures Challenge the Established International Order”, *China Monitor*, No. 18.

Hills, Evan B. and Zhengxu Wang (2014) "Institutional Barriers to China's Renewable Energy Strategy,” in Shujie Yao and Maria Jesus Herrerias, Eds., *Energy Security and Sustainable Economic Growth in China*. London: Palgrave Macmillan.

Hilton, I. and Oliver (2017) “The Paris Agreement: China’s ‘New Normal’ role in international climate negotiations”, *Climate Policy*, 17(1), pp.48-58.

Hornby, Lisa (2017). "China leads world on green bonds but the benefits are hazy," *Financial Times*, 3 May.

Hornby, Lisa (2018) *Financial Times* Presentation to the USC U.S.-China Institute, May 1, 2018. Available at: https://www.youtube.com/watch?v=LaBm_WUk8TA (Accessed: 20 December 2018).

Hove, Anders and Xinnan Wang (2018) *A different kind of renewable mandate:China’s Renewable Obligation Third Consultation Draft*. Beijing: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

Hove, Anders (2019) *Electric Vehicle Charging in China and the United States*.

HSBC Climate Change and World Resources Institute (2010) *Weeding Risk: Financial Impacts of Climate Change and Water Scarcity on Asia's Food and Beverage Sector*, Washington, DC: World Resources Institute.

Huang, G. (2013) "Xi Jinping to head reform panel, taking another role from premier: President's move seen as diminishing the power of Premier Li Keqiang", *South China Morning Post,* 31 December. [Online] Available at: http://www.scmp.com/news/china/article/1393479/xi-jinping-head-reform-panel-taking-another-role-premier (Accessed: 20 March 2017).

ICAO (2016a) Review of Draft Assembly Resolution text on a global MBM scheme for International Aviation. [Online] Available at: http://www.icao.int/Meetings/HLM-MBM/Documents/HLM_GMBM_WP10_China_EN.pdf (Accessed: January 22, 2017).

ICAO (2016b) *Joint Statement of Argentina, Brazil, China, India, Panama, Russian Federation and Saudi Arabia on International Aviation and Climate Change* [Online] Available at: http://www.icao.int/Meetings/HLM-MBM/Documents/Joint_Statement_1.pdf (Accessed: 20 March 2017).

ICAO (2016c) *The Statement of the Chinese Delegation on the ICAO Resolutions on the Consolidated Statement of Continuing ICAO Policies and Practices related to Environmental Protection – Climate Change and on the Consolidated Statement of Continuing ICAO Policies and Practices related to Environmental Protection – Global Market-Based Measures Scheme* [Online] Available at: https://www.icao.int/ Meetings/a39/Documents/Resolutions/China_en.pdf (Accessed: 26 December 2018).

International Council on Clean Transportation (2018) *China's New Energy Vehicle Mandate Policy (Final Rule)*.

International Energy Agency (IEA) (2016a) *Medium-Term Coal Market Report 2016.* Paris: IEA.

IEA (2016b) *Energy Efficiency in China 2016.* Paris: IEA.

IEA (2017) World Energy Outlook China Special Report: China Energy Outlook 2017. Beijing: Petroleum Industry Press. [Chinese]

Institute for Energy Economics and Financial Analysis (IEEFA) (2017) *China's Global Renewable Energy Expansion.* Cleveland: IEEFA.

IISD and GSI (2015) *Subsidies to Coal Production in China.* Manitoba and Geneva: IISD and GSI.

India-China Joint Statement on Closer Developmental Partnership, 19 September 2014. Available at: http://www.mea.gov.in/bilateral-documents.htm?dtl/24022/Joint_Statement_between_the_Republic_of_India_and_the_Peoples_Republic_of_China_on_Building_a_Closer_Developmental_Partnership (Accessed: 20 March 2017).

Jacob, Rahul (2011) "Drop in China's land sales poses threat to growth," *Financial Times*, 7 December.

Jamasmie, C. (2018) "Coal demand seen steady through 2023 thanks to India and China - IEA," *Mining.com*, 18 December.

Johnston, A.I. (2008) *Social States: China in International Institutions, 1980-2000.* Princeton, NJ: Princeton University Press.

Joint Statement on Climate Change between India and China during Prime Minister's visit to China, 15 May 2015. Available at: http://www.mea.gov.in/bilateral-documents.htm?dtl/25238 (Accessed: 20 March 2017).

Joint Statement on Climate Change between the Government of the People's Republic of China and the Government of the Federative Republic of Brazil, Brasilia, Brazil, 19 May 2015. Available at: http://en.ccchina.gov.cn/archiver/ccchinaen/UpFile/Files/Default/201505211 02001198192.pdf (Accessed: 20 March 2017).

Karhl, Frederich, James H. Williams, and Junfeng Hu (2013) "The Political Economy of Electricity Dispatch Reform in China," *Energy Policy* 53:361–369.

Karplus, V.J. (2015) *Double Impact: Why China Needs Coordinated Air Quality and Climate Strategies*. Beijing: Paulson Institute.

Karstensen, Jonas, Glen P. Peters, and Robbie M. Andrew (2013) " Attribution of CO2 emissions from Brazilian deforestation to consumers between 1990 and 2010", *Environmental Research Letters* 8.

