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WORKING PAPER

ASSESSING IMPLEMENTATION OF CHINA'S CLIMATE POLICIES IN THE 12TH 5-YEAR PERIOD

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EXECUTIVE SUMMARY

In recent years, China has promulgated and implemented a range of policies designed to address climate change, reduce greenhouse gas (GHG) emissions, and ease its transition to low-carbon and sustainable development. These policies respond both to global efforts to control climate change and to China's own need to restructure its economy and reform its production and consumption patterns. China is on track to exceed the goals it has set. There is always, however, more to learn. As China approaches the close of its 12th 5-Year-Plan (FYP) period (2011–15), a review of its climate policy framework and progress in implementing key policy instruments can shed light on areas where further government action will likely be needed for the country to meet and exceed its climate and energy goals beyond 2015.

China's Progress to Date in Meeting its Climate Targets

Every five years, China's national government adopts a plan that charts the country's development course for the next five years. The 12th FYP period (2011–15) marked a new era in China's climate actions. The highest level of government has realized that climate action aligns with China's development interests, and the government has made a concerted effort to shift the country's development path. In 2012, the Communist Party of China (CCP) prioritized the "building of Ecological Civilization" as its key development strategy and wrote the concept into its

CONTENTS

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constitution. In 2014, President Xi mandated a national energy security strategy that will create an "Energy Revolution" to fundamentally change energy consumption, production, technology, and governance.

Supported by high level political will and specific policy instruments, the 12th FYP set binding targets to increase forest coverage, reduce energy intensity and carbon dioxide emissions intensity, and increase the proportion of non-fossil energy (nuclear, hydro, solar, wind, biomass, and geothermal) in the primary energy mix, all by 2015. The carbon intensity reduction and non-fossil energy targets were incorporated into China's top economic and social development plan for the first time, marking the institutionalization of domestically enforceable climate change policies. At the same time, China has pledged to peak its carbon emissions around 2030 with the intention to try to peak earlier, and to achieve 20 percent non-fossil-fuel consumption by 2030. The government has developed a suite of climate and energy targets and strategies, summarized in Figure ES.1.

Assessing China's progress toward meeting its goals is not a straightforward task; the Chinese government has not published complete data on its progress toward its energy intensity and carbon intensity reduction goals. Drawing on

Figure ES.1 | **International Pledges, Domestic Targets, and National Policies**

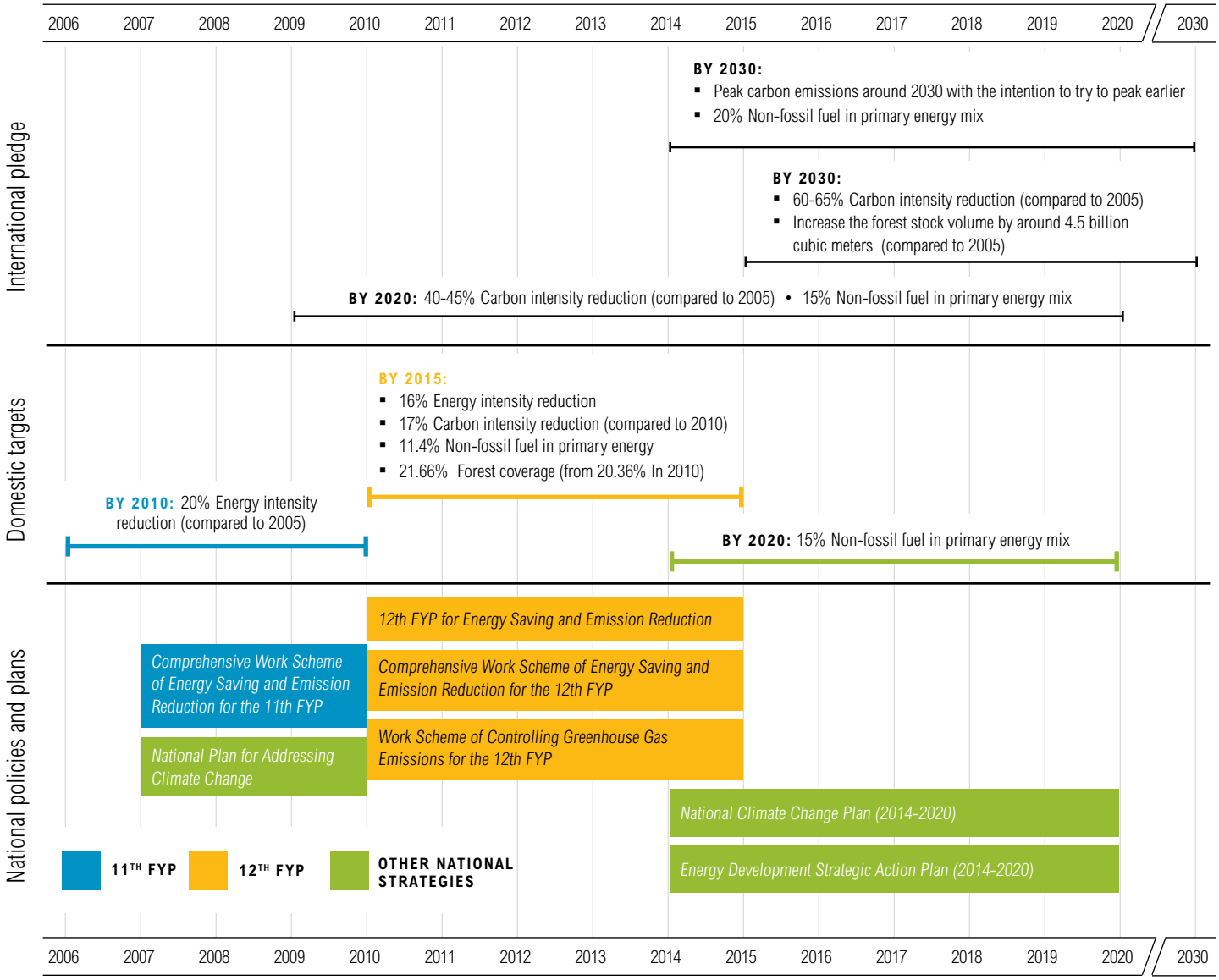
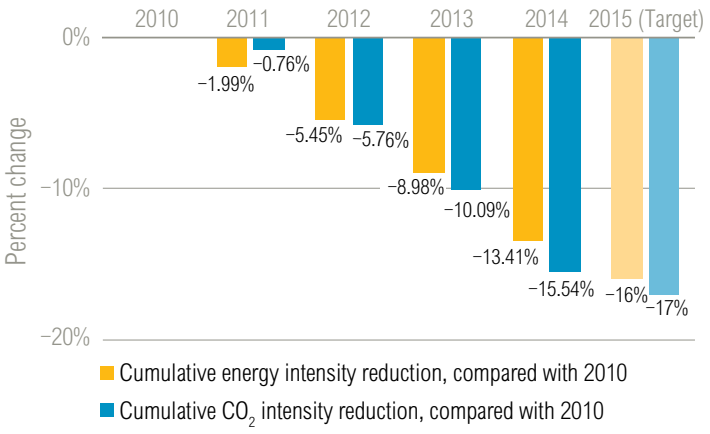


Figure ES.2 | **Energy and Carbon Intensity Reduction (2010–14)**



various sources, this paper calculates unofficial estimates for energy intensity reduction and carbon intensity, presented in Figure ES.2. The methods, underlying assumptions, and data used for these calculations are presented in Annex 1.

China is on track to exceed its 12th FYP targets. Its forest coverage rate in 2013 was 21.63 percent, and its non-fossil-fuel consumption in 2014 was 11.2 percent—both very close to the 2015 targets. The latest trends indicate that China will also likely exceed its energy intensity and carbon intensity reduction targets. In 2014, coal consumption and production dropped for the first time in 14 years, while total energy consumption grew only 2.2 percent. The production and import of coal decreased 6.0 percent and 38.8 percent, respectively, in the first five months of 2015 compared with the same period in 2014.

China's climate policy framework and assessing the implementation of four key policy instruments

Over the 12th FYP period, a comprehensive climate policy framework has emerged, covering both climate change mitigation and adaptation. The framework is supported by specific policies in energy, manufacturing, transport, and other sectors. These policies established specific, measurable, and time-bound targets. They also clarified the division of labor among government agencies, started to build a data infrastructure, and explored market mechanisms.

A closer look at the implementation of four policy instruments offers insight into China's progress under its climate policy framework, and suggests areas where further government action may be needed. The renewable energy feed-in tariff, energy-saving target disaggregation, the Passenger Car Fuel Economy Standard, and the Emissions Trading Scheme (ETS) pilots are key policy components of China's overall mitigation efforts. Using the Climate Policy Implementation Framework developed by WRI and its partners, this paper shows that these policy instruments are being implemented as intended, and that strong evidence suggests that they have resulted in real mitigation impacts. However, as the case studies demonstrate, challenges persist, including funding gaps, accounting loopholes, inadequate enforcement and compliance, and market illiquidity.

Key actions to watch for in the next 5-year period

China's actions in the upcoming 13th FYP period (2016–20) will have profound impacts on its GHG emissions. Whether it sets total energy and coal consumption control targets that are included in the national, sectoral, and provincial 13th FYPs, and if so, at what levels, will indicate the government's political determination. The form those targets take—whether they are hard "binding" or soft "expected"—will also have serious ramifications for China's GHG emissions.

While the peaking level was not identified in China's international pledge, various scenario studies suggest that China should be able to cap its energy-related CO_2 emissions around 9–10 $GtCO_2$ by 2020 with enhanced policies. Once the national GHG growth cap is set, it will need to be disaggregated to regional (province and municipality) and sectoral levels to be effective. A quantitative cap for GHG growth can inform the allowance allocation of China's anticipated national ETS, aligning the specific policy instrument with a high-level national target and ensuring that China is on track to achieve its emissions peak pledge.

Finally, putting a price on carbon is a key policy assumption shared by multiple scenario studies that project emissions peaking by 2030 or sooner. Based on experiences from China's seven pilot trading schemes, the government commissioned research for the national ETS design, and aims to have it operational as early as the second half of 2016. Whether the government can overcome the technical and political barriers to setting up the national ETS in line with its planned schedule will in part determine China's future emissions trajectory.

Challenges moving forward

Steering a large and quickly evolving emerging economy toward a sustainable future will not be easy. China will need to tackle multiple challenges as it develops, implements, and evaluates its policies to realize its vision for low-carbon development.

China needs to develop concrete and implementable policies in areas such as carbon capture utilization and storage, industrial process emissions, and agriculture emissions, where detailed policies are currently lacking. It should also strengthen its policy enforcement and compliance mechanisms: the case studies show that for some policies, consequences for noncompliance are insignificant. The government has made serious efforts to enhance transparency and data accuracy, but improvements are needed to distribute information in an accessible and transparent manner; to strengthen measurement, reporting, and verification (MRV) rules and systems to implement policies; and to punish data manipulation.

As multiple government agencies assume responsibility for addressing climate change in their sector, it is important to ensure coordination among climate and energy policies, and to integrate these policies with others. China's climate efforts would also benefit from innovative policies and mechanisms that go beyond the traditional command and control approach at a time when the low-hanging fruit are already picked and national leaders are calling for market forces to be given greater power.

Finally, China needs to develop a comprehensive system to track policy implementation and assess impacts. In contrast to MRV rules and systems that target regulated companies, a policy implementation tracking and assessment system focuses on the performance of policies in order to inform policy selection and design, improves policy implementation over time, and improves the cost-effectiveness and efficiency of resource use. Research institutes and civil society groups in China have started to assess the impacts of some climate and energy policies. Support from the government could encourage further progress toward transparent implementation and impact assessments.

Abbreviations

AQSIQ	General Administration of Quality Supervision, Inspection, and Quarantine of the People's Republic of China
BTC	Brookings-Tsinghua Center for Public Policy
CAFC	corporate average fuel consumption
CCER	China certified emissions reduction
CCP	Communist Party of China
CHP	combined heat and power
CH_4	methane
CO_2	carbon dioxide
CSG	China Southern Power Grid Company
DRC	Development and Reform Commission
EIC	economic and information commission
ETS	Emissions Trading Scheme
FYP	5-year plan
GAC	General Administration of Customs
GDP	gross domestic product
GHG	greenhouse gas
HFC	hydrofluorocarbon
MIIT	Ministry of Industry and Information Technology
MOC	Ministry of Commerce
MOF	Ministry of Finance
MRV	measurement, reporting, and verification
NBS	National Bureau of Statistics
NDRC	National Development and Reform Commission
NEA	National Energy Administration
N_2O	nitrous oxide
OECD	Organisation for Economic Co-operation and Development
PFC	perfluorocarbon
PV	photovoltaic
RMB	Ren Min Bi (Chinese yuan)
SASAC	State-Owned Assets Supervision and Administration Commission of the State Council
SF_6	sulfur hexafluoride
SGCC	State Grid Corporation of China
tCO_2e	tons of carbon dioxide equivalent
TCE	metric tons of coal equivalent
TOE	metric tons of oil equivalent
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WRI	World Resources Institute

INTRODUCTION

Under the United Nations Framework Convention on Climate Change (UNFCCC), countries have committed to stabilize greenhouse-gas concentrations in the atmosphere at a level sufficient to limit the increase in global average temperature to no more than 2°C above preindustrial levels. To make good on this commitment and avoid the most dangerous effects of climate change, the world must peak global carbon dioxide emissions by around 2020, and reach near-zero emissions by the end of this century.[1]

China is the largest energy consumer and greenhouse gas (GHG) emitter in the world. In 2014, China consumed 2.98 billion metric tons of oil equivalent (TOE), with coal, petroleum, and natural gas accounting for 66 percent of its energy consumption.[2] Including land-use change and forestry, China is estimated to have emitted around 10.68 billion metric tons of carbon dioxide equivalent (tCO_2e), or 23.2 percent of global GHG emissions in 2012.[3]

If the world is to avoid going above the 2°C target and achieve the emissions peak in 2020, China will need to transition to low-carbon development quickly. To assess China's efforts to control its GHG emissions, we must understand not only the number and types of climate policies it has promulgated but also its progress in implementing these policies and their effectiveness once in place.

This working paper aims to help policymakers and experts outside China better understand China's climate policies, including its national strategies and goals. The paper explores the implementation of four policy instruments considered to have the farthest-reaching mitigation impacts or mitigation potential, and looks forward to new actions the government is likely to take in the 13th 5-Year-Plan (FYP) period, between 2016 and 2020. While the paper does consider adaptation policies, it focuses primarily on mitigation policies because of their impacts on global emissions.

This paper is organized into four sections. The first section reviews China's climate targets during the 12th FYP period (2011–15) and its progress toward meeting these targets. The second section analyzes the emerging climate policy framework in China and presents case studies of four policy instruments. The case studies outline the development process and key characteristics of each policy instrument, and evaluate their implementation and intermediate effects to date. The third section identifies additional climate actions that China may pursue in the next five years, while the fourth section lays out some of the challenges that China will need to address going forward.

