

*China's Low-Carbon Competitiveness and
National Technical and Economic Zones*

Synthesis Report: China's Low-Carbon Readiness and Competitiveness 2015

March 2015

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Head Office

161 Portage Avenue East, 6th Floor, Winnipeg, Manitoba, Canada R3B 0Y4
Tel: +1 (204) 958-7700 | Fax: +1 (204) 958-7710 | Website: www.iisd.org

China's Low-Carbon Competitiveness and National-Level Economic and Technological Development Zones **Synthesis Report: China's Low-Carbon Readiness and Competitiveness 2015**

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Table of Contents

1.0 Overview of the Project	1
2.0 Low-Carbon Drivers for IDZs	3
2.1 National Targets Locally Implemented with Increased IDZ Accountability	3
2.2 The Continued Move to Market-Based Instruments	4
3.0 Overview of Research Results	5
3.1 Policy Trends and Drivers of Low-Carbon Development in China’s Industrial Zones	5
3.2 Business Sentiments on the Low-Carbon Policy Environment	7
3.3 Carbon Trading in Beijing: A Review of the First Compliance Period	10
3.4 Implementing Greenhouse Gas Inventory Management Systems for Economic Zones in China	12
3.5 Development of Eco-Efficient Industrial Parks in China: A Review	14
4.0 Priority Areas for Action	16
4.1 Improved Carbon Management and Information for Low-Carbon Operations.....	16
4.2 Moving to Energy Self-Supply.....	16
4.3 Exploring New Models of Clean Energy Finance.....	17
4.4 Building Climate-Resilient Infrastructure with Quick-Win, No-Regret Actions	17
4.5 Low Carbon, 2030: A Capacity Building Platform	17

1.0 Overview of the Project

China's drive to develop a low-carbon, resource-efficient economy is a top priority of the government, placing pressure on the industrial development zones (IDZs) to respond to a growing and diverse set of policy levers. The International Institute for Sustainable Development (IISD), with the support of the Swiss State Secretariat for Economic Affairs (SECO) and the Chinese Ministry of Commerce (MOFCOM), is working with Chinese industrial and economics zones to identify key policy trends that will affect competitiveness and to provide insight to help better manage the transition to a low-carbon, resource-efficient economy.

With government policy in the past focused heavily on expanding production, industrial zones are now being pushed to move fast to better manage energy and greenhouse gas (GHG) emissions. Indeed, there is a basket of priorities and policy instruments contained in the 12th Five-Year Plan (FYP) that are steadily being defined and implemented, with evidence that action is cascading down through multiple layers of government and through the economy. Central to the low-carbon transition are actions to move industry to improve its energy efficiency, decarbonize its energy sources and rationalize industrial production to improve resource productivity. Given this shift in priority from growth to a low-carbon, resource-efficient economy, there is a real and widespread need to improve governance structures and administrative functions within both zone management and enterprises.

Phase 1 of IISD's project investigated how low-carbon management standards accelerate the development of competitive, low-carbon enterprises in China's economic zones. In partnership with the China National Institute of Standardization, Phase 1 explored scaling up voluntary standards in emerging economies. Global research and an extensive business survey in China were used to assess business sentiments on how low-carbon management standards can help advance Chinese competitiveness. Phase 1 identified standards as a promising opportunity, but only one of a growing suite of low-carbon drivers for the industrial zones.

Phase 2 of the project, which this report showcases, supports a growing need in the zones to better respond to a dynamic array of policy levers. The work completed in this latest phase is focused on working with industrial zones and enterprises to help reveal the implications of the emerging mix of policies and to help them better manage their transition to low-carbon operations. Two main activities defined the work:

1. **Policy levers and their impact on low-carbon development in industrial zones.** IISD provided a business view on the emerging policy environment. Core actions include a systematic review of over 100 low-carbon and energy policies and programs, with insight provided on how the emerging policy mix, including carbon pricing, regulations, information programs and capacity building, will affect zone competitiveness. Then a survey of over 230 firms and zone managers identified business opinions on the emerging policy mix, highlighting areas where policy is working and where there is an opportunity for improvement. Finally, a policy view on the first compliance period of the Beijing emission trading pilot is provided, including a survey of 50 facilities to document business sentiments about GHG emission trading in Beijing.

This comprehensive suite of information will inform businesses and governments alike on how competitiveness is likely to be affected, how policy effectiveness is perceived by business and where there are opportunities for improving policy governance.

2. **Managing the transition to low-carbon, resource-efficient industrial zones.** The project also seeks to build readiness for industry to participate in the policy environment. Core capacity building at the facility and corporate levels includes GHG inventory development and performance reporting, as well as understanding strategies such as low-carbon certification to better cope with, and perhaps take advantage of, multiple overlapping policies and requirements.

Our insight and analysis provided in this summary report is oriented to both revealing the emerging low-carbon policy environment and providing a window between business and industry to better facilitate communication. Our efforts strive to reveal how policy can be better designed and how industry can better prepare for the low-carbon transition that is a top priority of the central government and is cascading down to the IDZs.

2.0 Low-Carbon Drivers for IDZs

Most of the large industrial emitters are located in China's 1,600 IDZs, which account for more than half of China's total GHG emissions from industrial sources, or roughly 35 per cent of total Chinese emissions. With China's 12th FYP putting a heavy emphasis on energy conservation and emission reductions, a mix of market-based and other regulatory instruments is now starting to affect the IDZs. While the seven regional emissions trading system pilots tend to dominate the headlines, there are also a whole host of other instruments that are being applied. These include efforts to phase out unproductive capacity, the Top 10,000 Energy-Consuming Enterprises program and a focus on economic development areas and pilot projects in cities and zones. Complementing these instruments is a suite of programs focusing on energy conservation and demand management, improving energy performance and fuel switching to lower-emitting energy.

Sorting through this considerable and comprehensive national action is not simple, but there are at least two trends that will continue to affect the IDZs:

- National targets locally implemented with increased IDZs accountability
- The continued movement to market-based policies, including a national cap-and-trade system.