Kennedy, Scott (2015) Critical Questions: Made in China 2025. Available at: https://www.csis.org/analysis/made-china-2025 (Accessed: 30 October 2018).

Kent, A.E. (2007) *Beyond Compliance. China, International Organizations, and Global Security*. Stanford, CA: Stanford University Press.

Kidney, S. (2017). *Myth buster: why China's green bond market is more orderly than you might think. An Overview from Climate Bonds Initiative*. Climate Bonds Initiative.

Lardy, N.R. (2012) *Sustaining China's Economic Growth: After the Global Financial Crisis*. Washington, D.C.: Peterson Institute for International Economics.

Lardy, N.R. (2014) *Markets Over Mao: The Rise of Private Business in China, Washington*. D.C.: Peterson Institute for International Economics.

Lee, Georgina (2017). "Why some Chinese green bonds are 'not so green' in the eyes of international investors," *South China Morning Post*, 25 November.

Levine, M., L. Price, N. Zhou, D. Fridley, N. Aden, H. Lu, M. McNeil, N. Zheng, Q. Yining, and P. Yowargana (2010) *Assessment of China's Energy-Saving and Emission- Reduction Accomplishments and Opportunities During the 11th Five Year Plan*, Berkeley, CA: Lawrence Berkeley National Laboratory.

Li, A.H. (2016) "Hopes of Limiting Global Warming? China and the Paris Agreement on Climate Change", *China Perspectives* 1, p.49.

Li, Cheng (2006) "Think National, Blame Local: Central-Provincial Dynamics in the Hu Era," *China Leadership Monitor*, 17: 1-24.

Li, X.B. (2010) *Civil Liberties in China.* Oxford, United Kingdom: ABC-CLIO.

Li, Kuo, Dawei Zheng, Yanan Hu, Ma Jianyong, Xu Yinlong, Andreas Wilkes, Sarah Optiz-Stapleton, Krystal Lair and Rebecca Nadin (2016) "Feeding China", in Rebecca Nadin, Sarah Opitz-Stapleton and Xu Yinlong, Climate Risk and Resilience in China. London and New York: Routledge.

Lieberthal, K. (2003) *Governing China: From Revolution to Reform, 2nd Edition*. New York: W. W. Norton & Company.

Liu, J. (2010) "China's road to sustainability" *Science* 328: 50.

Liu, C.C. (2015) "China will push for a legally binding treaty in Paris climate talks" *ClimateWire,* 19 November.

Liu, S. (2016) "China to reform fossil fuel subsidies" *China Dialogue*, November 16, 2016.

Liu, X.X. and Xiaoyan Zhou (2011) "Test of allocation relations between financial resources and real economy: Reasons for imbalance of economic structure", *Journal of Financial Research*, 2. [Chinese]

Lo, Kevin (2014) "China's Low-carbon City Initiatives: The Implementation Gap and the Limits of the Target Responsibility System," *Habitat International* 42, 236-244.

Lu, Yonglong Lu, Shuai Song, Ruoshi Wang, Zhaoyang Liu, Jing Meng, Andrew J. Sweetman, Alan Jenkins, Robert C. Ferrier, Hong Li, Wei Luo, Tieyu Wang (2015) "Impacts of soil and water pollution on food safety and health risks in China," *Environment International* 77: 5-15.

Ma, J. (2016) "China Green Finance Outlook", *China Finance*, 16, pp.20-22.

Ma, Zhong (2018) "How can we drink good water?", PowerPoint, November 20, 2018.

Martina, M., Hui Li, David Stanway and Stian Reklev; writing by Ben Blanchard and David Stanway; editing by Raju Gopalakrishnan and Robert Birsel (2014) "UPDATE 2-China to "declare war" on pollution, premier says" *Reuters*, 5 March. *Reuters* [Online]. Available at: http://af.reuters.com/article/idAFL3N0M20IS20140305?pageNumber=1&virtualBrandChannel=0 (Accessed: 20 October 2015).

Martina, M., Editing by Nick Macfie (2015) "China's choking air pollution goes west: Greenpeace" *Reuters*, 21 April. *Reuters* [Online]. Available at: http://www.reuters.com/article/2015/04/22/us-china-pollution-idUSKBN0ND06Z20150422 (Accessed: 20 March 2017).

McGrath, M. (2018) "China coal power building boom sparks climate warning," BBC News, 26 September.

McKinsey Global Institute (2015) *Debt and (Not Much) Deleveraging*. San Francisco, CA: McKinsey & Company.

Mearsheimer, J. (2014) *The Tragedy of Great Power Politics*. New York: W.W. Norton & Company.

Mendelsohn, R. and A. Dinar (2009) *Climate Change and Agriculture: An Economic Analysis of Global Impacts, Adaptation and Distributional Effects*, Cheltenham, UK: Edward Elgar.

Ministry of Ecology and Environment (2018) *China's Policies and Action for Addressing Climate Change*, November 2018.