Box 1.1 | **China's 5-Year Plan and Target Types**

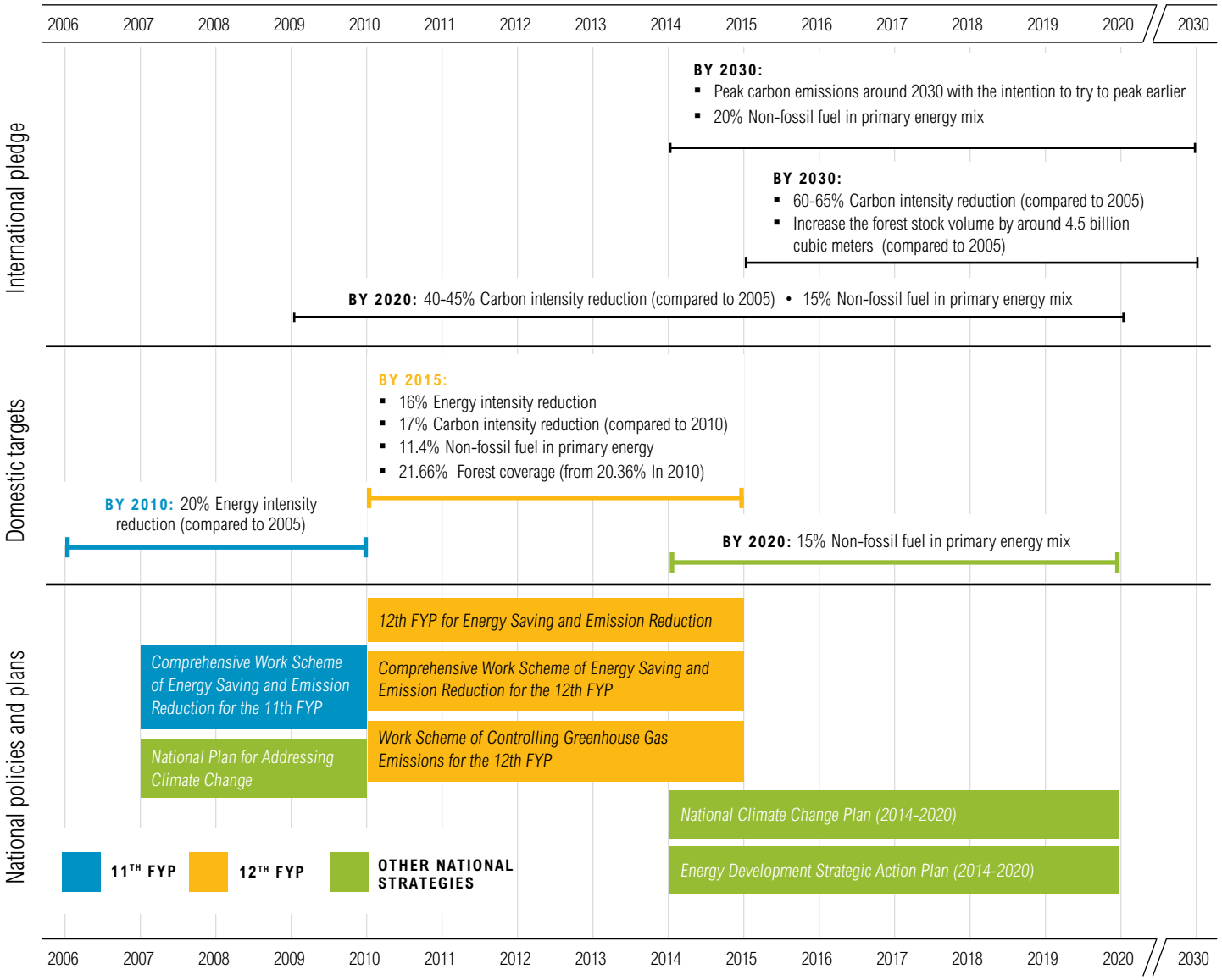
Every five years, China's central government develops a 5-year plan for national economic and social development (national FYP). The national FYP articulates the most important development targets and forms the basis for provincial, sectoral, and sector-specific provincial FYPs, which spell out targets and policies in greater detail. FYPs include "binding targets" and "expected targets." Binding targets are hard targets that the government strives to meet through administrative means, while expected targets are soft targets that are to be achieved through macroadjustment policies, such as fiscal, industrial, and investment policies, to create the requisite enabling economic, institutional, and market environment. Expected targets are generally less likely to be achieved precisely because they are accomplished by manipulating secondary forces rather than through direct intervention.

1. CLIMATE TARGETS AND PROGRESS DURING THE 12TH 5-YEAR-PLAN PERIOD

The 12th FYP period marks a new era for China's climate actions. China's 12th FYP carbon intensity target—17 percent reduction in 2015 compared to 2010—is its first legally binding, domestic climate change national policy.[4] Supported by a series of sectoral FYPs, specific policies, and actions, China updated its targets for energy intensity reduction, renewable energy development, and non-fossil energy use. To encourage local actions and build experience for national scale-up, China designated 42 provinces and cities as low-carbon pilots and initiated seven carbon emissions trading pilots across the country. The government promulgated the National Climate Change Plan (2014–20) and the Energy Development Strategic Action Plan (2014–20) in 2014 to guide its midterm efforts.

In 2013, after suffering the worst air pollution crisis in 52 years, nine provinces and cities that together account for 30 percent of China's coal consumption (including Beijing, Shanghai, and Guangdong) placed a cap on coal consumption.[5] In November 2014, China announced plans to peak its carbon emissions around 2030 with the intention to try to peak earlier, and to achieve 20 percent non-fossil energy consumption in 2030.[6]

Figure 1.1 | **International Pledges, Domestic Targets, and National Policies**



China's actions respond in part to global efforts to control climate change. More important, they reflect China's own needs for cleaner development, economic restructuring, and reformed production and consumption patterns. The previous model of development—described by President Xi Jinping as "unbalanced, uncoordinated, and unsustainable"[7]—is indeed no longer sustainable, even in a conventional economic sense.[8] The Communist Party of China (CCP) prioritizes the "building of Ecological Civilization" as its key development strategy and wrote the concept into its constitution in 2012.[9] Since then, China has shifted its economic strategy to a "new normal" model, which includes having slower but better quality growth at its core, with a particular emphasis on services, innovation, reduced inequality, and environmental sustainability.[10] The shift is evidenced by the CCP's decision to deepen reform[11] and President Xi's call for an "Energy Revolution" to fundamentally change energy consumption, production, technology, and governance.[12]

Overall Target and Progress

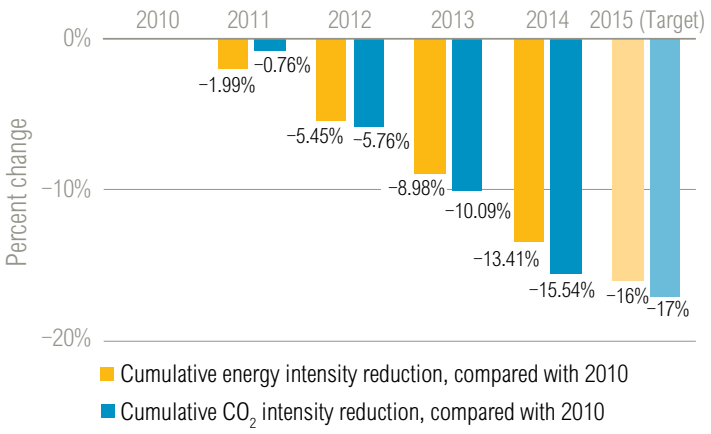
China's first national effort to address climate change began in 2006, when it announced its gross domestic product (GDP) energy intensity reduction target and forest coverage target in its 11th FYP. In 2007, China developed and implemented its first national climate change plan,

marking the beginning of a comprehensive climate change effort. In 2009, China pledged to reduce its GDP carbon intensity by 40 to 45 percent in 2020 compared with 2005.

The 12th FYP, issued in 2010, is a milestone for China's climate policies. The plan set binding targets to increase forest coverage to 21.66 percent, reduce energy intensity by 16 percent, reduce carbon dioxide emissions intensity by 17 percent, and increase the proportion of non-fossil fuels[13] in the primary energy mix to 11.4 percent, all by 2015. The last two targets were introduced into China's top economic and social development plan, marking the institutionalization of domestically enforceable climate change policies. In 2014, China took a further step, pledging to peak its carbon emissions by 2030 with the intention to try to peak earlier, and to increase the proportion of non-fossil fuels in its primary energy consumption to about 20 percent in 2030. In June 2015, China's intended nationally determined contributions put forward two new goals for 2030: (1) reducing carbon intensity by 60 to 65 percent below 2005 levels and (2) increasing its forest carbon stock volume by around 4.5 billion cubic meters from 2005 levels. At the same time, China developed a series of policies and plans to implement these targets and pledges (see Figure 1.1).

Because government data are not available, this paper estimates energy intensity reduction and carbon intensity reduction during the 12th FYP based on several other sources (see Figure 1.2). The numbers presented here may differ from the final data when these are released by the government. Annex I explains the underlying method, the assumptions, and the data used for this paper's estimates.

Figure 1.2 | **Energy and Carbon Intensity Reduction (2010–14)**



The latest trends put China on track to achieve and exceed its energy and carbon intensity reduction targets. In 2014, coal consumption and production dropped for the first time in 14 years, while total energy consumption grew only 2.2 percent. These trends continued into 2015, with the production and import of coal in China decreasing 6.0 percent[14] and 38.8 percent,[15] respectively, in the first five months of 2015 compared with the same period in 2014. China's forest coverage rate in 2013 was 21.63 percent,[16] and the proportion of non-fossil fuels in primary energy consumption was 11.2 percent in 2014,[17] both very close to the 2015 targets.

In June 2015, Premier Li Keqiang announced that China reduced its energy intensity and CO_2 emissions intensity for 2014 by 29.9 percent and 33.8 percent, respectively, compared to 2005 levels,[18] figures in line with estimated results above.

Energy Sector

Energy consumption accounted for 78.5 percent of China's GHG emissions in 2012.[19] To reduce energy-sector emissions, the government adopted a two-pronged strategy: control the growth in energy consumption and decarbonize the energy supply system.

For energy consumption, in addition to the energy intensity reduction target set out in the national FYP, the *12th FYP for Energy Development* established a total energy-consumption target of 2.94 billion TOE.[20] Compared to the United States in 2013, this is about two times the total energy consumption and less than 50 percent energy consumption per capita.[21] As coal accounts for 66 percent of China's energy mix,[22] the *12th FYP for Coal Industry Development* provides quantified guidance (not a target) to control coal consumption at 3.9 billion metric tons by 2015. In 2012, the *12th FYP for Key Regions' Air Pollution Prevention and Control* mandated the development of coal consumption control pilots in the Beijing-Tianjin-Hebei, Yangtze River Delta, and Pearl River Delta regions, as well as the Shandong Province city cluster. In 2013, the State Council (the chief administrative authority that oversees ministries and provincial governments) issued the *Air Pollution Prevention and Control Action Plan*, which encourages a decline of coal consumption in the Beijing-Tianjin-Hebei, Yangtze River Delta, and Pearl River

Delta regions by 2017, and mandates the development of mid- and long-term targets for national coal consumption control. Following these mandates, Beijing, Tianjin, Hebei, and Shangdong established city- or province-specific targets, committing to reduce coal consumption by 87 million metric tons from 2012 levels by 2017. Shanghai, Jiangsu, Zhejiang, and Guangdong have committed to achieve negative growth in coal consumption by 2017, and Liaoning province has committed to zero growth in coal consumption by 2017. The nine provinces and cities mentioned above account for 30 percent of China's coal consumption.[23] In 2014, China consumed 3.51 billion metric tons of coal, a 2.9 percent decline compared to 2013 and the first decline in 14 years.[24]

Despite its progress and effort (see also the sections below on the manufacturing and transport sectors), China consumed 2.98 TOE in energy in 2014, an increase of 2.2 percent from 2013,[25] making it very difficult for China to meet the 2015 energy-consumption target of 2.94 billion TOE.

For energy supply, the *12th FYP for Energy Development* set a target that non-fossil generation capacity should reach 30 percent of the total in 2015.[26] The *12th FYP for Renewable Energy Development* clearly states that "renewable generation becomes a major source for power" and that in 2015 renewable energy generation accounts for 20 percent of total generation.[27]

During the 12th FYP, China continues to invest heavily in renewable energy. New investment for renewable energy excluding large hydro increased from $38.7 billion in 2010 to $83.3 billion in 2014.[28] As a result, from 2010 to 2014, non-fossil energy generation capacity went from 256.7 GW to 444 GW, an increase of 73 percent. The share of accumulated installed capacity also increased, from 26.5 percent to 32.7 percent. By the end of 2014, China's renewable energy generation reached 1,245 TWh, accounting for 22.4 percent of the total.[29,30] China is on track to achieve its electricity installation and production targets (see Figures 1.3–1.5).

Manufacturing Sector

The manufacturing sector accounted for around 29.4 percent of GHG emissions from energy in 2012.[31] In 2012, the Ministry of Industry and Information Technology (MIIT) issued the *12th FYP for Industrial Energy Saving*, which set a 21 percent energy intensity reduction target (by 2015 compared with 2010) for industrial enterprises that have an annual revenue of $3.3 million or more. The plan also disaggregated the target to nine key industries and 20 major industrial products.

In 2012, the MIIT, the National Development and Reform Commission (NDRC), the Ministry of Science and Technology, and the Ministry of Finance (MOF) jointly issued the *Action Plan for Addressing Climate Change* in the

Figure 1.3 | **Renewable Energy Actual Generation**

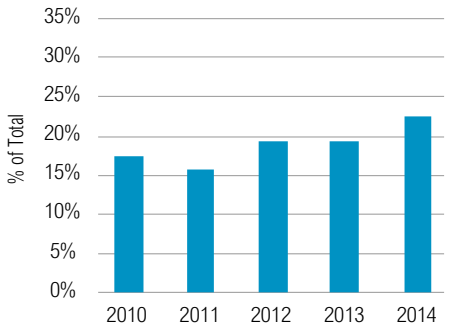


Figure 1.4 | **Non-fossil Generation Capacity**

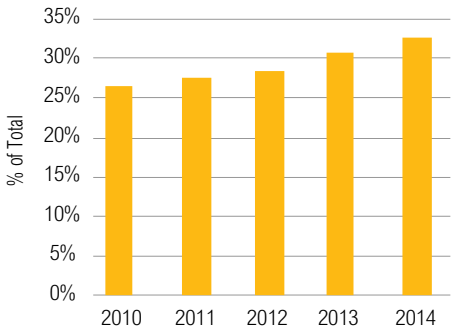
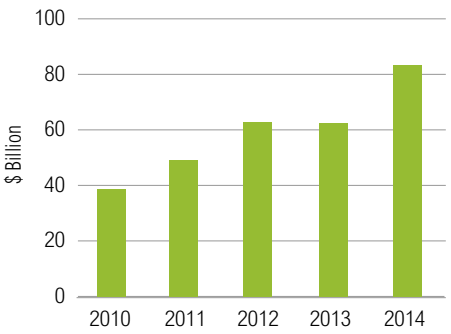


Figure 1.5 | **New Investment in Renewable Energy**



Sources: Generation and capacity data from Editorial Committee for China Electricity Year Book, China Electricity Year Book (2006–14); and China Electricity Council. Investment data from UNEP and Bloomberg New Energy Finance, Global Trends in Sustainable Energy Investment (2007–12). RE investment data exclude large hydro.

Box 1.2 | **Industrial Value Added**

Energy intensity and **carbon intensity** for the manufacturing sector are calculated on the basis of **industrial value added,** or per unit of added value of industrial output, which reflects the new value created by an industrial enterprise in a given period. It is different from **total value of industry**, which reflects the total value of industry output.

Source: National Bureau of Statistics, "Industrial Value Added."

Industrial Sector (2012–20). The action plan set the target of reducing carbon dioxide emissions intensity by 21 percent in 2015 compared with 2010, and 50 percent in 2020 compared with 2005.[32] The carbon intensity reduction target for 2015 is again disaggregated to nine key industries. In 2014, the NDRC issued an administrative notice to local development and reform commissions, mandating that large energy-consuming organizations, including manufacturing companies, report their GHG emissions annually.