Each of these trends is discussed below.

2.1 National Targets Locally Implemented with Increased IDZ Accountability

Starting in 2013, the China's National Reform and Development Commission (NDRC) selected a number of low-carbon zones that would spearhead this new shift towards more distributed and bottom-up policy development and implementation. Specific areas of action include the formulation of low-carbon development guidelines, the development of supportive policies facilitating low-carbon development, the establishment of low-emissions industries, GHG inventory management systems, and changing behaviour in consumers and households.

In late 2014, the central government committed to a 2030 GHG cap with an expectation that industrial emissions would be capped before 2020 while accommodating growing urbanization and industrial upgrading. With this national target set, each province, city and IDZ can expect to be allocated emission targets in the coming years. These targets will be further broken down and allocated out of big industrial emitters, and the IDZs will likely have direct authority to enforce enterprise compliance. This will then place pressure on the IDZs to monitor compliance, but also to improve their management systems and practices, provide technical guidance and help enterprises to manage the transition to low-carbon and resource-efficient operations. The IDZs therefore are providing an important buffer for the climate policy aspirations of government while helping enterprises both comply and thrive under the low-carbon policy regime.

In the spirit of more distributed policy development and implementation, local authorities are increasingly becoming responsible for designing and implementing regional programs, including sophisticated market-based cap-and-trade systems. Local authorities also became accountable for delivering on emission reduction targets in the short term. In this way, national-level targets will cascade down through the provinces and municipalities and ultimately to the industrial zones. Traditional lines of accountability for achieving economic growth objectives are fast being complemented with energy and emission targets.

2.2 The Continued Move to Market-Based Instruments

There are number of factors that helped prompt the movement or trial of emissions trading systems by China's central government. First, the development of the Clean Development Mechanism (CDM) in China, and its resounding success, led many to believe that emissions trading could provide an alternative to the historical approach of command and control. China's 11th FYP was heavily reliant on command-and-control approaches. The perceived inability of these command-and-control approaches to significantly address air quality in GHG emissions and to further goals like energy efficiency led to a culture of policy experimentation. A complementary view is that other command-and-control measures were somewhat successful at reducing the energy intensity of industry by 20 per cent by 2010, but that further using these instruments would lead to high costs and inefficient outcomes. With CDM success and challenges with command-and-control approaches coupled with the rise of a market economy, it now seems inevitable that emissions trading will be attempted.

With carbon intensity targets in the range of 40–45 per cent by 2020 outlined in the 11th FYP, further pressure was placed on the policy environment and incongruence with command-and-control seemed inevitable. Market-based instruments were then seen as being able to provide the incentives and innovation signals that would be required to align technology choice and behaviour with the long-term aspirations for carbon intensity improvements. We can then see this transformation from command-and-control-based and centrally planned policy instruments to more distributed and flexible policy instruments. Indeed, the swiftness of the transformation towards a wide range of policy instruments is rather impressive.

With the success of the pilot emission trading systems, we are now seeing a movement towards a unified national cap-and-trade system. In all likelihood, China's Carbon Trading System (CETS) will be launched nation-wide in the second half of 2016, covering more than 10,000 companies with annual emissions with annual emissions over 26,000 tonnes of carbon dioxide equivalent. These big emitters cover six industrial sectors, such as power generation, metallurgy (steel), non-ferrous metals, construction materials (cement), chemicals and aviation. By 2019, 40 per cent of China's total GHGs will be regulated in this carbon market. The total value of the market is expected to grow substantially in the near term (2018) in the range of US\$2 billion to \$12 billion.¹ Beyond 2019, when the amount of free quota is gradually decreased and firms will need to purchase allowances at auction, the carbon market could grow to US\$50 billion.

¹ Jiang Zhaoli. (2015). Launching national carbon market in 2016, 7 to10 Carbon Exchanges will be remained. [In Chinese.] Retrieved from <http://www.tangongye.com/CarbonAsset/NewShow.aspx?id=7500>

3.0 Overview of Research Results

In this section, we provide the results of research in five areas:

1. We first discuss the emerging low-carbon and energy policy landscape, highlighting our review of 100 policies and identifying trends to watch.
2. We provide an overview of the emerging eco-industrial and low-carbon zone certification programs.
3. Practical guidance is provided for both IDZs and enterprises on how to develop GHG inventories.
4. The results of business sentiments are presented, focusing on the business view of the emerging low-carbon and energy policy environment.
5. Finally, we provide an overview of the first year of compliance for the Beijing trade pilot scheme.

For each of these five areas, detailed reports are available

3.1 Policy Trends and Drivers of Low-Carbon Development in China's Industrial Zones

There is no question that China is implementing a comprehensive set of low-carbon and energy policies designed to transition the economy to become more resource efficient while addressing environmental quality, supporting industrial development and furthering energy security. Flowing from the 11th FYP, the 12th FYP implemented a whole series of plans, specific measures and guidelines catalyzing action in areas such how to improve energy and carbon intensity, reduce air pollution, accelerate renewable energy deployment, facilitate structural change and improve resource productivity.

We see evidence of action with nationally driven policies and programs beginning to cascade down to the provinces, the municipalities and, ultimately, the industrial zones. Policy guidance and program implementation are therefore flowing from multiple government actors and through multiple jurisdictions. Such a distributed system of policy setting is catalyzing a dynamic policy learning process both within and outside government. But it is also creating some challenges. Most notably, the distributed system of policies and programs, with limited central guidance on implementation detail, is leading to an overlapping and complex set of policies that the zones and their enterprises must sort out.

This distributed system is then leading to competitiveness risks associated with enterprises trying to understand and address what is required and how best to respond.

To help identify the policy landscape for industry, and to provide an overall review of trends in policy design and implementation, IISD reviewed 100 policies and programs targeted at industry. While this review is not exhaustive, it nevertheless provides a good overview of the emerging policy environment, revealing how centralized policy guidance is cascading down through the jurisdictions to the zones and their enterprises.