Ministry of Environmental Protection (2002) *Surface Water Quality Standard.* [Chinese]

Ministry of Environmental Protection and National Bureau of Statistics (2012) *Statistical Yearbook on Environment 2012*. Available at: http://tongji.cnki.net/kns55/Navi/YearBook.aspx?id=N2013030153&floor=1 (Accessed: 20 March 2017). [Chinese]

Ministry of Finance (2016) *Report on New Energy Vehicles Subsidies Investigation*. Available at: http://www.mof.gov.cn/zhengwuxinxi/bulinggonggao/tongzhitonggao/201609/t20160908_ 2413 434.htm (Accessed: 29 January 2017). [Chinese]

Ministry of Water Resources (2013) China Water Resource Bulletin 2013. [Chinese]

Nadin, R., Sarah Optiz-Stapleton and Jia Wei (2016) "Understanding Climate Risk and Building Resilience: Research and policy approaches in China", in Rebecca Nadin, Sarah Opitz-Stapleton and Xu Yinlong, Climate Risk and Resilience in China. London and New York: Routledge.

National Bureau of Statistics (2012-2017) *China Industry Economy Statistical Yearbook 2012.* Available at: http://tongji.cnki.net/kns55/Navi/YearBook.aspx?id=N2012110073&floor=1### (Accessed: 20 March 2017). [Chinese]

National Development and Reform Commission (NDRC) (2010) Notice of the National Development and Reform Commission on the Pilot Work of Low-Carbon Provinces and Cities, 2010 No. 1587. [Chinese]

NDRC (2017a) "Notice on the Publication of Pricing Measures for the Power Transmission of Regional Power Grids (Trial), Pricing Measures for the Power Transmission of Specific Inter-Provincial and Inter-Regional Power Transmission Project (Trial) and Guiding Opinion on Provincial Distribution Pricing and Pricing for Incrementally-added Distribution, NDRC Pricing Rule [2017] No.2269,"

NDRC (2017b) Circular Economy Development Evaluation Index System (2017 Edition). [Chinese]

NDRC (2018) Notice on Matters Relevant to Solar Power Generation in 2018, NDRC Energy [2018] No. 823.

NDRC and NEA (2017a) Notice of Opening Power Generation and Consumption Plan Orderly, NDRC Operation [2017] No. 294.

NDRC and NEA (2017b) Notice to Construct Spot Power Market Pilots, NDRC Energy [2017] No. 1453.

NDRC and NEA (2018) Targets and Tasks for Accelerating the Elimination of Non-compliance of 300,000 kW and Below Coal-fired Power Plants and the Release of Out-of-Length Capacity in the Coal-Electric Industry in 2018 (First Batch) Notice.

NDRC, Ministry of Education, Ministry of Industry and Information, Ministry of Finance, Ministry of Housing and Urban-Rural Development, Ministry of Transport, Ministry of Commerce, State-owned Assets Supervision and Administration Commission, General Administration of Quality Supervision, State Statistics Bureau, China Banking Regulatory Commission, National Energy Administration (2011), *Program of 10,000 Enterprises Implementing Energy-saving and Low-carbon Action.* Available at: http://www.sdpc.gov.cn/zcfb/zcfbtz/201112/t20111229_453569.html (Accessed: 20 March 2017).

National Energy Administration (NEA) (2016) Circular of the National Energy Administration on Establishment of a Monitoring and Early Warning Mechanism to Promote the Sustainable and Sound Development of Wind Power Industry, NEA New Energy [2016] No.196.

NEA (2017) *Press conference of 13th Five-Year energy development plan and renewable energy development plan.* Available at: http://www.nea.gov.cn/xwfb/ 20170105zb1/index.htm (Accessed: 20 March 2017).

NRDC (2015) China's Total Coal Consumption Control and Policy Research Group (2015) *China's Total Coal Consumption Control Program Research Report*. Beijing: NRDC.

Paris Agreement, Paris, November 2015. Available at: https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_english_.pdf (Accessed: 20 June 2017).

Peng, S., J. Huang, J. Sheehy, R. Laza, R. Visperas, X. Zhong, G. Centeno, G. Khush and G. Cassman (2004) "Rice yields decline with higher night temperature from global warming," *Proceedings of the National Academy of Sciences*, 101: 9971–9975.

Peoples Network (2017) "NDRC: the 2016 iron and coal production capacity task completed ahead of time", *Peoples Network* [Online]. Available at: http://energy.people.com.cn/ n1/2017/0125/c71661-29049432.html (Accessed: 20 March 2017).

Perkins, D. (2015) *The Economic Transformation of China*. Singapore: World Scientific.

Peters, G.P., Minx, J.C., Weber, C.L. and Edenhofer, O. (2011) Growth in emission transfers via international trade from 1990 to 2008. Proceedings of the National Academy of Sciences 108, 8903-8908. http://www.pnas.org/content/108/21/8903.abstract (as updated by the Global Carbon Project).

Rabinovitch, S. (2012) "Worries grow as China land sales slump," *Financial Times*, 5 January.

Ran, R. (2013) "Perverse Incentive Structure and Policy Implementation Gap in China's Local Environmental Politics," *Journal of Environmental Policy & Planning* 15.1, 17-39.