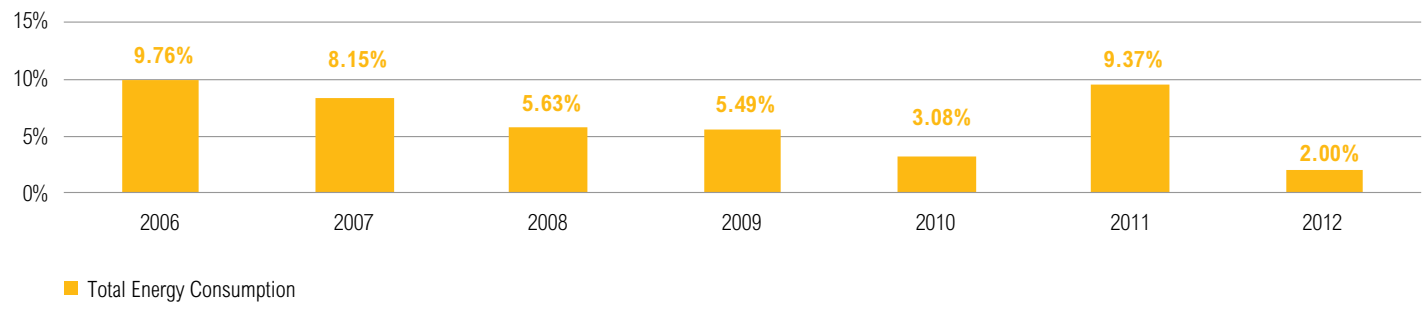
Chinese media have reported that energy consumption per value-added declined by a cumulative 21 percent in the first four years of the 12th FYP.[33] Since China's portion of non-fossil fuel has been increasing in the past few years over time, if confirmed, this drop would mean that China has essentially achieved its targets for energy and carbon intensity in the manufacturing sector. However, energy consumption for the manufacturing sector continues to rise (see Figure 1.6).

Transport Sector

The transport sector was responsible for 703 million tCO_2e in 2012, accounting for 8.1 percent of GHG emissions from energy use. While this share is small compared to that of other sectors, the transport sector's emissions increased 71 percent from 2005 to 2012, the highest of all sectors.[34] Generally, wealth creation and economic growth are accompanied by rising per capita CO_2 emissions from transport; the transport sector represents 30 percent of CO_2 emissions for Organisation for Economic Co-operation and Development (OECD) countries.[35] China's actions to mitigate transport sector emissions will become more and more important as its economy continues to grow.

Government efforts in the transport sector focus on improving transportation energy and emissions efficiency. Through *the 12th FYP of Energy Saving and Emission Reduction in the Road and Marine Transport Sector, the 12th FYP for Transport Sector, the Guidance on Implementing State Council's 12th FYP of Energy Saving and Emissions Reduction in the Road and Marine Transport Sector,* and *the GHG Emissions Control Work Scheme for the Transportation Sector for the 12th 5-Year*, the government has defined targets to reduce energy and carbon emissions intensity for commercial road passenger transport, road freight transport, inland river and ocean

Figure 1.6 | **Energy-Consumption Growth for the Manufacturing Sector (Year over Year Change)**



Source: Qi et al., 2013 Annual Review of Low-Carbon Development in China.

shipping, port operation, urban bus, urban taxi, and civil aviation transport (see Table 1.1). In addition, the government promulgated the Energy-Saving and New Energy Automotive Industry Development Plan (2012–20) in 2012, which set the target of average fuel consumption for domestic[36] passenger cars to 6.9 L/100 km in 2015 and further to 5.0 L/100 km in 2020 (see Section 2.3 for details). To support these targets, the government has proposed a road map for low-carbon development of the transport sector. Targeted approaches include increasing waterway transport for energy saving, continuing the trial operation of commercial vehicle fuel economy standards, increasing the use of clean and new energy vehicle and vessels, and actively promoting clean and efficient energy technologies.[37,38,39,40,41] In 2011, the Ministry of Transport developed the Transport Energy-Consumption Monitoring Scheme, requiring key transport enterprises to report energy-consumption data.[42]

No comprehensive data available in the transport sector enable target tracking. The Transport Energy-Consumption Monitoring Scheme, however, does provide certain data from key transportation enterprises from 2011 to 2014 (see Table 1.1). While the data can shed some light on recent trends, it should be noted that they may not be representative for the whole sector.

Table 1.1 | **Climate and Energy Targets Progress for Key Transportation Enterprises**

TRANSPORT SUBSECTOR	CO_2 INTENSITY REDUCTION TARGET BY 2015 (COMPARED TO 2005)[43,44,45,46]	ENERGY INTENSITY REDUCTION TARGET BY 2015 (COMPARED TO 2005)[47,48,49,50]	CUMULATIVE CHANGE OF ENERGY INTENSITY IN 2014 (COMPARED TO 2011)[51]
Commercial road passenger transport (excluding urban transport)	–7%	–6%	+7.1%
Commercial road freight	–13%	–12%	–9.1%
Ocean and coastal shipping	–17%	–16%	–27.1%
Commercial inland river shipping	–15%	–14%	Not available
Port operation	–10%	–8%	–14.6%
Urban bus	–17%	—	0%
Urban taxi	–26%	—	Not available
Civil aviation	–3% (compared to 2010)	–3% (compared to 2010)	Not available

Initial data show that results are mixed for energy efficiency improvement in the transport sector. Significant progress has been made in commercial road freight, ocean and coastal shipping, and port operation. In contrast, energy efficiency for urban bus and commercial road passenger transport has made no progress or even deteriorated. The data gap problem is also prominent.

The Ministry of Transport attempted to reduce demand for private cars. The government set targets for the number of buses per 10,000 people in given areas and the bus stop coverage rate, depending on the population of a city. It also selected 37 municipalities as public transit pilots and accelerated the development of urban railway and rapid bus transport systems. Eight major cities, including Beijing, Shanghai, and Guangzhou, have imposed restrictions on new passenger car purchases.

As a result, urban public transport in China has developed quickly. By 2014, the number of buses and the length of urban railways had increased 25.7 percent and 91 percent, respectively, compared with 2010. Bus and urban railway systems in China transported 98 billion people in 2014, up from 75 billion in 2010.[52,53] However, the demand for transport has also been rising quickly, as shown by the vehicle ownership growth. Civil aircraft and private passenger car ownership increased 66 percent and 84 percent in 2013, compared to 2010. By the end of 2013, there were almost 91 million private passenger cars in China.[54]

2. CLIMATE POLICY FRAMEWORK AND CASE STUDIES

A comprehensive climate policy framework, comprising macrostrategies, sectoral plans, and specific policy instruments, has emerged in China during the 12th FYP period. This section presents China's climate policy framework and explores four policy instruments that shed light on how climate policies actually work in China.

The authors consulted with experts in selecting three of the policy instruments considered in the case studies: the renewable energy feed-in tariff, energy-saving target disaggregation, and the Passenger Car Fuel Economy Standard. These three policies are considered to have furthest-reaching impact. The fourth case focuses on the GHG Emissions Trading Scheme (ETS) pilots. The authors chose this policy instrument in light of China's desire to embrace a market-based mechanism and its mitigation potential.

Box 2.1 | **Policy Instrument**

A policy instrument is the specific mechanism that obligates or incentivizes the technological or behavioral change that will in turn mitigate GHG emissions. It is different from a policy or plan, which lays out a government's broad goals and priorities with respect to climate change.

Source: Barua, Fransen, and Wood, "Climate Policy Implementation Tracking Framework."

This paper uses the Climate Policy Implementation Tracking Framework to conduct the case studies (see Box 2.2). While the paper tracks intermediate effects that are associated with these policies, the analysis cannot exclusively attribute effects to these policies: such attribution would require a comprehensive examination of all other policy and non-policy factors, which is outside the scope of this paper.

2.1 Policy Framework for Climate Action

During the 12th FYP period, a policy framework has emerged for climate actions, from macroplans and macrostrategies to specific policy instruments (see Figure 2.1). The *National Climate Change Plan (2014–20)* sets mid-term goals for China's climate policies and provides guidance in five areas: GHG emissions control, low-carbon pilots, climate change adaptation, capacity building, and international cooperation. The plan proposes a new forest restoration target; mandates the control of industrial emissions; and addresses sectors, such as building and transport, whose relative importance will increase as China's economy continues to grow.

The *Energy Development Strategic Action Plan (2014–20)* establishes a road map for China's energy future. The plan envisions a clean, efficient, safe, and sustainable energy system for China. It sets out a strategy to attain this vision based on energy saving, a strengthened domestic supply, innovation, and low-carbon energy. The action plan proposes quantitative control targets for total energy consumption and total coal use, and mandates that non-fossil fuel and natural gas reach 15 percent and 10 percent of total energy use, respectively, while mandating a decrease in coal to 62 percent.

Box 2.2 | Climate Policy Implementation Tracking Framework

The Climate Policy Implementation Tracking Framework (hereafter, the Tracking Framework) is one of a suite of policy tools developed by the World Resources Institute (WRI) and its partners. The Tracking Framework supports monitoring of progress toward climate policy adoption and implementation. It also provides guidance for evaluating institutional and governance factors that influence the effectiveness of policy implementation, for users who want to conduct a deeper policy implementation analysis.

TRACKING POLICY ADOPTION

The Tracking Framework can help users to identify milestones toward the adoption of a given policy instrument, and to assess progress against these milestones up to the point where the policy instrument is adopted and ready for implementation. To identify relevant milestones, users can consider whether legislative actions or executive and regulatory actions are required to adopt a specific policy instrument.

TRACKING POLICY IMPLEMENTATION

Policy implementation requires the mobilization and allocation of resources, as well as active administration and enforcement. The Tracking Framework supports the use of policy implementation indicators (also known as "key performance indicators") related to policy inputs, activities, and intermediate effects. Input indicators address mobilization and allocation of financial resources necessary for the policy implementation. Activity indicators address policy administration activities that must occur on a regular basis while the policy is in effect. Indicators for intermediate effects help to track the policy's intermediate effects, such as changes in behavior, technology, processes, or practices that result from implementation of a policy instrument.

POLICY KEY PERFORMANCE INDICATORS

INPUTS	ACTIVITIES	INTERMEDIATE EFFECTS	EFFECTS

■ Finance
■ Other inputs
	■ Licensing, permitting, and procurement
	■ Information monitoring
	■ Compliance and enforcement
	■ Other policy administration activities
		■ Behavioral changes
		■ Technology changes
		■ Process changes
			■ GHG effects
			■ Non-GHG effects
			  ■ Environment
			  ■ Social
			  ■ Economic

Source: Barua, Fransen, and Wood, "Climate Policy Implementation Tracking Framework."

To achieve goals outlined in the national 12th FYP and other macroplans, the government developed specific FYPs and policy instruments in the energy, industry, building, transport, forestry, water resources, and technology sectors.

The climate policy framework that emerged under China's 12th FYP is distinguished by several notable characteristics:

Increased attention to adaptation

During the 11th FYP, China's climate policy focused on mitigation. During the 12th FYP, adaptation began to

garner more attention. China's *National 12th 5-Year Plan for National Economy and Social Development* explicitly required that the country "fully consider climate change factors in project planning and construction of infrastructure and other major projects," and that China move toward "building adaptation capacity in agriculture, forestry, water resources, and other areas." The *National Climate Change Adaptation Strategy* of 2013 is China's first national-level climate adaptation plan.[55] The plan, based on a full assessment of the current and future impacts of climate change on China, set clear national guidelines and principles for the country's adaptation work, with specific objectives, key tasks, regional development priorities, and safeguarding mechanisms. The plan identified infrastructure, agriculture, water resources, coastal zones and related waters, forests and other ecosystems, human health, tourism, and other industries as the key sectors for adaptation. It articulated six areas for action: institutional mechanisms, capacity building, fiscal and other financial incentives, technical support, international cooperation, and implementation.

Comprehensive target system for climate and energy

China uses a target system to articulate priorities and enhance accountability. The energy intensity reduction target was first incorporated in the 11th FYP. During the 12th FYP period, China has gradually developed a comprehensive target system. The national 12th FYP set binding targets for energy intensity reduction, CO_2 intensity reduction, proportion of non-fossil-fuel energy consumption, and forest coverage rate, all to be achieved by the end of 2015. Based on the national FYP, sectoral plans further disaggregated targets in each sector and subsector, such as total energy-consumption targets; renewable installation and generation targets; and energy intensity reduction targets in the industrial, transport, and building sectors. Some of these targets, such as the energy intensity reduction target, are also disaggregated and incorporated into regional FYPs. These targets are supported by various policies in each sector and their completion status serves as the foundation for the government's assessment of FYP implementation.[56]

Clearly defined responsibilities

The division of responsibilities for addressing climate change challenges among different governmental agencies has become clear during the 12th FYP. The division is reflected in the various sectoral work plans. The MIIT issued the *Action Plan for Addressing Climate Change by the Industrial Sector (2012–20)*, which clarified its responsibilities, including industrial energy efficiency regulation, industrial process emissions reduction, low-carbon technology development and application, as well as production and consumption of low-carbon industrial products. The Ministry of Transport issued a *GHG Emissions Control Work Scheme for the Transportation Sector for the 12th 5-Year*, setting emissions-reduction requirements for road transport, marine transport, and urban passenger transport, and initiating key energy-saving projects in the sector. The State Forestry Administration issued *Key Actions to Address Climate Change by the Forestry Sector for the 12th 5-Year*, clarifying its responsibilities, including forestation, forest cultivation and operation, deserted land management, and wetland protection. The Ministry of Science and Technology issued a *National Climate Change Technology Development Plan for the 12th 5-Year* to guide the research and development of climate change observation technologies, low-carbon technologies, and adaptation technologies. The State Oceanic Administration is developing its plan to tackle climate change in the marine sector.[57]

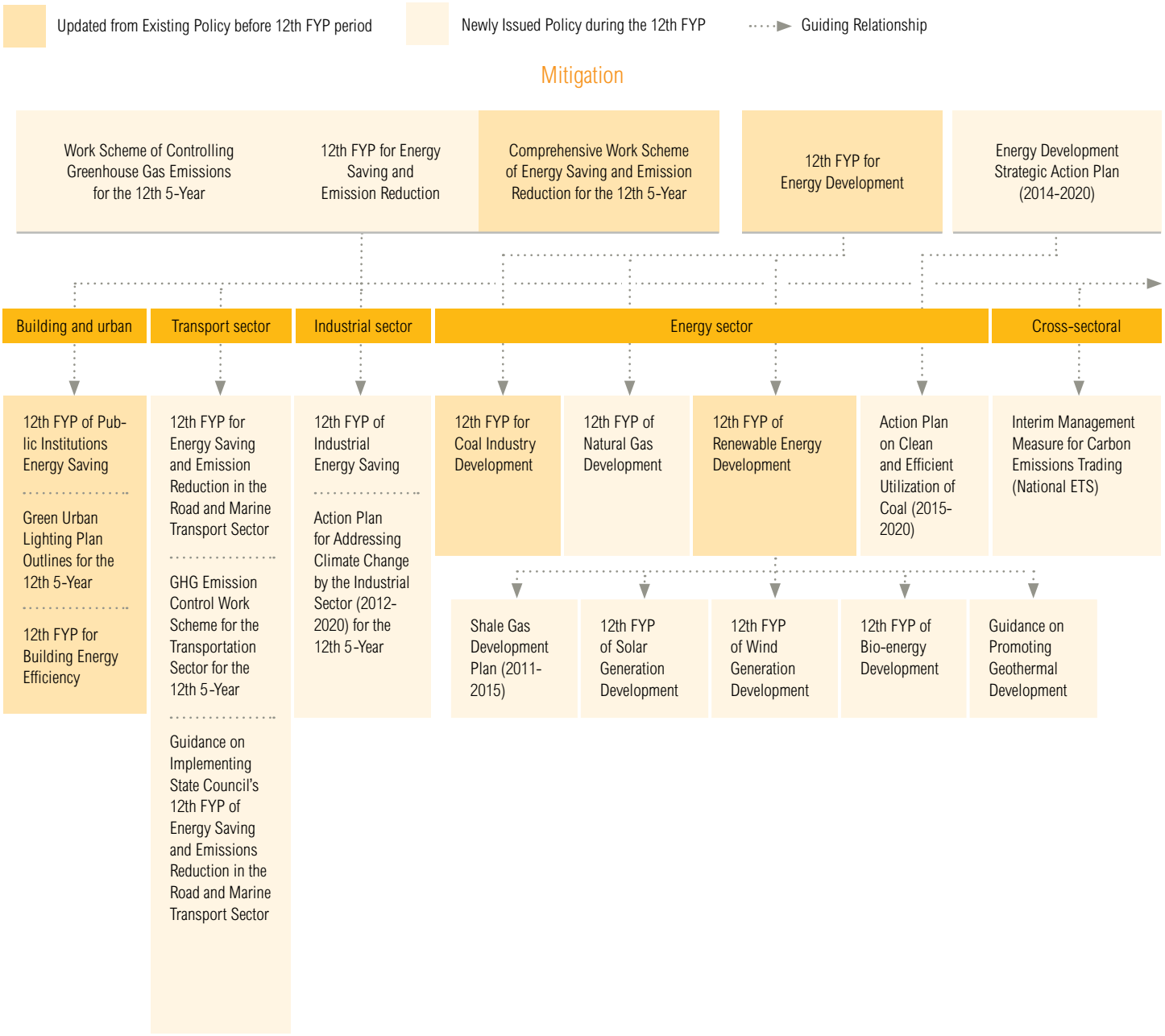
Enhanced data infrastructure

China has ramped up efforts to build the data infrastructure to support climate change policies. In 2013, the NDRC and the National Bureau of Statistics (NBS) jointly issued their *Guidance on Strengthening Data Collection to Address Climate Change*. The document articulated the division of labor, provided detailed guidance on the development of data collection and disclosure mechanisms, and proposed improvements for existing data collection practices. It also articulated a climate change indicator system, including 36 indicators in 19 categories, addressing climate change impact, climate change adaptation, GHG emissions control, funding, and management issues. In October 2013, the NDRC published GHG accounting and reporting guidelines for 10 industries, and guidelines for more industries have been published since then. All seven ETS pilots have developed technical specifications for GHG accounting and reporting, and they have directed regulated companies to report GHG emissions annually. In early 2014, the NDRC issued an administrative notice to local Development and Reform Commissions (DRCs), mandating GHG reporting for enterprises emitting 13,000 tCO_2e, or 3,500 TOE in annual energy consumption.