Based on our analysis, a number of key trends are worth noting:

- **The number of policies is steadily increasing in time.** Starting with the 12th FYP in 2010, the number of energy and climate policies has increased significantly. This proliferation includes central-level work plans and target-setting documents, specific measures that implement the high-level work plans and targets, and, finally, tools to help guide implementation. The focus of these policies has primarily been on improving

energy performance and, to a lesser extent, on reducing carbon emissions. There is also a mix of dual-focus policies that include lowering emissions and using energy more efficiently. This dual focus indicates that carbon policy is tightly bundled with energy policy, starting with the central-level work plans and target-setting guidance.

- **A comprehensive set of programs is being implemented, covering many emission sources.** Four main policy thrusts or programs dominate the survey results, namely: the regional carbon trading systems, phasing out unproductive capacity, the Top 10,000 Energy-Consuming Enterprises program and a focus on economic development areas and pilot projects in cities and zones. A broad suite of other programs also focuses on energy conservation and demand management, improving energy performance and altering energy. Clearly, there is broad and diverse policy coverage across many emission sources.
- **Policies and programs are well balanced, with a mix of regulations, capacity building, economic instruments and information programs.** There is, however, clearly a trend towards more flexible economic instruments, which are adding compliance flexibility to industry, thereby leading to lower compliance costs and likely fewer competitiveness impacts.
- **The trend towards economic instruments has taken off since 2012 when work got underway to frame up the regional cap-and-trade programs.** A mix of economic instruments are being implemented, including rebates, green finance, energy pricing, grants and subsidies, and trading. Work plans, guidance and tools supporting cap-and-trade implementation, however, are proliferating.
- **Regulations are becoming more flexible, thereby lowering compliance costs.** While the closure of inefficient plants is a dominant policy focus in our survey, in recent years, performance standards are outstripping the more traditional fiat-based regulations. Performance standards based on hitting a target, as opposed to implementing a technology (or closing a plant), allow industry to make choices that are cost-effective and appropriate for their own operations. The trend towards more flexible regulations, such as performance standards, is good news for industry.
- **The need to develop GHG inventories and an increase in audits.** Whether it is the requirement of obtaining a low-carbon or eco-industrial park certification, or of participating in the pilot emission trading systems, facilities and industrial parks are increasingly required to develop GHG emission inventories. Closely aligned to this is that auditing is being increasingly mentioned in policies and programs. Industry can therefore expect a rise in auditing to demonstrate the achievement of a range of energy and emission targets. This requirement to develop facility-level performance indicators on emissions and energy will be driven from the national level, which will place requirements on provinces, municipalities and industrial zones to demonstrate achievement in their nationally allocated targets and priorities.
- **Finally, we see significant evidence that the state-level policies are indeed cascading down to the provincial and municipal levels.** We see a rapid increase in municipal and provincial policies since 2010, indicating that state-level guidance is translating into action on the ground.

Given this dynamic and—at times—overlapping and uncertain energy and emission policy environment, the question for industrial zones is how to maintain low-carbon competitiveness? For industry, there are two key risks that need to be managed:

1. **First, there are risks associated with how firms or zones choose to respond to the policy environment.** The main risk is making wrong investments that could delay action, which would lock in expensive and high-emitting capital now that may have to be switched out later, or result in making early investments that result in over-compliance (reducing too much) at a higher cost than is needed.

2. **Second, clearly there are significant opportunities for industry to engage in and take advantage of subsidy and green finance opportunities, which will help competitiveness through lowering costs.** The number of policies and programs that include grants and subsidies, with links into the banking sector for green finance, clearly indicate an opportunity for industry to better take advantage of funding sources for the low-carbon transition.

To address these risks, there are four no-regrets actions that industry can pursue and that government policy-makers can support.

First, communicate the priority to senior management. Investments within IDZs and enterprises will be needed, requiring senior-level buy-in. At the very least, budgets and human capital will need to be initially allocated to better understand the emerging policy mix. Ultimately, larger blocks of financing will likely be needed to develop and maintain GHG emission inventories, to develop strategies to interact with the policy environment and to ultimately implement energy performance and emission reduction technologies and practices.

Second, understand the emerging policy environment and keep track of the trends. There is a real need to better understand the policy environment and to keep track of policy trends. One of the key challenges is that policies and programs are incoherent and uncoordinated, leading to uncertainties in requirements for compliance. Allocating personnel to keep track of these trends is a no-regrets action. Managers must become policy savvy and read the signs in terms of how policies and programs will affect operations or how to identify opportunities for green finance.

Third, quantify and better understand energy use and emission inventories. No-regrets actions include understanding baseline energy use, including electricity, and developing a GHG baseline emission inventory that highlights emission sources in the facility (or zone). This foundational information then forms the basis of developing strategies to take action.

Fourth, understand strategies to manage energy and emissions. Inevitably, there will be a need to demonstrate performance and take action. As a result, there needs to be a strategy within the organization that communicates opportunities for compliance while minimizing costs. Typically, the strategic options include energy-saving efficiency improvements, changes in management practices to improve emission and energy performance and, finally, more expensive investments, such as fuel switching or process changes.

3.2 Business Sentiments on the Low-Carbon Policy Environment

A major focus of the work was to assess the effectiveness of the policy environment from a business perspective, with the intention of providing policy-makers in government and industrial zones with information to help shape future policy design. Starting in May 2014, 1,000 companies were surveyed, with 230 questionnaires completed by both light and heavy manufacturing facilities in 16 provinces. In addition to these online surveys, 12 in-depth interviews and site visits were completed and a number of workshops held to solicit input. The participating enterprises included a mix of sectors and sizes, with the energy-intensive businesses accounting for one quarter of all respondents and light manufacturing accounting for the rest.

To our knowledge, this is the first systematic survey of business perceptions of China's carbon and energy policies.