REN21 (Renewable Energy Policy Network) (2018) *Renewables 2018 Global Status Report*. Paris: Renewable Energy Policy Network.

Rithmire. M.E. (2015) *Land Bargains and Chinese Capitalism: The Politics of Property Rights under Reform*. New York: Cambridge University Press.

Rutkowski, Ryan (2014) *The Economics of H_20: Water Price Reforms in China*, The Peterson Institute for International Economics.

SASAC (2019) Available at: http://www.sasac.gov.cn (Accessed: 2 January 2019).

Shapiro, J. (2001) *Mao's War on Nature*, Cambridge: Cambridge University Press.

Shen, C., Jing Jin, and Heng-Fu Zou (2012), "Fiscal Decentralization and Public Services in China," *Annals of Economics and Finance* 16.

Sheng, H. and Pu Qian (2015) *Opening Up China's Markets of Crude Oil and Petroleum Products: Theoretical Research and Reform Solutions*, Singapore: World Scientific.

Sheng, H. and Nong Zhao (2013) *China's State-Owned Enterprises: Nature, Performance and Reform,* Singapore: World Scientific Publishing.

Slater, Huw, Dimitri de Boer, Wang Shu and Qian Guoqiang (2018) *2018 China Carbon Pricing Survey.* Beijing: China Carbon Forum.

Solinger, D.J. (2002), "Labor Market Reform and the Plight of the Laid-off Proletariat," The China Quarterly.

State Council (2015b) *Action Plan for Water Pollution Prevention*.

State Council (2015b) Notice on Further Deepen Power System Reform, *State Council [2015] No.9.*

State Council (2016a) National Population Development Plan (2016-2030), 2016, No. 87.

State Council (2016b) *Report on the Work of the Government.* Updated March 17, 2016. Available at: http://english.gov.cn/premier/news/2016/03/17/content_281475309417987.htm (Accessed: 1 December 2018).

State Council (2016c) Opinions of the State Council on Resolving the Excessive Production Capacity of the Iron and Steel Industry to Realize the Development of the Depletion (Guo Fa [2016] No. 6).

State Council (2016d) State Council's Opinions on Resolving the Excessive Capacity of the Coal Industry to Realize the Development of the Depletion (Guofa [2016] No. 7).

State Council (2017) "*People's congresses: democracy behind China's success story",* 3 March. [Online]. Available at: http://english.gov.cn/policies/policy_watch/2017/03/03/content_281475583558450.htm (Accessed: 20 March 2017).

Swart, R., Markus Amann, Frank Raes, and Willemijn Tuinstra (2004) "A Good Climate for Clean Air: Linkages between Climate Change and Air Pollution", *Climatic Change*, 66(3): 263-269.

Tan, D. (2014) *Dirty, thirsty fashion: Blindsided by China's water wars.* CLSA: Blue Books.

Tsai, K.S. (2003) *Back-Alley Banking: Private Entrepreneurs in China*. Ithaca: Cornell University Press.

UK/ PRC Joint Climate Changes Statement, London, 17 June 2014. Available at: http://eu-un.europa.eu/articles/en/article_16606_en.htm (Accessed: 1 November 2015).

UN Food and Agriculture Organization (2018) "China at a glance." Available at http://www.fao.org/china/fao-in-china/china-at-a-glance/en/ (Accessed: 31 December 2018).

UNFCCC Submission Portal (2017) Available at: http://www4.unfccc.int/submissions/SitePages/sessions.aspx?search=Roadmap (Accessed: 20 March 2017).

Walter, C. and Fraser J.T. Howie (2003) *Privatizing China: The Stock Markets and Their Role in Corporate Reform*. Singapore: John Wiley & Sons (Asia) Pte Ltd.

Walter, C. and Fraser J.T. Howie (2012) *Red Capitalism: The Fragile Financial Foundation of China's Extraordinary Rise, Revised and Updated*, Singapore: John Wiley & Sons (Asia) Pte Ltd.

Wang, A. (2013) "The search for sustainable legitimacy: Environmental law and bureaucracy in China", *Harvard Environmental Law Review, 37*, pp.365-440.

Wang, J.N., Miao Ning, Gang Yan, and Jin-tian YANG (2010) "Implementing Climate-friendly Strategy for Air Pollution Prevention and Control", *China Soft Science*, 10, pp. 28-36. [Chinese]

Wang, Liming (2005) "Clusters Pulled by FDI in China and the Development of the SMEs", in Fan Houming, Huang Qingbo and Han Zhen, eds., Proceedings of SME Management and Innovation, Dalian, China: Dalian Maritime University Press.

Wang, Yufei, Qijiao Song, Jijiang He, and Ye Qi (2015) “Developing Low-carbon Cities through Pilots,” *Climate Policy* 15, 81-103.

Wang, Guoqing, Rebecca Nadin and Sarah Optiz-Stapleton (2016) "A balancing act: China's water resources and climate change", in Rebecca Nadin, Sarah Opitz-Stapleton and Xu Yinlong, Climate Risk and Resilience in China. London and New York: Routledge.

Wang, Y. and R. Zhang (2017) *China’s green bond market.* Available at: https://www.icmagroup.org/assets/documents/About-ICMA/APAC/China's-Green-Bond-Market-Jan-2017_110117.pdf (Accessed: December 31, 2018).