Utilizing market mechanisms

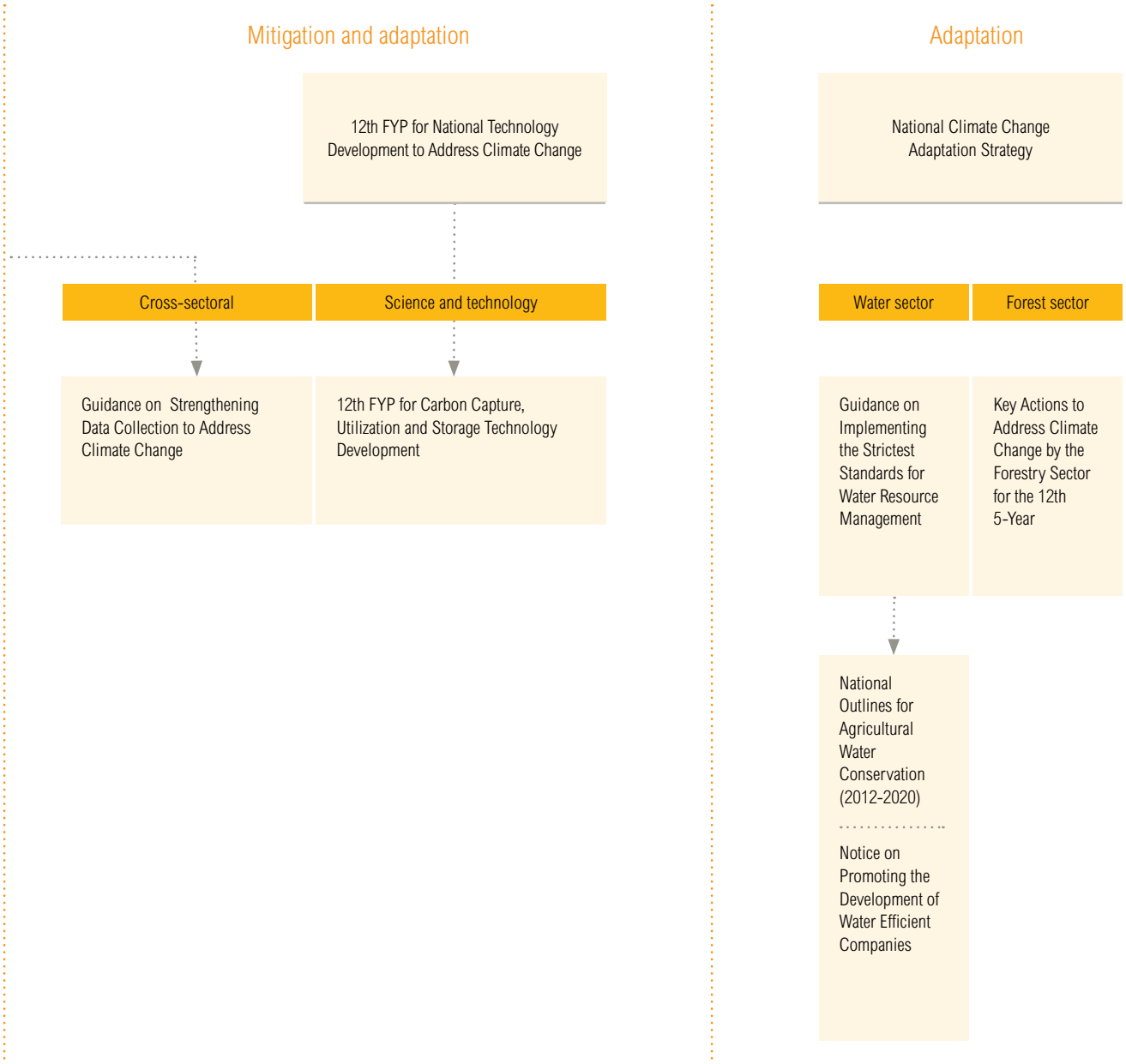
During the 12th FYP, China's climate policy became more diversified with the introduction of tools that emphasize the use of market mechanisms. Previously, China's climate and energy policies relied primarily on command and control measures, such as the energy-saving and emissions-reduction target disaggregation mechanism. The national 12th FYP in 2011 mandated the development of the carbon Emissions Trading Scheme (ETS) at the highest level of national planning.[58] In 2013, the CCP's *Decision on Major*

Figure 2.1 | **Framework of China Climate Policy during the 12th FYP Period**



Issues Concerning Comprehensively Deepening Reforms stated that the "market should play a decisive role in the allocation of resources."[59] As a result, China set up seven carbon emissions trading pilots and started trading in 2013 and 2014. In 2014, the NDRC issued the *Interim Management Measure for Carbon Emissions Trading* to kick off the official preparation of a national ETS, which is expected to be operational by the end of 2016 or early 2017.[60]

Figure 2.1 | **Framework of China Climate Policy during the 12th FYP Period**



2.2 The Renewable Energy Feed-In Tariff

Policy Overview and History

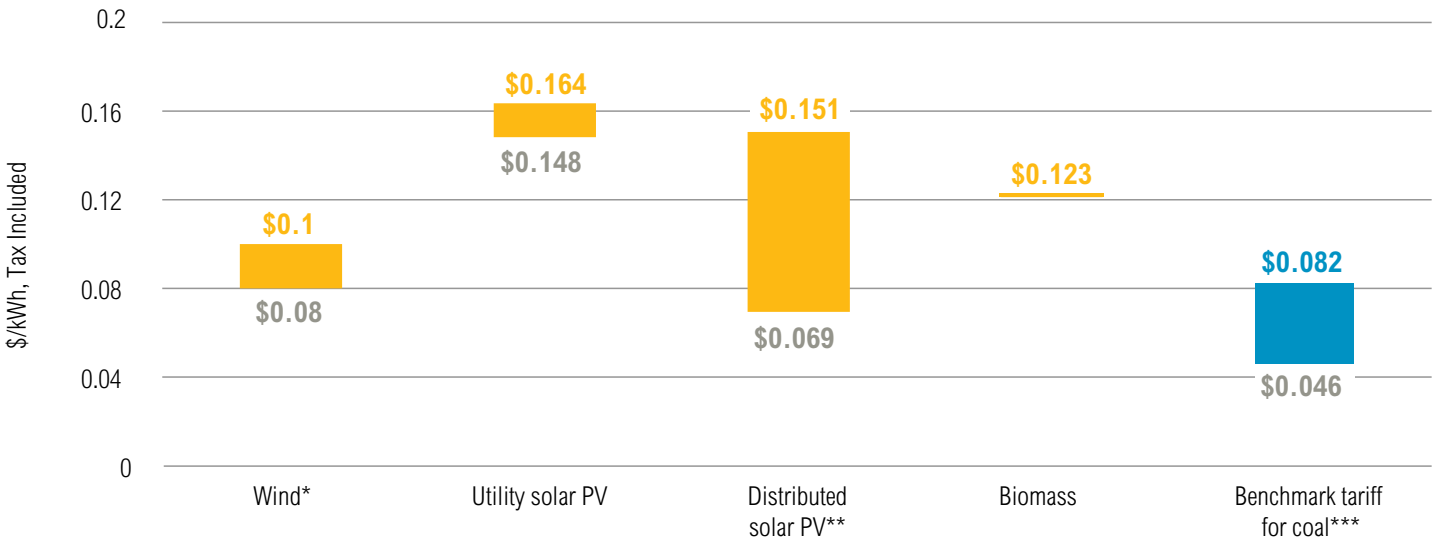
Since China enacted its Renewable Energy Law in 2006, the country has gradually established policies for financial support and cost-sharing mechanisms to encourage renewable energy development. Feed-in tariffs constitute one of the highest-profile policies behind China's rapid development of renewable energy, as the tariffs guarantee stable revenue for renewables.

During the 2009–14 period, China introduced feed-in tariffs for onshore wind generation (2009, 2014),[61] agricultural and forestry biomass generation (2010),[62] solar generation (2011, 2013),[63] and a "subsidy for full amount of generation" for distributed photovoltaic (PV) generation projects (2013). Funding is expected to come from the renewable energy surcharge on electricity but may also come from the national budget. At present, the feed-in tariffs for solar PV, grid-connected wind, and biomass vary depending on the region, but all are higher than the benchmark tariff for coal generation in the same region, as shown in Figure 2.2.

Between 2006 and 2011, the NDRC, MOF, and State Electricity Regulatory Commission (dissolved and merged with the National Energy Administration in 2013) jointly managed the renewable energy feed-in tariff. In 2012, based on the *Interim Measures for Operating the Renewable Energy Development Fund* and *Interim Measures for Renewable Energy Surcharge Management*, the MOF assumed the lead role in managing project approval, fund appropriation, and clearing, while the National Energy Administration (NEA) and NDRC supported project approval.

Grid companies collect renewable energy surcharges on consumers within their operating area.[64] The surcharge collected is then paid into the Renewable Energy Development Fund. The MOF, NEA, and NDRC jointly determine whether a renewable generation project qualifies for the fixed tariff subsidy. The MOF manages the fund and disburses subsidies to cover the difference between the renewable energy feed-in tariff and the local benchmark coal tariff, and to subsidize the costs of connecting renewable plants to the grid. Subsidies are also provided for the operational costs of public independent generation systems (also known as "off-grid plants") and for distributed photovoltaic projects.

Figure 2.2 | **Range of Feed-In Tariff by Technology Types (tax included)**



Sources: Feed-in tariff policy documents on renewable generation; National Development and Reform Commission, "Notice on Further Easing Conflicts Regarding Environmental Tariffs."

Notes: *In all regions, wind enjoys a feed-in tariff higher than coal.
**Subsidy for full amount of generation regardless of the region for $0.069 kWh. Power sold to grid also gets the same rate as the benchmark coal tariff from the local grid on top of the subsidy.
***Benchmark coal tariffs vary across provinces and include subsidies for desulfurization, denitrification, and dust removal.

The subsidy application and appropriation process varies depending on the entities to which one is applying. For renewable projects connected to provincial grid companies, which are subsidiaries of the State Grid Corporation of China (SGCC) or the China Southern Power Grid Company (CSG), applications are initiated by provincial grid companies. After the applications are preliminarily approved by provincial fiscal, price, and energy authorities, they are sent to the SGCC or CSG. The SGCC or CSG will then bundle the applications and submit them to the MOF, NDRC, and NEA. Once approved, the funds go directly to the SGCC or CSG, which disburse them first to the provincial grids and then to specific projects. For projects that connect to local independent grids, the application is initiated by the local independent grid; goes through provincial fiscal, price, and energy authorities; and is submitted to the MOF, NDRC, and NEA. Once approved, the funds go to the local fiscal authority before being disbursed to local independent grids and the projects. Finally, for off-grid projects, the application is submitted directly to provincial fiscal, price, and energy authorities, and then the MOF, NDRC, and NEA. The funds are disbursed through the provincial fiscal department to projects.[65]

Policy Implementation and Intermediate Effects Tracking

Implementation of the feed-in tariff policy depends on a number of factors: the collection of renewable surcharges, identification of renewable projects eligible for subsidies, and disbursement of the subsidies. Intermediate effects of the feed-in tariff policy could be reflected through the actual development of renewable energy. Table 2.1 identifies input, activity, and intermediate effects indicators relevant to the implementation of this policy and tracks their status.

Table 2.1 | **Tracking Implementation of the Renewable Feed-in Tariff**

	FINANCIAL INPUT	INDICATOR	RESPONSIBLE INSTITUTION	STATUS
INPUT	Providing funds to support renewable feed-in tariff	Amount of funds spent for renewable feed-in tariff	MOF	$8,275 million in 2014[66]

	LICENSING, PERMITTING, PROCUREMENT FUNCTION	INDICATOR	RESPONSIBLE INSTITUTION	STATUS
ACTIVITY	Approving eligibility of projects for renewable tariff subsidy	Number of projects approved to receive renewable feed-in tariff subsidy	MOF, NDRC, NEA	2,842 projects approved by August 2014 (including 29 public off-grid projects)[67]
		Installed capacity of projects approved to receive renewable feed-in tariff subsidy	MOF, NDRC, NEA	125.5 GW renewable generation installed capacity approved (including 12.3 MW of public off-grid projects) by August 2014[68]
	COMPLIANCE AND ENFORCEMENT	INDICATOR	RESPONSIBLE INSTITUTION	STATUS
	Collecting and disbursing renewable surcharge	Percentage of surcharge actually collected	Levied by grid companies	Estimated at around 68% in 2012 ($4 billion out of $6 billion)[69]
		Are disbursements made on time per policy requirements?	MOF and provincial fiscal departments	No (minor delay with few exceptions)

	EFFECTS ON BEHAVIOR, TECHNOLOGY, AND PRACTICE	INDICATOR	STATUS
INTERMEDIATE EFFECTS	Development of renewable generation	Ratio of curtailed renewable generation over its total generation (curtailment rate)	8% in 2014 for wind curtailment No national data available for solar generation curtailment Solar generation curtailment in Gansu[70] province in 2013 about 13.78%[71]
		Actual installed capacity for solar, wind, and biomass	154 GW[72]