We first asked enterprises questions about what types of management systems are in place to manage carbon and energy:

- **Most businesses have an environmental-management system in place.** In the survey, 60 per cent have environmental-management systems in place and 8 per cent have energy-management systems.
- **The smaller the firm, the less focus on energy-saving targets.** We found that less than 50 per cent of the facilities have an energy-saving target; the smaller the firm, the fewer targets or management systems are in place.
- **There is a very diverse range of energy-saving targets in place.** When energy-saving targets are in place, we found evidence of a significant variation in how those targets are specified (by product, fuel use or sales, for example), with little conformity across enterprises. This variation speaks to an opportunity to standardize energy targets across sectors, subsectors or products.
- **Most companies have not prepared a GHG emission inventory.** GHG inventories are clearly a lesser focus for enterprises. We found that only 20 per cent currently have a GHG inventory in place, with another 11 per cent planning to implement one. This leaves about 69 per cent of the sample without a GHG inventory in place. Companies identified a number of reasons for such low penetration of GHG inventories, including a lack of knowledge, questionable benefits from investing in the inventory and low perceived government priority for GHG inventories.

A major focus of the survey was also to assess the perceived policy effectiveness from a business perspective:

- **A significant number of policies are currently affecting companies.** Topping the list are subsidies for energy projects, differentiated electricity pricing and phasing out unproductive capacity. Energy-saving incentives and the pilot carbon-trading schemes were also identified as affecting business.
- **There is widespread concern about the fairness of free quota allocation in the carbon-trading pilots.** For example, many power plants received large quantities of free allocations while many manufactures with excellent energy performance had to buy carbon permits.
- **While a number of programs were identified as being impactful, there is also a low level of policy awareness.** Only 20 per cent of the firms indicate they are “well aware” of the policies, with 26 per cent “not aware at all” and 55 per cent “somewhat aware.” The level of policy awareness really decreases as the firm size decreases, with the smallest firms least aware of policies.
- **There is a policy gap and low policy coverage for the small emitters.** For 20 per cent of the sample, or the very smallest emitters using less than 3,000 tonnes of coal equivalent per year, there are limited policies in place. Of these small emitters, 15 per cent indicated that there is no policy affecting their businesses, 28 per cent were affected by at least one policy and 50 per cent are affected by at least two policies.

A key objective of low-carbon policy is removing barriers to implementing low-carbon and energy-conservation projects. To this end, we surveyed businesses to determine what factors currently limit their ability to implement low-carbon and energy-conservation projects.

Companies indicated they would be better able to participate if accountabilities were better defined and programs streamlined. Having a single government point of contact or “window” to coordinate multiple programs could reduce the high transaction costs associated with multiple reports to multiple levels of government across multiple programs.

There are also strong business views on improving the administrative effectiveness of the policies. One recommendation is to provide better policy continuity, with 52 per cent of respondents indicating a need to make policy more certain. The starting and stopping of policies makes it difficult for companies to be confident that long-term investment will achieve payback.

Companies also identified a need for better coordination between departments and agencies. Overlapping jurisdictions, both at the sector and the geographic levels, make it hard for companies to keep track of requirements and program opportunities. Reporting of the same or similar data to multiple departments and agencies at multiple levels of government was cited as a source of high administrative costs.

The survey also sought to understand what policy instruments are of interest to companies. Not surprising, 54 per cent of businesses indicated that they prefer subsidized energy project loans. Many companies cited the high paybacks associated with energy conservation and GHG technologies, with a need to accelerate these paybacks through subsidy programs. Another preference is to have a standardized procurement list of energy-saving technologies that would be eligible for the subsidy programs. Such a simplified list would reduce uncertainty and increase policy participation.

Mirroring a number of observations about a lack of information on energy and low-carbon technologies, companies are very interested in receiving better technical guidance and knowledge. Strengthening third-party technical capacity to provide specialized energy-efficiency and low-carbon services would also help.

Companies also identified opportunities to strengthen policy. Enterprises indicated a significant need for focused training, especially in low-carbon technologies and the pilot carbon-trading schemes. Companies are also very interested in receiving more training on technologies and benchmarks relevant to their facilities, but they would also like help developing strategies and corporate governance arrangements to better orient activities towards improving energy and emissions performance. Regarding the training methodology, peer-to-peer learning is the preferred method. Companies also recommended that government should start to compile sector-based technical guidance on energy standards and best practices.

Based on our interviews, workshops and analysis of the survey results, we offer six recommendations to help with short-term policy implementation. These include:

- **Focus on smaller enterprises.** While we found that the pilot carbon-trading schemes and the Top 10,000 Energy-Consuming Enterprises program cover a large share of the sampled enterprises, we also found a major gap in policies directed at small and medium-sized enterprises, which represent 40 per cent of national energy use.
- **More transparency in the carbon emission trading systems.** Implementing trading systems is very complex and not necessarily intuitive to enterprise leaders. There is clearly a need to better communicate with companies on policy developments, especially when it comes to how free quota allocations are calculated.
- **Incent more energy conservation through lowering energy-use participation thresholds.** Current energy conservation subsidies are dependent upon investments in the order of RMB10 million and energy savings are equivalent to about 500 tonnes of coal equivalent per year at the national and provincial levels. We identified a significant demand for more subsidies for smaller operations. Lowering the investment energy-saving threshold at both the local and municipal levels is a key low-carbon recommendation.
- **Streamline administrative procedures.** A common refrain from enterprises was the multiple government departments and jurisdictional levels involved in energy and low-carbon management. As a result, companies are unsure about which programs they are eligible to participate in, and the regulatory burden on these enterprises is increased by having to interact with multiple levels of government and multiple programs.

- **Establish a collaborative partnership between businesses, government and third parties.** Enterprises seem very eager to enter a dialogue with government to better understand the energy and low-carbon policy environment, to seek information on programs and to share experiences. Industry associations or other third parties could play a significant role in facilitating a dialogue between government and enterprises. Funding models for such third-party organizations could include a mix of public and private revenue models.
- **Focus on technical guidance and improving capacity within industry.** Enterprises have a high demand for credible technical guidance on facility management, on best practices and for benchmarking performance. There is a role for government to coordinate technical agencies working with businesses to identify technical standards for industry, renewable energy opportunities and sector benchmarks. Engaging a broad alliance of training institutes in helping to provide useful technical training, including through identifying standards and best practices, could help with policy implementation.