Welch. J., J. Vincent, M. Auffhammer, P. Moya, A. Dobermann and D. Dawe (2010) *Rice Yields in Tropical/subtropical Asia exhibit Large but Opposing Sensitivities to Minimum and Maximum Temperature*, Washington, DC: Proceedings of the National Academy of Sciences.

The White House (2014) *U.S.-China Joint Announcement on Climate Change, Beijing, China, 12 November 2014.* Available at: https://obamawhitehouse.archives.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change (Accessed: 20 March 2017).

World Bank (2018) Open Data, available at https://data.worldbank.org/ (Accessed: 31 December 2018).

World Watch Institute (2017) *Global Palm Oil Demand Fueling Deforestation*. [Online] Available at: http://www.worldwatch.org/node/6059 (Accessed: 20 March 2017).

Xinhua News (2018) “Xi stresses unswerving support for development of private enterprises” 2 November. *Xinhua Net* [Online] Available at: http://www.xinhuanet.com/english/2018-11/02/c_137575231_2.htm (Accessed: 4 January 2019).

Ye, Q. and Tong Wu (2015) China’s ‘yes’ to new role in climate battle*. Brookings Brief*. [Online] Available at: https://www.brookings.edu/articles/chinas-yes-to-new-role-in-climate-battle/ (Accessed: 20 March 2017).

Yueh, L. (2011) *Enterprising China: Business, Economic, and Legal Developments since 1979*. Oxford: Oxford University Press.

Zhang, B.J. (2002) "Change Ourselves, Influence the World: A Discussion on China's Diplomacy Clues in the 20th Century," *China Social Science*, 2002, No. 1.

Zhang, X.L. (2015) *China's Revolutionary Energy System Transformation Outlook.* Beijing, 5 November 2015. Beijing: Embassy of the Federal Republic of Germany.

Zheng, Heran. and Shixiong Cao (2015) "Threats to China’s Biodiversity by Contradictions Policy" *AMBIO* 44: 23-33.

Zhou, H.J., Xi Wang, Changgui Wang, Yi Yuan, Dandan Wang, Yinlong Xu, Jie Pan, Krystal Lair, and Anna Barnett (2016) "Adapting Against Disasters in a Changing Climate", in Rebecca Nadin, Sarah Opitz-Stapleton and Xu Yinlong, Climate Risk and Resilience in China. London and New York: Routledge.

Zweig, D. (2015) Chinese Politics Part 1, Lectures 1.3 and 5.6. Coursera. Available at: https://www.coursera.org/learn/chinesepolitics1 (Accessed: 20 March 2017).

Key Policy Documents By Subject

Ecological Civilization

2015.04 CPC Central Committee and State Council, Opinion on Further Promoting the Development of Ecological Civilization

中共中央国务院关于加快推进生态文明建设的意见（中发 [2015] 12 号）

2015.09 CPC Central Committee and State Council, Integrated Reform Plan for Promoting Ecological Progress

生态文明体制改革总体方案（中发 [2015] 25 号）

General Climate Change including Mitigation

2007.06 State Council, National Climate Change Program

中国应对气候国家方案（国发 [2007] 17 号）

2013.05 NDRC and National Bureau of Statistics, Opinion on Improving Statistical Work for Response to Climate Change

关于加强应对气候变化统计工作的意见（发改气候 [2013] 937 号）

2014.09 NDRC, National Plan for Climate Change (2014-2020)

国家应对气候变化规划（2014-2020）（发改气候 [2014] 2347 号）

2015.06 NDRC, Enhanced Actions on Climate Change: China's Intended Nationally Determined Contributions

强化应对气候变化：中国国家自主贡献

2016.10 State Council, Work Plan for Controlling Greenhouse Gas Emissions During the 13th Five-Year Plan Period

十三五”控制温室气体排放工作方案（国发 [2016] 61 号）

2016.08 State Council, National Science and Technology Innovation Plan During "13th Five-Year"

国务院关于印发“十三五”国家科技创新规划的通知（国发 [2016] 43 号）

2016.10 State Council, Work Plan for Controlling Greenhouse Gas Emissions in the 13th Five-Year Plan

“十三五”控制温室气体排放工作方案（国发[2016] 61 号）

2016.12 UNFCCC, First Biennial Update Report on Climate Change

气候变化第一次两年更新报告

2018.11 Ministry of Ecology and Environment, Annual Report of China's Policies and Actions on Climate Change 2018

中国应对气候变化的政策与行动 2018 年度报告

Carbon Trading

2011.10 NDRC, Notice on the Pilot Work on Carbon Emissions Trading
关于开展碳排放权交易试点工作的通知（发改办气候 [2011] 2601 号）

2012.06 NDRC, Interim Regulation of Voluntary Greenhouse Gas Emission Trading
温室气体自愿减排交易管理暂行办法（发改气候气候 [2012] 1668 号）

2014.12 NDRC, Interim Measures for the Management of Carbon Emissions Transactions
碳排放权交易管理暂行办法（国家发展和改革委员会令第 17 号）

2016.01 NDRC, Notice on Improving the Key Work of Starting the National Carbon Emissions Trading Market
关于切实做好全国碳排放权交易市场启动重点工作的通知（发改办气候 [2016] 57 号）