Box 2.3 | Electricity Grids in China

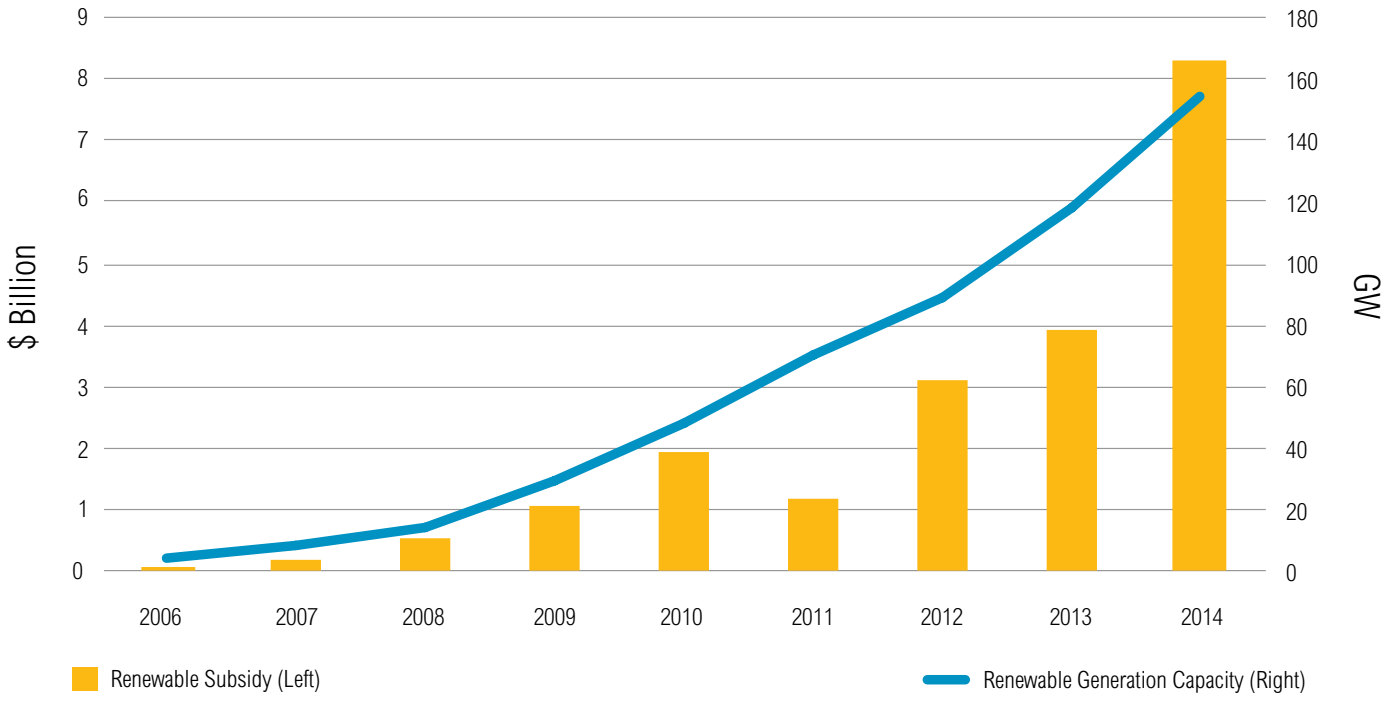
There are two major grids, the State Grid Corporation of China (SGCC) and the China Southern Power Grid Company (CSG), as well as 15 local independent grid companies in China. The SGCC and CSG serve 26 provinces and 5 provinces, respectively, through their subsidiary provincial grids. In 2012, 77 percent of installed grid connected capacity was connected directly to the SGCC, 18 percent connected to the CSG, and 5 percent connected to local independent grid companies (2014 China Statistical Yearbook).

This paper's review of the implementation of China's renewable energy feed-in tariff yields the following observations:

THE FEED-IN TARIFF HAS CONTRIBUTED TO THE GROWTH OF RENEWABLE GENERATION.

The tracking result shows that the government has operationalized all the steps needed to carry out the policy, from approving eligibility of projects to collecting the surcharge and disbursing funds to subsidized projects. The government has approved the installation of 2,842 projects totaling 125.5 GW of capacity in wind, solar, and biomass generation. By the end of 2014, China had disbursed $20 billion in feed-in tariffs and installed 154 GW of renewables (see Figure 2.4). While the growth in renewables cannot be entirely attributed to the feed-in tariff policy, the policy does contribute significantly to making China the world's biggest investor in renewable energy.

Figure 2.4 | Actual Renewable Energy Tariff Subsidies



Sources: National Development and Reform Commission, "Renewable Energy Subsidy and Quota Trading Arrangement." 2006–11; Ministry of Finance, "Central Government Funds Expenditure Budget Table." 2012–14; Bloomberg New Energy Finance, Renewable Generation Capacity Database.

Note: For 2006–11 subsidy data, normalized to annual amount assuming equal distribution for each month in the same batch. The amount is converted to USD with the median exchange rate for the year.

Table 2.2 | **Wind Curtailment in China, 2010–14**

	WIND GENERATION NOT SOLD TO GRID (TWH)	WIND GENERATION SOLD TO GRID (TWH)	CURTAILMENT RATE[80] (%)
2010	3.9	49.4	7.32
2011	12.3	74.1	14.24
2012	20.8	100.4	17.16
2013	16.2	140.1	10.36
2014	13.3	153.4	7.98

Sources: Wang, Z. "China Wind Curtailment Report."; National Energy Administration, "2014 Wind Energy Operation Status."

THE MISMATCH BETWEEN THE GROWTH IN RENEWABLE GENERATION AND THE INCREASE IN SURCHARGES HAS LED TO PAYMENT ARREARS AND FUNDING GAPS.

A survey conducted jointly by the MOF and NEA concluded that there was $175 million in subsidy arrears by the end of 2011,[73] an amount not paid until 2014. In 2012, the *Interim Measures for Renewable Energy Surcharge Management* stated that the feed-in tariff shall be disbursed on a quarterly basis. Interviews with renewable project owners confirm that although the disbursement schedule has improved since 2012, it does not meet the quarterly mandate. Indeed, as of May 2015, projects installed in 2014 have not received the relevant feed-in tariff for the year. Experts widely expect a funding gap in 2015.[74]

The payment arrears and funding gap are primarily attributable to surcharge growth that has not kept pace with the growth in qualified renewable generation. In response, China adjusted the renewable surcharge rate three times, from $0.00016/KWh in 2006 to $0.00246/KWh in 2013.[75] However, the challenge persists; total electricity consumption, the base against which the surcharge is levied, grew much slower than qualified renewable generation. In 2014, solar and wind generation increased 170.7 percent and 12.2 percent, respectively, while total electricity consumption grew 3.8 percent.

Low surcharge collection rates also prevent timely subsidy disbursement. In 2012, the collection rate was estimated at only 68 percent.[76] The long and complex process of subsidy application, verification, clearance, and allocation, involving several administrative authorities, also contributes to delays.[77]

CURTAILMENT REMAINS A CHALLENGE FOR GRID INTEGRATION.

The feed-in tariff is paid based on actual generation sold to the grid, meaning that power curtailment can hurt renewable projects. While the Renewable Energy Law and multiple policies require purchase of fully renewable electricity by the grid, renewable energy curtailment persists. Table 2.2 illustrates the wind curtailment rate, which is the ratio of curtailed (unsold) wind power generation to total wind power generation. During 2010–14, the curtailment rate was never lower than 7.39 percent and sometimes as high as 17.16 percent. Curtailment has improved since 2013, but it remains a challenge. National solar curtailment data are not available, but Gansu, the province that installed the largest amount of solar capacity in China, has reported a solar curtailment rate of 13.78 percent in 2013.[78] As solar capacity continues to grow quickly, curtailment is emerging as a threat to the industry.[79]

Curtailment persists for a range of reasons. Technically, the intermittent and turbulent nature of renewable generation requires the grid company to curtail wind or solar generation to maintain grid stability and safety. Conflicts between coal generation and wind generation arise in northeastern China mainly because combined heat and power (CHP) plants provide heating in the cold season and cannot be ramped down in the winter. In northwestern and northern China, insufficient capacity for outbound transmission poses a challenge. There are also serious institutional barriers to dispatching wind power and other renewable energy generation, including a lack of legislative support for guaranteeing the operation

hours of renewable generation, poor enforcement of the full-amount purchase mandate, and conflicts of interest between local governments, grid operators, and power generators.

2.3 Energy-Saving Target Disaggregation

Policy Overview and History

Energy-saving target disaggregation is a unique mechanism used by the government to meet its energy intensity reduction targets in both the 11th FYP and the 12th FYP. In essence, it is a top-down mechanism for higher-level government to disaggregate its target to lower-level governments, as well as for the government to disaggregate targets to key energy-consuming enterprises within relevant jurisdictions.

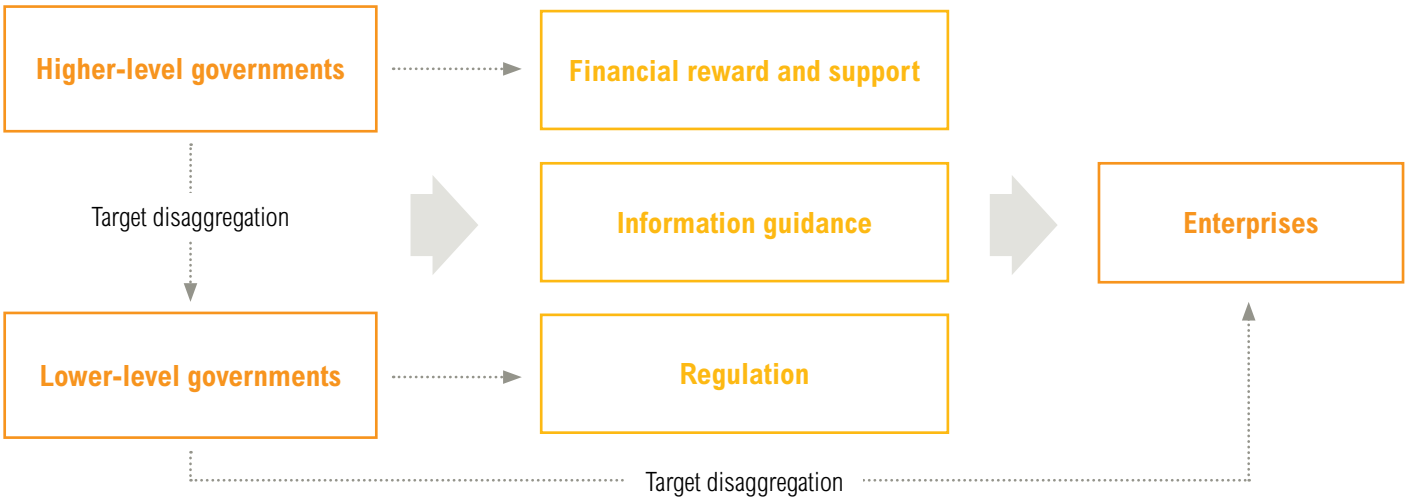
Figure 2.5 illustrates the policy's influence mechanism. The revised Energy-Saving Act of 2008 provided the legal basis for this policy, under which local governments (province, municipality, county, and town) and key energy-consuming enterprises are required to monitor and report their energy consumption and to meet energy-saving targets. The policy also includes economic incentives for businesses, such as special funds in the national budget that are designated to directly support energy-saving projects in enterprises or reward good performance. As Table 2.3 demonstrates, many local governments provided extra matching incentives, developed information guidance tools, and tightened regulations to ensure the achievement of local targets.

The policy, originated during the 11th FYP period, is led by the NDRC. During the 12th FYP period, the NDRC refined and improved the policy by adjusting its target types, the level of disaggregation, the target disaggregation mechanism, and progress disclosure as shown in Table 2.4.

Policy Implementation and Intermediate Effects Tracking

Key implementation steps include allocating funding to support energy-saving programs, disaggregating targets to regions and enterprises, assessing and disclosing target progress, and establishing and implementing a compliance and enforcement mechanism. Intermediate effects can be tracked by assessing the compliance rate of regions and enterprises, as well as energy saved. Table 2.5 presents the relevant indicators.

Figure 2.5 | **Influence Mechanism of the Energy-Saving Target Disaggregation Policy**



Source: Qi et al., 2013 Annual Review of Low-Carbon Development in China.

Table 2.3 | Extra Effort by Local Governments to Meet Energy-Saving Targets

MEASURE TYPE	LOCAL GOVERNMENT MEASURES
Financial reward and support	■ All provinces (except Tibet) have met or exceed the matching fund required by the national government for the Energy Performance Contract and provided extra tax and financing incentives.
Information guidance	■ Shandong province developed the energy-saving target progress barometer during the 11th FYP. This barometer was adopted nationally in the 12th FYP. ■ Sichuan province developed the Guidance on Strategic Emerging Industries to promote energy-saving industries and technologies.
Regulation	■ Sixteen provinces developed mandatory energy-consumption product standards that are more stringent than the national ones. ■ Local governments in Beijing, Tianjin, Shanxi, Gansu, and Jiangxi expanded the required scope and/or frequency for enterprise energy auditing.

Source: Adapted from Qi et al., 2013 Annual Review of Low-Carbon Development in China.

Table 2.4 | Comparison of Energy-Saving Target Disaggregation in the 11th and 12th FYPs

	11TH FYP	12TH FYP
Target type	■ GDP energy intensity reduction target by the end of FYP ■ Annual GDP energy intensity reduction target	■ GDP energy intensity reduction target by the end of FYP ■ Total energy-consumption target (expected target, not binding) ■ Annual GDP energy intensity reduction target
Level of disaggregation	■ Province–city–county–township ■ Enterprises[81]	■ Province–city–county–township ■ Enterprises[82] ■ Sectors ■ Administrative departments within a jurisdiction[83]
Disaggregation mechanism	■ Proposed by local governments and approved by central government	■ Central government commissioned studies, factoring in economic stage and structure, improvement potentials, and prior effort ■ Results fine-tuned after discussion with local governments
Progress disclosure	■ Energy intensity reduction progress by region	■ Energy intensity reduction progress by region ■ Target progress rating (since 2012) ■ Energy growth rating (since 2014)

Source: Adapted from Qi et al., 2013 Annual Review of Low-Carbon Development in China.

Table 2.5 | **Tracking Implementation of Energy-Saving Target Disaggregation**

	FINANCIAL INPUT	INDICATOR	RESPONSIBLE INSTITUTION	STATUS
INPUT	Funding to support energy-saving programs	Was government budget designated at the national and provincial level for energy-saving reward and support?	MOF, finance departments of each province	Yes[84,85]
		Energy-saving funding amount from national budget	MOF	$5.6 billion in 2014[86]

	OTHER POLICY ADMINISTRATION ACTIVITIES	INDICATOR	RESPONSIBLE INSTITUTION	STATUS
ACTIVITY	Disaggregating targets to regions and enterprises	Is the national target disaggregated to provinces, cities, counties, townships, and key energy-consuming enterprises?	State Council, NDRC, local DRCs or economic and information commissions (EICs)	Yes[87,88]
	INFORMATION MONITORING	INDICATOR	RESPONSIBLE INSTITUTION	STATUS
	Assessing and disclosing target progress	Is progress toward energy intensity reduction and energy-consumption growth targets for regions assessed and disclosed?	NDRC, NBS, local governments	Yes[89]
		Is progress toward energy-saving targets for key energy-consuming enterprises assessed and disclosed?	NDRC, local DRCs, EICs	Yes[90]
	COMPLIANCE AND ENFORCEMENT	INDICATOR	RESPONSIBLE INSTITUTION	STATUS
	Establishing and implementing compliance and enforcement mechanisms	Are compliance and enforcement mechanisms established for local governments and enterprises?	State Council, NDRC, provincial governments, municipal governments	Yes[91]
		Are compliance and enforcement mechanisms implemented for local governments and enterprises?	Organization Department of the Communist Party of China, NDRC; State-Owned Assets Supervision and Administration Commission of the State Council (SASAC), local DRC or EIC, local state-owned assets management commissions	Yes, but with limited details available[92]
	EFFECTS ON BEHAVIOR, TECHNOLOGY, AND PRACTICE	INDICATOR	STATUS	
	Provinces and enterprises meet their energy-saving targets	Percentage of enterprises that meet their energy-saving targets	92% in 2013 (12,928 out of 14,119 enterprises)[93,94]	
		Percentage of provinces on track to meet their energy-saving targets	86% (26 out of 30 provinces) by November 2014[95,96]	
	Energy saved through this policy	Energy saved by the 10,000 Enterprises program	175 million TOE during 2011–13[97,98]	

China's experience with energy-saving target disaggregation supports three observations:

THE MECHANISM HAS PRODUCED FAVORABLE RESULTS FOR REGIONAL GOVERNMENTS.

The national GDP energy intensity reduction target was disaggregated to 31 provinces, ranging from 10 percent to 18 percent intensity reduction over five years compared with the 2010 level.[99] The government has been diligent in assessing and generally transparent in disclosing target progress; the NDRC discloses energy intensity reduction achieved in each province, with a color-coded barometer to indicate progress on a quarterly basis.