3.3 Carbon Trading in Beijing: A Review of the First Compliance Period

As part of the IISD project, the Beijing Environmental Exchange conducted a review of the first compliance period of the Beijing pilot-trading scheme. The review looked at the first compliance period, providing survey results on the early experiences of business and providing recommendations to improve design.

The Beijing trading pilot was the third pilot scheme implemented in China, with 2013 being the first year of compliance. Firms were first required to report and verify emissions starting in August 2013, with authorities issuing firm level emissions quotas in November 2013. The scheme covered about 188 megatonnes (Mt) of GHGs with an overall emission objective to reduce carbon intensity by 18 per cent in 2015 relative to 2010. The GHG emitting threshold for enterprise inclusion in the trading pilot is 10,000 tonnes of carbon dioxide equivalent emitted per year from both direct and indirect emissions.

The program started in 2013, with 415 firms growing to 490 emitters in the first compliance period, and it is expected to cover 550 emitters in 2015. Covered sectors include manufacturing, services, heating, electricity and other industries such as cement and petrochemicals.

The first compliance year in the first compliance period (2013–15) ended in late June 2014, with over 20 Mt of emissions traded during the year for a total value in the order of RMB98 million. However, this value masks a significant surge in trading at the end of the compliance period. Notably on June 25, 2014, about 25 per cent of the year's total transactions occurred, with allowance prices spiking to record high of RMD77 per tonne, well above prices that had previously remained more or less stable at RMB50. Clearly, firms were concerned as the compliance year ended, and they waded into the market to obtain their quota.

The question is: why did such a spike in trading activity occur? There are four reasons for this spike in activity and for the inefficient outcomes that some firms experienced as they waded into a frothy market.

First, enterprises did not prioritize actions within their operations. The program required firms to rapidly develop a number of new internal administrative functions, such as GHG reporting, program rules and requirements, and trading. This is obviously complex, requiring resources and staff to be allocated and actions prioritized. However the evidence indicates that firms were slow to organize their internal activities. Notably, a full 90 per cent of firms did not meet the initial deadline for reporting emissions to the Beijing Development and Reform Commission (BDRC) in April 2014.

Second, enterprises expected the BDRC to release more quotas. Expectations were low that the first compliance period would bind on enterprises, with a belief that the regulator would release more quotas to ease initial scarcity. Enterprises thought they could bargain for more quotas, and took a wait-and-see approach to compliance. This perception obviously changed in time, and when enterprises believed the program would bind with non-compliance penalties applied, enterprises then waded into the market late in the compliance period.

Third, a lack of trading experience hindered market participation. Enterprises did not fully grasp the system required to assess their compliance obligation and then entered the market late as compliance loomed. Also contributing to the delay was a conservative view towards risk, where firms did not want to use scarce financial resources to obtain quotas in the market. This risk aversion meant that many firms missed a period of stable and low prices, and instead entered the market when prices were at historical highs. Firms could have benefited from obtaining professional guidance on market dynamics.

Fourth, banking and uncertainty lowered market liquidity. With uncertainty in market prices and the program in general, many enterprises were hesitant to sell their quota. As a result, this reduced market liquidity, and when demand jumped towards the end of the first compliance period, prices rose.

Ultimately, compliance was high for the first commitment period, with 97 per cent of firms submitting quotas aligned with their targets. Facing non-compliance penalties were 12 firms, with penalties applied in the order of 3–5 times the market price of RMD180 to RMD300 per tonne of non-compliance.

Another focus of the project was to survey 47 enterprises to gain a better understanding of their experiences with the first commitment year. We also followed up the surveys with some interviews. Businesses identified three findings aimed at improving the current trading scheme:

- **Better program coordination is badly needed to streamline the regulatory burden.** Currently, there are many programs affecting enterprises, with carbon trading being just one of many. The majority of respondents thought that better coordination is needed to reduce the regulatory burden that is increasing with the proliferation of national and local low-carbon and energy policies. Effort is therefore required to better understand the various reporting requirements and to streamline them to reduce transaction costs.
- **Improve industry benchmarking for both targets and quota allocation.** Given so many emitters and the short time frame for implementing the trading pilot scheme, it is not surprising that simplified procedures were implemented for allocation quotas and setting targets. But with a large number of regulated enterprises across so many sectors, there is clearly significant diversity in operations. As such, there is a need to better tailor allocations and target setting to reflect enterprise diversity. In time, therefore, effort is needed to better develop allocation methods and procedures that reflect enterprise diversity. One major need is to reflect the dynamic nature of production, where large shifts in production processes and outputs mean that adaptive quota setting is needed. The BDRC recognizes the issue and has made efforts to improve the allocation process.
- **Improve complementary policies.** After the release of detailed guidance by the BDRC in December 2013, many elements of the trading scheme have become clearer. However, there are still significant uncertainties for enterprises, namely:
 - Accounting standards to accurately account for the significant value represented by the allocations.
 - Tax treatment of revenue and costs associated with trading activity.
 - Subsidies for technology deployment, where more streamlined procedures are needed, as well as targeting smaller enterprises in light industry and the service sector.

- **Increase certainty for industry with program rules.** With the rapid deployment of the cap-and-trade pilot, there were areas of policy that were hastily developed. Now there is time to review the program to identify areas of improvement. Looking forward, new policies and design elements should be developed to consider how they will affect industry and the market.