Low Carbon Cities

2010.08 NDRC, Notice of the National Development and Reform Commission on the Pilot Work of Low-Carbon Provinces and Cities
国家发展改革委关于开展低碳省区和低碳城市试点工作的通知(发改气候 [2010] 1587 号)

2012.12 NDRC, Notice of the National Development and Reform Commission on the Pilot Work of the second batch of national Low-Carbon Provinces and Cities
国家发展改革委印发关于开展第二批国家低碳省区和低碳城市试点工作的通知(发改气候 [2012] 3760 号)

2017.01 NDRC, Notice of the National Development and Reform Commission on the Pilot Work of the third batch of national Low-Carbon Provinces and Cities
国家发展改革委关于开展第三批国家低碳城市试点工作的通知 (发改气候 [2017] 66 号)

Green Finance

2007.07 MEP, Opinions on Implementing Environmental Protection Policies and Regulations to Prevent Credit Risks
关于落实环保政策法规防范信贷风险的意见（环发 [2007] 108 号）

2007.07 CBRC, Notice on Preventing and Controlling the Risk of Loans in Industries with High Energy Consumption and High Pollution
防范和控制高耗能高污染行业贷款风险的通知（银监办发 [2007] 161 号）

2009.08 MEP, Notice on Full Implementation of Green Credit Policy to Further Improve Information Sharing Work
关于全面落实绿色信贷政策进一步完善信息共享工作的通知（环办 [2009] 77 号）

2014.06 CBRC, Key Evaluation Indicators for the Implementation of Green Credit
绿色信贷实施情况关键评价指标（银监办发 [2014] 186 号）

2015.08 PBOC Announcement [2015] No. 39
中国人民银行公告 [2015] 第 39 号

2015.12 NDRC, Green Bond Guidelines
绿色债券发行指引（发改办财金 [2015] 3504 号）

2016.05 MEP, China Green Finance Policy Progress Report 2016
中国绿色金融政策进展报告 2016

2016.08.31 NDRC and PBOC along with other five departments, Guidance on Building a Green Financial System

关于构建绿色金融体系的指导意见

2017.03 CSRC Guidance on Green Bond Support and Development

中国证监会关于支持绿色债券发展的指导意见（证监会公告 [2017] 6 号）

Adaptation

2004 NDRC, Initial National Communication on Climate Change of the People's Republic of China

中华人民共和国气候变化初始国家信息通报

2006, 2011 MOST, CMA and Chinese Academy of Sciences, 1st and 2nd National Report on Climate Change

第一、二次气候变化国家评估报告

Biodiversity

2010.09 MEP, China Biodiversity Conservation Strategy and Action Plan（2011-2030）

中国生物多样性保护战略与行动计划（2011-2030）（环发 [2010] 106 号）

2013.12 State Council, Regulations of the People's Republic of China on the Protection of Aquatic Wild Animals (2013 Revision)

中华人民共和国水生野生动物保护实施条例（2013 修订）（中华人民共和国国务院令第 645 号）

2016.02 State Council, Regulation of the Peoples' Republic of China on the Protection of Terrestrial Wild Animals (2016 Revision)

中华人民共和国陆生野生动物保护实施条例（2016 修订）（中华人民共和国国务 院令第 666 号）

2018.10 State Council, Wild Animal Conservation Law of the People's Republic of China (2018 Amendment)

中华人民共和国野生动物保护法（2018 修正）（中华人民共和国主席令第 16 号）

Water Policy

2011.12 National Health and Family Planning Commission, National Urban Drinking Water Sanitation Safety Guarantee Plan (2011-2020)

全国城市引用水卫生安全保障规划（2011-2020）(卫监督发 [2011] 95 号)

2012.01 State Council Guidelines on Implementing Stringent Water Resources Management System

国务院关于实施最严格水资源管理制度的意见（国发 [2012] 3 号）

2015.04 State Council, Action Plan on Water Pollution Prevention and Treatment

水污染防治行动计划（国发 [2015] 17 号）

2016.07 Ministry of Water Resources, Pilot Program of Returning farmland to lake

退田还湖试点方案（水规计 [2016] 418 号）

2016.12 NDRC and Ministry of Water Resources, Water Conservancy Reform and Development During “13th Five-year" Plan
水利改革发展“十三五”规划

2017.10 MEP, Water Pollution Prevention and Control Plan for Key River Basin (2016-2020)
重点流域水污染防治规划 (2016-2020)（环水体 [2017] 142 号）

2017.11 Ministry of Water Resources, Central Water Investment Plan Implementation Assessment Method
中央水利投资计划执行考核办法（水规计 [2017] 402 号）

2018.08 Ministry of Water Resources，Notice on Further Improving the Work of Supporting the Late Stage of Migrants of Large and Medium-sized Reservoirs
关于进一步做好大中型水库移民后期扶持工作的通知（水移民 [2018] 208 号）