The enforcement and compliance mechanism for regional governments was established in 2007 and involves public praise and shaming. Information concerning energy-saving performance is considered with government leaders' overall performance evaluations, and failure to achieve targets will disqualify a leader for promotion. Public information indicates that the praise and shaming approach is being implemented. Information on the implementation of other mechanisms, especially the linking of personnel performance evaluations to target achievement, is not available. As of 2014, 96.7 percent of provinces are on track to meet or beat their energy-saving targets in the 12th FYP.[100]

SUBSTANTIAL FUNDING HAS BEEN MOBILIZED TO SUPPORT ENERGY-SAVING ACTIONS.

In 2014 alone, the national government spent $5.58 billion on a variety of energy-saving programs. In addition to the national budget, each of the 31 provinces, autonomous regions, and municipalities established its own designated fund to support energy-saving projects and services.[101,102] It should be noted that the funding is allocated not only to support the target disaggregation mechanism but also to support the broader objective of achieving energy-saving targets. Therefore, the funding exists independent of the mechanism. However, the funding provides a powerful tool for regional governments to achieve their targets, while disaggregated targets and the associated accountability provide a strong incentive for the government to use the fund more effectively.

EFFORTS TO DISAGGREGATE AND ENFORCE ENTERPRISES' TARGET HAVE BEEN PROBLEMATIC.

Through the 10,000 Enterprises program, 14,877 key energy-consuming enterprises were directed to reduce 175 million TOE in energy usage compared with business-as-usual scenarios during the same period.[103] Since then, local governments have further disaggregated the target for lower-level governments and expanded the program to cover more enterprises within their jurisdiction. The government has established energy-saving supervision centers to monitor key enterprises' energy consumption and to enforce relevant regulations. The number of energy-saving inspection centers soared from 606 in 2010 to 881 in 2012. By 2013, all provinces, key cities,[104] and 68 percent of prefecture-level cities[105] had designated energy-saving supervision organizations.[106] Consequences for noncompliance include public shaming, compulsory energy auditing, rejection of new energy-intensive projects, disqualification for a series of national awards, and limitations on financing. For state-owned enterprises, relevant executives' overall performance evaluations are also linked to their enterprise's energy-saving performance.[107] In 2013, 92 percent of 10,000 Enterprises program participants were on track to meet their targets. The NDRC estimated that 175 million TOE were saved through the program in the first three years of the 12th FYP.[108]

However, a recent study found that disaggregating energy-saving targets to enterprises is problematic. The target disaggregation mechanism allows enterprises to choose from four different baseline measures when accounting for energy saved. While this inconsistency will not affect the integrity of regional targets, which are measured by GDP energy intensity, it produces to misleading results when aggregating energy-saved data across multiple enterprises. The complex nature of accounting for energy saved also makes it difficult for government agencies to verify company-reported data, making these data vulnerable to distortion. Finally, companies can achieve the energy-saved targets by expanding production, without taking energy-saving actions.[109] In addition to being subject to these accounting issues, the underlying methodology for target disaggregation is not transparent, resulting in complaints from enterprises about the fairness of the target disaggregation process. For example, in 2012, eleven enterprises in Shanxi province refused to cooperate with the government to assess the 2011 target completion status under the 10,000 Enterprises Energy-saving Program. One reason for enterprises' resistance was the lack of transparency in the government's target allocation process; the enterprises believed that the targets were not based on science.[110]

2.4 Passenger Car Fuel Economy Standard

Policy Overview and History

The government promulgated its Energy-Saving and New Energy Automotive Industry Development Plan (2012–20) in 2012, setting targets for average fuel consumption for domestic[111] passenger cars at 6.9 L/100 km in 2015 and 5.0 L/100 km in 2020. This translates into carbon dioxide emissions of about 120 g/km in 2020.[112]

China has issued a series of standards to achieve these targets. Table 2.6 shows the four phases of China's passenger car fuel economy standards.[113] Phases I and II only regulated minimum fuel economy for specific vehicles. Phase II standards, set in 2008, were equivalent to the world average fuel economy level in 2002.[114] In Phase III, China adopted an evaluation system of "vehicle fuel economy plus corporate average fuel consumption target," which translated into a 20 percent decrease relative to Phase II. The Phase III standard was enacted in 2012 and set annual targets that are increasingly strict each year. The Phase IV standard was announced on December 22, 2014,[115] and will be implemented beginning on January 1, 2016. This standard aims to achieve an average fuel consumption target for domestic passenger cars in 2020 of 5.0 L/100 km. The Phase IV standard is more stringent than U.S. fuel economy standards and on par with Japanese standards but still less aggressive than the European standard of 3.8 L/100 km in 2020. The European Union and the United States have proposed vehicle fuel economy standards for 2025 of 3 L/100 km and 4.8 L/100 km, respectively,[116] while China's passenger fuel economy standards for 2025 (Phase V) are still in the early conceptual stage.

Table 2.6 | **Fuel Economy Standard for China's Passenger Cars**

PHASE	NAME OF THE STANDARD	SERIAL NUMBER OF THE STANDARD	IMPLEMENTATION DETAILS
Phases I and II (including 2011 of the 12th FYP)	Limit of Fuel Consumption for passenger cars	GB 19578–2004	Phase I: since July 1, 2005 Phase II: since January 1, 2008.[117] Regulated fuel economy of single vehicles.
Phase III (corresponding to 2012–15 of the 12th FYP)	Limit of Fuel Consumption for passenger cars Fuel consumption evaluation methods and targets for passenger cars	GB 19578–2004 GB 27999–2011	Regulated manufacturers introduced for the first time target fuel economy based on vehicle types[118] and corporate average fuel consumption (CAFC).[119] Companies are required to reduce to 109% of CAFC standards in 2012 and gradually decrease to meet the standard in 2015.
Phase IV (corresponding to 2016–20, the 13th FYP)	Limit of Fuel Consumption for passenger cars Fuel consumption evaluation methods and targets for passenger cars	GB 19578–2014 GB 27999–2014	Will come into effect on January 1, 2016, with increasingly strict CAFC standards, and gradually meet 2020 standard.

Policy Implementation and Intermediate Effects Tracking

The implementation of these standards includes collecting of relevant information, assessing and disclosing progress, and developing and enforcing a compliance mechanism. Intermediate effects of the policy can be assessed by tracking the actual corporate average fuel-consumption data. Table 2.7 summarizes performance indicators for the passenger car fuel economy standard.

The review of the implementation status of China's passenger car fuel economy standards supports three important observations:

CHINA'S PASSENGER CAR FUEL ECONOMY STANDARDS HAVE ACHIEVED TANGIBLE RESULTS. China has taken steps to implement its standard policy for fuel economy in passenger cars. It established a vehicle fuel-consumption data-management system, which became operational in July 2012. Automobile companies can report their vehicle-level fuel-consumption data to the data-management system via software, and the system will periodically summarize and release the latest corporate average fuel-consumption data for China. The MIIT discloses progress in compliance with average fuel-consumption standards and annual reporting. In 2014, 99 percent of car companies submitted their CAFC reports on time.[133]

Although only 70.8 percent of domestic car companies and 59.3 percent of car import companies met their standard requirements in 2014, most companies with high car volume exceeded their standard requirements. Therefore, the average vehicle fuel consumption in 2014 for all domestic and imported cars exceeds the standards requirement (national CAFC).[134]

Table 2.7 | **Tracking Implementation of the Passenger Car Fuel-Economy Standard**

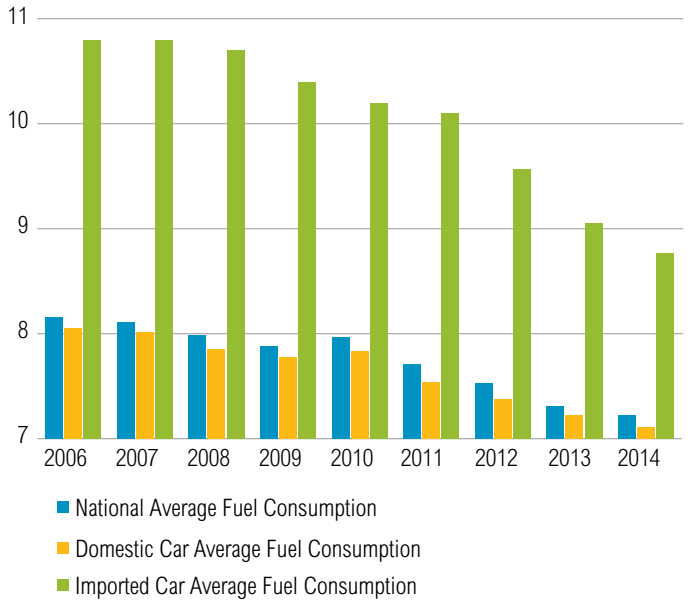
ACTIVITY	INFORMATION COLLECTION AND TRACKING FUNCTION	INDICATOR	RESPONSIBLE INSTITUTION	STATUS
	Establish the Vehicle Fuel-Consumption Data Management System	Is such a system in operation?	MIIT	Yes[120]
	Collect annual reports from companies on the implementation status of corporate average fuel consumption (CAFC)	Percentage of reports collected	MIIT	99% (120 out of 121) in 2014[121]
	COMPLIANCE AND ENFORCEMENT FUNCTION	**INDICATOR**	**RESPONSIBLE INSTITUTION**	**STATUS**
	Establish compliance and enforcement mechanism	Have rules for compliance and enforcement been established and have they gone into effect?	MIIT; NDRC; Ministry of Commerce (MOC); General Administration of Customs (GAC); General Administration of Quality Supervision, Inspection, and Quarantine of the People's Republic of China (AQSIQ)	Yes[122]
	Conduct sample checks on fuel economy of cars in the market against the reported data	Were such checks conducted?	MIIT	No public data found[123]

Table 2.7 | **Tracking Implementation of the Passenger Car Fuel-Economy Standard (continued)**

	COMPLIANCE AND ENFORCEMENT FUNCTION	INDICATOR	RESPONSIBLE INSTITUTION	STATUS
ACTIVITY	Enforce reward and/or punishment based on relevant rules	Percentage of companies in noncompliance that are notified publicly	MIIT, NDRC, MOC, AQSIQ, GAC	100% (39 out of 39) in 2014[124]
		Percentage of companies in noncompliance that submit an improvement plan	MIIT, NDRC, MOC, AQSIQ, GAC	87% (34 out of 39) in 2014[125]
		Percentage of companies in noncompliance on which a more stringent market entry requirement is imposed for new domestic car models[126]	MIIT, NDRC, MOC, AQSIQ, GAC	No public data available
		Percentage of companies in noncompliance whose applications for production expansion are rejected	MIIT, NDRC, MOC, AQSIQ, GAC	No public data available
		Percentage of companies in noncompliance on which strengthened customs inspections are imposed for imported cars	MIIT, NDRC, MOC, AQSIQ, GAC	No public data available
	OTHER POLICY ADMINISTRATION ACTIVITIES	INDICATOR	RESPONSIBLE INSTITUTION	STATUS
	Disclosing midterm implementation review and final report for all companies assessed	Was such information disclosed?	MIIT	Yes[127,128]

	EFFECTS ON BEHAVIOR, TECHNOLOGY, AND PRACTICE	INDICATOR	STATUS
INTERMEDIATE EFFECTS	Car manufacturers meet the standards	Percentage of domestic passenger car manufacturers that meet the standards	70.8% in 2014[129]
		Percentage of car import companies that meet the standards	59.3% in 2014[130]
		Average fuel consumption for domestic cars	7.11 L/100 km in 2014 The collective requirement for average corporate fuel consumption of all domestic cars was 7.40 L/100 km in 2014.[131]
		Average fuel consumption for imported cars	8.77 L/100 km in 2014 The collective requirement for average corporate fuel consumption of all imported cars was 9.21 L/100 km in 2014.[132]

Figure 2.6 | **China's Corporate Average Fuel Consumption (2006–14)**



Source: Kang et al., China Passenger Vehicle Fuel Consumption Development Annual Report.

At least in part because of the fuel economy standards, CAFC has been decreasing over time for both domestic and imported cars, as demonstrated by Figure 2.6.

STEPS SHOULD BE TAKEN TO ENSURE DATA ACCURACY. The integrity of the standards depends on accurate data. The system relies heavily on self-reported certified data, and it is unclear whether the MIIT conducts sample checks for sold cars to ensure data accuracy. In 2014, Chinese media reported that several testing centers responsible for certifying vehicle fuel economy data colluded with car producers to generate misleading data. In response, the MIIT ordered some testing centers to suspend operations and improve their testing systems.[135] However, there is no public information on whether the MIIT has established a comprehensive system to prevent data falsification in the future.

There is room to improve compliance and enforcement. Actually enforcing penalties against noncompliant companies is indispensable to an effective system. The *Notice on Strengthening Management of Corporate Average Fuel Consumption* took effect on November 1, 2014, marking the official establishment of China's CAFC management system. The enforcement measures against noncompliant companies include public notification, required submission of an improvement plan, more stringent market entry requirements for new domestic car models, rejection of application for production expansion, and strengthened custom inspections for imported cars.

However, the enforcement and compliance rules were published only 14 months before Phase III is scheduled to end in 2015. Companies are neither fined for noncompliance nor rewarded for compliance. There is no mechanism to reward over performance, such as CAFC credit trading. Penalties for noncompliant car import companies are especially weak, as they are subject only to "strengthened customs inspections." It is also unclear whether penalties beyond public notification and the requirement to submit improvement plans are being enforced against noncompliant companies.

China's domestic car CAFC was 7.11 L/100 km in 2014. Given historical performance, the 2015 target of 6.9 L/100 km is within reach. However, meeting the 2020 target of 5.0 L/100 km will require an average annual reduction of 6.2 percent from 2016 to 2020, which far exceeds the 2.3 percent annual reduction achieved from 2006 to 2013.[136] If this 2020 target is to be met, it will be critical that China improve compliance rules and strengthen enforcement of its fuel economy standards.

2.5 Carbon Emissions Trading Scheme

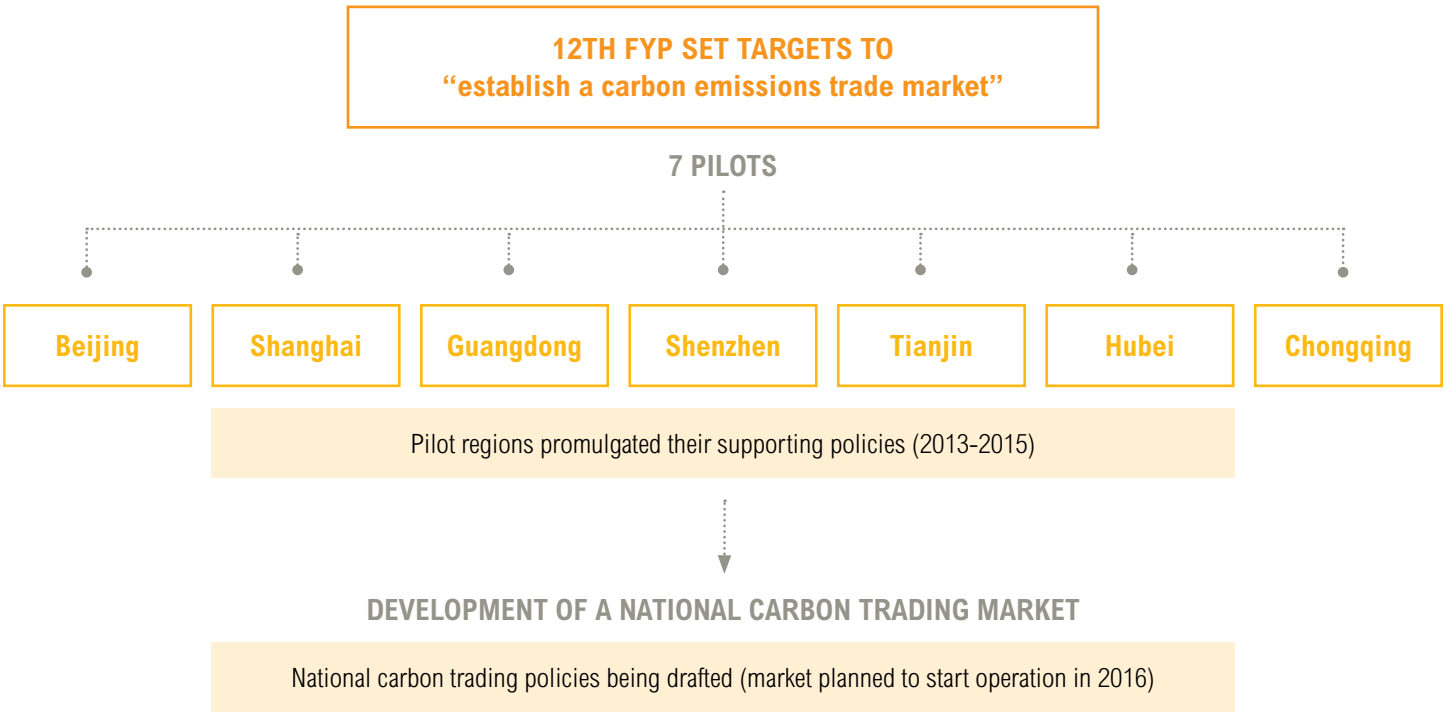
Policy Overview and History

The 12th FYP articulated, for the first time, that China should gradually establish a carbon emissions trading scheme (ETS) to help control GHG emissions. The *GHG Emissions Control Work Schedule for the 12th 5-Year* proposed to carry out carbon emissions trading pilots and to develop a national ETS. Figure 2.7 outlines the road map for ETS development.