There are of course actions that enterprises identified that they can improve, including:

1. **Build capacity to better understand the trading scheme.** There are three areas that business needs to strengthen in order to better manage its participation in the trading scheme: improve the general understanding of the trading system and trends in its development; understand reporting and verification requirements and trading market trends; and develop knowledge on the range of low-carbon and energy policies that will affect business.
2. **Understand your quota allocation method, compliance obligation.** The survey found that many enterprises are confused over the allocation process and how it affects their business. Effort is therefore required to both better understand internal emissions and how the allocation method applies to operations. This then makes for more technical and focused discussions with the regulators over quota allocations.
3. **Improve internal decision-making processes.** The lack of timely compliance in the first commitment year and our survey results demonstrated that enterprises generally do not have adequate internal processes to ensure timely and cost-effective decision making. Enterprises could therefore look at internal operations and develop systems and practices to better manage their participation in the trading scheme.
4. **Seek external assistance from third parties and other experts.** It is clearly difficult for enterprises to fully understand the complexities of the trading scheme. Understanding market dynamics can be a challenge. But there are external resources available to provide insight and expertise and to help with carbon-management decision making.

3.4 Implementing Greenhouse Gas Inventory Management Systems for Economic Zones in China

China is pursuing the development of low-carbon economic zones, and while there has been substantial work to define targets and indicators for achieving GHG emission reductions, there is now a need to provide guidance and tools to help the zones transition.

GHG inventories for industrial and commercial facilities are an essential component of the transition to low-carbon operations, as they provide the foundation for identifying abatement opportunities while measuring and assessing progress towards achieving GHG targets, whether at the zone or facility level. A GHG inventory system designed to be successful provides for frequent, accurate, consistent, complete and transparent reporting. GHG inventory success also requires many different stakeholders to supply information, conduct analysis, provide critical review and expert judgment, manage the compilation of the inventory and disseminate inventory data to stakeholders.

In our paper, IISD identifies concrete steps that can be implemented by economic zones overseeing low-carbon development and companies included in low-carbon programs to establish an effective GHG inventory management system.

Our approach reflects the collaboration needed between the economic zones, which have the authority to manage and report GHG emissions, and the enterprises that must deliver information. The approach is based on best practices and formal standards for GHG inventory development. The guidance presented is oriented to help zones and their

member companies to develop emission inventories for a wide range of GHG programs, such as carbon trading, absolute caps and performance standards, which we refer to as the dominant program rules. These program rules may evolve from either regional initiatives or national directives.

This GHG inventory guidance will help both authorities and companies in economic zones understand the basic concepts related to inventory planning, development and management, as well as how to monitor, report and verify emissions.

Figure 1 presents a conceptual framework for the development and implementation of a GHG inventory system for IDZs. The framework identifies different processes for planning, inventory development and zone management that, if followed, can effectively measure, report and verify emissions from covered entities (i.e., industrial or commercial facilities included in the program that must report emissions).

The different colours correspond to the leading actor(s): red identifies processes conducted primarily by the economic zone authority; green identifies processes conducted primarily by the covered industrial and commercial facilities and blue identifies processes that require extensive collaboration and engagement between economic zones and industrial facilities (entities covered by the program rules).

The GHG inventory system is a cycle that requires constant improvement and refinement to adapt to potentially changing coverage and targets, as well as to maintain the integrity and quality of the inventory system. While Figure 1 implies discreet and ordered steps, in reality, these processes overlap and are part of an annual cycle of reporting conducted at non-sequential stages.

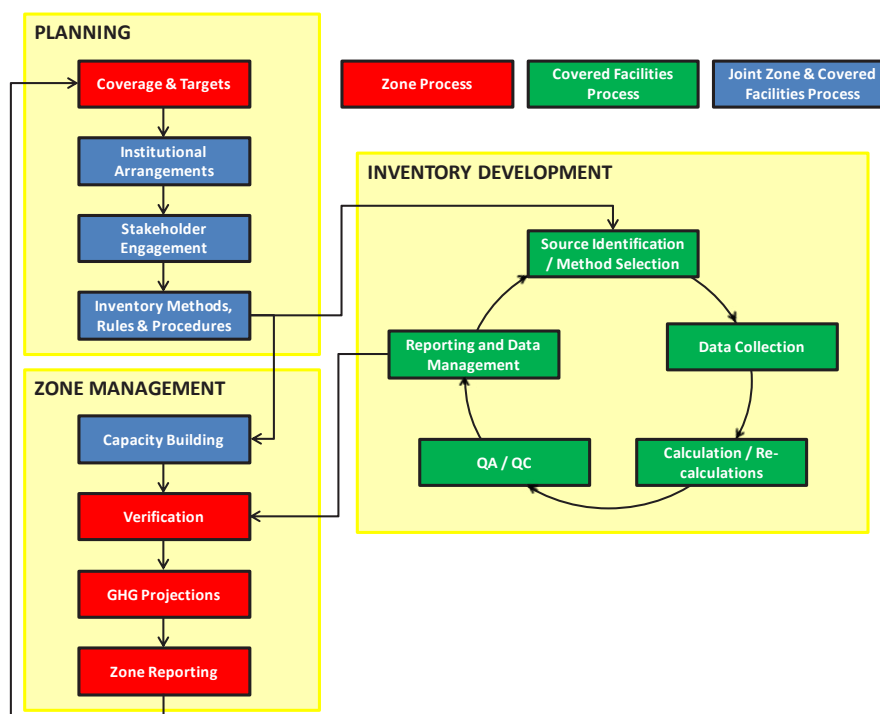


FIGURE 1: POTENTIAL FRAMEWORK FOR A GHG INVENTORY SYSTEM FOR CHINESE ECONOMIC ZONES

3.5 Development of Eco-Efficient Industrial Parks in China: A Review

With over 1,600 industrial zones and 72 per cent of national emissions coming from industry, the organization of economic activity in industrial zones is a major focus of the emerging policy landscape. While flagship programs such as the Top 10,000 Energy-Consuming Enterprises and the seven carbon emission trading pilots are a major focus of policy action, the emerging trend of eco-efficient industrial parks and low-carbon certification shows significant promise to help achieve China's low-carbon and energy goals. As well, the growing scarcity of natural resources necessitates increased resource efficiency, including improving industry reuse and recycling rates. Resource efficiency improvements are a major focus within the 12th FYP, with emphasis on improving China's circular economy.