Air Pollution

2013.09 State Council, Action Plan for Air Pollution Control
大气污染防治行动计划（国发 [2013] 37 号）

2018.07 State Council, Three-year Action Plan to Protect Blue Sky (2018-2020)
打赢蓝天保卫战三年行动计划（国发 [2018] 22 号）

Land Use and Land Use Change

2016.12 CPC & State Council, Several Opinions of CPC and State Council on Further Promoting the Structural Reform of Agricultural Supply Side and Accelerating the Cultivation of New Developmental Motive Forces of Agricultural and Rural Development (No.1 Document of 2017)
关于深入推进农业供给侧结构性改革加快培育农业农村发展新动能的若干意见（中发 [2017] 1 号）

2017.01 State Council, National Land Planning Outline (2016-2030)(No.3 Document)
全国国土规划纲要（2016-2030）（国发 [2017] 3 号）

2017.01 CPC & State Council, Opinions on strengthening the protection of cultivated land and improving the balance of occupation and compensation
中共中央、国务院关于加强耕地保护和改进占补平衡的意见（中发 [2017] 4 号）

2017.02 NDRC & Ministry of Land and Resources, National Land Remediation Plan
全国土地整治规划（2016-2020）（国土资发 [2017] 2 号）

2017.03 State Council, Guiding Opinions on Establishing Functional Zones for Food Production and Protected Zones for Production of Important Agricultural Products
国务院关于建立粮食生产功能区和重要农产品生产保护区的指导意见（国发 [2017] 24 号 ）

2017.03 Ministry of Land and Resources, Natural Ecological Space Use Control Measures (Trial)
自然生态空间用途管制办法（试行）（国土资发 [2017] 33 号）

2018.01 CPC and State Council, Opinions on Implementing the Rural Revitalization Strategy
关于实施乡村振兴战略的意见（中发 [2018] 1 号）

2018.01 MOF & Ministry of Land and Resources, Financial Management Measures for Land Reserve Funds

土地储备资金财务管理办法（财综 [2018] 8 号）

2018.03 Ministry of Land and Resources, Notice on Strictly Approved Land Remediation and New Standard Farmland Construction Projects

关于严格核定土地整治和高标准农田建设项目新增耕地的通知（国土资发 [2018] 31 号）

2018.06 Ministry of Natural Resources, Notice on Improving the Mechanism of Program of Plus and Minus Hook between Urban and Rural Construction Land

关于健全建设用地“增存挂钩”机制的通知（自然资规 [2018] 1 号）

2018.07 State Council, Notice on Strengthening the Protection of Coastal Wetlands and Strictly Controlling the Reclamation

关于加强滨海湿地保护严格管控围填海的通知（国发 [2018] 24 号）

Oil and Gas

2017.05 CPC Central Committee and State Council, Opinions on Deepening the Reform of Petroleum and Natural Gas System

中共中央、国务院, 关于深化石油天然气体制改革的若干意见

2018.03 NEA, 2018 Guidelines for Energy Work

能源局，2018 年能源工作指导意见

Energy Conservation

2017.01 State Council, Notice of the State Council on Printing and Distributing the "13th Five-Year Plan" Energy Saving and Emission Reduction Comprehensive Work Plan

国务院关于印发“十三五”节能减排综合工作方案的通知（国发 [2016] 74 号）

2017.03 State Council, Energy Conservation Regulation for State-funded Institutions (2017 Amendment)

公共机构节能条例 (2017 修订) [中华人民共和国国务院令第 676 号]

2018.02 NEA and NDRC, National Energy Administration's guidance on improving the power system's adjustment ability

国家能源局关于提升电力系统调节能力的指导意见（发改能源 [2018] 364 号）.

2018.10 NPC Standing Committee, Energy Conservation Law of the People's Republic of China (2018 Amendment)

中华人民共和国节约能源法 (2018 修正) [中华人民共和国主席令第 16 号]

2018.01 NDRC, National Key Energy Saving Low Carbon Technology Promotion Catalog (2017, Energy Saving Section)

国家重点节能低碳技术推广目录（2017 年本，节能部分）（2018 年第 3 号）

Electricity Reform

2015.03 CPC and State Council, Notice on Further Deepening Power System Reform

关于进一步深化电力体制改革的若干意见（中发 [2015] 9 号）

2015.11 NDRC and NEA, Opinions on Promoting the Reform of Transmission and Distribution Electricity Price

关于推进输配电价改革的实施意见（发改经体 [2015] 2752 号）

2015.11 NDRC and NEA, Opinions on Promoting the Construction of Electricity Market

关于推进电力市场建设的实施意见（发改经体 [2015] 2752 号）

2015.11 NDRC and NEA, Opinions on the Establishment and Operation of Power Trading Institutions

关于电力交易机构组建和规范运行的实施意见（发改经体 [2015] 2752 号）

2015.11 NDRC and NEA, On the Implementation of the Orderly Development of Electricity Plans

关于有序放开发用电计划的实施意见（发改经体 [2015] 2752 号）

2015.11 NDRC and NEA, Opinion on Promoting of the Reform of Electricity Retail Sales

关于推进售电侧改革的实施意见（发改经体 [2015] 2752 号）

2015.11 NDRC and NEA, Opinions on Strengthening and Standardizing the Supervision and Management of Self –serving Thermal Power Plants