In 2011, the NDRC announced that three provinces and four cities would pilot an ETS in China. The pilot provinces and cities account for 5 percent of China's area, 18 percent of its population, and 27 percent of its GDP.[137] The pilots have established institutions and rules for carbon trading, and they officially launched trading in 2013 and 2014. They are scheduled to operate at least until 2016, when the national ETS is to begin operating.[138] Table 2.8 summarizes the key features of the seven ETS pilots.

Pilots set trading thresholds to determine which companies are regulated by the ETS based on their annual GHG emissions or energy consumption. Hubei sets the trading

Figure 2.7 | **Road Map for Carbon Trading**



thresholds at an annual energy consumption of 42,000 TOE, which is equivalent to around 165,000 tCO_2e annual emissions,[141] eight times higher than other pilots (see Figure 2.9).

Policy Implementation and Intermediate Effects Tracking

Table 2.9 summarizes some of the key steps needed to implement an ETS, from allocating the allowance and issuing carbon offset credits, to collecting information and imposing penalties for noncompliance, to tracking implementation of the pilots. The table uses trading data and compliance rate as the immediate effect indicators.

Experience to date with China's seven ETS pilots supports several observations that bear on a future national ETS:

THE ETS PILOTS HAVE LAID THE FOUNDATION FOR A NATIONAL ETS

The implementation tracking indicates that China's ETS pilots have gone through all the necessary steps and become operational. All pilots have built ETS infrastructures, such as MRV systems, carbon offset rules, market intervention regulations, and compliance and enforcement mechanisms. While largely following the same framework, ETS pilots developed their MRV systems independently, resulting in minor differences. All pilots recognize China certified emissions reductions (CCERs) approved by the NDRC as carbon credits to offset the GHG emissions of enterprises covered by the ETS. Yet pilots also have various regulations limiting the use of CCERs, including the total allowed percentage, issue date of the credit, project types, and location. Pilots established regulations to prevent extreme market fluctuation. For example, Beijing, Shanghai, and Shenzhen established conditions and measures to regulate prices for emissions allowances.[154]

In 2014, pilots covered more than 2,000 enterprises in China.[155] ETS pilots have mobilized a broad range of players, including enterprises, regulators, service providers, and investors, to participate in the experimental use of a market-based mechanism to address climate change. Firsthand experience from the pilots will help inform the design and implementation of the national ETS as China scales up its effort in 2016.[156]

Table 2.8 | **Key Features of ETS Pilots**

RESPONSIBLE AUTHORITIES	LED BY LOCAL DRCS, SUPPORTED BY OTHER LOCAL AUTHORITIES FOR IMPLEMENTATION
Coverage	All pilots include major energy-intensive industries, including but not limited to power, steel, cement, and chemicals. Some pilots also include the building, service, or aviation sectors. The number of liable entities range from 114 (Tianjin) to 635 (Shenzhen), covering 30% (Chongqing) to 60% (Tianjin) of GHG emissions in the jurisdiction, with a median coverage of 49%. Most pilots cover CO_2 only, except for the one in Chongqing, which includes all Kyoto Protocol gases.[139]
Point of regulation	All pilots include direct and indirect emissions from electricity. There are some differences in how the pilots define indirect emissions: some account only for the consumption of purchased electricity, while others cover consumption of purchased electricity and heat. The calculation method for electricity emissions factors also varies, as some exclude emissions from power generation within their jurisdictions.
Allowance allocation	Pilots adopted the grandfathering method to allocate allowances for most industries (e.g., allocating to an enterprise an emissions allowance that equals a certain percentage of its GHG emissions in 2010), while the benchmarking method is used for newly built facilities or for certain industries (e.g., calculating the emissions allowances that will be allocated to a newly built power generating facility referencing the carbon intensity of the enterprise and the power generation of this facility). Guangdong, Shenzhen, and Hubei conducted auctions for emissions allowance allocation.[140] Other pilots generally distributed allowances free of charge.
Legal basis	Pilots issued regulations and/or laws that carry different legal weight. The People's Congress in Beijing and Shenzhen enacted local regulations, which have the greatest legal weight among pilots. Shanghai, Guangdong, and Hubei issued local administrative rules via government orders. Tianjin and Chongqing issued normative documents through government notices, which have the least legal weight.

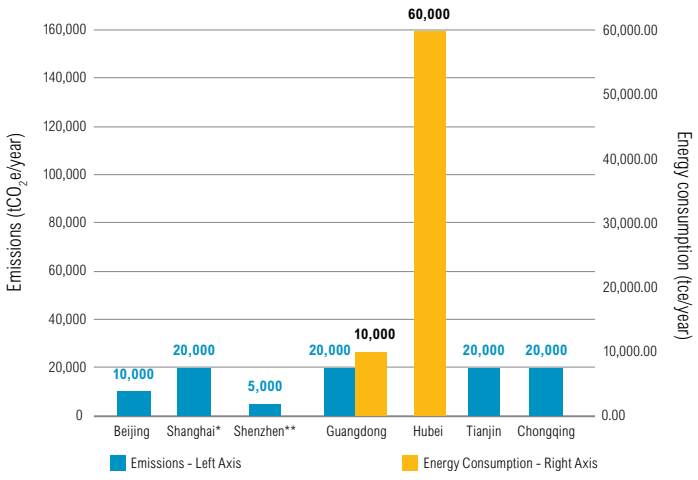
Sources: International Carbon Action Partnership, "ETS Map"; China Council for International Cooperation on Environment and Development, "Emissions Trading and Institutional Innovation."

THE MARKET LIQUIDITY OF THE ETS PILOTS IS LIMITED, RESTRICTING ITS MITIGATION IMPACT.

The market liquidity of ETS pilots needs to be improved. With the exception of Hubei, the vast majority (86 percent to 100 percent) of the allowance transactions in the pilots took place during the top 20 percent of trading days in 2014,[157] suggesting that it will be difficult to buy or sell allowances during the rest of the year. In 2014, 17 million allowances were traded, resulting in $99 million worth of transactions. The trading volume is low considering that the pilots' aggregated cap was around 1,239 million tCO_2e in the 2013–14 cycle.[158] As a benchmark, the California ETS has generated transactions for 171 million allowances, while its cap was only 160 million tCO_2e in 2014.[159]

The limited market liquidity resulted at least partially from the fact that many enterprises also need to meet energy-saving targets on their own (see Section 2.2).

Figure 2.9 | **Trading Threshold in Seven Pilot Trading Schemes**



Source: Adapted from International Carbon Action Partnership, "ETS Map."
Notes: *Threshold for nonindustry is 10,000 tCO_2/year in Shanghai. **Threshold is 20,000 m^2 for public buildings and 10,000 m^2 for government buildings in Shenzhen.

Table 2.9 | **Tracking Implementation of Carbon Emissions Trading Scheme (ETS) Pilots**

	LICENSING, PERMITTING, AND PROCUREMENT FUNCTION	INDICATOR	RESPONSIBLE INSTITUTION	STATUS
ACTIVITY	Allocating allowances to companies	Are allowances allocated by the government?	Local DRCs	Yes[142]
	Issuing China certified emissions reductions (CCERs)	Are CCERs issued according to relevant rules?	NDRC	Yes[143]
	INFORMATION COLLECTION AND TRACKING FUNCTION	**INDICATOR**	**RESPONSIBLE INSTITUTION**	**STATUS**
	Developing measurement, reporting, and verification (MRV) systems	Are MRV systems developed?	Local DRCs	Yes[144]
	Collecting regulated companies' emissions verification reports based on MRV system requirements	Are emissions verification reports collected on time?	Local DRCs	Minor delay[145]
	Collecting and disclosing information on trading volume and price	Are reports on trade volume and price published on a daily basis?	Local DRCs and emissions trading exchanges	Yes
	COMPLIANCE AND ENFORCEMENT FUNCTION	**INDICATOR**	**RESPONSIBLE INSTITUTION**	**STATUS**
	Developing compliance and enforcement mechanisms	Are compliance and enforcement mechanisms developed?	Local government/ local DRCs	Yes[146]
	Imposing penalties on companies for failing to report or to surrender allowances according to rules	Percentage of instances of noncompliance punished	Local DRCs	64% (14 out of 22) for 2013–14 compliance cycle[147,148]
	OTHER ACTIVITIES	**INDICATOR**	**RESPONSIBLE INSTITUTION**	**STATUS**
	Managing extreme market fluctuation	Are regulations in place to address extreme market fluctuation?	Local government/ local DRCs	Yes[149]

	EFFECTS ON BEHAVIOR, TECHNOLOGY, AND PRACTICE	INDICATOR	STATUS
INTERMEDIATE EFFECTS	Emissions control companies use carbon trading to adjust their operations and comply with requirements	Amount of emissions allowance traded	17 million tCO_2e by the end of 2014[150]
		Total turnover of emissions allowance traded	$99 million by the end of 2014[151]
	Emission control companies fulfill their compliance obligation through operation and production adjustment	Compliance rate	2013–14 compliance cycle: Beijing 97.1%, Shanghai 100%, Guangdong 98.9%, Shenzhen 99.4%, and Tianjin 96.5%[152,153]

Enterprises will only consider buying allowances for compliance when they do not have enough allowances after meeting their energy-saving targets. It is generally agreed that emissions caps set by ETS pilots were in line with the local carbon intensity reduction targets,[160] which were in turn in line with the regional energy intensity targets, on the basis of which enterprise-level energy-saving targets were derived. Therefore, ETS pilots have limited additional mitigation requirements. An assessment of the impact of the Beijing ETS estimated that the city will reduce an extra 4.87 million tCO_2e over three years of operation,[161] a modest amount when compared with the city's annual emissions of 116 million tCO_2e.[162]

DATA TRANSPARENCY AND ACCURACY HAVE IMPROVED, BUT CHALLENGES PERSIST

Accurate and transparent data are critical to ETS. Authorities in all ETS pilots require regulated enterprises to submit their emissions reports with third-party verification. Pilots have also developed rules for emissions measurement, reporting and verification (MRV), as well as accreditation management processes for third-party verification service providers. In addition to third-party verifications, some pilots (such as Beijing's) conducted emissions report cross-checks for a selection of companies. In 2013 and 2014, regulated enterprises were able to submit verified emissions reports. Trading volume and prices are transparent and available in a timely manner through exchanges. Local DRCs generally published ETS-related regulations, policies, and information transparently.

Despite the progress, challenges persist. While following roughly the same framework, each ETS pilot developed its MRV rules independently and used different criteria to vet third-party verification service providers. This variance raises questions about the comparability of reported results.[163] Technical review of relevant MRV rules also identified room for improvement, especially in GHG data quality management and use of emissions factors for purchased electricity.[164,165] ETS pilots could also be more transparent. For example, the total number of allowances and the actual emissions of enterprises in a given year are of critical importance to allowance prices, as relevant information can inform the current state of supply and demand. However, the Beijing ETS did not formally release the exact number of allowances issued in the 2013–14 cycle, and none of the seven ETS pilots published the emissions data of enterprises.

Box 2.4 | **Market Liquidity in ETS**

Liquidity is a measure of how easy it is to convert an asset to cash, or how rapidly the asset can be sold. In this market, greater liquidity signifies a healthier market because it means that companies are able to buy and sell emissions allowances in a timely manner to fulfill compliance obligations.

Source: Hsia-Kiung and Morehouse, Carbon Market California.

THE STRENGTH OF ENFORCEMENT MEASURES VARIES AMONG PILOTS

Each of the ETS pilots has developed enforcement and compliance measures, as demonstrated in Table 2.10. In Beijing and Shenzhen, the People's Congress has enacted local regulations, which have the greatest legal weight among pilots. As a result, enforcement measures for noncompliance are most stringent in these pilots; fines for enterprises that fail to surrender allowances are tied to the allowance market price, with no maximum cap. Shanghai, Guangdong, and Hubei issued local administrative rules via government orders, where failure to surrender allowances would subject an enterprise to a fine ranging from $1,640 to $24,600, with a reduced allowance for the next year. Tianjin and Chongqing issued normative documents through government notice, which has the least legal weight. In these two pilots, noncompliance is subjected to softer measures, such as public shaming and disqualification for financial support and/or rewards. Pilots also institute incentives for compliance, ranging from direct financial and technological support for emissions reduction/energy-saving projects to preferable credit from financial institutions.[166]

Compliance rates for the ETS pilots ranged from 96.5 percent to 100 percent for the five pilots that completed a compliance cycle in 2014. While noncompliant companies in Guangdong and Beijing were penalized, noncompliant companies in Tianjin suffered no significant consequences.[167] It should be noted that enforcement measures for noncompliance related to GHG reporting and verification, including data manipulation, are generally weaker than those for failure to surrender allowances, making this a weak point in the system. Furthermore, Beijing, Guangdong, and Tianjin extended the compliance deadlines in 2014 by a few weeks,[168] and Shanghai auctioned an additional 580,000 allowances for companies to buy and use for compliance, weakening the system's environmental integrity.[169]

Table 2.10 | **Penalties for Noncompliance in ETS Pilots**

ETS PILOT	FAILURE TO SURRENDER ALLOWANCE				NONCOMPLIANCE RELATED TO GHG REPORTING, VERIFICATION, OR OTHERS	
	Fine based on allowance shortfall amount	Fine not based on allowance shortfall amount	Reduction of allowance for next year	Other penalties	Fine	Other penalties
Beijing	3–5 times the shortfall amount for the average allowance price over preceding 6 months	—	—	—	$4,920–$8,200	—
Shenzhen	3 times the shortfall amount for the average allowance price over preceding 6 months	—	Shortfall amount	Public shaming; disqualification for preferential financial support and policies for 5 years	$1,640–$32,800	—
Shanghai	—	$8,120– $16,400	Shortfall amount	Public shaming and entry of credit record; disqualification for preferential financial support and policies for 2 years; disqualification for awards; rejection of new investment application	$1,640–$16,400	—
Guangdong	—	$8,200	2 times the shortfall amount	—	$1,640–$8,200	—
Hubei	1–3 times the shortfall amount for the average allowance price, maximum $24,600	—	2 times the shortfall amount	Public shaming and entry of credit record; report to relevant state-owned asset management commission (for state-owned enterprises); disqualification from applying for energy-saving projects	$1,640–$24,600;	50% reduction in allowance for next year
Tianjin	—	—	—	Disqualification for preferential financial support and policies for 3 years	—	Disqualification for preferential financial support and policies for 3 years
Chongqing	—	—	—	Public shaming; disqualification for energy-saving or climate change subsidy for 3 years; disqualification for awards; note in performance assessment of enterprise leadership (for municipally managed state-owned enterprises)	—	Public shaming; disqualification for energy-saving or climate change subsidy for three years; disqualification for awards; note in performance assessment of enterprise leadership (for municipally managed state-owned enterprises)

Source: Regulatory documents of ETS pilots.
Note: Shortfall amount equals reported emissions minus surrendered allowance and offsets.