Since 2000, under the guidelines of the Chinese central government, many local governments have been actively developing Ecological Industrial Parks and Circular Economy Parks in an effort to improve resource efficiency and achieve high-carbon productivity. More recently, in 2014, the Ministry of Industry and Information Technology (MIIT) and National Development and Reform Commission (NDRC) announced a country-wide demonstration program for low-carbon IDZs. More than 50 national IDZs participated in this program.

IISD reviewed three leading industry programs promoting resource efficiency and the low-carbon transition: the Eco-Industrial Park Demonstration Program, the Circular Transformation of Industrial Parks and the Low-Carbon Industrial Park Program. With about 15 per cent of all China's 1,600 industrial zones participating in one of these programs, and a push by the central government to expand program participation, the review is timely, focusing on identifying commonalities among these schemes, their potential impacts for the low-carbon transition, and the zones' motivations and impediments to participating in these initiatives.

The program review identified three important trends:

- **The movement towards eco-efficient industries is accelerating.** More and more industrial zones are joining one of the three eco-efficient programs; however, the abrupt rise in 2014 with 64 new zones participating is partly explained by the introduction of the new Low-Carbon Industrial Park Program.
- **The three reviewed programs pursue similar objectives, but duplication is likely not an issue.** The main focus of the programs is addressing growing resource scarcity, reducing air and water pollutants, and curbing carbon emissions. However, the duplication of the programs does not seem significant based on our analysis. Of the roughly 1,600 zones in China, about 211 (13 per cent) belong to at least one of the pilot programs, while only 33 belong to two or three of the programs.
- **All three programs either directly or indirectly target GHGs.** All three programs target energy intensity and the energy mix, and indirectly reduce GHGs through seeking to improve resource efficiency. The programs also require better management practices, including establishing energy-management systems; developing clean-production audits and the technological developments associated with those programs; and improving communication and raising awareness about environmental issues. These practices all help to strengthen internal management efforts to identify opportunities to improve energy use and reduce GHGs.

There are number of motivations for industrial parks to participate in these programs. An important first motivation is to attract investment, whether foreign or domestic, given the fierce competition among zones. Zone certification conveys to investors that pollution risks are being managed, that there is management transparency and that operations are oriented to improving resource efficiency and productivity.

Another important motivation is increasing pressure by multiple levels of government to achieve environmental- and resource-efficiency-related targets. Through participation in the programs, the zones can demonstrate that they are aligning operations with political priorities. This has political benefits for zone managers, but also economic benefits in the form of access to financial capital to implement energy-efficiency and GHG-reduction projects, often contingent on participation in the low-carbon and/or eco-industrial program.

Of course, zones also cite barriers to participation, including a lack of awareness and guidance. Also often mentioned is a lack of capacity and limited technological resources. In our report, we identified examples of training available to local governments, industrial zones and enterprises to better understand the core processes involved in becoming a low-carbon, eco-industrial zone. Our review clearly identifies that zones are seeking to build capacity, but that a lack of active training programs is a barrier to implementation.

Based on our review, there are three important conclusions about the state-of-play in low-carbon, eco-industrial zones in China:

First, China has a long history of developing standards and shared indicators to help zones improve their eco-industrial performance. A historical focus on improving water and material energy use across enterprises, as well as managing waste and air emissions, has shifted much more towards low-carbon zone certification in the 12th FYP. While there has been a steady increase since 2001 in participation, in 2014 alone there was an increase of over 40 per cent in the number of firms participating in one of China's three low-carbon or eco-industrial certification schemes.

Second, while certification programs are mostly voluntary, firms clearly see the benefit of participation. These benefits could be less tangible, such as demonstrating alignment with government priorities or differentiating products in the market place. The benefits could also be more tangible, including access to financing through participation in the schemes and in gaining access to technical expertise to help improve energy and emissions performance.

Third, the certification schemes provide a framework for enterprises to evaluate their own facilities, with certification requiring a systematic review of multiple aspects of the enterprise. Building internal capacity is particularly important, as industrial zones and their enterprises are increasingly asked to not only achieve economic growth, but also to minimize their environmental impact. Transitioning from growth-oriented business plans to a more balanced path requires new skills to be learned and capacity to be developed. By requiring a comprehensive review of internal systems, practices and the development of indicators, the certification schemes clearly provide an opportunity for enterprises to improve their performance.

To the extent enterprise capacity is improved through the certification process, China's push to implement three complementary, but at times overlapping, eco-industrial and low-carbon certification schemes is a good thing. Providing firms with frameworks to systematically assess their own operations will only aid enterprises to identify operational priorities that improve economic performance through resource efficiency. Improved capacity will then make enterprises all the better prepared to understand how China's emerging energy and emission policies will affect their businesses and to make cost-effective decisions that will help maintain competitiveness.

4.0 Priority Areas for Action

Based on our considerable analysis and conversations with a large number of IDZs and enterprises, this section offers a number of priority action areas. In some cases, recommendations are high level, and in other cases, they are very specific. The recommendations are designed to provide a conversation starter for both government and industry to open a dialogue. This dialogue seems to be currently lacking, yet it is critical to ensuring that enterprises transition to more resource-efficient and low-carbon production. Five recommendations discussed in this section are:

- Improved carbon management and information for low-carbon operations
- Moving to energy self-supply
- Exploring new models of clean-energy finance
- Building climate-resilient infrastructures with quick-win, no-regret solutions
- Low Carbon, 2030: A Capacity Building Platform

4.1 Improved Carbon Management and Information for Low-Carbon Operations

GHG inventories for industrial and commercial facilities are an essential component of the transition to low-carbon operations, as they provide the foundation for identifying abatement opportunities while measuring and assessing progress towards achieving facility-level GHG targets.

The IDZs have the authority to manage and report GHG emissions working with companies to assemble the information. But GHG inventories are just one essential function needed to ensure enterprises, and IDZs cost-effectively manage their emissions and energy performance. Emerging are pilot online carbon registry and management systems that are multi-faceted with information on GHG reporting protocols, city and/or IDZ-level GHG inventory, benchmarking of industry energy and emission performance, best management practices and a best available technology database. Pilot information portals of note include Zhenjiang (Jiangsu Province) and Zhongshan (Guangdong Province).