关于加强和规范燃煤自备电广监督管理的知道意见（发改经体 [2015] 2752 号）

2017.12 NDRC, Notice on the Publication of Pricing Measures for the Power Transmission of Regional Power Grids (Trial), Pricing Measures for the Power Transmission of Specific Inter-Provincial and Inter-Regional Power Transmission Project (Trial) and Guiding Opinion on Provincial Distribution Pricing and Pricing for Incrementally-added Distribution

关于印发《区域电网输电价格定价办法（试行）》《跨省跨区专项工程输电价格定价办法（试行）》和《关于制定地方电网和增量配电网配电价格的指导意见》的通知（发改价格规 [2017] 2269 号）

2017.03 NDRC and NEA, Notice of Opening Power Generation and Consumption Plan

国家发展改革委国家能源局关于有序放开发用电计划的通知（发改运行 [2017] 294 号）

2017.08 NDRC and NEA, Notice to Construct Spot Power Market Pilots

关于开展电力现货市场建设试点工作的通知（发改办能源 [2017] 1453 号）

Renewables

2015.06 NEA, MIIT and Certification and Accreditation Administration, Opinions on Promoting the Application and Upgrading of Advanced Photovoltaic Technology Products

三部门关于促进先进光伏技术产品应用和产业升级的意见（国能新能 [2015] 194 号）

2016.07 NEA, Circular on Establishment of a Monitoring and Early Warning Mechanism to Promote the Sustainable and Sound Development of Wind Power Industry

国家能源局关于建立监测预警机制促进风电产业持续健康发展的通知（国能新能 [2016] 196 号）

2018.05 NDRC, MOF and NEA, Notice on Matters Relevant to Solar Power Generation 2018

关于 2018 年光伏发电有关事项的通知（发改能源 [2018] 823 号）

Green Consumption

2016.02 NDRC, MOF, MOST and MEP, Guidance on Promoting Green Consumption
关于促进绿色消费的指导意见（发改环资 [2016] 353 号）

2018.04 NDRC, Development of Green Consumption of China's Residents in 2017
2017 年中国居民绿色消费发展情况

2018.09 State Council, Implementation Plan of Improving the Mechanism of Promoting Consumption System (2018-2020)
完善促进消费体制机制实施方案（2018-2020）（国办发 [2018] 93 号）

Circular Economy

2016.12 NDRC, Circular Economy Development Evaluation Index System (2017 Edition)
循环经济发展评价指标体系 （2017 年版）（发改环资 [2016] 2749 号）

2017.04 NDRC, Circular Development Leading Action
循环发展引领行动（发改环资 [2017] 751 号 ）

2017.09 NDRC and MOF, Notice on Carrying out Supervision Work in Middle and Late Period of Various Model Pilots of Circular Economy in Second Half of 2017
关于开展 2017 年下半年循环经济各类示范试点中后期监管工作的通知（发改办环 资 [2017] 1586 号）

2018.10 NPC Standing Committee, Circular Economy Promotion Law of the People's Republic of China (2018 Amendment)
中华人民共和国循环经济促进法（2018 修正）（中华人民共和国主席令第 16 号）

Electric Vehicles

2004，2014 Standardization Administration and AQSIQ, Limits of Fuel Consumption for Passenger Vehicles
乘用车燃料消耗量限值（GB 19578）

2011，2014 Standardization Administration and AQSIQ, Fuel Consumption Evaluation Methods and Targets for Passenger Vehicles
乘用车燃料消耗量评价方法及指标 （GB 27999 ）

2014.07 State Council, Guidance on Accelerating the Promotion and Application of New Energy Vehicles
关于加快新能源汽车推广应用的指导意见（ 国办发 [2014] 35 号）

2017.09 MIIT, MOF, MOC, General Administration of Customs and AQSIQ, Administrative Measures on Corporate Average Fuel Consumption and New Energy Vehicle Dual-credit Scheme for Passenger Vehicle Enterprises
乘用车企业平均燃料消耗量与新能源汽车积分并行管理办法（工业和信息化部 财 政部商务部 海关总署质检总局令第 44 号）

2018.02 NDRC and NEA, Guidance on Improving the Power System's Adjustment Ability
关于提升电力系统调节能力的指导意见（发改能源 [2018] 364 号）

2018.07 MOF, Notice on Energy Savings for New Energy Vehicles and Vessels
关于节能新能源车船享受车船税优惠政策的通知（财税 [2018] 74 号）

RD&D

2006.02	State Council, Outline of the national medium and long term science and technology development program (2006-2020) 国家中长期科学和技术发展规划纲要（2006-2020）
2007.06	MOST, China's Scientific and Technological Actions On Climate Change 中国应对气候变化科技专项行动
2016.06	NDRC and NEA, Energy Technology Revolution Innovation Action Plan (2016-2030) 能源技术革命创新行动计划（2016-2030）（发改能源 [2016] 503 号）
2017.04	MOST and NDRC, National Scientific and Technological Actions on Climate Change During the 13th Five-Year Plan Period 十三五"应对气候变化科技创新专项规划（国科发社 [2017] 120 号）

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