3. GOVERNMENT ACTIONS TO WATCH FOR IN THE NEXT FIVE YEARS

The 13th FYP period (2016–20) will be the final window for China to achieve its 2020 targets. During these five years the country will also launch efforts to peak its carbon emissions around 2030 with the intention to try to peak earlier. While China will no doubt formulate other new policies to reach these goals, this paper identifies three key government actions that will likely have long-lasting impacts on China's GHG emissions.

1. Total Energy and Coal Consumption Control

Energy consumption accounted for 78.5 percent of China's GHG emissions in 2012,[170] and coal accounted for 66 percent of energy consumption in 2014.[171] The *National Climate Change Plan (2014–20)* recognizes the importance of energy consumption and establishes a target to limit annual energy consumption to around 3.36 billion TOE by 2020. While the plan does not mention a quantified coal-control target, it does indicate that China will control coal consumption at a reasonable level and reduce coal consumption in key air pollution prevention regions. In a separate planning document, the *Energy Development Strategic Action Plan (2014–20)*, the government has set a target to control coal consumption at 2.94 billion TOE by 2020.

However, the energy-consumption and coal-control targets were both developed before January 2015, when energy and coal consumption data for 2013 were revised up by 11.2 percent and 12 percent, respectively, based on the Third National Economic Censuses. This data revision significantly reduced the remaining space for meeting the targets by 2020. At the same time, the latest data for 2014 indicated that energy consumption grew at the slowest rate in more than a decade and coal consumption dropped unexpectedly, making a lower coal target for 2020 more achievable (see Table 3.1).

Whether total energy and coal consumption control targets are included in the national, sectoral, and provincial 13th FYP and, if so, in what form (binding target or expected target) and at what levels, will indicate the government's political determination, and will profoundly affect China's GHG emissions.

2. GHG Growth Cap at the National and Local Levels

In the China-US Joint Announcement on Climate Change of November 2014 and in the Intended Nationally Determined Contributions of June 2015, China pledged to peak its carbon emissions around 2030 and its intention to peak earlier. To make good on this pledge, China will need to develop quantitative targets for the absolute growth of GHG emissions. A quantitative cap for GHG growth can also inform the allowance allocation of the national ETS, aligning the specific policy instrument with a high-level national target.[172] While the peaking level was not identified in the joint announcement, various scenario studies suggest that China should be able to cap its energy-related CO_2 emissions around 9–10 $GtCO_2$ by 2020 with enhanced policies.[173, 174, 175, 176, 177]

Like the energy-saving targets in the 11th and 12th FYP periods, a national GHG growth cap, once set, will need to be disaggregated to regional (provincial and municipal)

Table 3.1 | **China's Energy Consumption and Coal Consumption Control Targets and the Status Quo**

	NATIONAL CONSUMPTION (2014)	NATIONAL CONTROL TARGET (2020)	COMPOUND ANNUAL GROWTH RATE LIMIT IMPLIED BY TARGETS (2015–20)	GROWTH RATE IN 2014
Total energy consumption	2.98 billion TOE	3.36 billion TOE	< 2.01%	+2.2%
Coal consumption	3.94 billion metric tons	4.2 billion metric tons	< 1.07%	–2.9%

Sources: Government of China, National Climate Change Plan (2014–20); Government of China, Energy Development Strategic Action Plan (2014–20); and National Bureau of Statistics, "Statistical Communiqué for National Economic and Social Development in 2014."

Table 3.2 | **National Emission Trading Adoption Milestones and Current Status**

BUILDING BLOCKS	ADOPTION MILESTONE	CURRENT STATUS
Legal framework	■ Law(s) or high-level administrative regulations to provide legal basis for regulating GHG emissions through emissions trading.	■ No law adopted yet; national climate change law being drafted.
Organizational arrangement	■ Law(s) or administrative rule(s) to mandate government agencies to develop and manage ETS.	■ NDRC has issued "Carbon Emissions Trading Management Temporary Administration Rules," specifying NDRC and provincial DRCs as authorities to regulate ETS.
Coverage, cap, and allocation setting	■ Law(s) or administrative rule(s) that specify relevant methodologies and decisions. ■ List of regulated industries and enterprises. ■ Allowance allocated to each regulated enterprise.	■ No official laws, rules, or lists issued yet; an NDRC official has publicly indicated that ETS will initially cover companies emitting more than 26,000 tCO_2 in power, steel, nonferrous metal, building materials, chemical production, and aviation industries.[183]
Measurement, reporting, and verification systems	■ Law(s), administrative rule(s) or standard(s) that specify relevant methodologies and reporting requirements.	■ NDRC has issued accounting and reporting guidelines for 14 industries, and will likely issue another eight industrial guidelines; 10 of the relevant guidelines are being converted to national standards. ■ Six standards on emissions verification are being developed as national standards. ■ NDRC has issued an administrative rule mandating that certain enterprises report their GHG emissions.[184]
Carbon offset systems	■ Law(s), administrative rule(s), and standard(s) that specify relevant organizational arrangements, procedures, and management schemes.	■ NDRC has issued "Administrative Rules for Voluntary GHG Emissions Reduction Trading Management," which specify organizational arrangements, procedures, and management schemes for carbon offset.[185] ■ Institutional system already operational to generate China certified emissions reductions (CCERs).
Compliance	■ Law(s) or administrative rule(s) to specify enforcement agencies and penalties for noncompliance.	■ NDRC has issued "Carbon Emissions Trading Management Temporary Administration Rules," which specify punishment for noncompliance with few specifics; more detailed rules needed.
Market regulation	■ Law(s) or administrative rule(s) to specify market regulation activities and enforcement agencies.	■ No official laws or rules issued yet.
Trading systems and rules	■ Law(s) or administrative rule(s) to specify trading systems and rules.	■ No official laws or rules issued yet. An NDRC official has publicly indicated that there might be as many as nine exchanges for the national ETS, implying that the seven ETS pilots will serve the national ETS as well.[186]

and sectoral levels to be effective. As of now, only low-carbon pilot provinces and cities are required to develop low-carbon development action plans. Incorporating GHG emissions growth cap targets and low-carbon actions into the subnational FYPs will provide an effective mechanism to implement climate actions, and send a strong signal about the government's commitment.

3. National Pricing Scheme for Carbon

Putting a price on carbon is a key policy assumption shared by multiple studies that project carbon emissions will peak by 2030 or sooner.[178, 179, 180, 181] Based on experiences from the seven pilot trading schemes, the NDRC commissioned research in 2014 on design options for the national ETS, which it aims to launch as early as the second half of 2016. The national ETS is expected to evolve gradually and become a driver for emissions reduction toward the end of the 13th FYP period.[182]

The government will need to overcome a variety of technical and political barriers to set up the national ETS on the planned schedule. This paper has identified eight building blocks that are critical to implementing the national ETS. Table 3.2 summarizes these building blocks, along with relevant adoption milestones and current status.

4. OVERCOMING CHALLENGES AND MOVING FORWARD

Despite progress to date, China's policies have room for improvement. For China to achieve its goals, it will need to meet six challenges in the future.

Develop Implementation Details

While many policy instruments are already in place, some areas lack specific regulatory systems, standards, and other implementation details. For example, although China has issued the *Carbon Capture, Utilization, and Storage Technology Development Plan for the 12th 5-Year* and the *Notice on the Promotion of Carbon Capture, Utilization, and Storage Pilots and Demonstration*, there are neither national legislative and regulatory frameworks nor national environmental guidelines for the technology. And although the *National Climate Change Plan (2014–20)* indicated that the government will control industrial process emissions, methane emissions from rice fields, and nitrous oxide emissions from farmland, implementation details are not yet available.

Strengthen Enforcement and Compliance Mechanism

Case studies of key policies show that there is room to further strengthen policy enforcement and compliance. Renewable project owners face payment arrears and power curtailment, which are explicitly prohibited by relevant regulation. Imported car companies that do not comply with the fuel economy standard face only minor penalties, as do enterprises that fail to submit emissions allowances under some of the ETS pilots.

Increase Transparency and Data Accuracy

An effective approach to strengthening enforcement and compliance mechanisms is to promote transparency and encourage the public to monitor the process. The government provides information on compliance data, such as passenger car fuel consumption, progress toward energy-saving targets, and enterprise compliance in ETS pilots. However, many data are still not publicly available, such as in the transport sector and for various elements of the ETS pilots. Furthermore, some of the information is scattered throughout various official documents or made available through the press rather than through a central portal designated for specific policy schemes. These reporting practices make the information hard to access.

The government should also strengthen its effort to ensure data accuracy, including data related to MRV rules and systems for ETS pilots, energy-saving target disaggregation, and the fuel economy standard. Data manipulation, once confirmed, should be subject to serious penalties.

Improve Policy Coordination

As government agencies act upon their responsibilities to address climate change in their sector, it is important to ensure coordination among climate and energy policies. For example, disaggregating an energy-saving target at the enterprise level requires companies to take direct energy-saving actions, which reduces demand for emissions allowances even when costs for direct action are high. This undermines the underlying economic rationale for the ETS. Allowing enterprises to use emissions allowances issued by ETS pilots to fulfill energy-saving obligations, or simply substituting enterprise-level energy-saving targets with emissions allowances, could improve coordination between the two policies.

Policy coordination at a higher level, meaning integration between climate and energy policies and other policies, is also critical for China's effort to transform its economy. There are some early signs of success: the *National Plan for New Urbanization (2014–20)* spells out "low carbon" as one of the principles to guide urban development, and the *National Plan for Climate Change (2014–10)* addresses regional differentiation of climate change policy by integrating guidance from the *National Plan for Main Function Regions*. However, cases such as these are still rare, and climate change has yet to be fully integrated into other policies.

Spur Action through Innovation

Many low-hanging fruit for China's climate actions are already picked. To make further progress, new policies and approaches are needed. The renewable feed-in tariff is one example. While the policy has helped to spur renewable energy growth, it now faces a funding gap. If renewable energy is to play a bigger role in China's energy system, the growth rate of renewable generation will need to outpace the growth rate of total electricity consumption, on which the renewable surcharge is based. In the past 10 years, China has already raised the surcharge rate three times, a total increase of 1,500 percent. Meanwhile, the cost of renewable energy has come down significantly, making it possible to introduce new schemes such as competitive bidding or the renewable portfolio standard.

Disaggregating energy-saving targets to enterprises also creates problems because it induces excessive government intervention in the internal operation of enterprises. As part of its governance philosophy, the CCP states that the "market should play a decisive role in the allocation of resources."[187] To realize this vision, China will need to shift away from the traditional command-and-control approach and embrace a new mechanism to encourage action.

Develop Policy Tracking and Impact Assessment System

Different from MRV rules and systems that monitor regulated companies' performance under specific policy instruments, a policy implementation tracking and assessment system focuses on performance of policies. Such a system can help inform policy selection and design, improve policy implementation over time, and improve cost-effectiveness and the efficiency of resource use.

Many developed nations, including the United States, the United Kingdom, and Germany, have built a legislative basis for policy impact assessment; assigned government departments to conduct the impact assessments; developed policy assessment methodologies, tools, and models; established ex-ante and ex-post assessment systems; and built abundant publicly available database resources. Assessment results are made public and used in policy design, screening for optimum policies, and improvement of policy implementation.[188]

China has yet to establish a comprehensive system to track policy implementation and assess impacts. Fiscal-expenditure-based management policies and performance evaluation procedures are implemented internally within the government, with only limited public disclosure of the results. The assessments focus on macrostrategies such as the 12th FYP or on the progress of energy-saving targets; assessments of policy instruments are rare. Furthermore, assessments cannot attribute impact to policy instruments, as they do not consider other policy and non-policy drivers of change, such as economic factors unrelated to the policy instrument. In an encouraging sign, research institutes and civil society groups in China have started to assess the impact of some climate and energy policies.[189,190]An open and encouraging attitude on the part of the government could foster additional progress.

ANNEX I. METHOD AND DATA USED TO ESTIMATE PROGRESS OF CLIMATE AND ENERGY INTENSITY TARGETS

Calculation of Energy Intensity Reduction Target Progress Based on China's National Bureau of Statistics Data

This paper drew total energy consumption, GDP, and GDP Index data from the online database hosted by the National Bureau of Statistics (NBS) at http://data.stats.gov.cn/easyquery.htm?cn=C01. The paper then used the GDP Index to come up with GDP in terms of 2010 price, which serves as the basis for calculation. See Table A.1 for the GDP and energy data used, and Table A.2 for calculation results.

Table A.1 | **GDP and Energy Consumption from NBS**

	GDP CURRENCY PRICE (100 MILLION RMB)	GDP INDEX (LAST YEAR=100)	TOTAL ENERGY CONSUMPTION (TCE)
2010	407,137.8		360,648
2011	479,576.1	109.5	387,043
2012	532,872.1	107.7	402,138
2013	583,196.7	107.7	416,913
2014	636,462.7	107.4	426,000

Table A.2 | **GDP and Energy Intensity (2010–14) Based on NBS Data**

	GDP –2010 PRICE (100 MILLION RMB)	TOTAL ENERGY CONSUMPTION (TCE)	ENERGY INTENSITY (TCE/10,000 RMB)	ANNUAL ENERGY INTENSITY REDUCTION RATE COMPARED WITH 2010 (%)	CUMULATIVE ENERGY INTENSITY REDUCTION RATE COMPARED WITH 2010 (%)
2010	407,137.800	360,648	0.885813108	—	—
2011	445,815.891	387,043	0.868167797	−1.99	−1.99
2012	480,143.7146	402,138	0.837536737	−3.46	−5.45
2013	517,114.7806	416,913	0.806229131	−3.53	−8.98
2014	555,381.2744	426,000	0.767040625	−4.42	−13.41

Calculation of CO_2 Emissions Intensity Target Progress Based on NBS and BP Data

For reasons of data availability, this paper uses energy-related CO_2 emissions data from the *BP Statistical Review of World Energy 2015* and GDP data from the NBS to calculate carbon intensity target progress. See Table A.3 for the GDP and emissions data used, and Table A.4 for calculation results.

Table A.3 | **Energy-Related CO_2 Emissions (2010–14) Based on NBS Data and BP**

YEAR	GDP–2010 PRICE (100 MILLION RMB)	CO_2 EMISSIONS (MILLION TCO_2)
2010	407,137.800	8471.9
2011	445,815.891	9206.1
2012	480,143.7146	9415.4
2013	517,114.7806	9674.2
2014	555,381.2744	9761.1

Table A.4 | **Energy-Related Carbon Intensity (2010–14) Based on NBS and BP Data**

YEAR	CARBON INTENSITY (TCO_2/10,000 RMB)	ANNUAL CO_2 REDUCTION RATE COMPARED WITH 2010 (%)	CUMULATIVE CO_2 INTENSITY REDUCTION COMPARED WITH 2010 (%)
2010	2.08	—	—
2011	2.07	−0.76	−0.76
2012	1.96	−5.00	−5.76
2013	1.87	−4.33	−10.09
2014	1.76	−5.44	−15.54

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ECONOMIC TRANSFORMATION: China's economic restructuring, public finance, income distribution, and inequality.

SOCIAL SAFETY NET: China's health care delivery and financing, pension system reform, and efforts to manage social discontent.

URBANIZATION: Reforms of China's land ownership and utilization system and household registration system, formation and expansion of megacities, public policies and lessons learned for China's urbanization process.

CLEAN ENERGY AND CLIMATE CHANGE: US-China cooperation in the development and deployment of clean energy technologies.