IDZs can also use rapid assessment tools to benchmark performance, identify action priorities and build management capacity. Above, we identified a number of eco-efficient industrial park certification programs in China, which provide an opportunity for enterprises to adopt management frameworks to better assess performance. Such tools are useful to evaluate progress on climate actions by comparing various indicators based on economic output, land use and carbon emissions.

Through our interactions with enterprises, we continually heard of the need for capacity building and technical assistance. Enterprises and governments therefore need to work together to further develop GHG registration, carbon management systems and technology assessment tools. There is clearly a range of tools readily available, and effort could be first oriented to assessing promising tools and providing guidance.

4.2 Moving to Energy Self-Supply

The central government has announced the reform of the electricity system, and it indicates that electricity generation and sale to end users will be open to market competition. While the IDZs have limited control over the large state-owned electricity power plants that are supplying electricity to enterprises, they do have control over the energy supply that is owned and operated locally. They also can implement distributed electricity within the IDZ. With a more open electricity market, there is an opportunity for IDZs to deploy their own distributed energy systems—like

combined heat and power or solar photovoltaic—and supply electricity and heat to local companies at prices that are low relative to the state grid.

Another driver pushing IDZs towards self-supply is rising energy costs as China transitions to more natural gas and renewables. This fuel switching will of course increase energy costs for enterprises, raising competitiveness concerns. These cost risks are likely significant, with fuel-switching costs of coal to natural gas in the order of 30–50 per cent higher. Also adding to the risk is the movement to phase out small and inefficient coal-fired boilers providing steam in the IDZs.

This movement towards more distributed and clean energy supply could save energy costs and significantly improve the carbon intensity of production.

4.3 Exploring New Models of Clean Energy Finance

To develop new energy systems to self-supply energy and heat within the IDZ, there are financial barriers, especially given the long payback periods. New financing models are therefore needed to help shorten the payback periods for industry and help catalyze finance to deploy more low-emitting technologies. One promising financing model is public-private partnerships (PPPs), where agreements are struck and investments made by local governments to help leverage private sector finance. Complex financing from the IDZ and/or local governments may include direct subsidies, tax reductions and technical support. Such PPP schemes have wide applicability to various energy-supply options within the IDZ, including steam production and renewable electricity technologies.

4.4 Building Climate-Resilient Infrastructure with Quick-Win, No-Regret Actions

While the focus to date on climate change for IDZs and enterprises has been on climate change mitigation—that is, reducing emissions and improving energy performance—there is also a need to think about building climate-resilient infrastructure. While mitigation costs money, the potential scale of business disruptions from more frequent and intense climate change events could trigger significant costs. Given the long capital life of energy supply systems and production, future shifts in the frequency and intensity of climate change events such as storms could pose a significant long-term risk.

While this project did not look at IDZ climate-resilience infrastructure, we noticed a lack of attention to the importance of climate-proofing infrastructure. This lack of attention is not surprising given the pressure that the emerging climate and GHG policy is placing on IDZs and enterprises. Still, the risks are potentially significant, and efforts need to start now given the long life of capital.

Some no-regrets policies for climate-proofing infrastructure could include building climate change assessments into the design, and siting and building new infrastructure. Many IDZs also have comprehensive disaster-prevention plans that can form the basis of conceptualizing the risks to production. Identifying critical climate-sensitive infrastructure such as energy, water, information and communication technology, and transport is a no-regret strategy.

4.5 Low Carbon, 2030: A Capacity Building Platform

The Chinese government has committed to achieving peak GHG emissions by 2030, while at the same time increasing the share of non-fossil fuels in primary energy to around 20 per cent. Early indications are that the next 15 years of transformation towards a low-carbon economy will be a top priority for the Chinese government, creating both risks and opportunities for business, as technologies will need to be scaled up and widely deployed.

In order to scale up climate actions, many changes and catalyzing actions will be needed, including institutional reform, market liberalization and the scale-up of technologies. But at the heart of success is the need for capacity building in industry to successfully manage the transition to low-carbon and resource-efficient operations.

One of the prevalent barriers widely mentioned through our engagement with enterprises and IDZs is the lack of effective technical guidance. The capacity-building demand for technical guidance covers a wide range of topics, including: best available technologies in mitigation and adaptation; measuring, reporting and verification protocols for industrial managers and professionals; a PPP model for financing and operating clean energy projects; and GHG inventory development.

In order to meet the huge needs from both the public and private sectors, IISD recommends that a partnership be developed between business, government and third parties to launch a non-profit, capacity-building service platform—Low Carbon, 2030—to share insights, knowledge and successful stories, catalyzing the early peaking of carbon emissions for China.

The Low Carbon, 2030 initiative will focus on developing and transforming technical guidebooks to online materials and courses, to be posted on such websites as energy service provider Nandudu.com or the China Beijing Environment Exchange (CBEEX). The promotion will spread through social media like WeChat. The online courses, peers’ insights and successful stories will be filmed and broadcasted by YouKu.com or other online channels. Offline peer learning workshops and training sessions will be held in partnership with companies, authorities and institutes. The business survey will be conducted on a yearly basis to evaluate China’s carbon competitiveness. The annual progress result will be published.

IISD has worked with the government of China to promote policy directions that are consistent with the principles of sustainable development. IISD believes that the success of the country’s next round of development will depend on achieving “green growth”—not only economic targets for competitiveness, job creation and poverty reduction, but also sustainability goals like climate stabilization, water stewardship and natural resource efficiency.



FIGURE 2. CONCEPTUAL MODEL OF THE CAPACITY BUILDING PLATFORM: LOW CARBON

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International Institute for Sustainable Development

Head Office

161 Portage Avenue East, 6th Floor, Winnipeg, Manitoba, Canada R3B 0Y4

Tel: +1 (204) 958-7700 | Fax: +1 (204) 958-7710 | Website: www.iisd.org

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